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November 20, 2020

Via email

Dean Carroll
Wilmington Regional Office
127 Cardinal Drive Ext.
Wilmington, NC 28405
DAQ.publiccomments@ncdenr.gov

Re: Comments on the September Draft Air Quality Permit Number 10644R00 for Align Renewable Natural Gas, LLC Grady Road Project Upgrading Facility

Dear Mr. Carroll,

The Southern Environmental Law Center (“SELC”) submits these comments on behalf of Rural Empowerment Association for Community Help, North Carolina Conservation Network, North Carolina Environmental Justice Network, Cape Fear River Watch, Waterkeeper Alliance, Clean Air Carolina, North Carolina Sierra Club, Sound Rivers, Crystal Coast Waterkeeper, White Oak-New River Waterkeeper Alliance, Yadkin Riverkeeper, Winyah Rivers Alliance, Toxic Free North Carolina, Center for Biological Diversity, Natural Resources Defense Council, Public Justice, Animal Legal Defense Fund, and Food & Water Watch on the September 2020 draft air quality permit (“Updated Draft”) for an Upgrading Facility for Align RNG (“Align”) (Permit No. 10544R00). The undersigned urge the N.C. Division of Air Quality (“DAQ”) not to issue the Updated Draft as written. Thank you for the opportunity to provide comments on this important decision.¹

¹ SELC supports the comments submitted by the Lawyers’ Committee for Civil Rights Under Law on behalf of the North Carolina Environmental Justice Network, which provides thorough support for SELC’s request that DAQ not issue the Updated Draft until it conducts a full environmental justice analysis, including consideration of cumulative impacts, and provides for public participation on a new draft permit addressing any disparate impacts.

Just yesterday, the Fourth Circuit Court of Appeals upheld jury verdicts finding Smithfield Foods (“Smithfield”)—a 50 percent owner in Align, the Grady Road Project developer—liable for noxious odors, the presence of flies and buzzards, disruptive and polluting truck traffic, and other nuisance conditions at its hog operations using the lagoon and sprayfield system.² The Court wrote, “[i]t is past time to acknowledge the full harms that the unreformed practices of hog farming are inflicting” on people and the environment.³ If the Department of Environmental Quality (“DEQ”) issues the Updated Draft, it will allow Smithfield to lock-in these harms for decades to come.

Align’s Upgrading Facility is part of the Grady Road Project (“the Project”)—the first swine waste-to-energy project of its kind in North Carolina. Align is a joint venture between Smithfield, the largest hog processor in the world, and Dominion Energy, an energy giant with a footprint that covers much of the Southeast. The Project involves capping hog waste pits at 19 industrial hog operations to trap biogas, laying 34+ miles of pipeline to transport this biogas, and constructing an upgrading facility to process the collected biogas and inject it into the existing natural gas pipeline. The Project will lock-in a harmful, primitive waste management system at industrial hog operations in eastern North Carolina that has wreaked havoc on rivers, streams and air quality in eastern North Carolina, prevented people living nearby from using and enjoying their property, and harmed the health and wellbeing of neighbors and people downstream from industrial hog operations. Communities of color bear a disproportionate share of these impacts. The Grady Road Project will burden neighbors of these hog operations with even more pollution: the Project will include 20 entirely new sources of harmful sulfur dioxide (“SO₂”) emissions—

² *McKiver, et. al. v. Murphy Brown, LLC*, No. 19-1019, slip op. at 1 (4th Cir., Nov. 19, 2020) (Exhibit 1). Based on SELC’s analysis of public records obtained from the U.S. Army Corps of Engineers and publicly available information from DEQ, it appears several of the hog operations likely involved in the Grady Road Project are the subject of pending nuisance lawsuits.

³ *Id.* at 68 (Wilkinson, concurring).

19 flares at each of the industrial hog operations supplying biogas and the Upgrading Facility itself—and increase the risk of water pollution in Duplin and Sampson Counties and downstream.

In 2000, Smithfield promised North Carolinians that it would transition away from this harmful waste management system to cleaner technology that protects our waterways, air, and the neighbors of hog operations. Smithfield’s plans to cap hog waste lagoons to produce biogas—and generate significant revenue—flies in the face of this commitment. The corporation is poised to double-down on this harmful lagoon and sprayfield system, prioritizing its profits over the health and well-being of people and the environment. Simply capping a hog waste pit does not fix water pollution, rid the air of noxious odors, make these facilities any more resilient to the effects of climate change, or protect neighbors from the health harms that result from the lagoon and sprayfield system. To the contrary, capping hog waste pits will worsen pollution. Smithfield must be held accountable to its commitment to clean up the mess it has created over the last two decades.

The undersigned request that DAQ not issue the Updated Draft for the Upgrading Facility. DAQ lacks critical information from Align and, as written, the Updated Draft fails to meet the requirements of the federal Clean Air Act and state air quality regulations. DAQ has also failed to conduct a comprehensive analysis of direct and cumulative impacts of the Project or to minimize these impacts for communities living nearby the Grady Road Project, as required by Title VI of the Civil Rights Act of 1964.⁴ Align continues to withhold critical information from DAQ regarding the scope and the impacts of the Project. And for its part, DAQ has failed

⁴ DAQ did not require and Align did not provide any update to the May 2020 Draft Environmental Justice Report. SELC incorporates by reference all comments related to the Draft Environmental Justice Report and DAQ’s obligations under Title VI of the Civil Rights Act of 1964 included in SELC’s June 2020 comments.

to conduct a thorough review of the permitting materials, request relevant information from Align, and verify critical assumptions made by Align as part of its technical analysis.

Before issuing any permit for this Project, DEQ must have *full information* about *all components* of the Project, including the anticipated environmental and public health impacts and cumulative impacts, of the Upgrading Facility, 19 connected hog operations, and the pipeline connecting the Upgrading Facility to the 19 operations. The Grady Road Project is a complex, novel project that creates entirely new pollution sources that will have long-lasting impacts on the environment and public health of communities in eastern North Carolina that are already overburdened by pollution from the hog industry. DEQ must do its due diligence before issuing any permit for this facility.

SELC incorporates by reference the comments and exhibits it submitted on June 16, 2020, which are attached as Exhibit 2. The comments that follow supplement the June 16, 2020 comments, and provide technical feedback on the Updated Draft and responses to information provided by Align to DAQ in July 2020.

DAQ must do the following before issuing any permit for the Upgrading Facility. In issuing any new draft permit for the Upgrading Facility, DAQ must:

- Consider the 19 connected hog operations and the Upgrading Facility as one stationary source for the purposes of Title V and Prevention of Significant Deterioration (“PSD”) permitting, as well as major source determinations for National Emission Standards for Hazardous Air Pollutants (“NESHAP”), under the federal Clean Air Act and state air quality statutes and rules;
- Demand the following information from Align and independently verify:
 - the identification and location of the 19 connected hog operations involved in the Project;
 - the maximum daily and annual average quantities of biogas that will be produced at each connected hog operation;

- the composition of the biogas that will be produced at each connected hog operation, including the maximum hourly average hydrogen sulfide (“H₂S”) concentration in the biogas;
- the nature of the relationship between Align and each connected hog operation with regard to biogas purchase agreements (including a purchase contract), ownership and maintenance of equipment at each connected hog operation required for the Project, and other factors relevant to estimating air emissions from all components of the Project;
- the fate of excess biogas that is produced at the connected hog operations, including storage, venting of the covered lagoons, and flaring at the connected hog operations; and
- vendor guarantees supporting Align’s most recent calculations of the capture efficiency of the iron sponge system; and
- Correctly recalculate potential to emit SO₂ emissions and remodel SO₂ impacts for the purposes of demonstrating compliance with the National Ambient Air Quality Standards (“NAAQS”);
- Add several enforceable conditions to the permit, including,
 - the maximum instantaneous flow rate of 1,200 scfm of biogas;
 - a maximum instantaneous H₂S concentration at 3,500 ppm in the feed biogas to the Upgrading Facility; and
 - annual maximum limits of 360 hours for Scenario 2 operations and 240 hours for Scenario 3 operations;
- Establish proper locations for and increase the frequency of monitoring of gas flows and concentration of H₂S for biogas and tail gas;
- Remove the provision providing for less frequent monitoring after 6 months; and
- Solely for the purposes of calculating potential H₂S emissions to ensure compliance with 15A N.C. Admin. Code 2Q.0711(b), the Toxic Permit Emissions Rate, assume no more than a 60 percent conversion rate for the candlestick flare.

DAQ must also comply with its obligations under Title VI of the Civil Rights Act of 1964 to consider and minimize the direct and cumulative impacts of the Grady Road Project on communities living nearby before issuing any permit for the Project. The undersigned request that DEQ not issue any permit for the Grady Road Project, including the air quality permit for

the Upgrading Facility, until after the COVID pandemic has ended. Finally, DEQ must hold Smithfield accountable to its 20-year old promise to transition away from the lagoon and sprayfield system and toward cleaner technology that protects our waterways, air, and communities.

I. DEQ must meaningfully engage impacted communities and follow all guidelines in the Public Participation Plan when making decisions about the Grady Road Project

The Public Participation Plan, adopted by the Department in early 2020 as a result of a settlement reached with impacted community groups regarding pollution from industrial swine operations, outlines clear guidelines for engaging community members around DEQ decisions, and aims to achieve “fair treatment” and “meaningful involvement” of underserved and minority communities.”⁵ The Plan provides that the Department will make special efforts to “coordinate with community . . . organizations to implement public engagement strategies specifically for members of historically underserved communities.”⁶ The residents of Duplin and Sampson Counties who will be most adversely impacted by the Project are precisely the type of historically underserved communities that DEQ committed to reach out to and engage through the Plan. DEQ must make every effort to follow the guidelines outlined in the Plan when facilitating public engagement related to the Project.

While the undersigned appreciate DAQ re-issuing a draft permit for the Upgrading Facility and holding a public hearing on the Updated Draft, to date, the Department’s efforts to engage impacted community members have fallen short of the guidelines provided for under the Plan. The first public comment period associated with the draft air quality permit was noticed only in a local newspaper, and the subsequent email notification provided community members

⁵ N.C. Dep’t of Env’tl Quality, *Public Participation Plan* (May 4, 2020) <https://files.nc.gov/ncdeq/EJ/Public-Participation-Plan.pdf>.

⁶ *Id.*

only two weeks to provide comments on a complex and highly technical proposal.⁷ The public hearing for the Updated Draft was double-booked with another DEQ public hearing; upon request by community organizations, DAQ changed the date of the hearing. On community members' behalf, SELC and the Lawyers Committee for Civil Rights Under Law requested at least 60 days' notice for any virtual public hearing on the Updated Draft,⁸ however, DAQ provided less than this notice. In addition, the Department did not give community members the opportunity to provide input on the materials it distributed to community members about the hearing, and distributed materials about the hearing to a limited number of businesses, churches, and community centers in Duplin and Sampson counties. Permitting staff have yet to make an on-site visit to speak with those community members who may not have access to the hearing and consider their input before making a decision on the Updated Draft, as SELC and other organizations have requested numerous times.⁹ Finally, while it was impossible to gather for a traditional in-person public hearing, the virtual platform proved to be far from a perfect, as community members and other stakeholders struggled to access and participate in the hearing due to lack of access to broadband and familiarity with WebEx.

The Grady Road Project is a multi-faceted project implicating several water and air quality permitting programs. Pursuant to the Plan, and given the significant public interest in the

⁷ Letter from Blakely Hildebrand, SELC, to Dean Carroll, DAQ n. 2 (June 16, 2020) [hereinafter "SELC June 2020 Comments"] (Exhibit 2).

⁸ Letter from Blakely Hildebrand and Elizabeth Haddix to Michael Abraczinskas and Michael Pjetraj (Sept. 19, 2020) (Exhibit 3). DAQ hosted a virtual public hearing on November 16, 2020, and stated that 107 people signed up to offer public comments on the Updated Draft. This level of engagement indicates the public's significant interest in this project. While most commenters were able to provide feedback to DAQ, a significant number of people originally signed up to speak did not offer comments. While some level of attrition at the public hearing was expected, the number of people that did not speak was not expected and reflects the challenges inherent in hosting a virtual public hearing.

⁹ Renee Kramer, Title VI coordinator for DEQ, made an in-person visit to REACH on October 20, 2020 to drop off information about the November 16, 2020 public hearing and spoke to Devon Hall, Executive Director of REACH, during that visit.

Grady Road Project coupled with the racially disparate impacts of industrial hog operations, DEQ must commit to holding public hearings, soliciting public comments, and gather community input on *all decisions* related to the Grady Road Project, even if DEQ's underlying regulations do not require a public process. SELC reiterates its request for permitting staff to conduct a site visit and meet with impacted community members before issuing any permit for the Project.

II. Legal Background

A. N.C. Air Pollution Control Act & Federal Clean Air Act

In North Carolina, “the water and air resources of the State belong to the people.” N.C. Gen. Stat. § 143-211(a); *see also* N.C. Const. art. XIV, § 5 (“It shall be the policy of this State . . . to control and limit the pollution of our air and water . . .”). Through the Air Pollution Control Act and its regulations, DAQ implements the federal Clean Air Act (“CAA”) in North Carolina, as approved by the U.S. Environmental Protection Agency (“EPA”) in North Carolina’s State Implementation Plan (“SIP”). *See, e.g.*, 15A N.C. Admin. Code 2Q .0500 (implementing the Clean Air Act’s Title V program). North Carolina’s SIP must ensure compliance with the CAA, and incorporates significant portions of CAA’s implementing regulations directly. *Id.*; *see* 42 U.S.C. § 7410. North Carolina, like other states with SIPs, may adopt “more stringent, or at least as stringent” standards as EPA. 40 C.F.R. § 51.165.

Pursuant to the CAA, the EPA has set National Ambient Air Quality Standards (“NAAQS”) for six criteria pollutants, including SO₂. 40 C.F.R. § 50.17. The purpose of NAAQS is to “define levels of air quality which the [EPA] Administrator judges are necessary, with an adequate margin of safety, to protect the public health.” *Id.* § 50.2(b). North Carolina’s federally approved SIP sets ambient air quality standards in line with the federal NAAQS,

compare 40 C.F.R. Part 50, with 15A N.C. Admin. Code 2D .0400 *et seq.*, and provides that “[n]o facility or source of air pollution shall cause any ambient air quality standard in this Section to be exceeded or contribute to a violation of any ambient air quality standard,” 15A N.C. Admin. Code 2D .0401(c); *see also* 15A N.C. Admin. Code 2D .0501(c) (“[A]ny source of air pollution shall be operated with such control or in such manner that the source shall cause the ambient air quality standards . . . to be exceeded at any point beyond the premises on which the source is located.”). Compliance with the NAAQS is often demonstrated through dispersion modeling conducted during the permitting process of a new facility.

Title V of the Clean Air Act sets forth a federal operating permit program. 42 U.S.C. § 7661 *et seq.* Any stationary source that is considered a “major” source for purposes of Title V must apply for a Title V operating permit within 12 months of the facility commencing operation, and no source subject to Title V “may operate after the time that is required to submit a timely and complete application except in compliance with a permit” issued under Title V. 40 C.F.R. § 70.7(b); 15A N.C. Admin. Code 2Q .0501(e). The purpose of the Title V program is to identify all of a source’s CAA obligations and specify monitoring, recordkeeping, and reporting requirements sufficient to assure that the source is meeting those obligations and is otherwise operating in compliance with the Act.¹⁰ *See* 40 C.F.R. § 70.1.

B. Source Aggregation

Federal and state regulations outline under what circumstances pollution-emitting activities comprise a single stationary source for New Source Review (“NSR”) and Title V permitting purposes. Pursuant to CAA regulations, a stationary source means “any building, structure, or installation which emits or may emit a regulated [New Source Review] pollutant.”

¹⁰ *See 1990 Clean Air Act Amendment Summary: Title V*, EPA (Oct. 19, 2016), <https://www.epa.gov/clean-air-act-overview/1990-clean-air-act-amendment-summary-title-v>.

40 C.F.R. § 52.21(b)(i). Generally, “entities may be considered part of the same stationary source . . . if they (1) belong to the same industrial grouping; (2) are located on one or more contiguous or adjacent properties and (3) are under the control of the same person (or persons under common control).”¹¹ North Carolina has adopted this same test. 15A N.C. Admin. Code 2Q.0103(22). EPA has interpreted the requirements for the three prong test broadly. For example, even if entities do not belong to the same industrial grouping, EPA guidance considers that prong of the source aggregation test satisfied if one of the entities is a “support entity” to the other.¹² Similarly, EPA guidance explains that common control can be established “through ownership of multiple sources by the same parent corporation or by a parent and a subsidiary of the parent corporation” or if an entity “has the power to direct the management and policies of a second entity . . . through a contractual agreement or voting interest.”¹³

C. Potential to Emit

Under Title V of the CAA, 42 U.S.C. § 7661 *et seq.*, a stationary source is considered a major source if it emits, or has the potential to emit (“PTE”), 100 tons per year or more of any regulated pollutant. 40 C.F.R. § 70.2; *see* 15A N.C. Admin. Code 2Q .0103(22) (defining “major facility” in accordance with 40 C.F.R. § 70.2). A facility’s “potential to emit” is defined as “the maximum capacity of a stationary source to emit any air pollutant under its physical and

¹¹ Letter from William L. Wehrum, Assistant Administrator, EPA, to Patrick McDonnell, Secretary of the Pennsylvania Department of Environmental Protection at 1 (Apr. 30, 2018), https://www.epa.gov/sites/production/files/2018-05/documents/meadowbrook_2018.pdf (internal quotations omitted) [hereinafter “Meadowbrook Letter”]; *see also* 40 C.F.R. § 52.21(b)(6)(i).

¹² Letter from JoAnn Heiman, Chief Air Permitting and Compliance Branch, EPA, to James Pray 3 (Dec. 6, 2004), <https://www.epa.gov/sites/production/files/2015-07/documents/lincoln.pdf> (explaining that a “support facility” such as the grain elevator “may be considered to be a part of the same major group as the primary facility [the ethanol plant] supports even if the support facility would be classified in a separate group when operated independently.”) [hereinafter “Heiman Letter”] (Exhibit 4).

¹³ Letter from Richardson Long, U.S. EPA Region 8, to Julie Wrend, Colorado Dep’t of Public Health & Environment re: Single Source Determination for Coors/TriGen (Nov. 12, 1998) <https://19january2017snapshot.epa.gov/sites/production/files/2015-07/documents/coorstri.pdf> [hereinafter “Coors/TriGen Letter”].

operational design.” 40 C.F.R. § 70.2; *see* 15A N.C. Admin. Code 2Q .0103(28) (defining “potential emissions” as “the rate of emissions of any air pollutant that would occur at the facility’s maximum capacity to emit any air pollutant under its physical and operational design”).

Any physical or operational limitation on a capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation is enforceable by the Administrator. 40 C.F.R. § 70.2. Thus, a facility’s “potential to emit” is based on the maximum amount of pollutants the facility could emit if it operated at full capacity 24 hours per day, 365 days per year, taking into account enforceable permit restrictions or conditions. A facility’s potential to emit is meant to represent a “worst case” emissions calculation. EPA, *Draft New Source Review Workshop Manual*, at A19 (Oct. 1990) (discussing “methods for determining potential to emit”); *see also Voigt v. Coyote Creek Mining Co.*, 329 F. Supp. 3d 735, 772 (D. N.D. 2018) (citing *In re Peabody W. Coal Co.*, 12 E.A.D. 22, 2005 WL 428833 (EAB Feb. 18, 2005)).¹⁴

III. The Grady Road Project must be permitted as a single source

The Grady Road Project involves the creation of 29 new emissions points in Duplin and Sampson counties including the Upgrading Facility and the 19 connected hog operations, which must install lagoon covers, vents, and flares for the sole purpose of producing and marketing biogas. Even under Align’s rosiest projections these vents and flares will be utilized to dispose of excess biogas either through venting—which would emit methane, carbon dioxide, and sulfur compounds—or flaring, which would emit unburned methane, SO₂ and many toxic air

¹⁴ Although these materials relate specifically to the New Source Review and Prevention of Significant Deterioration contexts, the regulatory definition of “potential to emit” under these programs is essentially identical to the definition provided under the Title V context. *Compare* 40 C.F.R. § 51.166(b)(4) (New Source Review), *with* 40 C.F.R. § 70.2 (Title V).

compounds. Given the variability of biogas production,¹⁵ it is possible that flaring at the connected hog operations will be a common occurrence.

In addition, the Upgrading Facility itself will emit predominately SO₂ and H₂S emissions. If DAQ focuses its permitting efforts on only the two flares at Align's Upgrading Facility and overlooks the emissions generated at the 19 connected hog operations it will ignore significant emissions associated with the Grady Road Project. Such a permitting strategy would capture only 1 of the 20 emissions points created by Align, and would subject the communities who live and work near the project site to increased health risks associated with un-permitted SO₂ emissions and vented biogas emissions.

To meet the requirements of the federal Clean Air Act ("CAA") and protect the health of nearby residents, DAQ must account for *all* of these points of new air pollution when permitting the Project. DAQ has erroneously excluded emissions from the 19 connected hog operations from its permitting analysis. DAQ should permit the 19 connected industrial hog operations and the Upgrading Facility as a single source under the CAA.

Pursuant to EPA regulations, "entities may be considered part of the same stationary source . . . if they (1) belong to the same industrial grouping; (2) are located on one or more contiguous or adjacent properties and (3) are under the control of the same person (or persons under common control)."¹⁶ At least two of three prongs under the EPA's source aggregation test—the requirement for common control or common ownership and for the same industrial grouping category—are satisfied.¹⁷ Further, given the unique and model nature of the Project

¹⁵ See *infra* Part IV (A).

¹⁶ Meadowbrook Letter, *supra* note 11, at 1; see also 40 C.F.R. 42.21(b)(6)(i); 15A N.C. Admin. Code 2Q.0103(22).

¹⁷ See Meadowbrook Letter, *supra* note 11, at 1; see also 40 C.F.R. § 52.21(b)(6)(i) ("Building, structure, facility, or installation means all of the pollutant-emitting activities which belong to the same industrial

and Align’s failure to disclose information about the vast majority of the biogas-producing hog operations, DAQ has discretion to conclude that the adjacency/continuity prong of the source aggregation test is satisfied.¹⁸

A. All Components of the Grady Road Project are Under Common Control of Smithfield

The first prong of EPA’s source aggregation test is whether “all of the pollutant-emitting activities” are “under the control of the same person (or persons under common control)[.]” 40 C.F.R. § 52.21(b)(6)(i). There are many ways to demonstrate common control and meet this prong of the source aggregation inquiry. As explained in SELC’s comments on the Draft Permit, common control can be established “through ownership of multiple sources by the same parent corporation or by a parent and a subsidiary of the parent corporation.”¹⁹ Indeed EPA’s guidance specifically notes that “[t]his power and authority could be exercised through various mechanisms, including common ownership or managerial authority (the chain of command within a corporate structure, including parent/subsidiary relationships) [and] contractual obligations.”²⁰ EPA’s guidance aims “to minimize the potential for entities to be held responsible for decisions of other entities over which they have no power or authority” and to assess “the power or authority of one entity to dictate decisions of the other that could affect the applicability of, or compliance with, relevant air pollution regulatory requirements.”²¹

Here, Smithfield exercises common control over all components of the Grady Road Project through corporate governance and contract.

grouping, are located on one or more continuous or adjacent properties, and are under the control of the same person (or persons under control common)...”).

¹⁸ SELC notes that DAQ may present this Updated Permit case to EPA for additional guidance regarding source aggregation before issuing a final permit.

¹⁹ SELC June 2020 Comments, *supra* note 7, at 24 (citing Meadowbrook Letter and TriGen Letter).

²⁰ *Id.*

²¹ Meadowbrook Letter, *supra* note 11, at 6.

Align concedes that 3 of the 19 connected hog operations satisfy the common ownership or control criterion of the source aggregation test because they are owned or operated by Smithfield or one of its affiliates.²² For these 3 operations it is indisputable that Smithfield exercises direct control through its subsidiaries—Murphy-Brown and Align.²³

Though considerable evidence demonstrates otherwise, Align denies that the remaining 16 hog operations—which contract with Smithfield to raise hogs and with Align to produce biogas—are subject to control by Smithfield.²⁴ Align maintains that there is no common control because Align itself does not exert control in a manner that would determine whether each of the 16 hog operations “complies or does not comply with an existing permitting requirement.”²⁵ Align RNG is wrong because: (1) all components of the Grady Road Project are under common control of Smithfield through corporate governance and contract; (2) EPA’s analysis in the Ameresco Determination confirms Smithfield’s common control; and (3) Align also exercises sufficient control over emissions generating activities on the biogas-producing hog operations to establish common control. For these reasons, the Upgrading Facility *and* all 19 connected hog operations should be aggregated for the purposes of CAA permitting.

1. *Smithfield exerts control over all components of the Grady Road Project through corporate governance and contract*

Common control can be established through corporate management relationships such as the parent-subsidary relationship.²⁶ Smithfield, a 50 percent owner of Align, owns 3 of the 19

²² Letter from Kraig Westerbeek, Align RNG, to Brad Newland, DAQ 4 (July 27, 2020) [hereinafter “Align Response to July 13 Request”].

²³ Letter from Kraig Westerbeek, Align RNG, to Brad Newland, DAQ 1 (July 24, 2020) [hereinafter “Align Response to July 2 Request”] (“Three of the farms are company-owned by Murphy-Brown, LLC (a subsidiary of Smithfield)...”).

²⁴ *Id.*

²⁵ *Id.*

²⁶ Letter from Anna Marie Wood, EPA, to Gail Good, Wisconsin DNR 6 (Oct. 6, 2018) [hereinafter “Ameresco Determination”].

hog operations through a subsidiary, Murphy-Brown. Align conceded that these 3 connected hog operations meet this prong of the source aggregation test.²⁷

As EPA explained, it is also possible for:

[E]ntities that are separate in the sense that they lack a formal organizational link . . . but where one entity nevertheless exerts enough control over a substantial portion of the other's relevant operations, to be "persons under common control" in certain situations.²⁸

As explained in SELC's comments on the Draft Permit, Smithfield's existing contracts for hog production at the 19 connected hog operations and Align's new contracts for biogas production with those hog operations allow Smithfield to "direct the management and policies"²⁹ of the hog operations for the purposes of biogas production.³⁰ Smithfield, a 50 percent owner of Align, "dictates every aspect of the [hog] operations, down to the amount and type of feed the pigs receive" for those industrial hog operations with which Smithfield has a production contract.³¹ In

²⁷ Align Response to July 2 Request, *supra* note 23, at 1.

²⁸ Ameresco Determination, *supra* note 26 at 6.

²⁹ Meadowbrook Letter, *supra* note 11, at 3.

³⁰ SELC June 2020 Comments, *supra* note 7, at 25, n. 94. It does not matter that Smithfield controls the hog operations' operations generally, and not just in relation to biogas.

³¹ Lisa Sorg, *A federal appeals court judge's remarkable speech is the latest surprise in NC's hog nuisance lawsuit*, NC POLICY WATCH (Feb. 3, 2020) <http://www.ncpolicywatch.com/2020/02/03/a-federal-appeals-court-judges-remarkable-speech-is-the-latest-surprise-in-ncs-hog-nuisance-lawsuits/>; *see also* Expert Report of Thomas N. Hubbard, Joint Appendix, page 4004 (Feb. 19, 2018), *McKiver vs. Murphy Brown, LLC*, Case No. 19-1019 (4th Cir.) at 15 ("[T]he Smithfield Hog Production Division (and, ultimately, the WH Group) both owns the hogs and retains important rights to decisions that affect the hogs' value, including how they are fed, what they are fed, their medication, how they are transported, where they are kept, what other animals they are kept around, and where and when they are slaughtered. . . ownership of the hog provides [Smithfield] but not the grower, strong incentives to make these decisions in a way that accounts for how they affect the value of the hog"). The 4th Circuit Court of Appeals also noted the significant control exerted by Smithfield over all components of hog production at contract farms. ("Appellant imposes standard operating procedures for all of its contract growers. Specifically, Appellant (1) directs grower management procedures; (2) mandates design and construction of operations; (3) can require the use of technological enhancements; (4) can require capital investments; (5) dictates how many of its hogs are to be placed at a given operation; and (6) controls hog waste management systems."). *McKiver*, slip opinion at 5. Align's assertion that feed specification Smithfield imposes upon hog operations "does not affect air permitting compliance and applicability at either site" is false. It is well established that the diet of hogs directly impacts the composition of the biogas produced through animal waste. The composition of the biogas significantly impacts the emissions that are created as a byproduct of the upgrading process or through venting or flaring. *See, e.g.*, Guillaume Jarret et. al,

other words, Smithfield “exerts enough control” through its pre-existing contractual relationships to make the Upgrading Facility and the individual hog operations “persons under common control” of Smithfield.³² Align admitted as much in its Application to the North Carolina Utilities Commission, where it stated that “Align RNG’s project will leverage Smithfield’s relationship with local contract farmers, who raise and care for Smithfield’s hogs.”³³

Moreover, it is highly likely that the new contracts for biogas between Align and the hog operations would illuminate additional layers of control exerted by Smithfield—but Align has failed to disclose them to DAQ or the public. Instead, Align relies solely on an unsupported assertion that “farm owners . . . could sell [biogas] elsewhere or choose not to sell it at all.”³⁴ This claim—that Align has invested hundreds of millions of dollars into a project without guaranteeing a reliable supply of biogas—is farcical and lacks any support in fact.

Based on the evidence before DAQ, it is clear that Smithfield exercises significant control over the connected hog operations.

Impact of Pig Diets With Different Fibre Contents on the Composition of Excreta and Their Gaseous Emissions and Anaerobic Digestion, 160 AGRIC., ECOSYSTEMS & ENVT. 51, 57 (2012) (noting that “fibre-rich diets will result in increased CH₄ [methane] emissions [that] . . . in the case of anaerobic treatment of manure . . . will contribute to optimise energy production as heat and/or electricity, having a positive environmental impact.”).

³² Ameresco Determination, *supra* note 26, at 6.

³³ Application of Align RNG North Carolina, LLC, d/b/a/ Align Renewable Natural Gas for Approval to Participate in Pilot Program in Docket No. G-9, Sub 698 Docket No. G-9, Sub 764, 5 (Jan. 17, 2020). [hereinafter “Align Application to NCUC”]. Align also tacitly admits Smithfield high level of control over the hog operations when it asserts that the nature of the feedstock and consistent operation of anaerobic digesters is responsible for “absence of other sulfur compounds” in biogas. Align Response to July 2 Request, *supra* note 23, at 2. Align cannot have it both ways—either the hog operations are under Smithfield’s control and producing biogas under specific parameters, or they are not under Smithfield’s control and Align must account for increased range of Sulphur compounds that result from irregular operation of the 19 hog facilities.

³⁴ Align Response to July 13 Request, *supra* note 22, at 5.

2. *EPA's most recent guidance on "common control" suggests that the Grady Road Project should be permitted as a single stationary source*

Align relies heavily on EPA's 2018 guidance in its Ameresco Determination to argue that the 19 connected hog operations and Upgrading Facility should be considered separate sources. Align misreads this guidance.³⁵ In fact, the Ameresco Determination supports permitting the Grady Road Facility and hog operations as a single source.³⁶

Align cites the Ameresco Determination in support of its argument that "even if Align has ownership of certain equipment located at the farms, it is not a sufficient basis for combining otherwise separate facilities."³⁷ But as EPA explained in the Ameresco Determination, the degree of control Align has over the hog operations is not dispositive.³⁸ The relevant inquiry is the degree of control *Smithfield* has over Align and the hog operations. In other words, the question is whether Align and the hog operations, which both control aspects of the Grady Road Project's "pollutant-emitting activities[,] . . . are under control of the same person (or persons under common control)."³⁹ As discussed above, *Smithfield's* layers of contractual relationships with the biogas-producing hog operations and ownership of Align establishes *Smithfield's* common control of the polluting entities making up the Grady Road Project.⁴⁰

³⁵ Ameresco Determination, *supra* note 26, at 2.

³⁶ Notably, both JCL and Ameresco had their own Title V permits. As explained by the EPA, allowing a single activity—biogas production and upgrading—to be considered part of multiple stationary services can "artificially result in two sources . . . avoiding major NSR or title V requirements." *Id.* Such is the concern here—if the Grady Road Facility and the individual hog operations are permitted separately they may evade major source requirements. The 19 industrial hog operations do not currently have any air quality permits, meaning that all emissions from these facilities will go unaccounted for unless these emissions are controlled by the Updated Draft.

³⁷ Align RNG Response to July 13 Request, *supra* note 22, at 6.

³⁸ Ameresco Determination, *supra* note 26, at 5 ("[O]ne could have inferred that when multiple entities each exert a certain amount of "control" over a specific *activity* (first part of the regulatory text), then those *entities* themselves should also automatically be considered "persons under common control" (second part of the regulatory text). However, it would be inappropriate to automatically assume this . . .")

³⁹ *Id.* at 6; see 40 C.F.R. § 52.21(b)(6)(i).

⁴⁰ See *supra* Part II.A.1.

Align also improperly relies on the Ameresco Determination to argue that aggregating the 19 connected hog operations and Upgrading Facility as one source is a departure from the “common sense notion of a plant.”⁴¹ This is a mischaracterization of EPA guidance. In the Ameresco Determination, EPA stated that “overbroad source determinations that aggregate *wholly unrelated activities* . . . may not accurately reflect ‘a common sense notion of a plant.’”⁴² Clearly, the generation of biogas at a hog operation and the processing of that biogas at an Upgrading Facility are related activities, especially when the biogas at issue would not have been captured *but for* the existence of the Upgrading Facility.

Moreover, the example EPA used to illustrate activities that “stretch the plain meaning of ‘persons under common control’ and the notion of a ‘common sense notion of a plant’” do not remotely resemble the fact pattern at hand. EPA referenced that “two separately-owned manufacturing companies that operate independently with respect to all emissions-related activities, with the exception of a wastewater treatment plant over which they share control due to practical and economic convenience[,]”⁴³ as a situation that stretched the limits of common control. In contrast, the Grady Road Facility and the connected hog operations are both critical, interrelated components in the production and processing of biogas—an emissions-causing activity. This is *not* a situation where “entities each exercise some level of control over a single, limited aspect of otherwise separate operations.”⁴⁴

In sum, Align’s reliance on the Ameresco Determination is misplaced. In fact, this recent EPA guidance supports permitting the Grady Road Project as a single stationary source.

⁴¹ Align RNG Response to July 13 Request, *supra* note 22, at 6.

⁴² Ameresco Decision, *supra* note 26, at 6.

⁴³ *Id.* at 6 (citing Meadowbrook Letter, *supra* note 11, at 5, 7, 9).

⁴⁴ *Id.* at 4.

3. *Align’s control over equipment at the connected hog operations also satisfies the control prong of the source aggregation test*

Align claims that it will not exercise “day-to-day” control over the hog operations, and therefore does not have sufficient control to satisfy the source aggregation test.⁴⁵ But EPA does not require day-to-day control. EPA has specifically noted that:

The EPA has neither articulated nor intended to suggest that decision-making authority with respect to day-to-day operations is necessary to establish the requisite type or amount of “control.” Rather, as explained in the Meadowbrook Letter, the ability to dictate any decision that could impact compliance with or the applicability of permitting requirements—including higher-level decisions removed from day-to-day operations—can be sufficient to establish the relevant type of “control.”⁴⁶

In other words, the fact that owners of individual hog operations retain autonomy over the day-to-day operation of hog production is not dispositive to common control determinations made for the purpose of a CAA source aggregation.

The relevant inquiry is Align’s degree of control over operations which may result in the emission of air pollution.⁴⁷ Align’s ownership of the dehydrators, flow monitors, flares, and compressors at the connected hog operations, all of which are essential for the collection, transport, and production of biogas and have implications for emissions at the hog operations themselves and the Upgrading Facility, establishes control.⁴⁸ Align attempts to minimize this

⁴⁵ Align’s Response to July, 13 Request, *supra* note 22, at 5-6.

⁴⁶ Letter from Carl Daly Acting Director, Air and Radiation Division, U.S. EPA, to Danny Powers, Air Quality Program Manager, Southern Ute Indian Tribe at 4 (Jul. 23, 2019) <https://www.epa.gov/sites/production/files/2019-10/documents/jaques2019.pdf> [hereinafter “Daly Letter”] (Exhibit 5).

⁴⁷ See Meadowbrook Letter, *supra* note 11, at 6. The Fourth Circuit Court of Appeals also noted Smithfield’s, Align’s parent company, significant control over “abatement technologies” at its company-owned and contract farms. *McKiver*, at 9 (“Because of the extensive control [Smithfield] maintained over its contract growers . . . [Smithfield’s] president explained it had the *power to implement abatement technologies* at its growers’ operations by prescribing those technologies and getting money from the parent companies to help pay for them.”) (emphasis added).

⁴⁸ Align Response to July 13 Request, *supra* note 22, at 6 (“Align will own some minor non-emitting equipment located at the farms (gas dehydrators, flow measurement, and compressors) . . .”).

reality by stating that these pieces of equipment are non-emitting components of the design.⁴⁹

But these components and their operation could still “impact compliance with or the applicability of permitting requirements” because they impact the quantity and quality of biogas being produced, factors which indisputably impact air emissions.⁵⁰

Therefore, even if Smithfield did not have common control of Align and the hog operations, Align’s control of equipment that impacts the hog operations’ compliance with air permitting requirements is sufficient to establish control under EPA’s source aggregation test.

* * *

Smithfield’s corporate and contractual relationship with Align and the 19 connected hog operations satisfies EPA’s criteria for common control and ownership. And Align’s control over equipment impacting the hog operations’ and Upgrading Facility’s compliance with air quality regulations meets EPA’s criteria for common control. For these reasons, DAQ should find all components of the Grady Road Project are under the common control of Smithfield for the purposes of source aggregation analysis.

B. The Industrial Hog Operations Serve as Support Facilities to the Central Upgrading Facility

The second prong of the source aggregation test is whether the facilities share a common industrial grouping. 40 C.F.R. § 52.21(b)(6)(i). However, EPA has established that even when facilities do not share a common industrial grouping, this prong can be satisfied if one facility is

⁴⁹ *Id.*

⁵⁰ Daly Letter, *supra* note 46, at 4. Moreover, as previously discussed, even *if* Align lacked control over decisions that “could impact compliance with or the applicability of permitting requirements” at the hog operations, Smithfield’s exercise of common control over Align and the hog operations through corporate governance and contract on its own satisfies the control prong of the source aggregation test. While Smithfield’s contracts with these hog operations do establish control over day-to-day control over the operations by mandating strict animal management practices, this level of control exceeds what is required under EPA’s guidance. *See supra* note 31.

a “support facility” for the other.⁵¹ Align concedes that support facilities satisfy the common industrial grouping prong of the source aggregation test, but maintains the biogas-producing hog operations do not qualify as support facilities because they do not exist solely to support the Upgrading Facility.⁵² Align provides no support for this erroneous claim. The biogas-producing hog operations clearly meet the definition of support facilities set forth in EPA guidance.

Generally speaking, “where more than 50% of the output or services provided by a facility is dedicated to another facility that it supports, then a support facility exists.”⁵³ EPA has issued guidance stating that “[e]ven where this 50% test is not met ... other factors may lead the permitting authority to make a support facility determination.”⁵⁴ These other factors include:

- (1) the degree to which the supporting activity receives materials or services from the primary activity (which indicates a mutually beneficial arrangement between the primary and secondary activities);
- (2) the degree to which the primary activity exerts control over the support activity’s operations;
- (3) the nature of any contractual arrangements between the facilities; and
- (4) the reasons for the presence of the support activity on the

⁵¹ Heiman Letter, *supra* note 12, at 3 (explaining that a “support facility” such as the grain elevator “may be considered to be a part of the same major group as the primary facility [the ethanol plant] supports even if the support facility would be classified in a separate group when operated independently.”) The SIC Code should also not be determinative because Grady Road Facility has been miscategorized under SIC 1231. N.C. Dep’t of Env’tl Quality, Div. of Air Quality, Application #31/00179.19A, 1. DAQ relies on the Standard Industrial Classification Manual, 1972, as amended by the 1977 Supplement, which states that SIC Code 1321 covers “[e]stablishments primarily engaged in producing liquid hydrocarbons from oil and gas field gases. U.S. Dep’t of Commerce, Standard Industrial Classification Manual, 1972, Supplement 1977. This code categorization is not an appropriate fit since it corresponds to petroleum gas production, while the Grady Road Project involves swine-waste derived biogas production. Even Align characterized the Grady Road Facility as being under a different SIC Code—4925—in its application. BF Grady Rd Air Quality Permit Application 19 (Feb. 26, 2020).

⁵² Align RNG Response to July 13 Request, *supra* note 22 at 4; *In re Anadarko Petroleum Corp., Frederick Compressor Station*, Permit No. 950PWE035, Pet. No. VIII-2010-4, Order Denying Petition for Objection to Permit at 16 (EPA, Feb. 2, 2011) (“EPA explained that when two activities have different SIC codes, a support facility analysis may be conducted to determine whether the activities should be treated as having the same industrial grouping.”).

⁵³ Heiman Letter, *supra* note 12, at 3; *see also* DAQ, Stationary Source Determinations, <https://deq.nc.gov/about/divisions/air-quality/air-quality-permits/nsr-permitting/stationary-source-determinations> (“Using the support facility concept, an emissions unit that conveys, stores, or otherwise assists in the production of a primary product may be considered part of the stationary source’s primary activity.”).

⁵⁴ *Id.* at 3-4.

same site as the primary activity (e.g., whether the support activity would exist at that site but for the primary activity). Where these criteria indicate a support relationship, permitting authorities may conclude that a support activity contributing more or less than 50% of its output may be classified as a support facility and aggregated with the facility it supports as part of a single source.⁵⁵

As SELC explained in its comments on the Draft Permit, these factors are satisfied.⁵⁶

Align's response to DAQ's Request of Additional Information did not address any of the arguments SELC made in its comments, simply reasserting that unless the hog operations "exist solely to support [the central processing] facility," they do not qualify as support facilities.⁵⁷ This argument overlooks EPA guidance on how support facility determinations are made and ignores the fact that but-for the presence of the Grady Road Facility, the anaerobic digesters would not be installed and operated on hog facilities.

As discussed at length in SELC's comments on the May Draft Permit, "where more than 50% of the output or service provided by a facility is dedicated to another facility that it supports, then a support relationship is presumed to exist[.]"⁵⁸ Align's filings suggest that 100 percent of the biogas produced by the hog operations will go to serving the Upgrading Facility. Align has represented that the Upgrading Facility is "sized to accommodate the biogas production potential of the farms."⁵⁹ The decision to size the Upgrading Facility to accommodate the full production potential of the 19 hog operations would make little sense if the hog operations were selling biogas elsewhere.

⁵⁵ *Id.*

⁵⁶ SELC June 2020 Comments, *supra* note 7, at 20-23.

⁵⁷ *Id.* at 4.

⁵⁸ Heiman Letter, *supra* note 12, at 3; *see* SELC June 2020 Comments, *supra* note 7, at 20-21.

⁵⁹ Align Response to July 2 Request, *supra* note 23, at 2.

Now, however, Align claims that farm owners could “sell [biogas] elsewhere or choose not to sell it at all.”⁶⁰ This claim defies common sense and is completely unsupported. DAQ must require Align to disclose the biogas purchase contract between itself and the hog operations in order to confirm that the biogas output from these operations is dedicated to supplying the Upgrading Facility and that the hog operations are support facilities.

Even if the 50% test is not met, EPA guidance explains that “other factors may lead the permitting authority to make a support facility determination.”⁶¹ As explained in more detail in SELC’s comments on the Draft Permit, all of the factors described by EPA are met: (1) Align provides the hog operations materials in the form of gas dehydrators, flow monitors, and compressors⁶²; (2) Align can force hog operations to flare or vent biogas in the event of a system emergency or maintenance⁶³; (3) Smithfield has contracted with the hog operations to raise its hogs and its subsidiary, Align, has contracted with the same operations to produce biogas⁶⁴; and (4) “but for” the Grady Road Facility, anaerobic digesters would not be installed on the hog operations and biogas would not be produced.⁶⁵

Further, support facilities are “typically those which convey, store, *or otherwise assist* in the production of the principal product.”⁶⁶ Here, the hog operations “assist” in the production of

⁶⁰ *Align RNG’s Response to DAQ’s July, 13 Request for additional information* at 4.

⁶¹ Heiman Letter, *supra* note 12, at 3-4.

⁶² Align Response to July 2 Request, *supra* note 23, at 6.

⁶³ *Id.* at 2 (“The Farms, however, will be equipped with emergency flares and emergency vents installed on the anaerobic digesters for safety purposes. The emergency flares located at the farms will be used in the event that the biogas cannot be delivered to the BF Grady Road facility for an extended duration.”).

⁶⁴ Align RNG Application to NCUC, *supra* note 33 at 5.

⁶⁵ See SELC June 2020 Comments, *supra* note 7, at 22-23.

⁶⁶ *Id.* (emphasis added); see also, Heiman Letter, *supra* note 12, at 3 (explaining that a “support facility” such as the grain elevator “may be considered to be a part of the same major group as the primary facility [the ethanol plant] supports even if the support facility would be classified in a separate group when operated independently.”).

natural gas which is the principal product of the Upgrading Facility. For all these reasons, the 19 hog operations are support facilities to the Upgrading Facility.

C. The 19 Connected Hog Operations are Contiguous or Adjacent with the Central Processing Facility

SELC's comments on the Draft Permit pointed out that without critical information about the design and layout of the 19 hog operations connected to the Upgrading Facility, DAQ could not lawfully issue the Permit. Specifically, SELC explained that without more information about which connected hog operations would be producing biogas for the facility and where exactly these operations are located, it was impossible to determine whether the site of the Upgrading Facility and any or all of the hog operations were continuous or adjacent.⁶⁷ To date, Align has failed to provide this information. Neither DAQ nor the public have been informed of the identity or location the 19 connected hog operations involved in the Project. Instead Align merely asserts, absent any evidence, that the hog operations are located too far away from the Upgrading Facility to be considered adjacent or contiguous under federal regulations and guidance that it admits do not apply here.

Align is wrong for three primary reasons. First, the state of North Carolina, not the federal government, has "primary control" for air pollution prevention and air pollution control, and may consider "functional interrelatedness" to find adjacency or continuity.⁶⁸ 42 U.S.C. § 7401(a)(4). Second, the unique nature of Grady Road Project justifies a distinction from EPA guidance. Third, the Grady Road Project fits the "common sense notion of a plant." For these reasons, DAQ should find that the components of the Grady Road Project—the hog operations and Upgrading Facility—are adjacent.

⁶⁷ SELC June Comments, *supra* note 7, at 26-27.

⁶⁸ Furthermore, as previously discussed, the Grady Road Facility is not properly categorized under SIC Code 1321. *See supra* note 51. Therefore, the definition of "adjacent" adopted by EPA for oil and gas sources, *see* 81 Fed. Reg. 35,622 (June 3, 2016) does not control here.

1. *DAQ has discretion to determine that the Grady Road Facility and 19 hog operations are adjacent*

The CAA provides that “air pollution prevention . . . and air pollution control at its source is the primary responsibility of States and local governments[.]” 42 U.S.C. § 7401(a)(4). In the context of source determination analysis, DAQ has discretion to determine “what information supports a conclusion that pollutant-emitting activities are ‘close’ or ‘near’ enough to be ‘adjacent.’”⁶⁹

Align relies exclusively on EPA’s interpretation of “adjacent”—which has changed multiple times in the last decade—to assert that DAQ must take a narrow approach to this analysis.⁷⁰ Specifically, Align alleges that DAQ may not include “functional interrelatedness” in its consideration of whether the hog operations and Upgrading Facility are sufficiently close or near enough to be adjacent.⁷¹

But the CAA allows states to adopt “more stringent, or at least as stringent” definitions of the terms used by EPA. *See* 40 C.F.R. § 51.165(a)(1). As explained by the court in *Citizens for Pennsylvania’s Future v. Ultra Resources, Inc.*,

Consideration of interdependence in certain circumstances enlarges the definition of a “facility”, requiring that the NNSR meet a more stringent requirement in order to avoid being found to be a “major” source, since an inquiry into the interdependence of two or more emitting facilities may result in the aggregation of more emission sources than would be aggregated if the inquiry were limited solely to physical or geographic adjacency. This application also serves to promote the CAA’s goals of encouraging and assisting States in curtailing air pollution and assuring better air quality.

⁶⁹ Memorandum from Anne L. Idsal, Acting Assistant Administrator, to Regional Administrators, Regions 1-10 at 9 (Nov. 11, 2019) https://www.epa.gov/sites/production/files/2019-12/documents/adjacent_guidance.pdf [hereinafter *Adjacency Memorandum*].

⁷⁰ *See* Align Response to July 13 Request, *supra* note **Error! Bookmark not defined.**, at 2-3.

⁷¹ *Id.*

2015 WL 769757, *12 (M.D. Pa. Feb. 24, 2015). Because of the Grady Road Project’s unique and novel nature, and the particular challenges and risks associated with generating biogas from swine waste, DAQ should consider functional interrelatedness in its adjacency inquiry.

2. *The unique, novel nature of the Grady Road Project justifies DAQ exercising its discretion in making an adjacency determination*

Align describes the Grady Road Project as a “unique hub and spoke business model [that] facilitates the creation of a large-scale Alternative Gas project that is unlike any other”⁷²

Recognizing this, Align acknowledges that none of the EPA guidance it cites regarding adjacency determinations is directly applicable to the Project.⁷³ Because of the Project’s unique, novel nature—and significant environmental impacts—DAQ would be reasonable in determining that the Upgrading Facility and 19 connected hog operations should be permitted as a single stationary source under the CAA.

The Grady Road Project’s reliance on industrial hog operations’ animal waste for biogas production places it in a distinct category from traditional oil and gas facilities. The biogas producing hog operations are large, covering multiple acres and housing up to 48,000 animals at a single operation.⁷⁴ The hog operations rely on even more acreage to land-apply liquid animal waste.⁷⁵ The sheer scale of these operations, combined with the necessity that they be located at a distance from one another,⁷⁶ makes it difficult for them to be located alongside one another or the Upgrading Facility.

Even EPA’s guidance—which does not control here—acknowledges that adjacent properties do not need to be physically touching and may be “to some degree separated by a right

⁷² Align Application to NCUC, *supra* note 22, at 5.

⁷³ Align Response to July 13 Request, *supra* note 22, at 3

⁷⁴ *See infra* at p. 44, tbl 1.

⁷⁵ *See* N.C. Gen. Stat. 143-215.10C.

⁷⁶ *See* N.C. Gen. Stat. 106-803(a)(3) (prohibiting a swine house or lagoon from being within 500 feet of another property boundary).

of way or other type of similarly intervening property.”⁷⁷ The components of the Grady Road Project are “in reasonable proximity to one another” because, simply put, it is not possible, physically or legally, for the hog facilities to be located closer to one another or the Grady Road Facility. Given this limitation, unique to the swine-waste derived biogas industry, DAQ should find that the Grady Road Project satisfies the adjacency prong of the source aggregation test.

3. *The Grady Road Project fits the “common sense notion of a plant”*

Finally, the Grady Road Project fits the “common sense notion of a plant.” As explained by EPA,

The guiding principle behind how near properties need to be in order to be considered adjacent is “the common sense notion of a plant,” which involves a fact-specific analysis of the pollutant-emitting activities that comprise or support the primary product or activity of the operations.⁷⁸

As discussed above, a plant processing this volume of swine-waste derived biogas could only ever be configured with hog operations located within a reasonable distance from one another. The facts here weigh in favor of finding that the components of the Grady Road Project are adjacent to one another.

Furthermore, EPA regulations explicitly provide that a stationary source may be a “building, structure, facility, or *installation*.” 40 C.F.R. § 52.21 (emphasis added). The Cambridge English Dictionary defines an installation as “a place where there are buildings and equipment that have a particular, especially military, purpose.”⁷⁹ Here, all the buildings and equipment comprising the Grady Road Project all share the common purpose of generating and processing swine-derived biogas.

⁷⁷ Adjacency Memorandum, *supra* note 69, at 7.

⁷⁸ Meadowbrook Letter, *supra* note 11, at 4.

⁷⁹ *Installation*, Cambridge English Dictionary, <https://dictionary.cambridge.org/us/dictionary/english/installation> (last visited Nov. 19, 2020).

Finally, Align’s exaggerated claim that permitting the Grady Road Project as single source would allow “facilities hundreds of miles apart to be considered ‘adjacent’” is simply untrue.⁸⁰ As EPA has repeatedly stressed, source determinations are a “fact-specific” analysis.⁸¹ Concluding that the Grady Road Project constitutes a single source would not have any of the far reaching impacts Align predicts. In fact, making a single source determination for this Project would help “ensure that . . . sources do not take advantage of this flexibility to circumvent major source requirements,”⁸² and “serve[] to promote the CAA’s goals of encouraging and assisting States in curtailing air pollution and assuring better air quality.” *Citizens for Pennsylvania’s Future*, 2015 WL 769757 at *12.

* * *

In sum, DAQ may reasonably determine that the Upgrading Facility and the 19 connected biogas supplying hog operations should be permitted as a single source. All components of the Grady Road Project are controlled by persons under common control by Smithfield; the 19 connected hog operations are support facilities to the Facility; and the Facility and the hog operations are adjacent. More fundamentally, issuing a single source determination for these entities will ensure that the new emissions generated by the Grady Road Project are properly controlled and the people and environment of North Carolina are adequately protected. If DAQ considers the Upgrading Facility and 19 connected hog operations as stationary source, DAQ must recalculate PTE for SO₂, as well as any other criteria pollutant or hazardous air pollutant, for purposes of Title V and PSD applicability, major source determinations under the National Emission Standards for Hazardous Air Pollutants (NESHAP), and must also redo the air dispersion modeling to ensure compliance with all relevant NAAQS.

⁸⁰ See Align Response to July 13 Request, *supra* note 22 at 3.

⁸¹ Meadowbrook Letter, *supra* note 11, at 4.

⁸² Ameresco Determination, *supra* note 26, at 8.

IV. DAQ Reliance on Align’s Unsupported Assertions Regarding Flow and SO2 Emissions is Arbitrary and Capricious

Under Title V of the Clean Air Act, a stationary source is considered a major source if it emits or has the potential to emit (“PTE”) 100 tons per year (“tpy”) or more of any regulated pollutant. 40 C.F.R. § 70.2; *see* 15A N.C. Admin. Code 2Q .0103(22). As explained in SELC’s comments on the Draft Permit, DAQ’s reliance on unsupported assumptions made by Align in its application materials resulted in the Draft Permit underestimating the Grady Road Facility’s SO2 emissions.⁸³ This problem persists in the Updated Permit. DAQ’s arbitrary reliance on Align’s unsupported representations regarding the flow of biogas, the concentration of H2S and other sulfur compounds in that biogas, and the resulting SO2; the lack of enforceable conditions for flow and H2S concentration; and the confusing and inconsistent requirements for monitoring and recordkeeping render the Updated Permit unlawful as drafted.

Align has provided no information to DAQ explaining why and how only a maximum 1,200 standard cubic feet per minute (“scfm”) of biogas with a maximum 3,500 parts per million (“ppm”) of H2S will enter the Upgrading Facility at any time. Align must have a basis for asserting this estimated flow rate and concentration of H2S; these numbers do not come out of thin air. Moreover, Align provides scant information about the conditions under which flares at the 19 connected hog operations will be used. Align must disclose these details to DAQ so that the Division can properly determine whether permitting the Upgrading Facility can be done in a manner that protects air quality and public health.

In addition to demanding Align’s justification for its assumptions regarding flow and H2S concentrations, to bring the Updated Permit into compliance with the CAA and North Carolina law, DAQ must revise it to:

⁸³ *See* SELC June Comments, *supra* note 7, at 27-30.

- 1) include an enforceable condition limiting the incoming biogas flow rate to a maximum of 1,200 scfm;
- 2) include an enforceable condition limiting H₂S concentrations to a maximum of 3,500 ppm;
- 3) include maximum annual hourly limits of 360 and 240 for Scenario 2 (off-specification production) and 3 (bypass), respectively;
- 4) support the quantities of non-H₂S sulfur compounds in the feed gas and in the tail gas; and
- 5) support and account for an accurate capture efficiency rate for the iron sponge system.

As discussed further below, DAQ must also include robust and monitoring, recordkeeping, and reporting requirements to ensure that these limits are enforceable. Without such limits, DAQ must recalculate (1) the facility's PTE for SO₂ based on the worst-case scenarios relating to biogas flow, tail gas flow, H₂S concentrations in feed biogas, H₂S concentrations in tail gas flow, operating scenarios; (2) the presence of other sulfur compounds in the feed biogas and tail gas; (3) the control efficiencies in the iron sponge system—CD-1 and CD-2—for H₂S and non-H₂S compounds; and (4) SO₂ emissions that may result from overlapping change-out periods at CD-1 and CD-2. Properly accounted, the PTE for SO₂ may exceed the Title V major-source threshold of 100 tons per year, regardless of DAQ's determination about source aggregation.⁸⁴ DAQ must also conduct new modelling to reevaluate whether permitting the Grady Road Project will cause or contribute to an exceedance of the NAAQS for SO₂.

A. DAQ arbitrarily relies on Align's claim that the 19 hog operations will produce no more than 1,200 scfm of biogas

DAQ continues to arbitrarily rely on Align's unsubstantiated statement that the maximum feed biogas from the 19 connected hog operations supplying the Upgrading Facility will not exceed 1,200 scfm. This claim is not supported by any analysis of the hog operations' biogas

⁸⁴ See EPA, *Draft New Source Review Workshop Manual*, at A19 (Oct. 1990) (discussing "methods for determining potential to emit").

production potential. Since it is possible that the flow of biogas produced by the hog operations can exceed 1,200 scfm and since little is known about storage of such biogas at the individual facilities or the constraints on venting and/or flaring biogas at the facilities, DAQ must recalculate PTE to account for the maximum possible flow from the combined hog operations. Moreover, Align has failed to acknowledge the potential that combined the 19 hog operations, which it has yet to identify for DAQ, would produce biogas in excess of 1,200 scfm, and provided no evidence to support its contention that the 19 connected hog operations could not cumulatively produce more than 1,200 scfm of biogas. DAQ must consider the likelihood that the excess biogas would be vented or flared (at either the hog operations or the Upgrading Facility), leading to more unaccounted for air emissions.

1. *Align's claim that hog operations will provide no more than 1,200 scfm of biogas to the Upgrading Facility is unsubstantiated*

DAQ calculated the Upgrading Facility's PTE for SO₂ based on a maximum biogas flow rate of 1,200 scfm.⁸⁵ But neither DAQ nor Align has supported the critical assumption that the flow of biogas from the 19 hog operations will not exceed this threshold at any time.⁸⁶ Indeed, substantial evidence suggests otherwise. As explained in SELC's earlier comments, the amount of biogas produced by an anaerobic digester is highly variable and depends on numerous factors⁸⁷ including number, weight and age distribution of the hogs; the hogs' diets; the lagoon

⁸⁵ N.C. Dep't of Env'tl Quality, Div. of Air Quality, Draft Application Review, 8-9 (Sept. 17, 2020) [hereinafter "Updated Draft Permit Review"].

⁸⁶ While Align states that the PSA system is designed to process a maximum of 1,200 scfm of biogas there is nothing preventing more than 1,200 scfm from exiting the pipeline and *entering* the Upgrading Facility. Any excess gas would then be sent directly to the candlestick flare, increasing SO₂ emissions from the Upgrading Facility.

⁸⁷ SELC June 2020 Comments, *supra* note 7, at 29; Faith Tufaner & Yavuz Demirci, *Prediction of Biogas Production Rate from Anaerobic Hybrid Reactor by Artificial Neural Network and Nonlinear Regressions Models*, CLEAN TECH. & ENVTL. POL'Y 22, 713–24 (Jan. 2020) (analyzing reactor fill ratio, pH, alkalinity, organic loading rate, effluent chemical oxygen demand, effluent total suspended solids, and effluent suspended solids and effluent volatile suspended solids)

volume and size; the types of bacteria in the lagoon; pH; temperature; volatile solids loading; type of flush system; and other factors.⁸⁸

Align has not identified the 19 hog operations or disclosed each operation's expected biogas output, much less produced evidence that biogas production across all the operations will never exceed 1,200 scfm flow rate to the Upgrading Facility, even accounting for storage, venting, and flaring. Align conceded in its filings with the N.C. Utilities Commission that capping hog lagoons may result in "*variations or similarities in daily gas quantity* from similar digesters with identical feedstocks, and *variations of similarities in gas constituent concentrations* from . . . supplying methane to the gas Upgrading Facility."⁸⁹ In light of evidence demonstrating extreme variability in biogas production, it would be arbitrary and capricious for DAQ to issue a permit without a demonstration from Align that the raw biogas from the 19 hog operation cannot exceed a combined flow of 1,200 scfm to the Upgrading Facility. Specifically, DAQ must require Align to actually demonstrate—not just declare—that the cumulative flow from all of the hog operations will not exceed the flow rate used to calculate the Upgrading Facility's PTE. Align claims that the biogas gathering equipment is "sized to accommodate the biogas production potential of the farms"⁹⁰ and it defies logic that the company would size the facility for a given flow rate without data to support such a design. As such, providing information about each hog operation's biogas production potential to DAQ and the public should not be difficult.

⁸⁸ Tufaner & Demirci, *supra* note 87 at 713-24; N.C. Cooperative Extension Serv., Biogas anaerobic digester considerations for swine farms in North Carolina, 3 tbl. 9 (2008) <https://digital.ncdcr.gov/digital/collection/p249901coll22/id/20788> (showing significant variation in biogas production and methane content of biogas based on type of farm, animal weight, type of flush system, digester volume and size, hydraulic retention rate, loading rate, and type of digester).

⁸⁹ Align Application to NCUC, *supra* note 33, at 5.

⁹⁰ Align Response to July 2 Request, *supra* note 23, at 2.

Based on an analysis of information obtained through Freedom of Information Act requests and public information available on DEQ's website, SELC has developed a list of industrial hog operations that are likely to be connected to the Grady Road Project (Table 1). This analysis suggests the combined estimated biogas production across the 19 hog operations may vary considerably given the variability in the size of the operations and number and size of lagoons at each facility. As illustrated in the table below, the number of lagoons at each operation ranges from one to seven, and the number of animals at each facility varies greatly from 4,200 to 48,520 hogs. Align has yet to disclose to DEQ which operations are involved in the Grady Road Project, much less how many and which lagoons it plans to cap at each operation. These factors have a bearing on how much biogas is produced at each of the 19 connected hog operations.

Table 1. Industrial Hog Operations Likely Connected to the Grady Road Project⁹¹

Facility Name	Number of Hogs	Number of Lagoons
DM Farms Sec 2 Sites 1-4	31680	4
DM Farms Sec 3 Sites 1-3, Wendy 3-8	24846	7
Magnolia III, DM Section 4 Sites 1-4, Section 3 Sites 4-5	4400	7
Magnolia III, DM Section 4 Sites 1-4, Section 3 Sites 4-5	48520	7
Magnolia III, DM Section 4 Sites 1-4, Section 3 Sites 4-5	400	7
DM Farms Sec 1 Site 1 & Sec 2 Site 5	15840	2
DM Farms Sec 2 Sites 1-4	31680	4
Waters Farm 1-5 M&M Rivenbark	12308	2
Ronald Ezzell Farm #1-8	5760	3
Brice/Usher	17136	4
Reginald Kenan Farm	7344	1
Kilpatrick Farm 1, 2, 4 & 5 & Merritt Farm	18419	3
Pork Plus	4200	1
Bull Run	6000	1
Perry Smith Farm	5760	1
Magnolia 4 , Melville I & II, DELL, DM Section 1 Site 4	26280	6
Whitehorse Farms Inc.	7344	2
WCW Farms	4896	2
Farm 2701, 2102 & 2105	12598	3
Farm 2037 and 2038	20992	3
Pack's Pride	6260	2
D.M. Batts #1 - 5	18560	6
H&C Farm	7040	1

DAQ must therefore revise the Updated Draft to include an enforceable condition limiting the incoming biogas flow rate to 1,200 scfm. Unless there is an enforceable limit and evidence supporting the assumption that the combined biogas feed from 19 operations cannot exceed 1,200 scfm to the Upgrading Facility, DAQ must calculate PTE based on the maximum

⁹¹ This list and the map attached as Exhibit 6 were generated based on public documents produced from the U.S. Army Corps of Engineers in response to a Freedom of Information Act request and DEQ's publicly available list of permitted animal operations. Attached as Exhibit 6 is a map of the estimated route of the pipeline and the location of the hog operations likely connected with the Grady Road Project. See List of Permitted Animal Facilities – 4 -1-2020, N.C. DIV. WATER RES. <https://deq.nc.gov/about/divisions/water-resources/water-resources-permits/wastewater-branch/animal-feeding-operation-permits/animal-facility-map>.

possible flow rate. As discussed in more detail below, DAQ must require adequate monitoring to verify this critical assumption.

2. *Align has not accounted for flaring or venting of excess biogas*

As discussed in the previous section, Align’s claim that “there will be no excess gas” beyond the assumed biogas flow of 1,200 scfm lacks any support.⁹² Given the variability in output from anaerobic digesters, it is possible, and indeed likely, that flaring or venting will occur on site at the hog operations or else at the Upgrading Facility itself. Even if the PSA system is designed to process a maximum of 1,200 scfm, more than 1,200 scfm can enter the Upgrading Facility and be diverted to the candlestick flare as excess, increasing SO₂ emissions from the Upgrading Facility.⁹³ The candlestick flare, therefore, acts as a safety release valve for the entire system.

Align downplays the presence of flares at each hog operation, but the fact remains: the Grady Road Project includes 19 on-site flares at the connected hog operations. Align tacitly admits use of this equipment when it states that no flaring or venting will occur “[d]uring normal operations.”⁹⁴ The Updated Draft includes no information about the design basis for these flares, how those flares will operate, when they will operate, or how they impact air quality. Moreover, even if flaring does not occur, Align’s unsupported claim that the Upgrading Facility’s equipment is limited to accepting 1,200 scfm of biogas means venting of excess biogas may occur because of the potential for the 19 hog operations to produce a far greater flow of biogas.⁹⁵ Thus, emissions caused by venting (methane and other pollutants present in the raw biogas) and

⁹² Align Response to July 2 Request, *supra* note 23, at 2; *see supra* Part IV.A.1.

⁹³ There is nothing in the permitting record demonstrating that the Grady Road Project is somehow designed to restrict the amount of biogas that can travel to and enter the Upgrading Facility, regardless of how much biogas the subsequent equipment at the Upgrading Facility can process.

⁹⁴ Align Response to July 2 Request, *supra* note 23, at 2.

⁹⁵ *See supra* Part IV.A.1.

flaring (SO₂ and other air toxics) must be modelled and accounted for in the Updated Draft conditions.⁹⁶

As discussed earlier in this section there is a real possibility that must be reflected in DAQ's PTE calculations that the amount of biogas being produced by the hog operations and sent to the Upgrading Facility will exceed 1,200 scfm. If, as Align claims, the PSA System at the Upgrading Facility cannot process more than 1,200 scfm of biogas, the excess biogas will have to be flared or vented. The flaring could occur at the Upgrading Facility through the candlestick flare or at the individual hog operations. Flaring at either location would create additional SO₂ emissions not contemplated by this permit. Conversely, if the Upgrading Facility can process more than 1,200 scfm of biogas, then more SO₂ and other sulfur compounds will be generated through the upgrading process. One way or another, the possibility that biogas flow will exceed 1,200 scfm must be accounted for in the PTE calculations.

B. The record does not support a capture efficiency of 77.7% for the iron sponge system

The iron sponge system in CD-1 and CD-2 is the primary system Align will use to remove H₂S from a portion of the tail gas from the PSA system before it is flared in the hybrid flare (CD-3). This system is therefore explicitly relied on by Align and DAQ in order to reduce the Upgrading Facility's potential emissions of SO₂ to below the Title V major-source threshold of 100 tons per year. The capture efficiency of the iron sponge system is the fraction of tail gas treated in CD-1/CD-2 divided by the total tail gas generated in the PSA system, and the control efficiencies at CD-1 and CD-2 determine the amount of H₂S removed from the tail gas that is then flared at CD-3. The higher the capture efficiency and/or higher the control efficiency at CD-

⁹⁶ Align has also failed to provide data about emissions caused by the dehydrating and compressing of biogas that takes place on each connected hog operation using Align's equipment. *See* Align Response to July 13 Request, *supra* note 22, at 6.

1 and CD-2, the lower the SO₂ emissions from the Upgrading Facility. The basis of the capture efficiency must be supported by vendor specifications and guarantees. As discussed in more detail below, the vendor guarantees and specifications do not support the stated capture efficiency..

The concentration of H₂S in the incoming biogas, the flow of the biogas into the PSA system, the flow of tail gas exiting the PSA system, the flow of tail gas entering the CD-1/CD-2 iron sponge system for treatment, and the concentration of the H₂S of the tail gas leaving the iron sponge all impact the capture efficiency. Align asserts that the capture efficiency of the iron sponge system is 77.7 percent, which amounts to an H₂S rate of 5.54 lb/hour and an SO₂ emissions rate of 45.6 tons/year of SO₂.⁹⁷ The record does not support the reliance on such a high capture efficiency, and thus the estimated PTE for SO₂ may be significantly underestimated.

DAQ must assess the assumptions underlying the stated capture efficiency for the iron sponge system, including the vendor's recommendations for the maximum quantities of tail gas that can be treated in each of CD-1 and CD-2 and the impact of Align's new suggestion that both CD-1 and CD-2 will be used simultaneously rather than one at a time. Since the CD-1 and CD-2 vessels will be utilized simultaneously, tail gas will be bypassed when one or both media must be changed out. DAQ must account for this additional bypass when calculating SO₂ emissions. DAQ must verify that Align's vendor for the iron sponge system approves of Align's proposed use of CD-1 and CD-2. In addition, DAQ must re-calculate the PTE SO₂ to accurately reflect the approved use of CD-1 and CD-2, accounting for any increases in bypass during change out.

⁹⁷ Updated Draft Permit Review, *supra* note 85, at 9.

1. *The stated capture efficiency of the iron sponge system changed dramatically between Align’s December 2019 application and February 2020 response to DAQ*

In its original application to DAQ in December 2019, Align calculated the capture efficiency for the iron sponge system to be 57.4 percent.⁹⁸ This amounted to a H2S emissions rate of 10.34 lb/hour to the hybrid flare and an overall SO2 emissions rate of 83.5 tpy.⁹⁹ Align stated that the H2S concentration in the tail gas entering the iron sponge system would be 9,500 ppm, that the H2S concentration in the treated tail gas leaving the iron sponge vessels would be less than 100 ppm, and that the H2S concentration of the combined gas streams headed to the hybrid flare would be 4,100 ppm.¹⁰⁰ Align also estimated that 1,200 scfm of biogas would be processed in the PSA system, with 444 scfm of tail gas being produced.¹⁰¹ According to Align, approximately 225 scfm of tail gas would be treated in one vessel of the iron sponge system at a time, while 189 scfm would be bypassed.¹⁰² This results in a capture efficiency of 57.4 percent (255 scfm tail gas being treated by either CD-1 or CD-2 divided by 444 scfm total tail gas). At this capture efficiency, Align calculated the facility-wide PTE for SO2 at 88.8 tpy.¹⁰³

Just a few months later in its February 2020 response to DAQ’s request for additional information, Align re-calculated the capture efficiency for the iron sponge system to be 77.7 percent.¹⁰⁴ This increased capture efficiency reduced the rate of H2S emissions from the iron sponge system down to 5.54 lb/hour and the SO2 emissions rate to 45.60 tons/year.¹⁰⁵ While Align still assumed that the H2S concentration of the tail gas entering the iron sponge system

⁹⁸ New Source Permit Application Align RNG, LLC-B.F. Grady Road Project, App. B at 7 (Dec. 5, 2019) [hereinafter “December 2019 Application to DAQ”].

⁹⁹ *Id.* at 20.

¹⁰⁰ *Id.* at 12.

¹⁰¹ *Id.* at 15.

¹⁰² *Id.*

¹⁰³ *Id.* at 20.

¹⁰⁴ Response to January 17, 2020 Additional Information Request Align RNG, LLC-B.F. Grady Road Facility ID# 3100179, App. B at 7 (Feb. 26, 2020) [hereinafter “Align Response to January Request”].

¹⁰⁵ Updated Draft Permit Review, *supra* note 85, at 9.

would remain 9,500 ppm, the combined gas stream headed to the enclosed flare would have an overall H₂S concentration of 2,200 ppm due to the higher assumed capture efficiency.¹⁰⁶ Although Align still assumes that 444 scfm of tail gas would be produced from the PSA system, in its updated calculations Align assumed a much higher amount of tail gas—345 scfm—would be directed to CD-1/CD-2 for treatment.¹⁰⁷ According to Align’s new statements, the design capacity for CD-1 and CD-2 each is 300 scfm,¹⁰⁸ meaning that Align must use CD-1 and CD-2 simultaneously, with no redundancy, as initially proposed by Align and its vendor. These assumptions result in a new capture efficiency of 77.7 percent (345 scfm tail gas being treated by CD-1 *and* CD-2, divided by 444 scfm total tail gas). At this new capture efficiency, Align calculates that its facility-wide PTE for SO₂ is 50.08 tpy.¹⁰⁹

2. *Align’s proposed use of the iron sponge system does not conform to the vendor’s stated recommendations*

In its original October 2019 application to DAQ, Align explains that “only one media vessel will be employed at a time,” meaning that a portion of the tail gas is routed from the PSA to the iron sponge system and will go through either the CD-1 vessel *or* the CD-2 vessel for treatment before it is routed to the enclosed CD-3 flare.¹¹⁰ Once the operating vessel is spent, the spent vessel is manually turned off and tail gas is routed to the other vessel.¹¹¹ The schematics illustrating the GUS system confirm that tail gas moves through either CD-1 or CD-2, but not

¹⁰⁶ Align Response to January Request, *supra* note 104, at 12.

¹⁰⁷ *Id.* at 18.

¹⁰⁸ *Id.* at App. C at 2.

¹⁰⁹ *Id.* at 17.

¹¹⁰ BF Grady Road Air Quality Permit Application, 5 (Oct. 2 2019) [hereinafter “October 2019 Application to DAQ”].

¹¹¹ *Id.*

both simultaneously.¹¹² Align goes on to describe that changing out a vessel takes a full day of work, and vessels must be changed out every 45 days.¹¹³

In its December 2019 updated application to DAQ, Align provided that the vendor assumed that each CD-1 and CD-2 treat a flow rate of 240 scfm of tail gas,¹¹⁴ and that the vendor verified “that the vessels are sized to treat higher flow rates.”¹¹⁵ According to Align, this “higher flow rate” is 255 scfm.¹¹⁶ Align does not provide any documents from the vendor to support any flow rate higher than 240 scfm. Also missing from the record are any recommendations from the vendor regarding amendments to change out procedures needed for each CD-1 and CD-2. Align does not provide documentation of the vendor’s analysis of the impact of the higher 255 scfm flow rate through each vessel on the assumed control efficiency of H₂S through each vessel. H₂S is removed in each vessel by the iron impregnated wood chips. That removal process depends on the transfer of H₂S from the tail gas to the surface of the wood chips. This process, and therefore the removal or control efficiency, depends on the velocity, and therefore flow rate, of the tail gas through the vessel.

In its February 2020 response to DAQ’s request for information, Align states that “[o]ne vessel may operate at a time *or both vessels may be operated simultaneously* depending on the total tail gas flow rate.”¹¹⁷ In addition—and without explanation—Align asserted that the design

¹¹² December 2019 Application to DAQ, *supra* note 98, App. C at 8 (indicating that tail gas is split between CD-1 and CD-2, but does not enter both simultaneously). DAQ shared the same schematic indicating use of one vessel at a time during the November 16, 2020 public hearing. *See* Exhibit 7.

¹¹³ October 2019 Application to DAQ, *supra* note 110, at 5.

¹¹⁴ December 2019 Application to DAQ, *supra* note 98, at 12.

¹¹⁵ *Id.*

¹¹⁶ *Id.* at App. C at 2.

¹¹⁷ Align Response to January Request, *supra* note 104, at 11 (emphasis added).

capacity for the individual vessels of the iron sponge system is now 300 scfm.¹¹⁸ According to Align, the vessels will now be utilized simultaneously to treat a total of 345 scfm of the tail gas.

Not only does Align propose to use both vessels of the system at once, it also substantially increases the amount of tail gas routed to each of the individual vessels of the system from 240 scfm to 300 scfm. Both of these proposals conflict with Align's statements about the vendor's original recommendations. This increased flow rate will adversely affect the removal efficiency of H₂S in each vessel. Align and DAQ assume without justification that the removal efficiency will stay consistent while the flow rate changes from 240 scfm to 255 scfm and now 300 scfm. Align's application and supplemental materials do not justify the increased flow rate assumed or the simultaneous use of both CD-1 and CD-2. Without more information regarding the vendor's recommendations for flow through the iron sponge system, its impact on removal efficiency, and the impact on emissions from the simultaneous use of CD-1 and CD-2, DAQ cannot assume a 77.7 percent capture efficiency. Given these dramatic changes, which are not supported by or backed by vendor recommendations, DAQ cannot merely take Align's word for it that such changes are without emissions consequence. DAQ must request documentation supporting these assumptions, including vendor guarantees and specifications, independently review and verify those documents and re-assess the SO₂ PTE from the iron sponge system.

3. *Align does not account for bypass during change out of CD-1 and/or CD-2*

As noted above, the vendor recommends changing out CD-1 and CD-2 every 45 days and that this maintenance takes one full day with four to five workers when CD-1 and CD-2 are used one at a time and for a flow of 240 scfm for each vessel.¹¹⁹ If both CD-1 and CD-2 are in use simultaneously and with a flow rate exceeding 240 scfm, it is inevitable that one vessel is down

¹¹⁸ *Id.* App. C at 2.

¹¹⁹ Align's October 2019 Application to DAQ, *supra* note 110, at 5-6.

for maintenance for some period of time every 45 days (or more frequently given the increased flow), which would in turn increase the flow of tail gas to CD3, the enclosed flare, during change out. It is also inevitable that both vessels are down for some period of time since both vessels are required to handle the total flow of 345 scfm of tail gas and the capacity for each vessel is less than 345 scfm. This would, in turn, increase the flow of total bypass of untreated tail gas to the CD-3 flare during such simultaneous change outs and maintenance. DAQ's PTE calculations do not account for this completely different change out and maintenance regimen or the reduced capture efficiency, and the resulting impact on SO₂ emissions. To accurately account for increased SO₂ emissions during change out, DAQ must recalculate PTE for the CD3 enclosed flare and the Upgrading Facility.

* * *

For all of the reasons discussed above, it would be arbitrary for DAQ to accept Align's unsupported assumptions that the iron sponge system's capture efficiency is 77.7 percent. DAQ must request from Align the underlying data, including vendor guarantees, which support this capture efficiency as well as the proposed simultaneous use of the CD-1 and CD-2 vessels. DAQ must address the following:

- The basis for Align's assumption that each vessel can handle 300 scfm of tail gas with 9,500 ppm H₂S as compared to the vendor's assumption of 240 scfm, and the impact of flow rates higher than 240 scfm on the assumed H₂S removal efficiency through each vessel;
- How a 345 scfm flow rate will be split between the CD-1 and CD-2 vessels;
- The ramifications of simultaneous operation of both vessels with regard to duration and frequency of change out and maintenance; and
- The number of additional annual hours in which untreated tail gas will be bypassed to the CD-3 flare as a result of the simultaneous operation of both vessels.

DAQ must re-evaluate the facility's PTE for SO₂ based on the information above. Also, appropriate permit conditions limiting bypass hours should also be included in the Updated Draft once the technical bases for such hours have been thoroughly assessed.

C. DAQ underestimates concentration of H₂S and other sulfur compounds in biogas

As is the case with the biogas flow rate, DAQ continues to arbitrarily rely on Align's unsupported assertions related to the concentrations of H₂S and other sulfur compounds in the biogas. Since sulfur compounds convert to SO₂ when flared, accurate gas composition data is essential to the PTE calculations for the Project. To date, however, Align has failed to provide full information about the sulfur compound composition of biogas produced by the 19 connected hog operations and processed at the Upgrading Facility. Without this critical information, issuing an air permit for the Facility would be arbitrary and capricious. We acknowledge that the amount of other sulfur compounds is less than the amount of H₂S in the biogas. Even so, the fact that PTE approaches the 100 tpy threshold means that that DAQ must fully justify the assumed 0.05 lb/hour SO₂ emissions contributions from all non-H₂S compounds.

1. *Align's claim that the maximum daily H₂S concentration is 3,500 ppm is unsubstantiated*

In its comments on the Draft Permit, SELC critiqued DAQ and Align's unsupported assumption that the maximum concentration of H₂S of the incoming biogas would be 3,500 ppm. SELC referenced data from other biogas projects indicating that H₂S concentrations regularly exceed this amount and can be as high as 5,000ppm based on the literature,¹²⁰ and explained that this discrepancy meant that the Upgrading Facility's SO₂ emissions had likely been underestimated on this basis alone.¹²¹ Align has provided no additional information

¹²⁰ SELC does not claim that 5,000 ppm H₂S is the maximum that can never be exceeded. H₂S concentrations in biogas that may be produced depend on many factors, none of which have been addressed by DAQ or Align.

¹²¹ SELC June 2020 Comments, *supra* note 7, at 30.

supporting its assumption that the H₂S concentration will not exceed 3,500 ppm, other than asserting (without evidence) that 3,500 ppm is a “conservative” estimate.¹²² DAQ’s unquestioning reliance on this unsupported claim is arbitrary and capricious.¹²³ Given that Align presumably knows which 19 hog operations will participate in the Grady Road Project, Align has to provide DAQ with more and comprehensive data regarding gas composition at individual operations and therefore in the combined feed gas to the Upgrading Facility.

DAQ must request this information from Align and use the specific data to calculate the facility’s PTE based on an accurate estimate of H₂S concentrations. In addition, DAQ must revise the Updated Permit to include an enforceable condition limiting H₂S concentrations in the biogas to 3,500 ppm, and include sufficient monitoring conditions to ensure that limit is not exceeded.

2. *Align’s claims that the biogas will only contain trace amounts of other sulfur compounds is unsupported*

In its comments on the Draft Permit, SELC argued that DAQ and Align had failed to appropriately account for other sulfur compounds present in the incoming biogas and, as a result, underestimated the Upgrading Facility’s potential SO₂ emissions. In the Updated Permit, DAQ purports to address this issue by adding in 0.05 lb/hour of other sulfur compounds in the SO₂ emissions calculation equation. But this number is based solely on Align’s assertion that the incoming biogas will only contain “trace” amounts of these other sulfur compounds.

Specifically, in response to DAQ’s request for additional information on this issue, Align produced a Major Component Gas Analysis (“Gas Analysis Report”) from a single winter day at

¹²² Align Response to July 2 Request, *supra* note 23, at 2. Notably, Align changed its assumption about the H₂S concentration of the incoming biogas from 3,000 to 3,500 ppm. *Compare* December 2019 Application to DAQ, *supra* note 98, App. G at 4 (indicating an assumption of 3,000 ppm of H₂S in June 2019 proposal to Guild PSA manufacturer) *with* December 2019 Application to DAQ, *supra* note 98, at 14 (assuming H₂S concentration of 3,500 ppm).

¹²³ *See* Updated Draft Permit Review, *supra* note 85, at 19.

an unknown anaerobic digester somewhere in North Carolina.¹²⁴ Relying on the Gas Analysis Report to establish the reasonableness of Align’s sulfur compound concentration assumptions and the Upgrading Facility’s PTE would be arbitrary and capricious for several reasons.

First, the Gas Analysis Report reflects the chemical composition of biogas on a single day—January 11th, 2018—when, as noted in SELC’s initial comments, emissions data collected from North Carolina hog operations demonstrates that sulfur compounds *are generated in much higher concentrations during the summer months*.¹²⁵ As illustrated in the table below, data generated on a single day in the dead of winter can in no way be representative of the concentration of sulfur compounds in biogas at all times and does not satisfy the CAA’s requirement that PTE be calculated based on the “worst case” scenario, which for sulfur compounds is likely to occur on hot summer days.¹²⁶

Table 5
Seasonal H₂S, DMS and DMDS lagoon fluxes and emissions, and the environmental parameters during canister sampling.

Season	Flux ($\mu\text{g m}^{-2} \text{min}^{-1}$)/Emission ($\text{g day}^{-1} \text{AU}^{-1}$)			Lagoon temperature ($^{\circ}\text{C}$)	Lagoon pH	Wind speed (m s^{-1})	Air temperature ($^{\circ}\text{C}$)
	H ₂ S ^a	DMS	DMDS				
Summer	3.81 ^b (3.24) ^c N = 705 ^d 0.11 ^e	0.26 (0.08) n = 10 ^f 0.0073	0.22 (0.04) n = 8 0.0063	27.0 (3.34) n = 10	7.33 (0.16) n = 5	2.23 (0.87) n = 10	26.7 (3.32) n = 10
Fall	1.17 (1.62) N = 646 0.033	0.11 (0.08) n = 10 0.0031	0.04 (0.01) n = 10 0.0011	23.3 (1.67) n = 10	7.63 (0.16) n = 10	3.07 (2.03) n = 10	25.5 (3.01) n = 10
Winter	0.08 (0.09) N = 631 0.0023	0.05 (0.04) n = 11 0.0014	0.02 (0.02) n = 11 0.00071	12.3 (2.50) n = 11	8.08 (0.11) n = 11	2.38 (0.77) n = 11	8.59 (1.23) n = 11
Spring	0.27 (1.71) N = 478 0.0081	0.06 (0.03) n = 10 0.0017	0.11 (0.03) n = 10 0.0033	19.6 (1.77) n = 10	8.03 (0.07) n = 10	4.37 (1.80) n = 10	18.3 (6.24) n = 10

^a H₂S flux data from Rumsey and Aneja (2014).

^b Mean flux value.

^c ± 1 standard deviation.

^d N represents the number of 15 min averaged data points.

^e Emission value.

^f n is the number of canister samples.

¹²⁴ Align Response to July 2 Request, *supra* note 23, at 2; *see also id.* attach. 1.

¹²⁵ SELC June 2020 Comments, *supra* note 7, at 31.

¹²⁶ Ian C. Rumsey et al., *Characterizing Reduced Sulfur Compounds Emissions From a Swine Concentrated Animal Feeding Operation*, 94 ATMOSPHERIC ENV'T 458, Table 5 (2014).

Moreover, Align has not provided any information about the operating conditions of the anaerobic digester the Gas Analysis Report analyzed, except that it is located in North Carolina and is “very similar” to the installations proposed for the Grady Road Project.¹²⁷ This statement is meaningless because, as Table 1 suggests, the Project connects 19 hog operations, which information obtained through public records requests indicates likely vary significantly in size, number of lagoons, and volume of lagoons, bacteria types as well as feed, size and age distribution of animals.¹²⁸

Because these factors can significantly affect the amount and makeup of biogas produced by anaerobic digester, Align’s assumptions that the operation analyzed by the Gas Analysis Report is “very similar” to such a wide range of operations does nothing to support its claims. Instead, this meaningless assertion drives home the point that Align has not accounted for well-documented fluctuations in the chemical composition of biogas in its permit application and responses, and the assumption that levels of other sulfur compounds will not exceed 0.05 lb/hour is not reasonable.

To properly account for the presence of other sulfur compounds and the impact those compounds have on the facility’s PTE, DAQ must request additional information from Align about the hog operation that was used for the Gas Analysis Report as well as information demonstrating why or how that Gas Analysis Report can possibly be representative of each of the 19 connected hog operations that will be connected to the Upgrading Facility.

3. *DAQ must include a permit condition limiting Align’s annual operations under Scenario 2 and 3.*

The Grady Road Project’s SO₂ emissions are directly impacted by the amount of time the Facility operates in Scenario 2 (off spec) and Scenario 3 (bypass) because both utilize the

¹²⁷ Align Response to July 2 Request, *supra* note 23, at 2.

¹²⁸ See Table 1, *supra* page 34.

candlestick flare to burn off excess gas. Align and DAQ calculate PTE based on an assumption that Scenario 2 operations will not exceed 360 hours/year and Scenario 3 operations will not exceed 240 hours/year. The Updated Draft, however, does not include any conditions limiting the number of hours under Scenario 2 and Scenario 3 operations. Should the Upgrading Facility operate more than 360 hours/year under Scenario 2 and 240 hours/year under Scenario 3, which is entirely plausible, more biogas will be flared and more SO₂ will be emitted. In order to restrict the Facility's PTE, DAQ must revise the Updated Draft to include an enforceable condition limiting Scenario 2 operations to 360 hours/year and Scenario 3 operations to 240 hours/year, along with sufficient monitoring, recordkeeping, and reporting requirements to ensure compliance with those operating limitations. Without such conditions, DAQ must recalculate Align's PTE for SO₂ assuming a maximum operation of each scenario.

V. DAQ's Updated Draft raises new concerning issues about air pollution

DAQ made several changes to the Updated Draft, some of which addressed the concerns raised in our June 2020 comments. The updated provisions in the Updated Draft, however, raise new concerns about monitoring, toxic air pollutants, and the Upgrading Facility's continued reliance on a candlestick flare.

A. The Clean Air Act requires robust, enforceable monitoring, recordkeeping, and reporting requirements to ensure compliance with the Clean Air Act

The uncontrolled PTE for SO₂ of the Upgrading Facility exceeds the 100 tpy Title V major-source threshold.¹²⁹ To reduce its PTE below the threshold, Align is proposing to install an iron sponge system to remove H₂S from the tail gas. Align has also made several assumptions relating to the Upgrading Facility's operating conditions, discussed in more detail above. The Clean Air Act requires robust monitoring, recordkeeping, and reporting requirements to make

¹²⁹ Updated Draft Permit Review, *supra* note 85, at 4.

permit conditions enforceable and ensure compliance with emission limits. Such conditions are especially important here because, as discussed above, Align has made several unsupported assumptions that directly impact the Facility's PTE.¹³⁰ Moreover, several relevant conditions such as the generation of raw biogas at the 19 connected hog operations, the feed rate of biogas to the Upgrading Facility, the H₂S concentrations in the biogas vary widely based on other factors.

Despite these uncertainties, DAQ only requires Align to do the following in the Updated Draft:

- monitor the concentration of H₂S once every 8 hours, Condition 6(c)(i)(B)(II);
- analyze biogas on quarterly basis to determine the hydrogen sulfide concentration, Condition 6(c)(i)(C);
- record the flow and H₂S concentration hourly for each operating scenario, Condition 6(d)(i); and
- record the concentration of H₂S sampled quarterly from the biogas, Condition 6(d)(ii).

DAQ also allows Align to request a modification of monitoring requirements if the facility is in compliance after 6 months of operation.¹³¹ Taken together, these provisions are insufficient to ensure continuing compliance with the Clean Air Act and Align's claim that it is a minor source of SO₂ emissions.

To ensure continuing compliance, especially in light of the fact that the Grady Road Project is a novel project with potentially wide-ranging environmental and public health harms, DAQ must require continuous monitoring of flows and H₂S concentrations at critical points within the Upgrading Facility. Specifically, DAQ should modify the Updated Permit to provide for continuous monitoring as laid out below (monitoring location: parameter):

¹³⁰ See *supra* Part IV.

¹³¹ Updated Draft Permit Review, *supra* note 85, at 17 (Condition 6(d)(iv)).

- Feed Gas – at the inlet to the Upgrading Facility (and upstream of the upgrading bypass valve to the candlestick flare): Flow (scfm) and H₂S concentration (ppm)
- Feed Gas – immediately upstream of the PSA system: Flow (scfm)
- Untreated Tail Gas – leaving the PSA system (scfm) , H₂S concentration (ppm)
- Untreated Tail Gas – entering CD-1: Flow (scfm)
- Untreated Tail Gas – entering CD-2: Flow (scfm)
- Treated Tail Gas – Downstream of CD-1/CD-2 and before it is combined with bypassed tail gas: H₂S concentration (ppm)

Align should also continuously monitor temperature measurements, as needed, to calculate scfms for the flows at the various locations listed above. In addition, DAQ should require a monthly complete gas analysis for all sulfur compounds (i.e., total sulfur) present in the incoming feed gas for a period of at least 2 years.

Finally, DAQ should remove the permit condition allowing Align to petition DAQ for less frequent monitoring. In addition, DAQ should clarify what it means by “consistent and stable” results and should require *at least* 2 years of such testing rather than only 6 months. Extending the duration of frequent monitoring would account for the variability of H₂S concentrations and flow rates, especially seasonal variations, as well as any changes to the Facility’s emissions during start-up.

B. The unenclosed flare should be converted to an enclosed flare

As noted in our comments on the Draft Permit, the original draft permit conditions almost exclusively focused on CD-3, the enclosed hybrid flare, and failed to include any enforceable permit conditions related to the CD-4 candlestick flare, including monitoring and recordkeeping requirements.¹³² SELC recommended adding recordkeeping and monitoring requirements for the

¹³² SELC June 2020 Comments, *supra* note 7, at 39

candlestick flare to ensure compliance with the SO₂ emissions limit of 2.3 lb/SO₂/MMBtu, or in the alternative, a design similar to the enclosed hybrid flare.¹³³

DAQ did not adopt either recommendation. In the Updated Draft, DAQ requires a heat sensing device to confirm the presence of a flame and requires Align to calculate the daily facility wide emissions rate of H₂S when the Upgrading Facility combusts biogas at the candlestick flare for more than 10 hours per day as part of the Toxic Air Pollutants condition.¹³⁴ However, DAQ did not include any monitoring or recordkeeping requirements specific to the candlestick flare to ensure compliance with the SO₂ emissions limit,¹³⁵ nor is it evident in the permitting documents that DAQ considered an alternative design. Because there is no feasible way to directly and safely monitor emissions from an elevated, open flare, such as the candlestick flare, in order to ensure that it is operated at a specific combustion efficiency (which depends on many factors, including temperature, air flow, and weather conditions), DAQ should require Align to redesign the candlestick flare as an enclosed flare instead, whose emissions can be monitored.

C. The DAQ should update its assumptions regarding the emissions of Toxic Air Pollutants (“TAPS”) and add enforceable provisions to the TAPS condition

DAQ properly included a new Toxic Air Pollutant Emissions Limitation Requirement as part of Condition 8 of the Updated Draft. Under current assumptions, the facility has the potential to emit 4.79 lb/day of H₂S if Scenario 3 (bypass conditions) is run for at most 10 hours/day, and assuming a 100% combustion efficiency of the candlestick flare.¹³⁶ This level of H₂S is just shy of the toxic air pollutant emissions limit for H₂S of 5.1 lb/day. *See* N.C. Admin.

¹³³ *Id.*

¹³⁴ *See* Updated Draft Permit Review, *supra* note 85, at 20 (Conditions 8(c) and 8(f)).

¹³⁵ *See id.* at 7 (showing that the actual emissions rate in scenario 3, bypass operations, is 44.08 lb/hr of SO₂, which is well below the SO₂ emissions limit of 103.5 lb/hr).

¹³⁶ *See* Updated Draft Permit Review, *supra* note 85, at 18, 19.

Code 2Q.0711(b). In fact, if Align operates at Scenario 3 for just over 10 hours in any given day, then the facility's H₂S emissions will reach this limit, triggering the toxic air pollutant permitting requirements. To ensure that the facility's H₂S emissions remain below the relevant emissions threshold, DAQ must include an enforceable condition in the permit limiting Align to a maximum of 10 hours per day of Scenario 3 operations.

In addition, because of the simultaneous use of CD-1 and CD-2 discussed above, more bypassed tail gas will be combusted at CD3.¹³⁷ This additional bypass is not accounted for in the current PTE calculation.

Additionally, DAQ should assume a maximum 60 percent rather than a 100 percent conversion rate for H₂S to SO₂ from the candlestick flare for the purposes of calculating toxic air pollutant emissions rates, and adjust Condition 8 as appropriate. The conversion rate or combustion efficiency of the candlestick flare is directly related to the temperature of the flare and the amount of oxygen mixing at the flare, and many other conditions; these factors are difficult to control and are not monitored under conditions in the Updated Draft. Using a maximum 60 percent conversion rate will account for the potential inefficiency of the candlestick flare in converting H₂S to SO₂.¹³⁸

A maximum 60 percent conversion rate, however, is only appropriate for calculating H₂S emissions for compliance with North Carolina's TAPs requirements. As noted above, DAQ is required to calculate PTE on a worst-case scenario. As it relates to SO₂, the worst case scenario assumes that all H₂S is converted to SO₂ through flaring. Here, however, in calculating H₂S emissions, DAQ should do the reverse and assume that H₂S is not completely converted to SO₂ at the candlestick flare. Using a maximum 60 percent conversion rate in this instance is more

¹³⁷ See *supra* Part IV(B)(2).

¹³⁸ See CFD Flare Modeling Update, SETPMTC Meeting, Lamar University (Aug. 23, 2012) (Exhibit 10).

protective of air quality. If DAQ would prefer not having to deal with the complexities involving an open flare design, it should require Align to redesign the candlestick flare to be an enclosed flare. An enclosed design would allow Align to monitor the flare's operating parameters to ensure and verify that a specific conversion rate is achieved.

VI. The proposed facility would exacerbate the lagoon and sprayfield system's adverse water quality impacts, which must be considered by DEQ before any permits are issued for the Grady Road Project

As discussed at length in SELC's comments on the Draft Permit, the primitive lagoon and sprayfield system for waste management utilized by all industrial hog operations that are a part of the Grady Road Project has substantial adverse impacts on the environment and public health.¹³⁹ The nutrient-laden animal waste seeps through lagoons and from sprayfields into groundwater and runs off fields into streams and rivers, causing a multitude of ecological issues, including harmful algal blooms; heavy metal accumulation in sediments and plant and animal tissue; and eutrophication and fish kills.¹⁴⁰ The lagoon and sprayfield system also negatively impacts human health. A 2018 study found increased death rates from several diseases, low birth weight, and higher rates of infant mortality among North Carolina communities located in close proximity to industrial hog operations.¹⁴¹ Duke University researchers noted that these impacts are not the result of multiple demographic, behavioral, or socioeconomic factors, but rather are "due to the additional impact of multiple industrial hog facilities located in this area."¹⁴² Additional studies have confirmed the prevalence of these serious health issues in residents

¹³⁹ SELC June 2020 Comments, *supra* note 7, at 9-11.

¹⁴⁰ *Id.* at 9-10 n. 33.

¹⁴¹ Julia Kravchenko et al., *Mortality and Health Outcomes in North Carolina Communities Located in Close Proximity to Hog Concentrated Animal Feeding Operations*, 79 N.C.MED. J. 278, 278 (2018) (Exhibit 8).

¹⁴² *Id.* at 286.

living near industrial hog operations.¹⁴³ In North Carolina these environmental and public health impacts disproportionately burden communities of color.¹⁴⁴ Native Americans, African Americans, and Latinx Americans are 2.18, 1.54, and 1.39 times more likely than whites to live within three miles of industrial hog operations, respectively.¹⁴⁵

The Grady Road Project will exacerbate these harms. As explained in SELC's previous comments, it is well established that covering lagoons for biogas production causes the nitrogen content of the liquid manure to increase significantly.¹⁴⁶ Liquid manure stored in covered lagoons generally has 2.5 times more nitrogen compared to manure slurry in an open lagoon.¹⁴⁷ This nitrogen-heavy waste is then sprayed onto crop fields, heightening the risk of over-application of nutrients. Overloading soil with nutrients such as nitrogen, or other hog waste constituents can cause or contribute to surface water and groundwater pollution and intensify the

¹⁴³ See SELC June 2020 Comments, *supra* note 7, at 10-11.

¹⁴⁴ Steve Wing et al., *Environmental Injustice in North Carolina's Hog Industry*, 108 ENVTL. HEALTH PERSP. 225, 225 (2000).

¹⁴⁵ Steve Wing, Jill Johnson, *Industrial Hog Operations in North Carolina Disproportionately Impact African-Americans, Hispanics and American Indians*, (Aug. 29, 2014) <https://www.ncpolicywatch.com/wp-content/uploads/2014/09/UNC-Report.pdf>.

¹⁴⁶ SELC June 2020 Comments, *supra* note 7, at 11-14. Curiously, during the November 16, 2020 public hearing regarding the Grady Road Project, Christine Lawson stated that the nitrogen content of the effluent did *not* increase. SELC can find no research supporting this assertion. To the contrary, it is well established that “[I]and application of digester effluent, compared with fresh manure, may have a higher risk for both ground and surface water quality problems. Compounds such as nitrogen, phosphorus, and other elements become more soluble due to anaerobic digestion and therefore have higher potential to move with water.” Natural Resources Conservation Service, Conservation Practice Standard – Anaerobic Digester, https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1254996.pdf; see also ROSE M. STENGLEIN ET AL., IMPERMEABLE COVERS FOR ODOR AND AIR POLLUTION MITIGATION IN ANIMAL AGRICULTURE: A TECHNICAL GUIDE, 7 (Apr. 2011) <https://lpeic.org/wp-content/uploads/2019/03/Impermeable-covers-FINAL.pdf> (explaining that trapping gas under lagoon covers further concentrates available nutrients within the lagoon effluent that gets sprayed onto fields).

¹⁴⁷ S.G. LUPIS, N. EMBERTSON & J.G. DAVIS, COLORADO STATE UNIVERSITY EXTENSION, BEST MANAGEMENT PRACTICES FOR REDUCING AMMONIA EMISSIONS, <https://extension.colostate.edu/topic-areas/agriculture/best-management-practices-for-reducing-ammonia-emissions-lagoon-covers-1-631b/>; N.C. Cooperative Extension Serv., *Biogas Anaerobic Digester Considerations for Swine Farms in North Carolina* at 5 <https://digital.ncdcr.gov/digital/collection/p249901coll22/id/20792> (“Overall, the nitrogen contained in effluent that is applied to land may be significantly increased in a covered lagoon or covered digester when ammonia loss is reduced.”).

environmental and public health issues discussed above. In addition, capping a lagoon may increase the downward pressure on the waste in the lagoon, increasing the likelihood of pollution from the lagoon leaching into groundwater resources.¹⁴⁸

North Carolina law requires hog operations to apply waste to fields at or below the agronomic rate. 15A N.C. Admin. Code 02T.0113(b)(3).¹⁴⁹ The agronomic rate is the rate at which “the amount of waste and other materials applied to soil to meet the nitrogen needs of the crop, but does not overload the soil with nutrients or other constituents that cause or contribute to a contravention of surface water or groundwater standards, limit crop growth, or adversely impact soil quality.”¹⁵⁰ Operators of industrial hog operations must develop and implement animal waste management plans that comply with the agronomic rate requirement; these plans provide details about the quantity of waste applied to cropland, the nutrient content of the waste, the acreage of the cropland to which waste is applied, and the cover crops on the land application sites, among other details. To comply with state law, individual hog operations that cap their lagoons must request permission from DEQ before making major modifications to a facility.¹⁵¹ In addition, individual hog operators must make substantial adjustments to the operation’s animal waste management plan to account for the increased amount of nitrogen in the land-applied liquid waste.¹⁵² These adjustments could include spreading the same amount of liquid manure over a larger amount of land or changing the cover crops on land application sites.

¹⁴⁸ D. Miller & R. Longest, *Reconciling Environmental Justice with Climate Change Mitigation: A Case Study of North Carolina Swine CAFOs*, 21 Vt. J. of Env’tl. L. 524 (2020) (Exhibit 9).

¹⁴⁹ See also North Carolina Env’tl. Mgmt. Comm’n Dept. of Env’tl. Quality, Swine Waste Management System General Permit, Condition II(4) [hereinafter “Swine General Permit”]. Swine General Permit Condition II(4).

¹⁵⁰ 15A N.C. Admin. Code 02T .0103(1)

¹⁵¹ Swine General Permit, *supra* note 149, Condition V(8).

¹⁵² *Id.* Condition I(4), V(8), VII; see also 15A N.C. Admin. Code 02T .0103(1), 15A N.C. Admin. Code 02T .1304(b).

Otherwise, these operations substantially increase the risk of over-application of nutrient-laden wastewater and the threat to surface and groundwater resources.

Without substantial changes to animal waste management plans at each of the connected hog operations that are part of the Grady Road Project, greenlighting the Project may cause hog operations to either over-apply animal waste in violation of state law or increase the amount of land they on which they spray with liquid manure, further expanding the footprint of the lagoon and sprayfield system and its negative environmental and public health impacts. To date, only 4 industrial hog operations involved in the Grady Road Project have submitted requests to DEQ for major modifications to install lagoon covers; DEQ has not approved any of these requests. According to the Division of Water Resources (“DWR”) staff, none of the operations involved in the Grady Road Project have submitted “major changes” or “amendments” to their animal waste management plans under the swine general permit to the Division.¹⁵³

This expansion of the lagoon and sprayfield system directly conflicts with Smithfield’s 20-year-old commitment to move away from reliance on this primitive technology and towards a modern waste management system that minimizes air, water, and public health impacts. DEQ should ensure that Smithfield at a minimum invests in a complete waste management system that substantially reduces or eliminates odors and water pollution, as required by the 2000 Smithfield Agreement.

VII. Conclusion

The Grady Road Project is the first of its kind in North Carolina. The Project would have far-reaching adverse effects on the rivers, streams, and the air we breathe and the health and

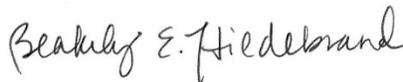
¹⁵³ See Swine General Permit, *supra* note 149, Condition I(4). During the November 16, 2020, public hearing on the Updated Permit, Christine Lawson confirmed that none of the operators for the 19 connected hog operations had submitted “major changes” or “amendments” to animal waste management plans to the Division of Water Resources.

well-being of neighbors and communities downstream. These impacts would be disproportionately borne by communities of color in Duplin and Sampson counties. DEQ must conduct a rigorous, comprehensive review of all components of this project; independently verify the information provided by Align; hold Smithfield and Dominion accountable for their pollution; consider the cumulative impacts of the Grady Road Project and the countless other pollution sources in the area; and uphold their obligation to protect the people and environment of North Carolina. In addition, DEQ must ensure that the permitting process is transparent, that the public has full information, and that the public has ample opportunity to provide input in all of decision-making processes for the Grady Road Project. As the Fourth Circuit Court of Appeals noted yesterday, “[i]t is past time to acknowledge the full harms that the unreformed practices of hog farming are inflicting” on communities and our environment. DEQ has the responsibility to prevent further harm from these practices, and the undersigned call on DEQ not to issue the Updated Draft for the Grady Road Project.

For all of the reasons state above, we oppose the Updated Draft as currently written, and respectfully request that DAQ adopt the recommendations outlined above. Please do not hesitate to reach out to Blakely Hildebrand (bhildebrand@selcnc.org or 919-967-1450) to discuss this matter further.

Thank you for your consideration of these comments.

Sincerely,



Blakely Hildebrand
Staff Attorney



Maia Hutt
Staff Attorney



Heather Hillaker
Staff Attorney



Sam Hicks
Associate

Submitted on behalf of:

Devon Hall, Sr., Executive Director
Rural Empowerment Association for Community Help

Sherri White-Williamson, Environmental Justice Policy Director
North Carolina Conservation Network

Naeema Muhammed, Organizing Director
North Carolina Environmental Justice Network

Kemp Burdette, Cape Fear Riverkeeper
Cape Fear River Watch

Will Hendrick, Senior Attorney
Waterkeeper Alliance

Joel Porter, Policy Manager
Clean Air Carolina

Erin Carey, Director of Coastal Programs
North Carolina Sierra Club

Jillian Howell, Pamlico-Tar Riverkeeper
Matthew Starr, Upper Neuse Riverkeeper
Katy Hunt, Lower Neuse Riverkeeper
Sound Rivers

Larry Baldwin, Waterkeeper
Crystal Coast Waterkeeper

Thomas Mattison, New Riverkeeper Emeritus
White Oak-New River Waterkeeper Alliance

Edgar Miller, Executive Director
Yadkin Riverkeeper

Jefferson Currie II, Lumber Riverkeeper
Cara Schildtknecht, Waccamaw Riverkeeper
Winyah Rivers Alliance

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Hannah Connor, Senior Attorney
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Natural Resources Defense Council

Jessica Culpepper, Food Project Director
Public Justice

Christine Ball-Blakely, Staff Attorney
Animal Legal Defense Fund

Tyler Lobdell, Staff Attorney
Food & Water Watch

CC:

Michael Regan, Secretary, N.C. Department of Environmental Quality

John Nicholson, Chief Deputy Secretary, N.C. Department of Environmental Quality

Sheila Holman, Assistant Secretary for the Environment, N.C. Department of Environmental
Quality

Sushma Masemore, Deputy Assistant Secretary for Environment and State Energy Director, N.C.
Department of Environmental Quality

Michael Abraczinskas, Director, Division of Air Quality

Michael Pjetraj, Deputy Director, Division of Air Quality

Danny Smith, Director, Division of Water Resources

Jeremy Tarr, Senior Advisor for Climate Change Policy, Office of the Governor

Exhibit 1

PUBLISHEDUNITED STATES COURT OF APPEALS
FOR THE FOURTH CIRCUIT

No. 19-1019

JOYCE MCKIVER; DELOIS LEWIS; DAPHNE MCKOY; ALEXANDRIA MCKOY; ANTONIO KEVIN MCKOY; ARCHIE WRIGHT, JR.; TAMMY LLOYD; DEBORAH JOHNSON; ETHEL DAVIS; PRISCILLA DUNHAM,

Plaintiffs - Appellees,

and

DENNIS MCKIVER, JR.; LAJUNE JESSUP; DON LLOYD, Administrator of the Estate of Fred Lloyd; TERESA LLOYD; TANECHIA LLOYD; CARL LEWIS; ANNETTE MCKIVER; KAREN MCKIVER; BRIONNA MCKIVER; EDWARD OWENS; DAISY LLOYD; A. (DAUGHTER); A. (SON),

Plaintiffs,

v.

MURPHY-BROWN, LLC, d/b/a Smithfield Hog Production Division,

Defendant – Appellant.

AMERICAN FARM BUREAU FEDERATION; NATIONAL PORK PRODUCERS COUNCIL; NORTH CAROLINA FARM BUREAU FEDERATION; NORTH CAROLINA PORK COUNCIL; NORTH AMERICAN MEAT INSTITUTE; NATIONAL ASSOCIATION OF MANUFACTURERS; GROCERY MANUFACTURERS ASSOCIATION; CHAMBER OF COMMERCE OF THE UNITED STATES OF AMERICA; NATIONAL TURKEY FEDERATION; NATIONAL CHICKEN COUNCIL; JOEY D. CARTER; JOEY CARTER FARMS; WILLIAM R. KINLAW; KINLAW FARMS, LLC; PAUL STANLEY; PAGLE CORP.; GREENWOOD LIVESTOCK, LLC,

Amici Supporting Appellant.

LAW PROFESSORS WITH EXPERTISE IN TORT AND REGULATORY LAW; AMERICAN ASSOCIATION FOR JUSTICE; NORTH CAROLINA JUSTICE CENTER; HUMANE SOCIETY OF THE UNITED STATES; PUBLIC JUSTICE, P.C.; FOOD & WATER WATCH; WATERKEEPER ALLIANCE, INC.; NORTH CAROLINA ENVIRONMENTAL JUSTICE NETWORK; RURAL EMPOWERMENT ASSOCIATION FOR COMMUNITY HELP; DR. LAWRENCE CAHOON; ELIZABETH CHRISTENSON; DR. BRETT DOHERTY; MIKE DOLAN FLISS; DR. JILL JOHNSTON; BOB MARTIN; DR. SARAH RHODES; DR. ANA MARIA RULE; DR. SACOBY WILSON; DR. COURTNEY WOODS,

Amici Supporting Appellee.

Appeal from the United States District Court for the Eastern District of North Carolina, at Wilmington. W. Earl Britt, Senior District Judge. (7:14-cv-00180-BR; 5:15-cv-00013.BR)

Argued: January 31, 2020

Decided: November 19, 2020

Before WILKINSON, AGEE and THACKER, Circuit Judges.

Affirmed in part, vacated and remanded in part by published opinion. Judge Thacker wrote the opinion, in which Judge Wilkinson concurred. Judge Wilkinson wrote a concurring opinion. Judge Agee wrote an opinion concurring in part and dissenting in part.

ARGUED: Stuart Alan Raphael, HUNTON ANDREW KURTH, LLP, Washington, D.C., for Appellant. Tillman J. Breckenridge, PIERCE BAINBRIDGE BECK PRICE & HECHT, LLP, Washington, D.C., for Appellee. **ON BRIEF:** Robert M. Tata, Washington, D.C., Trevor S. Cox, Kevin S. Elliker, David M. Parker, HUNTON ANDREWS KURTH LLP, Richmond, Virginia, for Appellant. Mona Lisa Wallace, John Hughes, WALLACE AND GRAHAM, P.A., Salisbury, North Carolina; Tanya Fridland, PIERCE BAINBRIDGE BECK PRICE & HECHT, LLP, Washington, D.C., for Appellees. Michael B. Kimberly, Washington, D.C., Timothy S. Bishop, Brett E. Legner, Jed Glickstein, Chicago, Illinois, Michael B. Kimberly, MAYER BROWN LLP, Washington, D.C.; Ellen Steen, Travis Cushman, AMERICAN FARM BUREAU FEDERATION, Washington, D.C.; Phillip Jacob Parker Jr., NORTH CAROLINA FARM

BUREAU FEDERATION, Raleigh, North Carolina; Michael C. Formica, NATIONAL PORK PRODUCERS COUNCIL, Washington, D.C., for Amici The American Farm Bureau Federation, National Pork Producers Council, North Carolina Farm Bureau Federation, and North Carolina Pork Council. Daryl L. Joseffer, Michael B. Schon, UNITED STATES CHAMBER LITIGATION CENTER, Washington, D.C., for Amicus Chamber of Commerce of the United States of America. Sean Marotta, HOGAN LOVELLS US LLP, Washington, D.C., for Amici Chamber of Commerce of the United States of America, North American Meat Institute, National Association of Manufacturers, Grocery Manufacturers Association, National Turkey Federation, and National Chicken Council. Matthew Nis Leerburg, Kip D. Nelson, Troy D. Shelton, FOX ROTHSCHILD LLP, Raleigh, North Carolina, for Amici Joey D. Carter, Joey Carter Farms, William R. Kinlaw, Kinlaw Farms, LLC, Paul Stanley, Pagle Corp., and Greenwood Livestock, LLC. Steven M. Virgil, WAKE FOREST UNIVERSITY SCHOOL OF LAW, Winston-Salem, North Carolina, for Amici Law Professors with Expertise in Tort and Regulatory Law. Elise Sanguinetti, President, Jeffrey R. White, AMERICAN ASSOCIATION FOR JUSTICE, Washington, D.C.; David Arbogast, ARBOGAST LAW, San Carlos, California, for Amicus American Association for Justice. Elizabeth Haddix, Mark Dorosin, JULIUS L. CHAMBERS CENTER FOR CIVIL RIGHTS, Carrboro, North Carolina, for Amici North Carolina Environmental Justice Network and the Rural Empowerment Association for Community Help. Emily P. Turner, NORTH CAROLINA JUSTICE CENTER, Raleigh, North Carolina; J. Jerome Hartzell, HARTZELL & WHITEMAN, LLP, Raleigh, North Carolina, for Amicus North Carolina Justice Center. Anna Frostic, Laura Fox, Peter Brandt, THE HUMANE SOCIETY OF THE UNITED STATES, Washington, D.C., for Amicus The Humane Society of the United States. Marianne Engelman-Lado, YALE SCHOOL OF FORESTRY & ENVIRONMENTAL STUDIES, New Haven, Connecticut; Peter Hans Lehner, Alexis Andiman, EARTHJUSTICE, New York, New York, for Amici Dr. Lawrence B. Cahoon, Elizabeth Christenson, Dr. Brett Doherty, Mike Dolan Fliss, Dr. Jill Johnston, Bob Martin, Dr. Sarah Rhodes, Dr. Ana María Rule, Dr. Sacoby Wilson, and Dr. Courtney Woods. Tarah Heinzen, FOOD & WATER WATCH, Washington, D.C., for Amicus Food & Water Watch. David S. Muraskin, Jessica L. Culpepper, Kellan Smith, PUBLIC JUSTICE, P.C., Washington, D.C., for Amici Public Justice and Food & Water Watch. Chandra T. Taylor, Blakely Hildebrand, Nick Jimenez, SOUTHERN ENVIRONMENTAL LAW CENTER, Chapel Hill, North Carolina, for Amicus Waterkeeper Alliance.

THACKER, Circuit Judge:

Murphy-Brown, LLC (“Appellant”) challenges a jury verdict against it awarding compensatory and punitive damages to neighbors of its hog production facilities. Those neighbors, residents of rural Bladen County, North Carolina, sought relief under state nuisance law from odors, pests, and noises they attribute to farming practices Appellant implemented at an industrial-scale hog feeding farm. Having heard evidence of those harms and Appellant’s role in creating them, a jury returned a verdict in favor of the neighbors, to the tune of \$75,000 in compensatory damages per plaintiff, along with a total of \$5 million in punitive damages, which was subsequently reduced to \$2.5 million due to North Carolina’s punitive damages cap.

Appellant asserts seven reasons why we should overturn the decision below and grant a new trial. For the reasons detailed below, we affirm the jury’s verdict as to liability for compensatory and punitive damages, but we vacate the award of punitive damages and remand for a rehearing on that issue based on our evidentiary standards.

I.

A.

Appellant is a commercial hog producer, who contracted with third-party “grower” Kinlaw Farms LLC (“Kinlaw Farms”) to operate an industrial hog feeding facility in Bladen County, North Carolina.¹ Appellant is a single-member LLC of a wholly owned

¹ Appellant is a vertically integrated hog producer, which means Appellant farms hogs on an industrial scale by controlling each stage of pork production from the raising and feeding of the livestock to slaughter and packaging for sale. Appellant operates in part (Continued)

subsidiary of Smithfield Foods, Inc. (“Smithfield”), which is in turn owned by WH Group Limited (“WH Group”), a publicly traded company based in Hong Kong.

Industrial farming operators like Appellant require their contract growers like Kinlaw Farms to comply with specific policies. The controlling industrial farmer issues detailed mandates to its growers in order to ensure consistency across their various contract operations. Appellant imposes standard operating procedures for all of its contract growers. Specifically, Appellant (1) directs grower management procedures; (2) mandates design and construction of operations; (3) can require the use of technological enhancements; (4) can require capital investments; (5) dictates how many of its hogs are to be placed at a given operation; and (6) controls hog waste management systems.

Joyce McKiver, Delois Lewis, Daphne McKoy, Alexandria McKoy, Antonio Kevin McKoy, Archie Wright, Jr., Tammy Lloyd, Deborah Johnson, Ethel Davis, and Priscilla Dunham (collectively, “Appellees”) are North Carolina residents who owned properties near Kinlaw Farms. Appellees are a subset of a number of plaintiffs (“Plaintiffs”) who sued Appellant for alleged nuisances associated with the hog operations at Kinlaw Farms.

The operation at Kinlaw Farms annually maintained nearly 15,000 of Appellant’s hogs. These hogs generated approximately 153,000 pounds of feces and urine daily. Kinlaw Farms housed the hogs in hog sheds that used vents and fans to move fumes from the hogs to the outside of the building. By design, the hog waste in the sheds fell through

by supplying livestock and feed to contractors known as “growers” who house and care for Appellant’s hogs for certain portions of the animals’ life cycle, subject to Appellant’s control.

slats in the flooring, where the waste was then stored in three open-air pits within view of Appellees' homes. These pits or "lagoons" contained millions of gallons of hog waste.

As part of its standard operating procedures for contract growers, Appellant wrote the policy dictating how Kinlaw Farms disposed of the waste from Appellant's hogs. At Appellant's direction, Kinlaw Farms used what is known as the lagoon-and-sprayfield method for hog waste disposal. Kinlaw Farms periodically drained waste from the lagoons and spread it across open "sprayfields" on the Kinlaw Farms property. Approximately eight million gallons of hog feces were sprayed in the air annually at Kinlaw Farms.

Appellant was aware of the proximity of Kinlaw Farms to neighboring residences because Appellant's corporate predecessor had sited and designed the facility, and Appellant routinely visited the Kinlaw Farms property for inspections. Notably, because of its operations' proximity to surrounding properties, Appellant instructed its growers to refrain from applying the hog waste to sprayfields "out of respect for [their] neighbors" if the contractor was aware that neighbors planned to have guests over for weddings or cookouts. Despite this policy, spraying of hog waste in summer months occurred at Kinlaw Farms as regularly as three to five days a week for an average of six hours per day.

Additionally, through its contractual arrangement, Appellant was solely responsible for the Kinlaw Farms trucking schedule and for the decision of where to site the facility's entrance road that passed near Appellees' properties. Trucks frequented Kinlaw Farms on a regular basis to deliver new hogs, take away live hogs, and pick up dead hogs. Appellant set Kinlaw Farm's delivery and pickup schedules for trucks at an all-day, all-night pace.

As an example, on one night in 2016, at least 12 trucks passed through to the Kinlaw Farms property between midnight and six in the morning.

At Appellant's direction, hog carcasses pending pickup were stored in "dead boxes," dumpsters placed in open fields on the Kinlaw Farms property. Hog carcasses would pile up and rot in these dumpsters in open fields until collection of the carcasses was scheduled. These dead boxes attracted dozens of buzzards and flies that would accumulate around the dead boxes and frequent Appellees' neighboring properties.

B.

For decades predating the lawsuit at issue here, agricultural experts and lay media alike researched and reported environmental effects associated with industrial hog operations in Eastern North Carolina. Indeed, Appellant itself collected and stored hundreds of newspaper articles documenting neighbors' complaints about lagoon-and-sprayfield industrial hog operations and was aware of scientific studies and state government documents reporting the effects of odor, including upper respiratory and gastrointestinal ailments, on neighbors of concentrated animal feeding operations like Kinlaw Farms. For years, Appellant defended its practices against critics in North Carolina communities and public offices, and routinely opposed regulations that would require lagoon-and-sprayfield operations to curtail their effects on neighbors. In particular, Appellant's former director Don Butler admitted that Appellant was aware of Bladen County community complaints about unabated lagoon-and-sprayfield hog operations of the

kind Appellant prescribed to its growers -- specifically that individuals were complaining about “odor, flies, noise, trucks, [and] interference with their quality of life.” J.A. 7466.²

Although there is no evidence of complaints made directly to Appellant about Kinlaw Farms specifically, Kinlaw Farms did receive complaints from one plaintiff in this suit and another neighbor, who also complained about Kinlaw Farms to the North Carolina Department of Environment and Natural Resources. The record demonstrates that all parties agreed Kinlaw Farms consistently followed Appellant’s policies, compliance which Appellant actively monitored. Yet before the recent nuisance suits, Appellant had neither monitored odor at any operation (including Kinlaw Farms), nor terminated a grower because of complaints about odor.

C.

Reacting to mounting community pressure, in 1997, North Carolina banned new lagoon-and-sprayfield hog operations. *See* N.C. Sess. Laws 1997–458. Existing farms including Kinlaw Farms were grandfathered in and not subjected to the ban, but the North Carolina legislature did bind the state’s Department of Agriculture to “develop a plan to phase out the use of . . . lagoons and sprayfields as primary methods of disposing of animal waste at swine farms.” *See id.* § 12.4(a). And in 1999, North Carolina’s governor announced an intention to end lagoon-and-sprayfield operations.

The following year, Smithfield, Appellant’s parent company, signed an agreement with the Attorney General of North Carolina to fund research for replacement technologies

² Citations to the “J.A.” refer to the Joint Appendix filed by the parties in this appeal.

and to implement technologies found to be feasible (the “AG Agreement”). In 2006, the scientific expert designated by the AG Agreement identified alternative abatement technologies but, applying the AG Agreement’s criteria, the designee did not deem those technologies economically feasible at that time for existing hog farms. This 2006 feasibility analysis did not consider Smithfield’s profits or ability to pay.

Appellant’s growers were not expected to pay for waste management improvements on their own. Because of the extensive control Appellant maintained over its contract growers -- and the control in turn exerted over Appellant by Smithfield and its parent WH Group -- Appellant’s president explained it had the power to implement abatement technologies at its growers’ operations by prescribing those technologies and getting money from the parent companies to help pay for them. Due to the integrated nature of Appellant’s farming operations, company procedures would have Appellant receive funding from the parent companies for waste management improvements it might choose to implement.

D.

In 2013, Appellant and several of its contract growers, including Kinlaw Farms, were sued in North Carolina state court by neighbors of their hog operations, including Appellees. As Appellees explained, “after learning the full extent of [Appellant’s] control over the operations causing the nuisance and the growers’ powerlessness to address it,” the plaintiffs dismissed those state actions and refiled suit in federal court in the Eastern District of North Carolina in 2014, naming Appellant only. Appellees’ Br. 16.

The district court for the Eastern District of North Carolina coordinated 26 related cases filed by neighbors of Appellant's various hog operations as part of a Master Case docket.³ During the Master Case proceedings, the district court issued a number of decisions, including denying Appellant's motion for judgment on the pleadings based on failure to join its contract farmers including Kinlaw Farms as necessary parties. The court also denied Appellant's motion to dismiss claims for noneconomic damages and motion for partial summary judgment on the plaintiffs' punitive and annoyance damage claims. On the other hand, the court granted the plaintiffs' motion for partial summary judgment on Appellant's statute of limitations defense.

In the fall of 2017, the district court ordered trials to move forward from the Master Case docket, with Appellees' case being first in line. During the trial, the district court denied Appellant's motion to bifurcate the punitive damages phase from the liability phase of the trial and also denied Appellant's evidentiary objections as to proof of profits, executive compensation of its parent companies, and certain expert opinions. At the close of all evidence, the district court denied Appellant's motion for judgment as a matter of law as to (i) the sufficiency of evidence to support punitive damages; (ii) vicarious liability;

³ In all, this opinion refers to three sets of plaintiffs involved in suits against Appellant. Complainants in the Master Case Docket cases were neighbors of Appellant's various hog operations. Among this broadest set of neighbor plaintiffs were our Plaintiffs, neighbors of Kinlaw Farms whose claims related particularly to Appellant's operations there. Appellees are a subset of the Plaintiffs who originally brought suit against Appellant over the Kinlaw Farms operation.

(iii) the statute of limitations; and (iv) evidence supporting fear of future injuries. And, before submitting the case to the jury, the district court rejected Appellant's proposed jury instructions relating to the (i) statute of limitations; (ii) scope of available compensatory damages; and (iii) vicarious liability for contractors.

In Spring 2018, the jury returned a verdict awarding \$75,000 in compensatory damages to each of the ten Appellees and also awarding \$5 million in punitive damages. The district court then applied North Carolina's punitive damages cap, reducing the total punitive award to \$2.5 million. *See* N.C. Gen. Stat. § 1D-25(b) (limiting per-plaintiff punitive damages to the greater of \$250,000 or treble compensatory damages); *Rhyne v. K-Mart Corp.*, 594 S.E.2d 1, 5 (N.C. 2004) (explaining N.C. Gen. Stat. § 1D-25 “applies to limit recovery of punitive damages per each plaintiff”). Appellant timely appealed, challenging each of the rulings noted above.

Following the judgment, Appellant terminated its relationship with Kinlaw Farms and withdrew its hogs from that facility, alleging in the termination letter that Kinlaw Farms failed to “comply with standard operating procedures.” J.A. 9593 (quoting May 4, 2018 Kinlaw Letter at 2, *McKiver v. Murphy-Brown, LLC*, No. 14-cv-00180-BR (E.D.N.C. Sept. 28, 2018), ECF No. 324-2). On appeal, Appellant asserts, “[t]he jury’s nuisance finding effectively required that Kinlaw Farm cease operations until any nuisance is abated.” Appellant’s Br. 12.

II.

Appellant raises seven purported errors on appeal, each of which Appellant contends will require a new trial. We address each in turn.

A.

Necessary and Indispensable Party

First, Appellant argues that Kinlaw Farms was a necessary and indispensable party to this suit, and thus, should have been joined pursuant to Federal Rule of Civil Procedure 19. Appellant presented this argument to the district court in both a motion pursuant to Federal Rule of Civil Procedure 12(c) and in a post-trial motion. The district court rejected Appellant's contentions on each occasion.

1.

We review a district court's Rule 19 rulings for an abuse of discretion. *Nat'l Union Fire Ins. Co. of Pittsburgh v. Rite Aid of S.C., Inc.*, 210 F.3d 246, 250 (4th Cir. 2000) (citation omitted). Generally, "[t]he inquiry contemplated by Rule 19 is a practical one," properly "addressed to the sound discretion of the trial court." *Coastal Modular Corp. v. Laminators, Inc.*, 635 F.2d 1102, 1108 (4th Cir. 1980) (citations omitted).

2.

Rule 19 sets up "a two-step inquiry." *Owens-Illinois, Inc., v. Meade*, 186 F.3d 435, 440 (4th Cir. 1999) (citation omitted). We ask "first whether the nonjoined party is necessary under Rule 19(a) and then whether the party is indispensable under Rule 19(b)." *Gunvor SA v. Kayablian*, 948 F.3d 214, 218 (4th Cir. 2020) (citation omitted).

Pursuant to Rule 19(a), a party is necessary if

- (A) in that person's absence, the court cannot accord complete relief among existing parties; or
- (B) that person claims an interest relating to the subject of an action and is so situated that disposing of the action in the person's absence may: (i) as a practical matter

impair or impede the person's ability to protect the interest; or (ii) leave an existing party subject to a substantial risk of incurring double, multiple, or otherwise inconsistent obligations because of the interest.

Fed. R. Civ. P. 19(a). A necessary party should be ordered into the action. *See Owens-Illinois, Inc.*, 186 F.3d at 440. But “[w]hen a party cannot be joined because its joinder destroys diversity, the court must determine whether the proceeding can continue in its absence or whether it is indispensable pursuant to Rule 19(b) and the action must be dismissed.” *Id.* (citation omitted).

Rule 19(b) provides guidance on the identification of an indispensable party: “If a person who is required to be joined if feasible cannot be joined, the court must determine whether, in equity and good conscience, the action should proceed among the existing parties or should be dismissed.” Fed. R. Civ. P. 19(b). In this regard, we are given the following nonexclusive factors to consider:

- (1) the extent to which a judgment rendered in the person's absence might prejudice that person or the existing parties;
- (2) the extent to which any prejudice could be lessened or avoided by: (A) protective provisions in the judgment; (B) shaping the relief; or (C) other measures;
- (3) whether a judgment rendered in the person's absence would be adequate; and
- (4) whether the plaintiff would have an adequate remedy if the action were dismissed for nonjoinder.

Id. “Courts are loath to dismiss cases based on nonjoinder of a party, so dismissal will be ordered only when the resulting defect cannot be remedied and prejudice or inefficiency will certainly result.” *Owens-Illinois, Inc.*, 186 F.3d at 441 (citations omitted).

Neither prong of Rule 19 is to be applied merely as a “procedural formula.” *Home Buyers Warranty Corp. v. Hanna*, 750 F.3d 427, 433 (4th Cir. 2014) (quoting *Provident Tradesmens Bank & Trust Co. v. Patterson*, 390 U.S. 102, 119 n.16 (1968)). To the contrary, the “[d]ecisions must be made pragmatically, in the context of the substance of each case, and courts must take into account the possible prejudice to all parties, including those not before it.” *Id.* (citations and internal quotation marks omitted).

3.

Applying Rule 19(a), there is nothing before us to suggest that the district court could not have “accord[ed] complete relief among existing parties” in this suit without the addition of Kinlaw Farms, and Appellant does not so claim. Fed. R. Civ. P. 19(a)(1)(A). Nor does Appellant argue that it would be subject to multiple or inconsistent judgments. Fed. R. Civ. P. 19(a)(1)(B)(ii).

Instead, Appellant argues “Kinlaw Farms has significant pecuniary and contractual interests threatened by this litigation.” Appellant’s Br. 55. This argument is aimed at the second prong of Rule 19(a)’s test -- whether a third party “claims an interest relating to the subject of an action” whose ability to protect that interest “as a practical matter” will be impaired or impeded if excluded from the existing suit. Fed. R. Civ. P. 19(a)(1)(B)(i). This aspect of the test “directs us to consider a non-joined party’s ability to protect its own interests.” *Home Buyers Warranty Corp.*, 750 F.3d at 433.

Appellant insists that Kinlaw Farms needed to be made a party to this suit in order to protect its own interests. Yet Kinlaw Farms did not seek to join the suit or otherwise “claim[] an interest relating to the subject of an action” before the district court, and

Appellant did not assert a claim against Kinlaw Farms to bring the grower into the suit. Fed. R. Civ. P. 19(a)(1)(B)(i). Unlike the instant case, our Rule 19(a) decisions Appellant cites each involve a situation where the contracts or obligations of the “necessary” party were being interpreted or were otherwise directly at issue. *See Home Buyers Warranty Corp.*, 750 F.3d at 434 (determining third parties “actively contesting their liability in state court” under a contract and entitled to insurance by the defendants for construction defects like those alleged had “a natural interest in any adjudication of the terms of [the] contract”); *Yashenko v. Harrah’s NC Casino Co.*, 446 F.3d 541, 552–53 (4th Cir. 2006) (deeming necessary and indispensable the third party whose preferential hiring policy dictated the defendant casino operator’s conduct, where the court would be deciding the legality of the policy); *Nat’l Union Fire Ins. Co. v. Rite Aid of S.C., Inc.*, 210 F.3d 246, 251 (4th Cir. 2000) (indicating that the court’s decision would “necessarily require it to interpret the notice provisions of the policy and other agreements” between the plaintiff and the absent party).

“[E]ven if [an absent party] is alleged to have played a central role” in the action at issue, “and even if resolution of the action will require the court to evaluate the absent party’s conduct,” that party “in many cases . . . will not have interests that warrant protection under Rule 19(a)(1)(B)(i).” *Ward v. Apple Inc.*, 791 F.3d 1041, 1050 (9th Cir. 2015). The interest in question should “be more than a financial stake, and more than speculation about a future event.” *Id.* at 1051 (internal quotation marks omitted).

Here, the suit’s practical consequence for the third party, Kinlaw Farms, was Appellant’s termination of its grower relationship. But Appellant’s post-verdict

termination of Kinlaw Farms was not a necessary or inevitable consequence of anything resolved in this suit. Though no doubt financially difficult for Kinlaw Farms, that termination was not compelled by the court's decision and cannot control Appellees' case. Appellant's termination letter to Kinlaw Farms suggested that Kinlaw Farms failed to "comply with standard operating procedures." J.A. 9593 (quoting May 4, 2018 Kinlaw Letter at 2, *McKiver v. Murphy-Brown, LLC*, No. 14-cv-00180-BR (E.D.N.C. Sept. 28, 2018), ECF No. 324-2). But this is the exact opposite of what Appellant (and Appellees) argued at trial, where both parties had contended that Kinlaw Farms followed Appellant's policies to the letter.

Nothing found by the jury in this case or mandated by the judgment required Appellant's termination of its relationship with Kinlaw Farms after the litigation was over. The jury's decision left Appellant free to continue its grower relationship with Kinlaw Farms in a manner that respects the property rights of its neighbors if it so chose. Appellant's assessment of the costs and benefits of doing so -- and its business decision based thereon -- cannot retroactively make Kinlaw Farms a necessary party.

And even assuming Kinlaw Farms *was* a necessary party, dismissal of a case is "a drastic remedy that should be employed only sparingly." *Gunvor SA*, 948 F.3d at 219 (quoting *Home Buyers Warranty Corp.*, 750 F.3d at 433). Owing deference to the district court's determination under the abuse of discretion standard, we see no reason to hold that Kinlaw Farms is a necessary party, let alone an indispensable one whose absence warrants dismissal. Appellant's arguments that Kinlaw Farms is indispensable are cursory and do not creditably address any of the Rule 19(b) factors, other than pointing out that Plaintiffs

could have brought this suit against Kinlaw Farms and Appellant in state court. There is nothing to indicate that the judgment rendered is not adequate or that Kinlaw Farms's absence unfairly prejudices either Kinlaw Farms or Appellant. We therefore affirm the district court's judgment as to Rule 19.

B.

Statute of Limitations

Next, Appellant contends the district court erred in rejecting its statute of limitations defense. Appellant contended that Plaintiffs' claims should have been barred by a three-year statute of limitations applying to actions involving a "continuing" nuisance. In response, Plaintiffs moved for partial summary judgment on Appellant's statute of limitations defense, asserting that this case involves a "recurrent" nuisance, for which the three-year limit acts only to constrain the amount of damages available, not to completely bar the claim. The district court partially denied Plaintiffs' summary judgment motion with regard to certain other affirmative defenses but held "as a matter of law" with regard to the statute of limitations defense that the alleged nuisance was recurring. J.A. 3473.⁴ Appellant alleges this was error. Appellant further claims the court erred in refusing to give an instruction for the jury to decide whether the nuisance was continuing or recurring.

⁴ The denial of Plaintiffs' summary judgment motion with regard to the other affirmative defenses is not at issue in this appeal.

1.

We review a district court's summary judgment decision de novo, *Woods v. Berryhill*, 888 F.3d 686, 691 (4th Cir. 2018) (citation omitted), and the court's refusal to grant a jury instruction for abuse of discretion, *United States v. Savage*, 885 F.3d 212, 222 (4th Cir. 2018). A district court's refusal to provide a jury instruction is reversible only if the defendant's requested instruction "(1) was correct; (2) was not substantially covered by the court's charge to the jury; and (3) dealt with some point in the trial so important, that failure to give the requested instruction seriously impaired the defendant's ability to conduct his defense." *Savage*, 885 F.3d at 223 (quoting *United States v. Lewis*, 53 F.3d 29, 32 (4th Cir. 1995)).

2.

North Carolina law applies a three-year statute of limitations for suits based on "trespass upon real property," and this standard applies equally to nuisance actions. N.C. Gen. Stat. Ann. § 1-52(3); *Wilson v. McLeod Oil Co.*, 398 S.E.2d 586, 596 (N.C. 1990). "When a trespass is a continuing one," the suit must be "commenced within three years from the original trespass, and not thereafter." N.C. Gen. Stat. Ann. § 1-52(3). A "continuing" nuisance (involving a single event causing ongoing damage) is materially distinct from a "recurrent" nuisance (involving repeated injuries). *See Wilson*, 398 S.E.2d at 596.

The North Carolina Supreme Court in *Wilson v. McLeod Oil Co., Inc.*, 398 S.E.2d 586, 595 (N.C. 1990), made clear that the distinction between a continuing trespass and a recurrent one hinges on whether there has been a completed act. The *Wilson* court

referenced a previous case in which it had rejected a statute of limitations defense for repeated flooding:

“Suppose [the defendant] had lamed the plaintiff’s horse more than three years ago, and he had continued lame ever since; the action would be barred. So, as he first injured the plaintiff’s land more than three years ago, and it has continued injured ever since, the action is barred.” [*quoting the defendant*].

The fallacy [in this premise] is in not drawing the distinction between a *single* act of injury and *continuous* acts. In our case, he flooded the land more than three years ago, it is true; and for that the action is barred; but he has also continued to flood it anew every day within three years, and for that the action lies.

Id. (quoting *Spilman v. Roanoke Nav. Co.*, 74 N.C. 675, 678 (1876) (emphasis in original)).

Noting this, the *Wilson* court refused to apply the statute of limitations to bar a suit where plaintiffs complained of ongoing seepage of gasoline from a neighboring property. *See id.* at 596. Because the invasion of the plaintiffs’ land stemmed from an ongoing leak, the North Carolina Supreme Court concluded that it was a renewing or recurrent injury and not complete. *See id.* Though damages were to be limited to the previous three-year period, the court did not bar the plaintiffs’ nuisance suit from going forward even though there was evidence to demonstrate that the plaintiffs knew of gasoline contamination well before the three-year mark. *See id.*

Appellant itself cites *Wilson* in attempt to support its defense. However, Appellant fails to apply the case’s analysis to the facts at hand. The harm claimed here is the loss of use and enjoyment of property caused by repeated invasion by odor, noise, and pests. Appellant argues that statements by Appellees referring to these invasions as constant

raised a material dispute of fact for the jury to decide whether the nuisance was continuing. *See, e.g.*, Appellant's Br. 53 (citing one Appellee's statement that "there's not a day we don't have trouble with buzzards" (quoting J.A. 7425), another Appellee's testimony that "the odor was 'always annoying' and that she heard 'hogs squealing all the time'" (quoting J.A. 7754-55), and another Appellee's statement "that traffic annoyed her 'all the time, day and night'" (quoting J.A. 7917)). In response, Appellees point out that interpreting these statements as though there was literally unending odor, truck noise, and pests is unreasonable. We agree with Appellees on this point.

Moreover, even at that most extreme, Appellees' cited harms would be no less constant than the gas seepage in *Wilson*, claims which were spared from the three-year statute of limitations due to their recurrent nature. As the North Carolina Supreme Court there explained, "[c]ontinuous injuries caused by the maintenance of a nuisance are barred only by the running of the statute against *recurrent* trespasses" *Wilson*, 398 S.E.2d at 596 (emphasis supplied) (quoting *Anderson v. Waynesville*, 164 S.E. 583, 587 (N.C. 1937)). In this regard, it is important to note that Appellees did not rest their case on establishing Kinlaw Farms constituted a nuisance per se. That is -- the nuisance alleged was not simply the years-ago construction of a lagoon-and-sprayfield hog operation -- but rather the ongoing maintenance of conditions that in fact caused harm.

Put in the simple terms of the *Wilson* court, the question before us is whether the injurious act is completed or ongoing. *See Wilson*, 398 S.E.2d at 595 (quoting *Spilman*, 74 N.C. at 678). That is, do the harms flow from something done in the past as a single, complete act or do the harms constitute a renewed, avoidable violation each time they

occur? Here, maintenance of odiferous, noisy, and pest-ridden farm operations resulted in repeated -- i.e., recurrent -- invasions of Appellees' properties. The nuisance was not the solitary act of building a lagoon-and-sprayfield hog farm in the past but was instead the practical operation of that farm in a manner inconsistent with its neighbors' use and enjoyment of their own properties. The district court's decision as to the applicable statute of limitations was therefore not legal error and refusing to give the inapplicable jury instruction on continuing nuisances was not an abuse of discretion.

C.

Private Nuisance Damages

Appellant's third argument in this appeal is that North Carolina private nuisance law bars recovery of compensatory damages of any kind, other than damages for reduction in the harmed properties' fair market or rental value. Specifically, Appellant points to a 2017 amendment to North Carolina's Right to Farm Act (the "2017 RTFA amendment") enacted three years after the filing of the lawsuit in this case. The 2017 RTFA amendment limited compensatory damages in nuisance suits to the reduction in fair market value caused by the nuisance (for permanent nuisances) and to the diminution in fair rental value (for temporary nuisances). *See* N.C. Sess. Laws 2017-11, codified at N.C. Gen. Stat. § 106-702. Appellant asserts that the amendment merely "clarified" this limitation on the available forms of compensatory damages in North Carolina nuisance law. Appellant's Br. 44.

Because Appellees stipulated they were not seeking damages for property or rental value losses and focused only on loss of use and enjoyment of their property, the parties

do not disagree that this suit *if filed today* would likely be barred by the 2017 RFTA amendment. But the question before us is whether the 2017 RTFA amendment's limitation of damages actually changed the state's law or simply clarified a preexisting principle. If the former, the district court did not err; if the latter, Appellant's argument holds water.

At summary judgment, the district court concluded that the issue of annoyance and discomfort damages should go to the jury, citing longstanding North Carolina case law allowing such recovery in nuisance suits, including compensation for "the inconvenience, discomfiture, and unpleasantness sustained." J.A. 3476 (quoting *Thomason v. Seaboard Air Line Ry.*, 55 S.E. 198, 204 (N.C. 1906)). In the face of that decision, Appellant still sought a jury instruction that North Carolina plaintiffs "may not recover damages for physical discomfort or annoyance." J.A. 5373. The district court refused to give this instruction.

1.

We review a district court's summary judgment decision de novo, *Woods*, 888 F.3d at 691, and the refusal of a jury instruction for an abuse of discretion, *Savage*, 885 F.3d at 222.

Both federal and North Carolina courts maintain a longstanding presumption against retroactive application of legislation. See *Landgraf v. USI Film Products*, 511 U.S. 244, 265 (1994); *Vanderbilt v. Atl. Coast Line R.R. Co.*, 125 S.E. 387, 391 (N.C. 1924). Indeed, "the presumption is very strong that a statute was not meant to act retrospectively, and it ought never to receive such a construction if it is susceptible of any other." *Vanderbilt*, 125 S.E. at 391 (quoting *U.S. Fid. & Guar. Co. v. United States*, 209 U.S. 306, 314 (1908)).

We must not give a statute a retroactive construction “unless the words used are so clear, strong and imperative that no other meaning can be annexed to them or unless the intention of the Legislature cannot be otherwise satisfied.” *Id.* (quoting *U.S. Fid. & Guar. Co.*, 209 U.S. at 314).

In North Carolina, “[t]he primary goal of statutory construction is to effectuate the purpose of the legislature in enacting the statute.” *State v. Curtis*, 817 S.E.2d 187, 189 (N.C. 2018) (internal quotation marks omitted). “The intent of the General Assembly may be found first from the plain language of the statute, then from the legislative history, the spirit of the act, and what the act seeks to accomplish.” *Midrex Techs., Inc. v. N.C. Dep’t of Revenue*, 794 S.E.2d 785, 792 (N.C. 2016) (quoting *Lenox, Inc. v. Tolson*, 548 S.E.2d 513, 517 (N.C. 2001)). And of course, “[a] statute will not be construed to have retroactive effect unless that intent is clearly expressed or arises by necessary implication from its terms.” *In re Mitchell’s Will*, 203 S.E.2d 48, 50 (N.C. 1974) (citations omitted). Case law is thus very clear that we should look for clear signs of intentional and unavoidable retroactive application if a statute is indeed to have that effect.

2.

Turning to the statute’s text, the 2017 RTFA amendment, enacted as HB 467 on May 11, 2017, includes the following effective date language: “This act is effective when it becomes law and applies to causes of action commenced or brought on or after that date.” N.C. Sess. Laws 2017-11, codified at N.C. Gen. Stat. § 106-702. Appellees argue that our inquiry should start and end with this provision inasmuch as they assert this language speaks clearly about which causes of action fall under the amended law and no other part

of the statute provides such a “clear, strong and imperative” message. *Vanderbilt*, 125 S.E. at 391 (quoting *U.S. Fid. & Guar. Co.*, 209 U.S. at 314).

Appellant, for its part, points to the 2017 RTFA amendment’s title: “An Act to Clarify the Remedies Available in Private Nuisance Actions Against Agricultural and Forestry Operations.” N.C. Sess. Laws. 2017-11. This title, Appellant asserts, indicates that the North Carolina General Assembly only intended the law to “clarify” existing law rather than change anything substantive about the law. According to Appellant, this distinction matters because North Carolina law provides, “[a] clarifying amendment, unlike an altering amendment, is one that does not change the substance of the law but instead gives further insight into the way in which the legislature intended the law to apply from its original enactment.” *Ray v. N.C. Dept. of Transp.*, 727 S.E.2d 675, 681 (N.C. 2012) (citation omitted). If the 2017 RFTA amendment only clarified “the way in which the legislature intended the law” to originally apply, the amendment would be stating the law *as it applied* at the time of the pending suit as well as how it will apply going forward. *Id.* (“[I]n addition to applying to all cases brought after their effective dates, [clarifying] amendments apply to all cases pending before the courts when the amendment is adopted, regardless of whether the underlying claim arose before or after the effective date of the amendment.” (citations omitted)).

Evaluating each of these arguments, we note -- as do Appellees -- that the 2017 RTFA amendment expressly states it will apply to causes of action *going forward*. See N.C. Sess. Laws 2017-11. And, apart from the amendment’s title, no provision lends itself to a view that the legislature was merely “clarifying” North Carolina law on damages.

While we cannot ignore the act's title, it does not control as compared to the operative text of the statute. *See United States v. Capers*, 61 F.3d 1100, 1110 (4th Cir. 1995) (explaining that the drafters' characterization of an enactment as clarifying "cannot be accepted as conclusive, because that would enable [them] to make substantive changes in the guise of 'clarification'" (internal quotation marks omitted)).

Nevertheless, Appellant points to *Ray v. North Carolina Department of Transportation*, 727 S.E.2d 675, 682 (N.C. 2012), which specifies that a prospective effective date does not itself determine whether a law is clarifying or altering. In *Ray*, the court held that the amendment relevant there was meant to clarify "the General Assembly's original intent" regarding claims created "when the legislature enacted the S[tate] T[ort] C[laims] A[ct]." *Id.* There, the court explained, "[g]iven that all statutes have [] effective dates, an effective date standing alone, is insufficient information" for the court to determine whether an enactment is clarifying or substantive. *Id.*

But if the 2017 RTFA amendment is a "clarifying" one -- what precisely is it clarifying? Before the 2017 amendment, North Carolina's RTFA codified the "coming-to-the-nuisance" defense, thereby limiting *who* could bring nuisance claims. But before 2017, the law did not contain any provision as to the damages available for those claims. This situation poses a stark contrast to *Ray* and the examples it contains -- situations where a statute "initially fails expressly to address a particular point" related to what the statute originally set out or created. *See Ray*, 727 S.E.2d at 682 (suit at issue was brought under the State Tort Claims Act, which originally "did not address the application of the public duty doctrine to claims *made under it*" (emphasis supplied)); *Ferrell v. Dep't of Transp.*,

435 S.E.2d 309, 311 (N.C. 1993) (law empowering department to reconvey property did not specify at what price).

By contrast, here, the General Assembly added a new section to the RTFA expressly limiting the damages available in private common law actions for nuisance. The RTFA never previously purported to do anything of the sort. For the “clarifying” principle to apply here, we would need to conclude that, through the original RTFA and its previous amendments, the General Assembly intended -- but never saw fit to mention -- that the law revoked a long-recognized measure of recovery in North Carolina nuisance suits, being the loss of use and enjoyment of one’s property beyond mere property value. *See, e.g., Hanna v. Brady*, 327 S.E.2d 22, 25 (N.C. Ct. App. 1985) (explaining the availability of “physical pain, annoyance, stress, deprivation of the use and comforts of one’s home” as damages “left to the sound judgment and discretion of the trier of fact”).

In *Ray*, the court concluded, “[b]ecause the legislature left essentially all [the state’s] pre-amendment cases intact,” the amendment did not constitute “a complete change in the law but instead only an explanation of the limited role of the public duty doctrine” to suits brought pursuant to the State Tort Claims Act. 727 S.E.2d at 683. In the case of the 2017 RTFA amendment, however, stripping all but property value losses from traditional nuisance suits did violence to North Carolina precedent. While it is true that the parties here are able to cite to conflicting authorities, it is beyond debate that North Carolina case law dating back over 100 years includes recognition of loss of use and enjoyment from

annoyance and discomfort, as well as other forms of damages now barred by the 2017 RTFA amendment.⁵

Thus, the 2017 RTFA amendment represents a substantive, forward-looking change in the law. This is supported by the legislative history and statements about the law's intended effect. Even focusing on Appellant's substantive-versus-clarifying test, we have nothing from which to conclude the 2017 RTFA amendments should apply retroactively. In contrast, we have a multitude of backdrop principles guiding us firmly away from that conclusion.

For one thing, the implications for vested rights -- and therefore the doctrine of constitutional avoidance -- support rejection of retroactivity here.

Both the federal and North Carolina constitutions protect vested rights. *See Landgraf*, 511 U.S. at 266 (noting the Fifth Amendment's role in protecting vested rights); *Fogleman v. D & J Equip. Rental, Inc.*, 431 S.E.2d 849, 852 (N.C. 1993) (refusing retroactive application of an amended statute where it "deprived appellants of vested rights and, thus, was unconstitutionally retroactive"). Even where there are two reasonable constructions of a statute's language, we are to avoid adopting the unconstitutional reading. *See United States v. Mills*, 850 F.3d 693, 699 (4th Cir. 2017).

⁵ *See BSK Enters., Inc. v. Beroth Oil Co.*, 783 S.E.2d 236, 249–50 (N.C. Ct. App. 2016); *Broadbent v. Allison*, 626 S.E.2d 758, 762 (N.C. Ct. App. 2006); *Evans v. Lochmere Recreation Club, Inc.*, 627 S.E.2d 340, 343 (N.C. Ct. App. 2006); *Whiteside Estates, Inc. v. Highlands Cove, LLC*, 553 S.E.2d 431, 440 (N.C. Ct. App. 2001); *Hanna v. Brady*, 327 S.E.2d 22, 25 (N.C. Ct. App. 1985); *Barrier v. Troutman*, 55 S.E.2d 923, 926 (N.C. 1949); *Oates v. Algodon Mfg. Co.*, 8 S.E.2d 605, 606 (N.C. 1940); *Thomason v. Seaboard Air Line Ry.*, 55 S.E. 198, 204 (N.C. 1906).

In North Carolina, the right to compensatory damages “vest in a plaintiff upon injury.” *Rhyne v. K-Mart Corp.*, 594 S.E.2d 1, 12 (N.C. 2004) (citation omitted). Appellant’s only response to this point is to say that a right to annoyance damages did not exist at the time of injury. But, as explained, the weight of North Carolina case law and the district court’s determination on the basis of that law are to the contrary. And, “annoyance” damages aside, the 2017 RTFA amendment limited available damages to *only* reduction in market value (for permanent nuisances) and rental value (for temporary nuisances). *See* N.C. Sess. Laws 2017-11, § 1; codified at N.C. Gen. Stat § 106-702(a). This without question would strip plaintiffs in pending suits of vested rights to damages noted even in Appellant’s authorities, such as “reasonable costs of replacement or repair [and] restoration of the property to its prenuisance condition; and other added damages for incidental losses.” *Rudd v. Electrolux Corp.*, 982 F. Supp. 355, 372 (M.D.N.C. 1997).

Further, policy and justice concerns weigh against allowing retroactive amendments to alter the damages available in pending suits. A decision in Appellant’s favor as to the effect of the 2017 RTFA amendment would reward powerful defendants who, faced with a possible judgment against them, could escape responsibility by raising a specter of doubt about something the state’s courts have long made available. North Carolina’s legislators were worried about the constitutionality and fairness of the RTFA’s amendment, and these concerns motivated the change from the original language -- specifying it would apply to pending cases -- to the current version applying only to claims filed on or after the effective date. Motivated by all of the above concerns, we have previously declined to apply responsive enactments and we do so here. *See Ward v. Dixie Nat’l Life Ins. Co.*, 595 F.3d

164, 171–72 (4th Cir. 2010) (refusing to retroactively apply an amendment where, on first appeal, we ruled for the plaintiffs and the state legislature then adopted a definition purporting to affect pending cases that “was, in effect, that advocated by defendants and rejected by this court”).

We therefore affirm the district court with regard to the availability of compensatory damages beyond property or rental value in this case.

D.

Expert Testimony

Next, Appellant asserts the district court erred when it approved the testimony of Appellees’ expert, Dr. Shane Rogers, but excluded certain opinions of Appellant’s own expert, Dr. Pamela Dalton.

1.

We review a district court’s decisions on the admissibility of expert testimony for abuse of discretion. *United States v. Campbell*, 963 F.3d 309, 313 (4th Cir. 2020).

Rule 702 of the Federal Rules of Evidence provides that a qualified expert witness “may testify in the form of an opinion or otherwise if . . . [his or her] scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue.” Fed. R. Evid. 702(a). The expert’s testimony must be “based on sufficient facts or data” and be “the product of reliable principles and methods.” Fed. R. Evid. 702(b), (c). And “the expert [must] reliably appl[y] the principles and methods to the facts of the case.” Fed. R. Evid. 702(d).

“Implicit in the text of Rule 702 is a district court’s gatekeeping responsibility to ‘ensur[e] that an expert’s testimony both rests on a *reliable* foundation and is *relevant* to the task at hand.’” *Nease v. Ford Motor Co.*, 848 F.3d 219, 229 (4th Cir.) (alteration in original) (emphases in original) (quoting *Daubert v. Merrell Dow Pharms.*, 509 U.S. 579, 597 (1993)). “With respect to reliability, the district court must ensure that the proffered expert opinion is based on scientific, technical, or other specialized knowledge and not on belief or speculation, and inferences must be derived using scientific or other valid methods.” *Id.* (internal quotation marks omitted) (emphasis omitted). “Relevant evidence, of course, is evidence that helps ‘the trier of fact to understand the evidence or to determine a fact in issue.’” *Id.* (quoting *Daubert*, 509 U.S. at 591).

As the Supreme Court has repeatedly explained, *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 597 (1993), offers district courts several guidepost factors that the court “*may consider*” in assessing an expert’s evidentiary reliability to the extent that the factors are relevant to the specific facts of the case at hand. *See Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137, 141 (1999) (emphasis in original). These factors include “[w]hether a theory or technique . . . can be (and has been) tested”; whether the theory or technique “has been subjected to peer review and publication”; whether a given technique has a “high known or potential rate of error and whether there are standards controlling the technique’s operation”; and “[w]hether the theory or technique enjoys general acceptance within a relevant scientific community.” *Id.* at 149–50 (internal quotation marks omitted). These factors “may or may not be pertinent in assessing

reliability, depending on the nature of the issue, the expert's particular expertise, and the subject of his [or her] testimony.” *Id.* at 150 (internal quotation marks omitted).

2.

a.

Dr. Rogers

i.

Appellees called upon Dr. Shane Rogers to testify that a DNA marker of hog feces could be found on the homes neighboring Kinlaw Farms, as support for the idea that hog waste chemicals could and did reach their properties. The district court qualified Dr. Rogers as “an expert in environmental engineering, . . . animal waste management engineering and technology, and microbiology.” J.A. 6185. The district court was informed that Dr. Rogers earned a Ph.D with honors in environmental engineering, has held professorships in civil and environmental engineering for a decade, and previously served as an environmental engineer at the United States Environmental Protection Agency. His specialty was described as “the fate and transport of fecal pathogens.” *Id.* at 6184.

According to Appellant, Dr. Rogers offered unreliable opinions both in his report and at trial. As support, Appellant cites purported errors in sample collecting and limited training and experience of Dr. Rogers's teams. Appellant further contends that Dr. Rogers utilized a DNA indicator called Pig2bac to show the presence of fecal material “as a proxy for odor” leaving the farm, even though he conceded that he is not an expert on how people perceive odor and that this use of Pig2bac had not been peer-reviewed. Appellant's Br. 35.

Appellant argues the district court did not discharge its *Daubert* “gatekeeping” responsibility in admitting the testimony of Dr. Rogers. In this regard, Appellant asserts that the court failed to “make any reliability findings” and did not use “*Daubert’s* guideposts or any other factors to assess the reliability of [Rogers]’s testimony.” Appellant’s Br. 34 (quoting *Nease*, 848 F.3d at 230). Appellant further complains that its request for a *Daubert* hearing was refused.

ii.

As to the reliability of Dr. Rogers’s testimony, the errors Appellant alleges as to Dr. Rogers’s sample collecting and labeling were explained to the district court in briefing as resulting from *Appellant’s* last minute changes to the sampling location. Appellees informed the court that these issues were fully considered in the report’s methodology. And, while it is true that Dr. Rogers’s Pig2bac method itself has not been peer-reviewed, this is only one of the several factors -- that do not “necessarily nor exclusively” apply in every case. *Kumho Tire Co. Ltd.*, 526 U.S. at 141 (citing the “flexible” nature of the reliability test (quoting *Daubert*, 509 U.S. at 594)). “[A] trial court *may* consider one or more of the more specific factors that *Daubert* mentioned when doing so will help determine that testimony’s reliability.” *Id.*

Here, though Dr. Rogers’s work itself had not been peer-reviewed, Pig2bac, upon which the report was based, has been used globally to demonstrate the traceability of swine fecal wastes and was applied in this case using protocols for sampling and analysis by a team of four Ph.D. holders, each with experience with field work, animal operations, and environmental health and engineering. Moreover, Appellant was permitted to put on a

counter-expert, Dr. Jennifer L. Clancy, who critiqued Dr. Rogers's report but who also admitted that Dr. Rogers's method "was acceptable," at least "in some cases." Dep. of Jennifer Lee Clancy, Ph.D. at 4, *McKiver v. Murphy-Brown, LLC*, No. 14-cv-00180-BR (E.D.N.C. Sept. 28, 2018), ECF No. 124-1.

Finally, any contention that Dr. Rogers was not qualified was met with evidence that his area of expertise in waste management qualified him to opine on odor traceability, waste management measures, and their testability. *See* Expert Report of Dr. Shane Rogers at 4, *McKiver v. Murphy-Brown, LLC*, No. 14-cv-00180-BR (E.D.N.C. Sept. 28, 2018), ECF No. 81-2 (citing Dr. Rogers's work with livestock agriculture and related emissions and "development of good management practices to decrease potential exposures of manure pollutants to neighbors and downwind produce growing areas"). Although Dr. Rogers is not (and never claimed to be) an expert on the ability of humans to perceive odor, that is beside the point. Appellees called Dr. Rogers as an expert on tracing how the compounds creating odor travel in agricultural settings.

Taking all of this information as a whole, we conclude that the district court did not abuse its discretion in determining that Dr. Rogers's opinions were both reliable and relevant to the issues in this case.

iii.

Further, as to Appellant's grievance that the district court ruled on the admissibility of the testimony of Dr. Rogers without first affording Appellant a hearing, this argument fails.

A trial court has “considerable leeway in deciding in a particular case *how* to go about determining whether particular expert testimony is reliable.” *Kumho Tire Co., Ltd.*, 526 U.S. at 152 (emphasis supplied). As the Supreme Court has made clear, *Daubert*’s factors “do *not* constitute a definitive checklist or test.” *Id.* at 150 (emphasis in original) (internal quotation marks omitted). “[T]he gatekeeping inquiry must be tied to the facts of a particular case.” *Id.* (internal quotation marks omitted). Importantly, “[t]he trial court must have the same kind of latitude in deciding *how* to test an expert’s reliability, and to decide whether or when special briefing or other proceedings are needed to investigate reliability, as it enjoys when it decides *whether or not* that expert’s relevant testimony is reliable.” *Id.* at 152 (emphasis in original).

As the Supreme Court has explained, the district court here was entitled to rely on the parties’ materials without requiring further submissions or a *Daubert* hearing. The district court’s ruling from the bench reflected that it considered the parties’ arguments and briefing as to Dr. Rogers’s qualifications, area of expertise, and the relevance and reliability of his report. We conclude that the district court had sufficient information before it -- as detailed above -- such that refusing to grant a *Daubert* hearing was not an abuse of discretion.

b.

Dr. Dalton

i.

According to Appellant, it was prejudiced by the district court’s “allowing *only* Plaintiffs’ expert to testify on the central issue.” Appellant’s Br. 33 (emphasis in original).

While Dr. Rogers was permitted to testify, Appellant argues that its own odor expert, Dr. Pamela Dalton, was improperly prevented from testifying about her “odor monitoring study and her opinion regarding the lack of odor nuisance emanating from Kinlaw Farm[s].” J.A. 8596. The district court qualified Dr. Dalton, a scientist specializing in understanding the human perception of odor, as an odor expert, but it barred her from offering certain testimony about odor monitoring she conducted at Kinlaw Farms. Appellant’s arguments about the testimony of Dr. Dalton are inaccurate on a number of levels.

First, contrary to Appellant’s assertions, the issues on which Dr. Rogers and Dr. Dalton opined are not the same.⁶ Dr. Rogers did not purport to opine as to whether odors reaching Appellees’ properties constituted a nuisance or that an objective measure of objectionable odors was even possible. Dr. Dalton, on the other hand, asserted “to a reasonable degree of scientific certainty . . . that the normal operating activities at the farm do not produce odors that travel offsite at an intensity, frequency or duration that would be considered a nuisance level at the [Appellees’] properties.” Expert Report of Pamela Dalton, Ph.D, MPH at 5, *McKiver v. Murphy-Brown, LLC*, No. 14-cv-00180-BR (E.D.N.C. Sept. 28, 2018), ECF No. 96-1. Dr. Dalton also indicated, “It is generally agreed that unless

⁶ Though the Rules of Evidence do not guarantee perfect correspondence of adverse expert witness testimony, Appellant was in any event permitted to use Dr. Jennifer L. Clancy as a rebuttal witness to Dr. Rogers. Dr. Clancy’s testimony included her critique of Dr. Rogers’s methodology and report.

an odor can be detected at a 7:1 dilution or higher, it is not an objectionable odor.” *Id.* at 4.

Citing its obligation to ensure “a valid scientific connection to the pertinent inquiry,” *Nease*, 848 F.3d at 229 (quoting *Daubert*, 509 U.S. at 592), the district court rejected the proposed testimony of Dr. Dalton as to the odor levels emanating from Kinlaw Farms. Though the court did allow Dr. Dalton to testify about the unreliability of human self-reports of odor, it excluded Dr. Dalton’s “testimony about the odor monitoring study and her opinion regarding the lack of odor nuisance emanating from Kinlaw Farm[s].” J.A. 8596. The district court explained, “North Carolina (unlike some other jurisdictions) has not adopted a dilution to threshold ratio or any other objective standard for assessing whether an odor is objectionable,” and even Dr. Dalton recognized “the perception of odors is a highly subjective experience.” *Id.* For these reasons, the district court concluded that her testimony “would have a strong likelihood of confusing or misleading the jury,” and her opinion based on her report would likewise “not be helpful to the jury and would be confusing.” *Id.*

ii.

We conclude that the exclusion of Dr. Dalton’s odor monitoring testimony was not an abuse of discretion. Though an expert’s “opinion is not objectionable simply ‘because it embraces an ultimate issue to be decided by the trier of fact’ -- [here, whether the odors leaving Kinlaw Farms created a nuisance] -- . . . such an opinion may be excluded if it is not helpful to the trier of fact under Rule 702.” *Kopf v. Skyrn*, 993 F.2d 374, 377–78 (4th Cir. 1993) (quoting Fed. R. Evid. 704(a)). Dr. Dalton purported to provide objective

evidence as to whether Kinlaw Farms was giving off odors constituting a nuisance and asserted that odors below a particular threshold were not considered objectionable. Given that North Carolina has not adopted an objective measurement for nuisance odors, and that Plaintiffs themselves would be testifying about their experiences relative to the nuisance at their respective properties, the district court's judgment that Dr. Dalton's testimony would not be helpful and would in fact confuse the jury was not an abuse of discretion.

3.

The Supreme Court has cautioned appellate courts against “fail[ing] to give the trial court the deference that is the hallmark of abuse-of-discretion review” in the expert testimony context. *General Elec. Co. v. Joiner*, 522 U.S. 136, 143 (1997). “[I]t is very much a matter of discretion with the court whether to receive or exclude the evidence; [such that] the appellate court will not reverse in such a case, unless the ruling is manifestly erroneous.” *Id.* at 142 (quoting *Spring Co. v. Edgar*, 99 U.S. 645, 658 (1879)). This is true whether the evidence is physical or testimonial, from a lay witness or expert. *See id.* Here, none of the concerns lodged by Appellant render the district court's evidentiary decisions “manifestly erroneous.” *Id.* (quoting *Spring Co.*, 99 U.S. at 658). And Appellant's argument that the district court erred in admitting one expert without the other fails to appreciate that the testimonies speak to different issues -- one to whether odor-causing particles are present and the other to whether the odors were causing a nuisance -- not to mention that no such parity is guaranteed by the Rules of Evidence. We therefore affirm the district court's decisions as to admission and exclusion of the testimonies of Drs. Rogers and Dalton, respectively.

E.

Jury Instruction as to Vicarious Liability for Nuisance

Next, Appellant contends the district court misstated North Carolina law in its jury instruction on nuisance. Specifically, the district court instructed the jury that a party can be vicariously liable for nuisance “if it employs an independent contractor to do work which that party knows or has reason to know to be likely to involve the creation of a nuisance.” J.A. 9165. This language was based on section 427B of the Restatement (Second) of Torts (1965). Appellant claims, however, that this instruction misstated North Carolina law because the North Carolina Supreme Court has not explicitly adopted the language from this Restatement.

1.

“We review de novo whether the district court’s instructions to the jury were correct statements of law.” *Gentry v. East West Partners Club Mgmt. Co.*, 816 F.3d 228, 233 (4th Cir. 2016) (quoting *Emergency One, Inc. v. Am. FireEagle, Ltd.*, 228 F.3d 531, 538 (4th Cir. 2000)). “Even if a jury was erroneously instructed, however, we will not set aside a resulting verdict unless the erroneous instruction *seriously* prejudiced the challenging party’s case.” *Id.* (emphasis in original) (quoting *Bunn v. Oldendorff Carriers GmbH & Co. KG*, 723 F.3d 454, 468 (4th Cir. 2013)).

2.

First, we look to the language of Restatement section 427B, which states, “One who employs an independent contractor to do work which the employer knows or has reason to know to be likely to involve a trespass upon the land of another or the creation of a public

or a private nuisance, is subject to liability for harm resulting to others from such trespass or nuisance.” The comments to section 427B explain that the section applies particularly “where the contractor is directed or authorized by the employer to commit such a trespass, or to create such a nuisance, and where the trespass or nuisance is a necessary result of doing the work.” Restatement (Second) Torts § 427B cmt. b. But the section 427B rule will apply even if the employer did not “direct[] or authorize[]” the nuisance; “[i]t is sufficient that the employer has reason to recognize that, in the ordinary course of doing the work in the usual or prescribed manner, the trespass or nuisance is likely to result.” *Id.*

3.

As Appellant indicates, North Carolina’s highest court has not expressly adopted the Restatement provision at issue. But Appellees urge that North Carolina case law demonstrates the Restatement’s “likely to” liability theory applies here.

First and foremost, we are mindful of our role as a federal court sitting in diversity. In *Rhodes v. E.I. du Pont de Nemours & Co.*, 636 F.3d 88 (4th Cir. 2011) we explained, “[a] federal court acting under its diversity jurisdiction should respond conservatively when asked to discern governing principles of state law.” *Id.* at 96 (citing *Day & Zimmermann, Inc. v. Challoner*, 432 U.S. 3, 4 (1975) (per curiam)). As a result, “in a diversity case, a federal court should not interpret state law in a manner that may appear desirable to the federal court, but has not been approved by the state whose law is at issue.” *Id.* With this principle in mind, in *Rhodes*, “we decline[d] the plaintiffs’ invitation to predict that the West Virginia Supreme Court of Appeals would adopt the specific provisions of the Restatement advanced by the plaintiffs.” *Id.* The *Rhodes* court identified a case from West

Virginia's highest court directly conflicting with one of the Restatement theories the plaintiffs urged and found nothing else to show the alternative theory had been "embraced" by the state's courts. *See id.* at 95–96.

"But in a situation where the [state's highest court] has spoken neither directly nor indirectly on the particular issue before us, we are called upon to predict how that court would rule if presented with the issue." *Private Mortg. Inv. Servs., Inc. v. Hotel and Club Assocs., Inc.*, 296 F.3d 308, 312 (4th Cir. 2002). The state's intermediate appellate courts' decisions "constitute the next best indicia of what state law is, although such decisions may be disregarded if the federal court is convinced by other persuasive data that the highest court of the state would decide otherwise." *Id.* (internal quotation marks omitted).

We are therefore tasked with understanding whether North Carolina has embraced the jury instruction's rule, as borrowed from the Restatement.

4.

In *Coastal Plains Utilities, Inc. v. New Hanover County*, 601 S.E.2d 915 (N.C. Ct. App. 2004) itself -- the case Appellant cites for what it says is a general rule against contractor liability -- the intermediate Court of Appeals of North Carolina considered a party's argument that a contractor's employer is liable for a trespass "if the independent contractor's trespass was committed at the direction of the employer, or where the work necessarily involved a trespass or *where trespass is likely to occur.*" *Id.* at 925 (emphasis supplied) (internal citations omitted). The plaintiff there directly cited Restatement section 427B for this principle and argued that the defendant's water and sewer system was likely to result in a trespass. *See id.* at 925–26. Without question, the court went straight to

applying the “*likely to*” test Appellant here challenges. *Id.* at 926. The independent contractor rather than its employer designed the project, so the court observed, “[The plaintiff] ha[d] not pointed to any evidence that the project, if properly designed, *would likely have caused a trespass*. Without such evidence, the County could not be held liable under this theory.” *Id.* at 926 (emphasis supplied). If “North Carolina does *not* hold employers vicariously liable for hiring independent contractors to do work that is ‘likely’ to create a nuisance,” as Appellant contends, Appellant’s Br. 47 (emphasis in original), we would expect that the Court of Appeals would have just said so, rather than attempting to apply that very standard.

The district court’s jury instruction on the “likely to” exception here thus appears to be consistent with North Carolina law. The district court here possessed North Carolina precedent applying that very test, with nothing from the state’s highest court to suggest otherwise. Application of the test appears in the very case Appellant advances to demonstrate North Carolina’s rule. *See* Appellant’s Br. 47 (quoting *Coastal Plains Utils., Inc.*, 601 S.E.2d at 923). Where the *Rhodes* court saw the West Virginia Supreme Court of Appeals announcing a contrary rule to the Restatement and silence as to an alternative Restatement theory, 636 F.3d at 96, the district court here was presented with North Carolina precedent applying the exact exception provided in the jury instruction it selected.

Still, Appellant argues that the allegedly erroneous vicarious liability jury instruction given by the district court “significantly prejudiced” Appellant’s defense and permitted “reams of so-called ‘notice’ evidence about odor problems at other farms” to be admitted. Appellant’s Br. 49 (emphasis omitted). In Appellant’s view, evidence that

Appellant knew of odor problems at contract grower operations other than Kinlaw Farms would only be relevant under a theory of vicarious liability. But Appellant's awareness of the known issues associated with its prescribed farming methods is relevant under a direct liability theory as well, such that -- even if the contested instruction as to vicarious liability were erroneous -- prejudice did not result.

In North Carolina, harms caused by a "corporation's acts or policies" constitute "a theory of direct liability" in the punitive damages context. *Everhart v. O'Charley's Inc.*, 683 S.E.2d 728, 737 (N.C. Ct. App. 2009). Therefore, the jury's finding in favor of punitive damages could rest on Appellant's acts itself, in making and enforcing the problematic policies and decisions, not merely on its direction of Kinlaw Farms. Evidence of the known effects of Appellant's policies and procedures, as uniformly applied across their various grower operations including Kinlaw Farms, would therefore be relevant irrespective of any supposed vicarious liability theory based on supervision of its contractor.

As a result, we hold that the contested jury instruction did not prejudice Appellant because the evidence admitted and the jury's judgment equally apply under a theory of direct liability such that, even if the instruction were erroneous, it did not prejudice -- much less "seriously prejudice[]" -- Appellant. *Gentry*, 816 F.3d at 233 (emphasis in original).

F.

Punitive Damages

Finally, Appellant asks us to decide whether the district court erred in submitting the issue of punitive damages to the jury, rather than deciding as a matter of law that Appellees could not meet the punitive damages standard.

1.

At the close of Appellees' case and again at the close of all evidence, Appellant moved for judgment as a matter of law that Appellees did not present sufficient evidence to meet North Carolina's standard for punitive damages. The district court denied the motion each time.

We review denial of a motion for judgment as a matter of law de novo, with all evidence and reasonable inferences taken in the light most favorable to the nonmoving party. *See Russell v. Absolute Collection Servs., Inc.*, 763 F.3d 385, 391 (4th Cir. 2014).

Judgment as a matter of law pursuant to Federal Rule of Civil Procedure 50 is proper when "a party has been fully heard on an issue during a jury trial and the court finds that a reasonable jury would not have a legally sufficient evidentiary basis to find for the party on that issue." Fed. R. Civ. P. 50(a)(1). A district court should grant judgment as a matter of law "if the nonmoving party failed to make a showing on an essential element of his case with respect to which he had the burden of proof." *Russell*, 763 F.3d at 392 (internal quotation marks omitted).

North Carolina makes punitive damages available to plaintiffs who demonstrate that (1) the defendant is liable for compensatory damages and (2) either fraud, malice, or willful

or wanton conduct are present as aggravating factors and are related to the injury for which compensatory damages were awarded. N.C. Gen. Stat. Ann. § 1D-15(a). A plaintiff bears the burden of proving the existence of one of the aggravating factors by clear and convincing evidence. *Id.* § 1D-15(b). Here, Appellees alleged “willful or wanton conduct,” which North Carolina defines as “the conscious and intentional disregard of and indifference to the rights and safety of others, which the defendant knows or should know is reasonably likely to result in injury, damage, or other harm.” *Id.* § 1D-5. “Willful or wanton conduct means more than gross negligence.” *Id.* (internal quotation marks omitted).

North Carolina does not permit punitive damages to be awarded “solely on the basis of vicarious liability for the acts or omissions of another.” N.C. Gen. Stat. Ann. § 1D-15(c). “Punitive damages may be awarded against a person only if that person participated in the conduct constituting the aggravating factor giving rise to the punitive damages, or if, in the case of a corporation, the officers, directors, or managers of the corporation participated in or condoned the conduct” in question. *Id.* In this context, we have previously explained, “[t]he plain meaning of ‘condone’ is to ‘forgive or overlook,’ or ‘permit the continuance of.’” *Vandevender v. Blue Ridge of Raleigh, LLC*, 901 F.3d 231, 239 (4th Cir. 2018) (quoting *Miller v. B.H.B. Enters., Inc.*, 568 S.E.2d 219, 225 (N.C. Ct. App. 2002)). This means, for example, “[a] manager condones employees’ actions when the manager is aware of those actions and fails to intervene.” *Id.* (citation omitted).

2.

Appellant argues Appellees did not put forth evidence from which a reasonable jury could conclude Appellant engaged in willful or wanton conduct as an aggravating factor supporting punitive damages. Appellant makes no argument that the conduct at issue was not “related to” the claimed injuries. N.C. Gen. Stat. Ann. § 1D-15(a).

a.

Appellant Claims Lack of Knowledge

Appellant’s primary wanton-and-willful argument is that it lacked knowledge of the conditions associated with its operation at Kinlaw Farms, and therefore cannot be said to have consciously disregarded any possible nuisance there. Appellant points, in part, to a lack of complaints from Appellees to Appellant as to the Kinlaw Farms operation. But Appellees argue that industrial hog operations are a “predictably messy business,” *In re Murphy Brown, LLC*, 907 F.3d 788, 792 (4th Cir. 2018), and contend Appellant “has known for decades that its ‘messy business’ is a nuisance when placed near residences,” Appellee Br. 30.

i.

Knowledge of Harms

A lack of complaints about Kinlaw Farms in particular does not save Appellant from punitive damages. There can be no doubt that Appellees provided evidence of Appellant’s deliberate corporate policies and evidence that Appellant *knew* these policies had associated harms. Appellees’ proof in this regard included Appellant’s own collection of

media articles reporting conditions associated with its farming practices and policies, as well as its knowledge of studies detailing the effects of lagoon-and-sprayfield operations and types of effective remediation.⁷ This evidence details effects on properties much further from the various hog operations than Appellees' were from Kinlaw Farms. Yet, despite this knowledge, Appellant persisted in practices it knew were reasonably likely to result in injury to neighboring properties. The practices include but are not limited to (i) use of the existing lagoon-and-sprayfield waste management system without further remedial measures; (ii) the use of "dead boxes" to collect corpses; and (iii) persistent and unconstrained truck traffic.

Still, according to Appellant, the lack of evidence that it had received complaints about Kinlaw Farms in particular forced Appellees to resort to what it calls a "nuisance per se" argument. Appellant's Br. 20. But Appellees' theory of liability was not that all lagoon-and-sprayfield farms are "inherently bad," as Appellant phrases it, *id.* at 22, but rather that they create known risks to neighbors that must be monitored and remediated to avoid creating a nuisance. That is, Appellees sought to provide evidence sufficient for a reasonable jury to conclude that, *in practice*, Appellant's persistent use of lagoons and sprayfields with only minimal remedial methods -- i.e. methods not comparable to known

⁷ Articles in Appellant's possession and read into the record include accounts explaining that hog farms in Bladen County "stink" with a "sickening and nauseating odor," such that neighbors "can't plan outdoor activities because [they] never know which way the wind will blow." J.A. 7451. In one letter in Appellant's possession read at trial, a Bladen County resident explained that the hog farm in her community was affecting her "house and land and most of all [her] health" and that she had made verbal complaints about odor "several times." *Id.* at 7449.

effective methods -- created a nuisance affecting neighbors of Kinlaw Farms, and that Appellant knew its failure to fully remediate the harms associated with those practices was “reasonably likely to result in injury, damage, or other harm.” N.C. Gen. Stat. Ann. § 1D-5. For instance, Appellant admitted awareness of a number of available waste management technologies (such as soil technologies or lagoon covers) that would prevent nuisance odors from reaching neighbors and admitted that it could have its growers change to such technologies if it so chose.

Yet Appellant argues that, because its farms were operated legally and consistent with all requisite permits, Appellees failed to prove that its lagoon-and-sprayfield operations were nuisances per se. This is beside the point. Lawful enterprises can constitute a nuisance in fact. *See Jones v. Queen City Speedways, Inc.*, 172 S.E.2d 42, 47 (N.C. 1970). The parties do not debate that Kinlaw Farms’s grandfathered use of the lagoon-and-sprayfield system satisfied North Carolina’s permitting requirements. But North Carolina law hardly “protects” these operations as Appellant suggests. Appellant’s Br. 21. Indeed, new hog operations seeking permits in North Carolina cannot utilize the lagoon-and-sprayfield methods as they existed at Kinlaw Farms and existing lagoon-and-sprayfield farms are being slated for conversion to other methods of waste management. *See* N.C. Gen. Stat. § 143-215.10I; N.C. Sess. Laws 1997–458. The farm’s “grandfathering” does not serve to shield Appellant from nuisance liability, but rather is evidence a jury could use to conclude Appellant knew its operations posed a threat of nuisance to neighboring properties absent additional remedial measures.

Moreover, Appellees' claims were not solely based on effects of lagoon-and-sprayfield practices, but also on other known side effects associated with industrial hog farming. For example, "dead boxes" and frequent traffic doubtlessly can create a nuisance in fact by interfering with neighbors' use and enjoyment of their land due to pests, odors, and noises. Appellant's former director Don Butler's testimony reflected the company's knowledge that Bladen County residents complained about "odor, flies, noise, trucks, [and] interference with their quality of life" from neighboring hog farms. J.A. 7466. A jury reasonably could hold Appellant responsible for knowing about the likelihood of these resultant harms but still persisting in its existing carcass-management and trucking policies.

Appellant cites *Finch v. BASF Catalysts, LLC*, No. 1:16-cv-1077, 2018 WL 3941978 (M.D.N.C. Aug. 16, 2018), for the principle that "general awareness of danger is not enough to establish a conscious disregard of a known duty." *Id.* at *5–6 (citation omitted). Indeed, "knowledge of broad statements about potential harms under undefined conditions is insufficient to show willful and wanton misconduct." *Id.* at *6 (internal quotation marks omitted). But, although Appellant may not have had received specific complaints about Kinlaw Farms, the known dangers here were far from generic.

Appellant had far more knowledge than the defendant in *Finch*, who was only "generally aware asbestos had health risks." 2018 WL 3941978, at *6. Appellant was specifically aware of the risks associated with its chosen policies: Appellant possessed studies of Eastern North Carolina lagoon-and-sprayfield hog farms that explained the effects of those operations on their neighbors' properties, received comments specifically about farms managed with its own methods, and knew Kinlaw Farms was in fact

implementing those practices as directed. The evidence demonstrates that Appellant ensured that its growers, including Kinlaw Farms, uniformly applied its practices: Appellant conducted weekly inspections of Kinlaw Farms to confirm that it maintained total compliance with Appellant's prescribed policies. From this, a jury could reasonably conclude Appellant knew that Kinlaw Farms's compliance with those procedures would create nuisance conditions for its neighbors.

Further still, Appellees' evidence demonstrated that Appellant knew the conditions as they *actually* existed at Kinlaw Farms based on multiple weekly inspections of the facility, including the proximity of neighbors, number of hogs, use of dead boxes, trucking schedule, and absence of control technologies. Thus, Appellees provided evidence from which a jury could conclude Appellant knew the procedures in place at Kinlaw Farms did not adequately address -- and actually persisted in -- known harms associated with lagoon-and-sprayfield operations and similar tightly controlled large hog farms in the region.

ii.

Intentional Disregard of Harms

In all, there is abundant evidence supporting Appellant's conscious disregard of the conditions at Kinlaw Farms. Appellees supplied evidence that Appellant knew the farming methods it mandated at Kinlaw Farms -- including lagoon-and-sprayfield waste management, minimal distance from neighboring properties, dead boxes, all-hours trucking, and a high volume of hogs -- caused known impacts to neighbors. This evidence included scientific studies and news reports in Appellant's own collection, exposure to and participation in years of accumulated public comment on Appellant's practices, and visible

political pressure to ensure adequate mitigation of the effects of those practices -- practices Appellant worked hard to ensure its contract growers, including Kinlaw Farms, implemented precisely. Appellees further provided evidence that, despite this knowledge, Appellant did not attempt to alleviate the effects of methods it knew Kinlaw Farms used at Appellant's direction. Appellees also provided evidence demonstrating Appellant was aware of available technologies and its ability to alleviate the above described harms but chose not to implement those technologies. Finally, Appellees' evidence demonstrated that Appellant did not even attempt to assess the impact of its operations on neighbors, despite known risks.

Based on this abundance of evidence, a jury could reasonably conclude that Appellant persisted in its chosen farming practices despite its knowledge of the harms to its neighbors, exhibiting wanton or willful disregard of the neighbors' rights to enjoyment of their property.

b.

Proactive Measures by Parent Companies

Appellant also attempts to defeat punitive damages by relying on proactive measures taken by its parent companies as evidence that it could not have acted with wanton or willful disregard. Appellant offers *Faris v. SFX Ent., Inc.*, No. 3:04-cv-08, 2006 WL 3690632, at *7 (W.D.N.C. Dec. 12, 2006), for the proposition that "even ineffective action may 'show assertive effort inconsistent with disregard or indifference to the safety of others,'" Appellant's Br. 22–23 (quoting *Faris*, 2006 WL 3690632, at *7).

First, as a district court opinion, *Faris* has no precedential value. See *Booker v. S.C. Dep't of Corrs.*, 855 F.3d 533, 538 n.1 (4th Cir. 2017). Beyond that, *Faris* fails to aid Appellant's cause. In *Faris*, having heard word that two patrons had been electrically shocked in a stairwell, the defendant concert venue had a maintenance worker tape off the fixtures suspected of causing the problem; thus, the tortfeasor acknowledged the problem and took targeted action aimed at completely removing the risk of harm. 2006 WL 3690632, at *7. The court credited the defendant's repeated efforts to correct, then test the correction, of the danger. *Id.* Therefore, the district court in *Faris* concluded that the plaintiff had not "produce[d] evidence that [the defendant] intentionally turned a blind eye to the danger: he looked, he saw, and he acted," though his action was unfortunately ineffective. *Id.*

The *Faris* court itself contrasted the facts presented there with a situation -- much like Appellant's -- where the defendant "looked at [its options], saw the danger involved in using [the chosen approach], and used it despite the known danger." 2006 WL 3690632, at *7. Here, Appellees presented clear and convincing evidence Appellant knew about likely harms, denied their existence, and fought for them not to come to light. Appellees also provided evidence demonstrating that the supposed proactive steps -- investment in feed conversion and nutrient output -- were motivated by profit and/or efficiency of operations, as opposed to concern for neighbors of Appellant's hog operations. The fact that Appellant's policies expressly encouraged growers to avoid spraying at times neighbors were known to be outside demonstrates that Appellant knew its sprayfield operation was still likely to interfere with its neighbors' use and enjoyment of their

property, even taking into account other supposed proactive efforts. Even further, Appellant's indifference to the effectiveness of its supposed remediation methods reasonably implies corresponding indifference to the rights of others to be free from the harms those methods are meant to avoid. *See id.* (noting defendant's repeated efforts to ensure problem was resolved).

Appellant's conduct -- through its parent Smithfield -- might suggest an effort to reduce some odor effects. But a jury could still reasonably find conscious disregard of neighbors' rights as evidenced by Appellant's awareness that its methods fell far short of abating the problem, while it rejected alternatives demonstrably able to do so.⁸ Moreover, even making proactive efforts to reduce fecal odor does not excuse Appellant from persisting in other practices such as dead boxes and all-hours trucking without any attempt to limit these practices out of respect for neighbors' rights. On the whole, Smithfield's limited proactive measures cannot rescue Appellant from punitive damages.

⁸ We pause here to note the inapplicability of *Ward v. Autozoners, LLC*, 958 F.3d 254 (4th Cir. 2020) provided by Appellant as supplemental authority on this point. *Ward* is wholly inapposite to the case at hand. *Ward* applied a theory of vicarious liability pursuant to Title VII, which provides its own separate standard for punitive damages, requiring the employer to act "with malice or with reckless indifference." 42 U.S.C. § 1981a(b)(1). In *Ward*, we concluded that an employee's supervisors had been negligent "at best . . . not recklessly indifferent" where "there was simply not sufficient evidence demonstrating that [they] engaged in . . . steps [to address harassment] with 'subjective appreciation' of the inadequacy." *Id.* at 268. Appellant attempts to use *Ward* to illustrate how punitive damages represent a "high standard [for a plaintiff] to meet," but the standard the plaintiff there was asserting would apply punitive damages "imputed to an employer based solely on negligence by management level employees." *Id.* at 269 & n.5 (emphasis supplied). Here, by contrast, we are of course not applying Title VII's punitive damages standard, and the evidence in the record supports a reasonable jury finding more than negligence.

c.

Participation in or Condoning Misconduct

Appellant's final argument as to why punitive damages should not have been an available option for the jury is that Appellees failed to prove Appellant's officers, directors, or managers "participated in or condoned" any misconduct. Appellant's Br. 24 (quoting N.C. Gen. Stat. § 1D-15(c)).

i.

Appellant's Policies

Pursuant to North Carolina law, "[a] corporation may be subject to punitive damages based on a theory of direct liability where the corporation's acts or policies constitute the aggravating factor." *Everhart v. O'Charley's Inc.*, 683 S.E.2d 728, 737 (N.C. Ct. App. 2009) (citation omitted). In *Everhart v. O'Charley's, Inc.*, 683 S.E.2d 728 (N.C. Ct. App. 2009), an intermediate North Carolina appellate court considered whether a company's policy of requiring managers to complete an incident form before rendering aid to customers in medical distress met the wanton-and-willful standard. There, the court concluded a jury could reasonably find the company chose to protect the restaurant from harm over preventing or mitigating harm to others, and from this the jury could find willful or wanton disregard of guests' rights. *See id.* at 736. As in *Everhart*, a reasonable jury here could conclude that Appellant's own policies reflected conscious and intentional disregard of the safety and wellbeing of others in the interest of protecting the company's bottom line, rendering direct liability applicable. *See id.* at 737 (explaining that the company's policy "recklessly disregards customers' safety and well-being in order to begin

the process of protecting O'Charley's against potential litigation," supporting direct liability).

Here, Appellees advanced evidence that Appellant's own corporate policies -- as opposed to a separate policy of Kinlaw Farms -- prescribed the lagoon-and-sprayfield system, waste and carcass management, and all-hours truck traffic underlying the complaints. As a result, in contrast to vicarious liability for acts of its contractor, Appellant's liability is premised on the corporation's *own* act of maintaining a set of policies it knew perpetuated the effects of hog farming that (i) caused the state to outlaw such operations within a mile of homes, except where neighbors came to the nuisance and (ii) resulted in well-documented complaints and study results that applied to Kinlaw Farms, since the policies mandated uniform conditions across Appellant's grower sites.

ii.

Officers & Managers Condoning Conduct

Furthermore, the evidence demonstrates that Appellant's officers and managers had notice of the harms caused by its operations, based on studies, community meetings, and political engagement. *See* N.C. Gen. Stat. Ann. § 1D-15(c). Yet Appellant's leadership persisted in mandating the culpable practices and participated in political efforts aimed at minimizing regulation of harms known to be associated with Appellant's chosen farming methods. This evidence is sufficient to support punitive damages.

In *Vandevender v. Blue Ridge of Raleigh, LLC*, 901 F.3d 231, 238–39 (4th Cir. 2018), plaintiffs provided sufficient evidence to support an award of punitive damages by demonstrating the defendants' managers had notice that their policy of maintaining

inadequate staffing created a danger to their facilities' patients. *See* 901 F.3d at 238–39. Similarly, here Appellees provided sufficient proof by demonstrating Appellant's principals had notice that their policy of maintaining their standard lagoon-and-sprayfield systems, bins, and trucks created annoyance and disturbance to neighbors, as evidenced by (i) community comments; (ii) studies focused on their practices and region; (iii) successful legislation/activism to ban their form of farming and find alternatives; (iv) regular inspections of the farm in question, showing knowledge that its practices were by-the-book; and (v) longstanding advocacy to *limit* nuisance suits by neighbors, from which a jury could reasonably infer knowledge that Appellant intended to persist in its methods without amending its conduct to respect its neighbors' use and enjoyment of their property. We did not require the plaintiffs in *Vandevender* to show the defendant knew the likely harms had already come to pass at the facility in question.

It is therefore clear that a jury could find Appellant's principals at minimum "forg[a]ve," "overlook[ed]," or "permit[ted] the continuance of" the conditions at Kinlaw Farms. *Vandevender*, 901 F.3d at 239 (each quoting *Miller*, 568 S.E.2d at 225). Appellees here provided evidence that Appellant's decisionmakers actually *required* Kinlaw Farms' continued application of the problematic policies and attendant harms (such as dead boxes), in the face of statewide policy pressure to change these methods due to their known effects on neighbors when used as Appellant prescribed and with the knowledge that area residents were complaining about odor, flies, noises, and trucks associated with industrial hog operations.

Therefore, considering all evidence in the light most favorable to Appellees, we conclude the district court did not err in allowing the jury to decide whether Appellant's principals "participated in or condoned" the aggravating conduct -- here, requiring its growers to persist in methods known to have associated harms.

d.

In sum, Appellees presented "clear and convincing evidence that [Appellant] w[as] fully aware" of the nuisance effects of its prescribed farming practices "yet did nothing or worse." *Vandevender*, 901 F.3d at 239. From the evidence here, a jury could reasonably conclude Appellant and its officers "knew -- because they were repeatedly told -- that [their currently prescribed remediation of odors, noise, and pests] was reasonably likely to result in [injury to neighboring properties]." *Id.* at 240. "They nonetheless deliberately continued to disregard duties imposed by law" -- here the duty not to harm neighbors' use and enjoyment of their own land -- "because doing so would increase profits." *Id.* "This is precisely the type of egregious conduct punitive damages are meant to deter." *Id.* (citing N.C. Gen. Stat. § 1D-1, which explains that the purpose of punitive damages is "to punish a defendant for egregiously wrongful acts and to deter the defendant and others from committing similar wrongful acts").

Having reviewed all of the evidence in this case, we lack reason to reject either the district court's submission of the question of punitive damages to the jury or the jury's determination here that clear and convincing evidence established that punitive damages apply.

G.

Financial Evidence

Appellant's final assignment of error is that the district court erred by admitting financial information of Appellant's "corporate grandparent" Smithfield and "ultimate parent entity" WH Group, and by refusing to bifurcate the punitive damages portion of the trial from the liability phase due to the allegedly inflammatory nature of such evidence. Appellant's Br. 26. The contested evidence includes the values of Appellants' parent companies and their executive compensation.

We address this "parent evidence" argument in two parts. First, we analyze the evidence in the context of the jury's verdict as to liability. Then, we do the same with regard to punitive damages.

1.

Parent Evidence with Regard to Nuisance Liability

a.

Federal Rule of Evidence 403 states that a "court may exclude relevant evidence if its probative value is substantially outweighed by a danger of," among other things, "unfair prejudice." Fed. R. Evid. 403. "Except under the most 'extraordinary' of circumstances, where [the district court's] discretion has been plainly abused, this Court will not overturn a trial court's Rule 403 decision." *In re C.R. Bard, Inc. MDL No. 2187, Pelvic Repair Sys. Products Liab. Litig.*, 810 F.3d 913, 920 (4th Cir. 2016) (internal quotation marks omitted).

b.

We turn first to assess the probative value of the challenged financial evidence with regard to liability. The finances and executive compensation expenditures of Smithfield and WH Group were relevant to the question of nuisance liability because they are probative of the feasibility or impracticality of Appellant's adoption of mitigation measures to avoid the harm to neighbors' lands. In this regard, Appellees put forward testimony indicating that if Appellant wanted to cover its lagoons, Smithfield or WH Group would cover the costs. Specifically, Appellant's president George Schmidt testified as follows:

[Appellees' Counsel]: If or when -- if the hog production division wanted to go cover the lagoons, it could go ask Smithfield or WH Group for the money to do it, right?

Mr. Schmidt: That would be the procedure, yes.

[Appellees' Counsel]: And, as a matter of fact, if you wanted to do it, that would be where you'd get the money, you'd go to Smithfield or the WH Group for them to give you the money, right?

Mr. Schmidt: Correct.

J.A. 7908. The ability of Smithfield and WH Group to pay is therefore relevant evidence of whether Appellant would face undue hardship in abating the nuisance. If the cost of remediation were to be borne by a highly profitable parent company, Appellant's claim that it would be harmed -- or that financial limitations prevented successful remediation -- rings hollow. Indeed, the AG Agreement itself committed Smithfield to providing financial assistance to convert lagoon-and-sprayfield systems operated by its contract growers. Smithfield's ability to pay to do so thus is fundamental in deciding whether such

conversions were feasible. And significantly, Appellant conflated itself with its parent company, Smithfield, when asking the district court to credit Appellant with the AG Agreement and other policies adopted by Smithfield as though they were Appellant's own.

For all these reasons, we deem the parent financial evidence relevant to the question of whether any feasible effective remedial measures were out of Appellant's reach. Therefore, we cannot conclude that the district court abused its discretion in deciding the probative value of this evidence -- which speaks to a key defensive argument raised -- was not "substantially outweighed" by unfair prejudice. Fed. R. Evid. 403. The district court carefully considered whether mention of Appellant's parent companies' finances was unduly prejudicial and whether this prejudice outweighed the probative value of that information. Further, the court made clear that the parent companies' information could not itself be used to argue in favor of punishing Appellant. *See* J.A. 5726–27 (explaining that comparing individual executives' salaries to local residents or using the foreign identity of Appellant's corporate grandparent could not be used to argue in favor of punishment). The court also recognized that keeping information about parent companies' ability to pay from the jury would permit a defendant to unfairly claim both that it is too poor to afford existing remedial measures, but also that it has been proactive (through its parent company) in developing new alternatives. And because Appellant wanted to claim Smithfield's conduct as a shield, the district court reasonably concluded that evidence of Smithfield's ability to cover remediation costs also could come in as a sword.

Furthermore, due to North Carolina's particular nuisance framework, mention of the parent companies' identities and ownership bears a cognizable relationship to the

question before the jury. *See* N.C. Pattern Jury Instr. (Civ.) § 805.25 (noting the relevance of the “nature, utility, and social value of the defendant’s operation” to the existence of a nuisance). The task before the jury was to compare the *community’s benefit with Appellees’ harm*, and the fact that much of the profit from the injurious conduct left the area while Appellant and its local grower Kinlaw Farms were left unable to afford to abate the harm speaks to whether and how much the community benefitted from the operation.

Ultimately, the district court did not bar Appellant from claiming its parent companies’ efforts as its own, but likewise also did not bar evidence of those companies’ abilities to do better. Though Appellant admits that contrasting “the community’s benefit against the harm to [Appellees]” is consistent with North Carolina law, Appellant’s Br. 28 (citing N.C. Pattern Jury Instr. (Civ.) § 805.25), it nonetheless contends that conflating Appellant and its parent companies in this analysis was unnecessary and unfair. But having invoked its parent companies’ identities in its defense, Appellant cannot complain that the court allowed the jury to have information about those entities for the purposes of comparing benefits and harms as delineated by North Carolina law. Where this is the case, we cannot override the district court’s considered judgment that the evidentiary value of the parent companies’ information was not substantially outweighed by undue prejudice.

2.

Parent Evidence with Regard to Punitive Damages

Though we decline to overturn the district court’s admission of Appellant’s parent company financial evidence relevant to liability, we reach a different conclusion as to bifurcation and the amount of punitive damages. Specifically, we conclude that the value

and compensation evidence was relevant to whether punitive damages should have been awarded and do not disturb the district court's considered judgment that any prejudice associated with that information did not substantially outweigh its probative value in that context. However, this evidence does not bear the same level of relevance to the determination of the amount of punitive damages supported by Appellant's conduct. Because of this irrelevance and because of the particular ability of potentially inflammatory evidence to sway a jury's calculation of punitive damage awards, we vacate the judgment below as to the amount of punitive damages and remand for rehearing on that issue alone.

a.

We review a district court's decision not to bifurcate a trial for abuse of discretion. *Shetterly v. Raymark Indus., Inc.*, 117 F.3d 776, 782 (4th Cir. 1997).

North Carolina has a mandatory bifurcation statute. N.C. Gen. Stat. § 1D-30. "But, in our federal system, bifurcation is a case-specific procedural matter within the sole discretion of the trial court." *Nester v. Textron, Inc.*, 888 F.3d 151, 163 (5th Cir. 2018) (citation omitted). Federal courts sitting in diversity "are to apply state substantive law and federal procedural law." *Hanna v. Plumer*, 380 U.S. 460, 465 (1965). Therefore, "a district court is simply not bound by state law when deciding whether to bifurcate." *Nester*, 888 F.3d at 163 (citing *Getty Petroleum Corp. v. Island Transp. Corp.*, 862 F.2d 10, 15 (2d Cir. 1988) and *Rosales v. Honda Motor Co.*, 726 F.2d 259, 260 (5th Cir. 1984)); see *Shugart v. Cent. Rural Elec. Co-op*, 110 F.3d 1501, 1504 (10th Cir. 1997); *Sellers v. Baiser*, 792 F.2d 690, 694 (7th Cir. 1986); *Moss v. Associated Transp., Inc.*, 344 F.2d 23, 27 (6th Cir. 1965).

Federal Rule of Civil Procedure 42(b) specifies, “[f]or convenience, to avoid prejudice, or to expedite and economize, the court may order a separate trial of one or more separate issues” As we have explained, “when it is determined that the evidence relevant to the appropriate amount of punitive damages will be prejudicial to the jury’s consideration of liability or compensatory damages, bifurcation of the trial under Fed. R. Civ. P. 42(b) remains an available solution.” *Mattison v. Dallas Carrier Corp.*, 947 F.2d 95, 110 (4th Cir. 1991) (citation omitted). This does not mean it is the *only* solution. “[S]ince the evidence usually overlaps substantially, the normal procedure is to try compensatory and punitive damage claims together with appropriate instructions to make clear to the jury the difference in the clear and convincing evidence required for the award of punitive damages.” *Hangarter v. Provident Life & Acc. Ins. Co.*, 373 F.3d 998, 1021 (9th Cir. 2004) (alteration in original) (quoting *McLaughlin v. State Farm Mut. Auto. Ins. Co.*, 30 F.3d 861, 871 (7th Cir. 1994)).

“The party requesting separate trials bears the burden of convincing the court that such an exercise of its discretion will (1) promote greater convenience to the parties, witnesses, jurors, and the court, (2) be conducive to expedition and economy, and (3) not result in undue prejudice to any party.” *F&G Scrolling Mouse, LLC v. IBM Corp.*, 190 F.R.D. 385, 387 (M.D.N.C. 1999) (citations omitted).

b.

Appellant raises a very real specter of prejudice stemming from the parent company financial information. The Supreme Court has reminded us that “the presentation of evidence of a defendant’s net worth creates the potential that juries will use their verdicts

to express biases against big businesses, particularly those without strong local presences.” *State Farm Mut. Auto. Ins. Co. v. Campbell*, 538 U.S. 408, 417 (2003) (quoting *Honda Motor Co. v. Oberg*, 512 U.S. 415, 432 (1994)). Importantly, “[o]ur concerns are heightened when the decisionmaker is presented . . . with evidence that has little bearing as to the amount of punitive damages that should be awarded,” because “[v]ague instructions, or those that merely inform the jury to avoid passion or prejudice do little to aid the decisionmaker in its task of assigning appropriate weight to evidence that is relevant and evidence that is tangential or only inflammatory.” *Id.* at 418 (internal quotation marks omitted).

As explained above, the district court here did not abuse its discretion where, through the AG Agreement and Appellant’s admissions, Appellant’s ability to remediate harms necessarily implicated the financial worth and expenditures of its parent companies. But having decided to admit this evidence on the question of liability, the district court nonetheless needed to evaluate the effect that same information would have in the context of punitive damages and whether the risk of prejudice -- as described by the Supreme Court -- required bifurcation.

A jury must be convinced by clear and convincing evidence to award punitive damages. This is a higher evidentiary burden than applies to the simple question of whether a defendant is liable for a nuisance. In finding nuisance, the jury had already concluded that Appellant had the ability to abate the harm without undue hardship. As with nuisance liability, we recognize the relevance of parent company financials relative to punitive damages where, as here, a defendant admits the connection of its parents to its own ability

to abate a nuisance. However, with regard to determining the *amount* of punitive damages to award, we fail to see what value the parent company financial evidence would have that could possibly outweigh the substantial risk of prejudice it carries in that delicate context.

As the Supreme Court has recognized, inflammatory financial evidence can be especially destructive in the context of punitive damages because of the leeway given to juries in selecting the appropriate amount necessary to punish and deter. *See State Farm Mut. Auto Ins.*, 538 U.S. at 417 (explaining how “punitive damages pose an acute danger of arbitrary deprivation of property” because of the “wide discretion” given to juries “in choosing amounts”). To be sure, juries are and should be afforded substantial room to exercise their discretion, but it is the court’s responsibility to ensure that the tools the jury uses to exercise that discretion are appropriate. *See Mattison*, 947 F.2d at 105 (“When a jury is left to its own devices to take property or mete out punishment to whatever extent it feels is best in the course of the process, our sensibilities about that process are offended.”).

“[A] defendant’s financial position is a proper consideration in assessing punitive damages.” *See Stamathis v. Flying J, Inc.*, 389 F.3d 429, 442 (4th Cir. 2004) (citing *Pacific Mut. Life Ins. Co. v. Haslip*, 499 U.S. 1, 22 (1991)). The jury here was instructed to consider Appellant’s ability to pay punitive damages, and the district court did not reference Appellant’s parents’ ability to pay. This makes sense: while testimony indicated that Appellant’s parent companies would be responsible for remediation costs -- justifying admission of the financial evidence on the matter of liability -- there was no such evidence

that Appellant's parent companies would be made to bear the costs of a punitive damage award.

Still, without a more specific jury instruction, a jury exposed to the high-dollar values of Appellant's parent companies and the parents' executive compensation could understandably -- but inappropriately -- apply that information when it came time to decide how much money would be required for Appellant to "feel" the effect of the damages award. Appellees used the high values and high-dollar compensation figures of Smithfield and WH Group to argue that Appellant, through its relationship to these wealthy parents, "ha[d] the money to eliminate the odor, [yet] cho[se] to do nothing." J.A. 5817; *see also* J.A. 9050 ("They know there is a problem. They know there is a fix. They willfully choose not to do anything about it. Not even figure out how much it would cost [to fix], but yet they pay \$245 million to four people over four years. That's the kind of money they can spend when they want to.") But though this evidence is relevant to the question of whether Appellant's refusal to change policies and technologies was a willful choice, it does not bear the same relevance to the proper *amount* of punitive damages necessary "to punish [*Appellant*] for egregiously wrongful acts." N.C. Gen. Stat. § 1D-1.

Thus, given the irrelevance of the parents' financial information to the amount of punitive damages, and given the lack of guidance provided to the jury as to how that information is to be applied in the analysis, in the absence of a limiting instruction, we conclude that the district court should have bifurcated the trial pursuant to Federal Rule of Civil Procedure 42(b) in order to avoid any undue prejudice associated with such evidence. To be quite clear -- we do not disturb the district court's decision to submit the availability

of punitive damages to the jury or the jury's determination that those damages are appropriate in this case; rather, we are only remanding for a new calculation of those damages absent the parent company financial evidence that threatens significant prejudice without any relevance to the question of the appropriate *amount* of punitive damages to award.

“Exacting appellate review ensures that an award of punitive damages is based upon an application of law, rather than a decisionmaker’s caprice.” *State Farm Mut. Auto. Ins.*, 538 U.S. at 418 (internal quotation marks omitted). Juries are given greater latitude in assigning value to punitive damages than they possess in the liability and compensatory damages contexts, where the damages awarded are grounded in actual losses to the plaintiff. Because of this distinction, our deferential standard of review requires us to only redress the evidentiary prejudice as it pertains to the amount of punitive damages, where financial prejudice has a unique ability to do harm to a defendant. Here, a limited remand so that the amount of the punitive damages award can be reconsidered with constraints on the parent financial information will ensure that the award is based solely on Appellant’s own conduct and ability to pay, and not on any unfair prejudice against its status as the subsidiary of a wealthy parent. We therefore vacate the jury’s judgment as to the amount of punitive damages, and remand for rehearing with omission of the inflammatory parent company financial evidence.

III.

For the foregoing reasons, we conclude that none of Appellant’s arguments require the grant of a new trial wholesale. We do however remand this case for the limited purpose

of determining the proper amount of punitive damages without the parent company financial evidence, including executive compensation.

*AFFIRMED IN PART;
VACATED AND REMANDED IN PART*

WILKINSON, Circuit Judge, concurring:

I am pleased to concur in Judge Thacker's well-reasoned opinion. It ably explains why compensatory and punitive damages were appropriate here and why the admission of certain financial information, specifically the valuation and executive compensation structure of Murphy-Brown's parent companies, was especially prejudicial with respect to the amount of any punitive award. As Judge Thacker notes, punitive damages represent an especially unmoored and ungrounded form of relief, and it makes sense to keep their consideration free of gratuitously inflammatory evidence. The danger of an unleashed jury, moreover, is far greater where it sets the amount of a punitive award than when it determines willfulness and wantonness. *See Sasaki v. Class*, 92 F.3d 232, 238 (4th Cir. 1996) (affirming a jury finding of punitive liability while remanding for a redetermination of punitive damages). It is that danger that Judge Thacker rightly perceives requires a remand here.

I write separately, however, to highlight the facts in this case that support the jury's finding that liability for compensatory and punitive damages in some amount was warranted. It is past time to acknowledge the full harms that the unreformed practices of hog farming are inflicting.

This is not to say that the industry is unimportant. In fact, quite the contrary. Hog farming is central to economic life in North Carolina. It supports 46,000 much-needed, mostly low-skill jobs and accounts for approximately \$11 billion of the state's annual economic productivity. Brief of the American Farm Bureau Federation et al. as *Amici Curiae* Supporting Appellant 8, *McKiver v. Murphy-Brown* (No. 19-1019) [hereinafter

Am. Farm Bureau Brief].¹ This economic activity is concentrated in the state's relatively rural eastern region. Sampson, Duplin, and Bladen counties collectively contain over forty percent of the state's hog farms, where size undoubtedly makes for market efficiencies. *See id.* at 8–9. The efforts of those who work in these farms play an important role in preserving the nation's food supply. Pork products include not only bacon, sausage, ham, and pork chops, but also byproducts with pharmaceutical applications. Inedible byproducts such as pig hair and skin can be useful in producing, respectively, such things as paint brushes and wallets. John R. Romans et al., Purdue University, *Pork By-Products*, <https://www.animalgenome.org/edu/PIH/128.html>.

It is the hog's misfortune, and, I suppose, humanity's good fortune that it has become such an indispensable animal. To safeguard the hog farming industry, the state legislature amended the Right to Farm Act, limiting future nuisance recoveries to declines in a property's market value. *See* N.C. Sess. Laws 2017-11, codified at N.C. Gen. Stat. § 106-702. The state had also generally capped punitive awards per plaintiff at “three times the amount of compensatory damages or two hundred fifty thousand dollars (\$250,000), whichever is greater.” N.C. Gen. Stat. § 1D-25(b). In passing these laws, the state legislature acted within its constitutional police powers.

¹ While it is of course true that amicus briefs were not part of the jury's consideration, they align in this case to an exceptional extent with the extensive trial testimony that is herein referenced.

But our job is different. In this case, the ancient tort of nuisance, which has long refereed disputes between neighbors, *see e.g., Tenant v. Goldwin* (1705) 92 Eng. Rep. 222, is claimed to have a very contemporary application. Plaintiffs, almost all of modest means and minorities, live in close proximity to Kinlaw Farms, the hog farm at issue in this case. They have brought suit contending that Murphy-Brown, which by virtue of contract directed Kinlaw's operations, "substantially" and "unreasonabl[y]" interfered—in a "willful and wanton" manner—with the "use and enjoyment of their property." Complaint at 35, 39, *McKiver v. Murphy-Brown, LLC*, No. 4:14-cv-00153-F (E.D.N.C. Aug. 21, 2014); *see also Morgan v. High Penn Oil Co.*, 77 S.E.2d 682, 689 (N.C. 1953); N.C. Gen. Stat. § 1D-15(a). The industry counters that such suits pose "a dire threat to hog farming" in North Carolina, and—even more urgently—"an existential threat to the livelihoods of farmers and the food security of our Nation." Am. Farm Bureau Brief 3, 9. As noted above, I fully recognize the essential contributions of the pork industry in general, and of North Carolina's hog farms in particular. I am also not so naive as to imagine that hog farming could ever be an antiseptic enterprise. But the record here reveals outrageous conditions at Kinlaw Farms—conditions that, when their effects inevitably spread to neighboring households, violated homeowners' rights to the healthful enjoyment of their property. All this the jury recognized, and its verdict, once capped, was essentially a just one.

How did it come to this? What was missing from Kinlaw Farms—and from Murphy-Brown—was the recognition that treating animals better will benefit humans. What was neglected is that animal welfare and human welfare, far from advancing at cross-

purposes, are actually integrally connected. The decades-long transition to concentrated animal feeding operations (“CAFOs”) lays bare this connection, and the consequences of its breach, with startling clarity. Once, most hogs were raised on “smaller, pasture-based hog farms.” J.A. 618. Now, the paradigm has shifted: “large numbers of hogs, often many thousands” crowd together in each of the many cramped “confinement structures” that comprise the typical hog CAFO. J.A. 618; *see also* USDA Nat’l Agric. Statistics Serv., 2017 Census of Agriculture: Vol. 1, Ch. 1: U.S. National Level Data, Tbl. 23: Hogs and Pigs – Inventory by Type of Producer: 2017. The following illustrates how Kinlaw, an endpoint of this pasture-to-CAFO transition, created serious ecological risks that, when imprudently managed, bred horrible outcomes for pigs and humans alike.²

The warp in the human-hog relationship, and the root of the nuisance in this suit, lay in the deplorable conditions of confinement prevailing at Kinlaw, conditions that there is no reason to suppose were unique to that facility. Confinement defined life for the over 14,000 hogs—all of which Murphy-Brown owned—that Kinlaw Farms had crammed into its twelve confinement sheds. J.A. 6197–98, 6908. Consistent with Kinlaw’s role as a “finishing” facility, hogs arrived at around forty pounds, to be fattened to over seven times their starting weight. J.A. 6200. The one thing that never grew with the hogs, though, was the size of their indoor pens. Even though “[h]ogs grow bigger now,” *id.*, the pens’ design has not changed a whit in twenty-five years. *See* J.A. 6200, 7823. The sad fate of Kinlaw’s

² Following the jury verdict, Smithfield Hog Production stopped placing new hogs at and removed existing hogs from Kinlaw Farms. J.A. 9322–23.

hogs was, therefore, to remain in these densely packed pens from the time they arrived to the time they were shipped for slaughter, straining in vain as their increasing girth slowly but surely reduced them to almost suffocating closeness. *See* J.A. 6198.

To manage waste under such conditions, the concrete floors of Kinlaw's sheds were partially slatted. *Id.* These slats were supposed to allow the hogs' feces and urine to fall through to a gutter system below. J.A. 6200–02. But due to the close confinement just described, hogs were often packed too tightly to defecate over the slats. J.A. 5211. As a result, waste built up, *id.*, and as photos of Kinlaw's facilities show, hogs ended up covered in feces. J.A. 6758–64; *see also* J.A. 5828–29, 8510, 9027.

The waste that did make it through the slats to the gutter system was flushed four to six times a day to one of three nearby open-air “lagoons”—essentially three uncovered, 8 million-gallon cesspools. J.A. 6202–03; *see also* J.A. 6740–41. From there, the waste material was sprayed into the air, to fertilize nearby crops—a waste disposal method known as the lagoon-and-sprayfield system. J.A. 4980, 6203–04, 6958–59.

The dangers endemic to such appalling conditions always manifested first in animal suffering. Ineluctably, however, the ripples of dysfunction would reach farm workers and, at last, members of the surrounding community. To start, take the basic issue of air quality. When pigs defecated, gases accumulated in their sheds. J.A. 5217, 6198–99. But at certain concentrations—only possible under conditions of overcrowded, indoor confinement—these gases could become toxic, even fatal, to the hogs. J.A. 6199. To prevent its hogs from dying in their own wind, Kinlaw ventilated their sheds by opening curtains that released these noxious fumes unfiltered into the air outside. J.A. 5217, 6197–99.

Viewing the sheds' diminished air quality solely as a "hog problem" misses the very real hazard it represented for workers. *See* Brief for Dr. Lawrence B. Cahoon et al. as *Amici Curiae* Supporting Plaintiffs-Appellees 9–15, *McKiver v. Murphy-Brown* (No. 19-1019) [hereinafter Dr. Cahoon Brief]. Workers, after all, breathe the same air as the hogs they tend. Given that these gases could kill pigs, it is entirely unsurprising that "approximately 50 percent of [CAFO] workers experience one or more of the following health outcomes: bronchitis, toxic organic dust syndrome, hyper-reactive airway disease, chronic mucous membrane irritation, occupational asthma and hydrogen sulfide intoxication." J.A. 8244.

What may seem surprising, but should not, is the gaseous spiral's final arc: the air quality threat posed to Kinlaw's neighbors. Like workers, neighbors living within two miles of hog CAFOs suffer from elevated rates of respiratory problems. J.A. 8242–43. Nearby residents may also suffer from aggravated rates of high blood pressure, depression, and infant mortality. Dr. Cahoon Brief 10–13; *see also* J.A. 8243. One study has even shown that children attending schools as far as three miles away from a hog CAFO face an increased likelihood of presenting asthma-related symptoms. Dr. Cahoon Brief 13; *see also* J.A. 935.

This triangular rotation among animals, workers, and homeowners is no fluke. It repeats again and again. Consider another similarly structured example: the problem of viral disease. It is well-established that close confinement leads to the "increased risk of the spread of disease" between hogs. J.A. 5206; *see also* Brief for the Humane Society of the United States as *Amici Curiae* Supporting Plaintiffs-Appellees 17, *McKiver v. Murphy-*

Brown (No. 19-1019) [hereinafter Humane Society Brief]. The buildup of excrement is, for example, “conducive to . . . breeding flies and insects,” J.A. 5211, which are known “vectors of disease,” J.A. 2567. Indeed, Kinlaw Farms suffered an outbreak of Porcine Epidemic Diarrhea Virus. J.A. 1801. It was, again, the hogs that suffered first.

But humans are not far behind. Pathogens like H1-N1 “swine flu,” which incubate and mutate in pigs, can sometimes jump to human hosts. J.A. 5204–05, 5972–73. The swine flu outbreak of 2009, which led to almost 275,000 hospitalizations and 12,500 deaths in the United States, put the country on notice of that fact. In any future pig-to-human transmission, individuals working directly with affected pigs at facilities like Kinlaw are likely to be among the first infected, followed shortly thereafter by other members of their community.

Analogous is the problem of diseases communicated not virally, but rather through bacterial infection. And again, it starts with the harms that pigs suffer in confinement: to compensate for the stressors of close confinement, CAFOs commonly administer antibiotics at subtherapeutic concentrations both “as prophylactic drugs and to increase feed efficiency and daily weight gain.” J.A. 5205; *see also* J.A. 5973; Humane Society Brief 17, 23. The predictable result is the genesis of novel strains of antibiotic-resistant bacteria. J.A. 5205. These strains, much more difficult to eradicate, plague the hogs more acutely.

As before, though, the problem’s impact on pigs is only the first link in a longer chain that wraps around workers and the surrounding homeowners. Antibiotic-resistant bacteria can spread from hogs to people, J.A. 5971–72; *see also* J.A. 5206 (“The capacity

for human care workers, their families, and residents of nearby communities to become infected with antibiotic-resistant microorganisms from swine CAFOs has long been documented.”), and even beyond the farm’s neighboring communities. J.A. 5972–73. The human health implications arising from antibiotic-resistant bacteria are severe: “if we use antibiotics . . . when we don’t really need them to treat people, they’ll lose their effectiveness when we really need them.” J.A. 5971; *see also* J.A. 5205–06.

The fourth and, in many senses, final confinement-related variation on this theme is the sheer amount of death at hog CAFOs like Kinlaw. Up to “ten percent of pigs die in confinement most likely due to complications from their overcrowded environment and lack of individualized veterinary care.” Humane Society Brief 11; J.A. 9014. The hogs at Kinlaw faced a slightly lower, but still significant, mortality rate of around seven percent. *See* J.A. 5201–02. This figure assumes that Kinlaw operated at full capacity. There is some suggestion that Kinlaw operated above capacity to account for the fact that “some [hogs] are going to die.” J.A. 6908.³

Dying hogs imperil human well-being in other ways. As Judge Thacker has noted, the problem lies in Kinlaw’s method of storing and disposing of the numerous dead hogs. *See* Maj. Op., *ante* at 48–49. Kinlaw piled carcasses into uncovered storage containers that

³ The calculation works are follows. Kinlaw Farms had a permitted hog count of 14,688. J.A. 5202. Based on the typical finishing operation turnover of 2.5 sellouts per year, J.A. 5201, approximately 36,720 hogs passed through Kinlaw in a year ($= 14,688 \times 2.5$). Kinlaw had average weekly fatalities of 49 hogs, J.A. 5202, or 2,548 hogs per year ($= 49 \times 52$). Thus, around 6.9% of hogs passing through Kinlaw were expected to die ($= 2,548 / 36,720$).

plaintiffs call “dead boxes.” J.A. 4956, 5679–80, 7867. Unfortunately for Kinlaw’s neighbors, exposed hog carcasses attracted buzzards and flies, which range with scant concern for property rights. J.A. 8446. A sorely unwelcome buzzard startled one neighbor’s little girl so badly that she slammed a door on her foot. J.A. 7757. Other homeowners detailed their distress at finding flies in their hair and food, J.A. 7317, and suffering invasions of “more gnats than you’ve ever seen in your life,” J.A. 7352. These unwelcome visitations were not minor inconveniences. They were hazardous to health and vectors of disease. *See* J.A. 1098–99, 2566–67. And they originated with the mistreatment of Kinlaw’s hogs.

The plentiful hog carcasses of Kinlaw Farms also posed a nuisance to neighbors when they were carted away daily in “dead trucks,” which caused the worst of the odors. J.A. 7260–62. Other Kinlaw trucks created noise and dust ceaselessly. As part of the initial design, Murphy-Brown placed a private service road leading to Kinlaw Farms within feet of nearby homes when an alternate route would have impacted neighbors far less. J.A. 2024, 7271–72, 7813–16, 7918. Instead, neighbors suffered from trucks constantly entering and leaving Kinlaw Farms—the truck delivery schedule, set by Murphy-Brown, showed eleven deliveries between 12:30 a.m. and 5:30 a.m. during a single morning. J.A. 7273. Again, Murphy-Brown cut corners and its neighbors suffered for it.

At the risk of replaying this theme *ad nauseum*, it should be observed that these interlocking dysfunctions were characteristic not just of close confinement but of the lagoon-and-sprayfield system as well. The negative effects on animals, workers, and homeowners are here all visible in a single glance. As with any large, uncovered cesspool,

it should come as no surprise that “[e]nvironmental and health concerns with the lagoon technology include emissions of ammonia, odors, pathogens, and water quality deterioration.” J.A. 6384 (internal citations omitted). The waste in these lagoons almost “certainly” contained “pathogenic microorganisms and bacteria,” including antibiotic-resistant bacteria. J.A. 6969. When this waste material is sprayed into the air, everything around, including nearby homes, is at the mercy of the prevailing winds. J.A. 5242–43. While the odor potential from spraying untreated hog waste high into the air—where it then drifts toward nearby homes—is self-evident, Murphy-Brown also knew of odor complaints from neighbors of hog farms with setups similar to Kinlaw. J.A. 5242–43, 7466–68. Nevertheless, it persisted in requiring the system for Kinlaw.

Even setting dispersion aside, the existence of lagoons maintained like Kinlaw’s tends to compromise local water quality. Studies have shown that many lagoons leach waste material into both surface water and groundwater. Dr. Cahoon Brief 15. In surface water, leakage can produce toxic algae blooms inimical to local wildlife and their habitat. *Id.* at 15–16; *see also* J.A. 5974–76. And waste that enters groundwater creates a health hazard, particularly for any nearby residents who drink or bathe with well water. Dr. Cahoon Brief 17–18; *see also* J.A. 5975. Water quality concerns are especially pressing here because Kinlaw—like many eastern North Carolina hog facilities—sits in a floodplain. J.A. 618, 5761–63. Similarly situated lagoons have overflowed during hurricanes, Dr. Cahoon Brief 18; J.A. 5761, and even under less dramatic weather conditions, recently sprayed waste material at Kinlaw can easily flow into the nearby Cape Fear River. *See* J.A. 624, 5231. Needless to say, deterioration in the local water quality is

a grievous blow to both animal and human welfare. Here as elsewhere, these two values are not orthogonal, but integrally connected.

At the end of all this wreckage lies an uncomfortable truth: these nuisance conditions were unlikely to have persisted for long—or even to have arisen at all—had the neighbors of Kinlaw Farms been wealthier or more politically powerful. Indeed, North Carolina’s ban on building new lagoon-and-sprayfield systems arose after CAFOs threatened to expand into a General Assembly member’s home district of Moore County, a popular destination for golfers and tourists. Stuart Leavenworth, *Golfers Take on Pork Producers over Hog-Farm Rules*, News & Observer, Feb. 27, 1997 (“When it hits home in your district, you become more keenly aware of problems that other parts of the state are having. . . . Travel and tourism are so very important to my district.” (quoting Rep. Richard Morgan of Moore County)); *see also* N.C. Sess. Law 1997-458; J.A. 5810–11, 7532. In 1997, residents of Bladen County suffered from a poverty rate almost twice that of Moore County—by 2018, the poverty rate grew to nearly three times that of Moore County. *State and County Estimates for 1997*, U.S. Census Bureau, Small Area Income and Poverty Estimates Program, <https://www.census.gov/data/datasets/1997/demo/saipe/1997-state-and-county.html>; *2018 Poverty and Median Household Income Estimates—Counties, States, and National*, U.S. Census Bureau, Small Area Income and Poverty Estimates Program (Dec. 2019), <https://www.census.gov/data/datasets/2018/demo/saipe/2018-state-and-county.html>. And a substantial proportion of residents near Kinlaw Farms are people of color. J.A. 5697.

It is well-established—almost to the point of judicial notice—that environmental harms are visited disproportionately upon the dispossessed—here on minority populations and poor communities. *See* Brief of the North Carolina Environmental Justice Network and the Rural Empowerment Association for Community Help as *Amici Curiae* Supporting Plaintiff-Appellees 26, *McKiver v. Murphy-Brown* (No. 19-1019) (noting that “[Industrial hog operations are] disproportionately concentrated in communities of color” and “that African Americans, Latinos, and Native Americans are 1.54, 1.39, and 2.18 times (respectively) more likely than whites to live within three miles of one or more [operations].”); *see also* J.A. 2263–64, 8422–23, 8426. But whether a home borders a golf course or a dirt road, it is a castle for those who reside in it. It is where children play and grow, friends sit and visit, and a life is built. Many plaintiffs in this suit have tended their hearths for generations—one family for almost 100 years. J.A. 7796. They are exactly whom the venerable tort of nuisance ought to protect. *Murphy-Brown’s* interference with their quiet enjoyment of their properties was unreasonable. It was willful, and it was wanton. The record fully supports the jury’s finding that punitive damages were warranted.

Moreover, plaintiffs’ suffering—stemming from *Murphy-Brown’s* mistreatment of its hogs—was avoidable. The scale of industrial hog farming is no warrant to ride roughshod over the property rights of neighbors, the health of workers and community members, and the lives of the hogs themselves. In fact, not one of the above problems is insuperable. Many can be mitigated using “[s]imple management and manure handling controls.” J.A. 5221. For example, facilities could decrease the number of hogs penned in each shed, *id.*, install covers on lagoons to lessen air and water pollution, J.A. 7896–900,

or implement available controls to remove pollutants from the air prior to ventilation, J.A. 5223. Moreover, “[i]f Smithfield paid for more labor, [it] may be able to keep the swine houses cleaner, which would also keep the hogs cleaner, reduce the dust, and reduce the odor.” J.A. 5221. This suggestion appears particularly apt for Kinlaw, where a single employee managed all twelve hog sheds—over 14,000 hogs—largely by himself. *Id.*

Perhaps due to labor constraints, Kinlaw flushed waste from the gutter beneath the sheds “around four to six times a day,” while a North Carolina State facility using similar technology flushes waste “up to 12 times a day.” J.A. 6202. This difference matters, because when you flush more, “it’s less waste accumulation so, of course, less opportunity for . . . gases and other things to evolve and to be emitted from the hog facility.” *Id.*

Beyond these straightforward improvements, more sophisticated solutions abound. Of note, “Terra Blue” advanced wastewater treatment technology—which was developed under the AG Agreement, *see* Maj. Op., *ante* at 8–9—is known for “pathogen reduction, odor reduction beyond the property boundaries, and . . . treat[ing] . . . wastewater constituents to a high quality before that material is disposed of.” J.A. 6985–86. It is sometimes true that economic development and environmental quality are incompatible. But it is not always the case, and the notion that we are invariably forced to a binary choice is a fallacy. Mutual benefit would seem within reach here. Advanced systems may benefit hogs *and* farmers by decreasing hog mortality and increasing weight gain “compared to the traditional lagoon management.” *See* J.A. 6392. However, Murphy-Brown never diverged from the lagoon-and-sprayfield system, J.A. 1988, 2005–10, or instructed Kinlaw to

implement any available technological improvements, or so much as considered the cost. J.A. 7628, 7656–65, 7874–80.

All this and more this nuisance lawsuit has laid bare. Courts may take note when an industry has “unduly lagged in the adoption of new and available devices.” *The T.J. Hooper*, 60 F.2d 737, 740 (2d Cir. 1932). While it is obviously not our job to displace corporate decision-making with our own, improvements in technology may bear relevance at trial to a company’s remediation efforts and options. As Gregg Schmidt, the president of Murphy-Brown, wrote in 2013: “We also believe that . . . many of our contract farms are approaching the age where significant renovations are necessary to ensure that the farm continues to operate efficiently.” J.A. 5231. These renovations were long overdue at Kinlaw Farms.

And efficiency is only one piece in the responsible stewardship of this essential industry. Leaders of such industries can cultivate them in ways that account for their full impact on *all* stakeholders. Business Roundtable, *Statement on the Purpose of a Corporation* (Aug. 2019). Smithfield itself has put it best:

We believe that financial stability and sustainability go hand in hand. Our sustainability strategies help us improve our company.

We seek to create value for our stakeholders, for our employees, and for our company as a whole. . . . We believe we can create greater value for each of our stakeholders by recognizing the intrinsic interconnections between our business objectives and our sustainability objectives. . . .

We use the term “value creation” broadly and think of it in ways that go beyond just our own company’s value.

J.A. 6632. Stakeholders do not just include consumers, suppliers, and employees; they include neighbors of hog facilities, children who go to school nearby, medical patients who rely on antibiotics, wildlife and water sports enthusiasts, and many more.

Finally there is Wilbur, the pig who was friends with a spider, a rat, geese, sheep, cows, and a little girl. *Charlotte's Web* reminds us that all life is interconnected. And while not all pigs will be pardoned like Wilbur, it is fitting that the creatures who give their very lives for us, receive in return our efforts to make their brief stay on earth less intolerable. For their sake and for ours. Such is the web of life.

AGEE, Circuit Judge, concurring in part and dissenting in part:

Although I concur in the resolution of several issues addressed in the majority opinion, I disagree that the admission of evidence relating to Murphy-Brown's corporate parents posed an improper risk only to the jury's calculation of punitive damages. In my view, the admission of this evidence was also patently erroneous as to liability for both compensatory and punitive damages. The prejudice from this error is so profound that a full new trial is necessary.

In addition, I disagree with the majority opinion's affirmance of the district court's decisions regarding the admissibility of certain expert witness testimony. Specifically, I conclude the district court abused its discretion in (1) failing to exercise its *Daubert*¹ gatekeeping function, which should have led to the limitation of testimony from Plaintiffs' expert witness Dr. Shane Rogers, and (2) excluding Murphy-Brown's expert witness Dr. Pamela Dalton from testifying about the results of olfactometer measurements taken at and near Kinlaw Farms. These evidentiary errors so affected the entire trial that they too require remanding for a new trial.

For these reasons, described in greater detail below, I respectfully dissent in part.²

¹ *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

² I concur in the majority opinion's conclusions that: (1) Kinlaw Farms was not a necessary and indispensable party in this case, Maj. Op. II.A; (2) the statute of limitations would not bar Plaintiffs' nuisance claims because this case alleged a "continuing" nuisance, Maj. Op. II.B; and (3) at the time this case was filed, North Carolina law authorized recovery of compensatory damages for loss of use and enjoyment of property, and the 2017 amendment to the Right to Farm Act does not operate retroactively to bar Plaintiffs from recovering such damages as a matter of law, Maj. Op. II.C.

I. Legal Background & District Court Proceedings

A. North Carolina Nuisance Law

Before exploring the particulars of the evidentiary errors, a brief discussion of Plaintiffs' claim is warranted. Each of the ten plaintiffs asserted a single cause of action—private nuisance under North Carolina law—against a single defendant, Murphy-Brown, LLC, d/b/a Smithfield Hog Production Division. Because operating “a lawful enterprise is not a private nuisance *per se*,” Plaintiffs asserted that Kinlaw Farms was a private nuisance *per accidens*, meaning that they alleged it “bec[a]me [a] nuisance[] by reason of [its] location, or by reason of the manner in which [it was] constructed, maintained or operated.” *Watts v. Pama Mfg. Co.*, 124 S.E.2d 809, 813 (N.C. 1962).³ A plaintiff must prove two things to hold a defendant liable for creating or maintaining a private nuisance *per accidens*: “(1) that the defendant’s use of its property, under the circumstances, unreasonably invaded or interfered with the plaintiff’s use and enjoyment of the plaintiff’s property; and (2) because of the unreasonable invasion or interference, the plaintiff suffered substantial injury.” *Elliott v. Muehlbach*, 620 S.E.2d 266, 269 (N.C. Ct. App. 2005). The two elements operate in tandem, as North Carolina courts have summarized a plaintiff’s prima facie case to require a showing of “the existence of a substantial and unreasonable interference with the use and enjoyment of [the plaintiff’s] property.” *The Shadow Group, L.L.C. v. Heather Hills Home Owners Ass’n*, 579 S.E.2d 285, 287 (N.C. Ct. App. 2003).

³ I have omitted internal quotation marks, alterations, and citations here and throughout the opinion, unless otherwise noted.

The “unreasonableness” component of a nuisance *per accidens* cause of action recognizes that individuals generally have freedom to use their property as they desire and some interferences with another person’s use of his property are expected when living in community. *Watts*, 124 S.E.2d at 815. This inquiry does not look to “whether a reasonable person in plaintiffs’ or defendant’s position would regard the invasion as unreasonable, but whether reasonable persons generally, looking at the whole situation impartially and objectively, would consider it unreasonable.” *Id.* at 814. That is why “[w]hat is reasonable in one locality and in one set of circumstances may be unreasonable in another [sic].” *Id.* North Carolina courts have identified many circumstances that factfinders can consider when determining whether an interference is unreasonable, including:

the surroundings and conditions under which defendant’s conduct is maintained, the character of the neighborhood, the nature, utility and social value of defendant’s operation, the nature, utility and social value of plaintiffs’ use and enjoyment which have been invaded, the suitability of the locality for defendant’s operation, the suitability of the locality for the use plaintiffs make of their property, the extent, nature and frequency of the harm to plaintiffs’ interest, priority of occupation as between the parties, and other considerations arising upon the evidence.

Id. “[N]o single factor is decisive, [and] all the circumstances in the particular case must be considered.” *Elliott*, 620 S.E.2d at 270.

The “substantial injury” component recognizes that because “[t]he law does not concern itself with trifles,” recovery is limited to invasions involving “more than slight inconvenience or petty annoyance.” *Watts*, 124 S.E.2d at 815. North Carolina courts have explained that a “substantial interference” means “a substantial annoyance, some material

physical discomfort or injury to the plaintiff's health or property." *The Shadow Group*, 579 S.E.2d at 200.

B. The Claim & the Trial

Plaintiffs' case was built around the allegation that three aspects of Kinlaw Farms' operations constitute a cognizable nuisance: (1) regular—though not constant—odors emanating onto their property from hogs and the lagoon-and-sprayfield waste management system; (2) buzzards and flies that frequented their properties, particularly when hog carcasses were stored in "dead boxes" awaiting removal from Kinlaw Farms; and (3) trucks driving on the dirt road that passed close to their residences to access Kinlaw Farms throughout the day and night to deliver and remove hogs. Plaintiffs each lived between one-tenth to one-half mile from the hog-confinement buildings, waste lagoons, or sprayfields on Kinlaw Farms; several of Plaintiffs' residences abut the unpaved roads used to access Kinlaw Farms.

Much of the evidence Plaintiffs submitted in support of their case was uncontested and is not at issue on appeal. Broadly described, their evidence included Plaintiffs' anecdotal descriptions of all three complained-of circumstances; records about Kinlaw Farms' operations, including waste spraying and truck transport schedules; expert testimony about how the lagoon-and-sprayfield waste management system works and the long-studied effects of industrial hog operations, including the type of lagoon-and-sprayfield system used at Kinlaw Farms, on surrounding communities; and testimony about

North Carolina's hog industry generally, including legislative action regulating it from the 1990s to present day.⁴

Similarly, much of Murphy-Brown's evidence was uncontested and is not at issue on appeal. It consisted of testimony describing (and records documenting) Kinlaw Farms' compliance with North Carolina laws regulating lagoon-and-sprayfield waste management systems on hog farms; Smithfield Foods, Inc.'s cooperation in studies regarding odor reduction following a 2000 agreement with North Carolina's Attorney General ("2000 AG Agreement")⁵; Murphy-Brown's responsiveness to reports of odor problems at *other* farms and the *absence* of any such complaints about Kinlaw Farms; efforts Murphy-Brown had undertaken to minimize odors associated with hog waste at its farms, including Smithfield Foods, Inc.'s research and development of hog feed that decreased the volume and odor of

⁴ Both parties presented extensive evidence about North Carolina's regulation of the industry. It included newspaper articles and scientific and legislative reports regarding statewide complaints about industrial hog farm odors in the 1990s that led to the legislature's decision to prohibit new lagoon-and-sprayfield waste storage systems from being created (while old systems were grandfathered in), as well as decades-long lobbying efforts in opposition and support of changes to the industry within the state and at other Murphy-Brown-affiliated farms in the United States.

⁵ The 2000 AG Agreement was entered into by the North Carolina Attorney General and Smithfield Foods, Inc. and several of its subsidiaries, including Murphy Farms, in which Smithfield Foods, Inc. agreed to participate in and fund research into "environmentally superior" waste management technology, and to subsidize the installation of any technology on its own and contract farms if an independent panel determined the technology was "technically, operationally and economically feasible" to implement. J.A. 7714, 7717. (That same year, Smithfield Foods, Inc. acquired Murphy Farms, which was later merged "with and into" Murphy-Brown. *See* J.A. 206, 597-98.)

hog feces; and anecdotal testimony from other individuals living within a few miles of Kinlaw Farms who testified they were not bothered by odors or the other alleged nuisances.

As relevant here, Murphy-Brown challenges the evidentiary decisions described above, which are reviewed for abuse of discretion. “A district court abuses its discretion if its conclusion is guided by erroneous legal principles or rests upon a clearly erroneous factual finding.” *Westberry v. Gislaved Gummi AB*, 178 F.3d 257, 261 (4th Cir. 1999). A district court’s evidentiary decision is subject to reversal only if, after considering the full record, the Court is left with “a definite and firm conviction that the court below committed a clear error of judgment in the conclusion it reached upon a weighing of the relevant factors.” *Id.* Lastly, evidentiary errors are subject to harmless-error review, meaning that erroneous decisions warrant a new trial only if the error affected a party’s “substantial rights.” Fed. R. Civ. P. 61. This standard requires that the error “so fatally infect[ed] the trial” as to violate the trial’s “fundamental fairness.” *Ward v. AutoZoners, LLC*, 958 F.3d 254, 273 (4th Cir. 2020).

II. Trial Testimony About Murphy-Brown’s Corporate Parents

Murphy-Brown challenges the admission of certain evidence about its corporate parents, which it contends allowed Plaintiffs to argue that Murphy-Brown should be held liable based on evidence about its parent corporations, which are not parties in this case.

A. Factual Background and District Court Ruling

Murphy-Brown is the sole defendant in this case. After the case was filed, but before trial, Murphy-Brown began doing business under the name “Smithfield Hog Production Division.” This tradename change reflected an ongoing effort to rebrand all Smithfield

Foods, Inc. subsidiaries under the “Smithfield” name. Throughout trial, the district court, counsel for both parties, and witnesses referred to “Murphy-Brown” and “Smithfield” using this interchangeable shorthand. Depending on context, sometimes “Smithfield” meant Murphy-Brown; sometimes it meant corporate parent Smithfield Foods, Inc.; and sometimes it meant the entire chain of corporate entities from Murphy-Brown on up to its ultimate corporate owner, WH Group Limited (“WH Group”).

But Murphy-Brown is not the same corporate entity as Smithfield Foods, Inc. In 2000, Smithfield Foods, Inc. purchased Murphy Family Farms; it later merged Murphy Family Farms with its other hog production subsidiaries to operate that aspect of Smithfield Foods, Inc.’s business under the name “Murphy-Brown.” In 2013, Smithfield Foods, Inc. became a “wholly-owned subsidiary of Shuanghui International Holdings Limited,” a China-based company, and a year later Shuanghui changed its name to WH Group. J.A. 8286.⁶

Murphy-Brown filed motions in limine seeking to exclude evidence about its own and its parent companies’ financial condition, executive compensation as well as its Chinese ownership. The district court denied the motion to exclude evidence of Murphy-Brown’s financial condition and reserved ruling on the parent companies’ financial condition until trial. It granted the motion to exclude “references to and evidence of

⁶ The actual relationship is more complicated, as Murphy-Brown’s sole member is John Morrell & Co., which is a wholly-owned subsidiary of Smithfield Foods, Inc., which is owned by United Global Foods (US), Inc., which is owned by Ipopema 127. In turn, that entity is owned by SFDS Malta Limited, which is owned by Rotary Vortex Limited, which is owned by WH Group.

Chinese ownership, exports of pork to China and other Asian nations, and racial issues.” J.A. 5796. Specifically, it ruled that Plaintiffs could “bring out that the WH Group is a Chinese corporation,” but that they could not mention communism or government control of Chinese corporations and could not “emphasize the ownership by the Chinese or any foreign entity.” J.A. 5724. The district court later agreed to the clarification that Plaintiffs could elicit testimony that “there is Chinese ownership,” but advised that they could “not stress that . . . I mean, it’s a fact and the fact that it’s a Chinese ownership is okay, but to argue that somehow you should punish these people because the grandparent corporation, whatever, is owned by the Chinese is unacceptable and I will not permit it.” J.A. 5727.

At trial Plaintiffs were permitted to introduce evidence that WH Group was a Chinese-based company doing business on the Hong Kong stock exchange, a fact they repeatedly referenced during opening and closing statements. From the outset of the trial, Plaintiffs characterized this case as a foreign company using cheap production methods in North Carolina:

In 2013, a Chinese company called Shuanghui purchases Smithfield Murphy-Brown for \$7.1 billion dollars. In the largest ever purchase of an American company by the Chinese. 25 percent of the pork in the United States is produced in the country, but owned by a foreign company. Using the cheapest waste disposal method available makes it cheaper to grow hogs in North Carolina than it is in China. 30 percent of Smithfield’s hogs are exported. The waste stays here.

Shuanghui is renamed WH Group and in 2015, Murphy-Brown is renamed Smithfield Hog Production Division. This is part of the one Smithfield initiative instituted by the new foreign owners. It’s a symbol of the fact that this is all one economic enterprise. The Smithfield Hog Production Division creates the hogs that Smithfield turns into the pork so that the foreign owner, WH Group, can make a profit. I’ll refer to this corporate organization through the trial as they refer to themselves,

Smithfield. So during the trial when you hear Murphy Farms, Carroll's, Brown's of Carolina, Premium Standard Farms, Smithfield Hog Production, Shuanghui, WH Group, those are all part of one economic entity: Smithfield.

In 2016, the Smithfield Hog Production Division sold \$2.7 billion dollars worth [sic] of pork.

J.A. 5813–14. Plaintiffs emphasized that under “Smithfield’s” current operations, “all this profit goes to the owners of Smithfield, that foreign company, WH Group,” but argued that if “Smithfield” implemented even more odor-reducing technologies to implement on its North Carolina farms, then

some of that profit would benefit the North Carolina economy by paying for those things. . . . Smithfield can give back to North Carolina by creating jobs and spending money cleaning up their mess and the neighborhoods. A company doesn't get to cut costs or make profits by ruining the neighbors' use and enjoyment of their property. It's Smithfield's hogs, Smithfield's hogs' waste, Smithfield's profit. Smithfield must pay for the harm.

J.A. 5853.

During trial, Plaintiffs interrogated Murphy-Brown executives about Smithfield Foods, Inc.'s approximately \$1 billion profit annually, WH Group's nearly \$2 billion profit annually,⁷ and the combined \$245 million that three Smithfield Foods, Inc. executives and one Murphy-Brown executive earned from 2010 to 2015.⁸ When Plaintiffs began questioning Murphy-Brown executive Donald Butler about WH Group's \$2 billion profits,

⁷ Plaintiffs' reference to the corporate parents' profits varied, with most references citing “Smithfield's” \$2 billion in profit, attributing to Murphy-Brown all of WH Group's profits for its worldwide business.

⁸ Specifically, Plaintiffs were permitted to introduce evidence relating to the compensation paid to Smithfield Foods, Inc.'s President and CEO, Executive Vice President and CFO; the Pork Group's President and COO; and Murphy-Brown's President. (Continued)

Murphy-Brown objected, but was summarily overruled each time. The next day, Murphy-Brown raised a more detailed objection, reminding the district court that it had deferred ruling on the motion in limine to exclude evidence about the corporate parents' profits, and that Plaintiffs were supposed to obtain a ruling before questioning witnesses about it, but had failed to do so. Murphy-Brown pointed out that because of the way Plaintiffs were "using the word 'Smithfield' interchangeably to refer both to Murphy-Brown and to the parent company, the manner in which [Plaintiffs' counsel was] doing this [was] very confusing and misleading to the jury and certainly would have left the impression that it[] [was] Murphy-Brown that had \$2 billion of profits." J.A. 7808. Further, Murphy-Brown argued that this information was irrelevant and extremely prejudicial, and it sought a limiting instruction and a ruling prohibiting further questioning of this kind. The district court "accept[ed] responsibility" for what had occurred the day before, but indicated that it would continue to allow this testimony—without any limiting instruction—because "the evidence that has been presented by [Plaintiffs] on the integrator setup of this company

Consistent with Plaintiffs' collective reference to the compensation for these four positions throughout trial, Murphy-Brown challenges as prejudicial the admission of the entire \$245 million in compensation. But the analysis to determine admissibility of financial compensation for the President of Murphy-Brown differs from the analysis for the admissibility of the financial compensation for the non-party Smithfield Foods, Inc. executives. For current purposes, it's sufficient to point out that the district court's decision failed to recognize the meaningful distinctions between parties and non-parties, as well as subsidiary and parent corporations. At any future trial, the analysis must consider these differences in determining admissibility, if any, of such evidence.

makes an admission of evidence” about WH Group or Smithfield Foods, Inc. admissible as evidence about Murphy-Brown “itself.” J.A. 7810–11.⁹

Plaintiffs later questioned Murphy-Brown’s president, Gregg Schmidt, about the combined \$245 million compensation paid to four “Smithfield” executives over six years. In so doing, Plaintiffs elicited testimony that compensation information was “no longer a matter of public record” because “the foreign ownership of Smithfield” meant that it was “no longer obligated to make certain . . . Security Exchange Commission filings with the United States Government.” J.A. 7882. Schmidt acknowledged that “Smithfield” was no longer “listed on the New York Stock Exchange,” but was “part of a company that[] [was] listed on the Hong Kong Exchange so it ha[d] different reporting requirements.” J.A. 7882.

During closing statements, Plaintiffs once again used the district court’s rulings to full effect, referring to the billions of dollars in profit of WH Group and Smithfield Foods, Inc. on at least six separate occasions and peppering in references to the executive compensation multiple times as well. *E.g.*, J.A. 9005 (“Smithfield refuses to implement [odor-reducing technologies] despite profits of \$2 billion every year.”); 9009 (“Despite \$2 billion in profit every year, Smithfield says it’s too expensive.”); 9011 (“And last year, in a single year, WH Group made \$2 billion in profit. \$2 billion in profit. Selling pork.”);

⁹ The parties described the corporate structure as being “vertically integrated,” meaning not just that each subsidiary is entirely owned by each corporate parent all the way to WH Group, but also that Smithfield Foods, Inc. owns every aspect of its pork-related business from feed to hogs to slaughterhouses to pork processing and sales. As its rebranding indicated, Murphy-Brown is Smithfield Foods, Inc.’s hog production division. Murphy-Brown owns the hogs it places on its own and contract-farmers’ industrial hog farms to be raised and slaughtered.

9043 (“It’s all about a \$2 billion a year profit not being spent to fix their own mess.”); 9050 (“They willfully choose not to do anything about [this problem]. Not even figure out how much it would cost, but yet they pay \$245 million to four people over four years.”); 9051–52 (“We know how Smithfield values the harm. Smithfield values the harm in their own dollars. Murphy-Brown revenue, \$3 billion every year. WH Group after tax profit, \$2 billion every year. Smithfield after tax profit, \$1 billion every year. The cost of covering all North Carolina lagoons, \$500 million. The pay for just four Smithfield executive [sic], from 2010 to 2015, \$245 million.”); 9125 (“And finally, the defendant’s ability to pay punitive damages as evidenced by its revenues or net worth. And that’s why we’re discussing it. . . . The revenues are \$3 billion dollars every year. . . . [W]hether the defendant profited by the conduct—is \$2 billion every year for WH Group, \$1 billion dollars every year for Smithfield.”).

B. Analysis

Murphy-Brown raises two interconnected errors in the district court’s evidentiary rulings: (1) the admission of evidence about non-party corporate parents’ financial information to establish a subsidiary’s liability and assess damages; and (2) the admission of evidence that a *Chinese* corporation owns Murphy-Brown, which Plaintiffs exploited to argue this case was against foreign big business in an appeal to xenophobia. Each argument involves slightly different focal points and is addressed separately, although they rely on interconnected facets of the record and the law.

1. Ignoring Foundational Principles of Corporate Liability to Admit Evidence About the Finances of Murphy-Brown's Parent Corporations

Plaintiffs were the masters of their complaint and decided to name only one defendant: Murphy-Brown. This decision means that any judgment obtained would be against Murphy-Brown alone. As a matter of essential due process, “a person is not subject to a judgment entered in litigation in which he has not been named as a party or been made a party by service of process.” *Life Techs. Corp. v. Govindaraj*, 931 F.3d 259, 264 (4th Cir. 2019). So even assuming Plaintiffs proved their nuisance claims against Murphy-Brown, that judgment—including any compensatory or punitive damages award—could be levied against Murphy-Brown alone. Neither WH Group nor Smithfield Foods, Inc. could be held liable in this case.

Even if Plaintiffs *had* named any of Murphy-Brown's corporate parents as a defendant, their ability to obtain judgment against those defendants would have been contingent on a separate analysis and determination of whether the evidence permitted judgment against that defendant either directly or by piercing the corporate veil. Put another way, before establishing liability, Plaintiffs would have had to first demonstrate to the court that it was appropriate to disregard corporate formalities and allow one or more of the parent corporations to be held liable for the conduct of Murphy-Brown. This course is required by the cardinal rule of corporate law that “a parent corporation (so-called because of control through ownership of another corporation's stock) is not liable for the acts of its subsidiaries.” *United States v. Bestfoods*, 524 U.S. 51, 61 (1998); accord *Watters v. Wachovia Bank, N.A.*, 550 U.S. 1, 43 (2007) (Stevens, J., dissenting) (“[T]he primary

advantage of maintaining an operating subsidiary as a separate corporation is that it shields the [parent corporation] from the operating subsidiaries' liabilities."); *Richardson v. Bank of America, N.A.*, 643 S.E.2d 410, 421 (N.C. Ct. App. 2007) (same). In appropriate cases, an "equally fundamental principle of corporate law" provides "that the corporate veil may be pierced and the [corporate parent] held liable for the [subsidiary's] conduct when, *inter alia*, the corporate form would otherwise be misused to accomplish certain wrongful purposes, most notably fraud, on the [corporate parent's] behalf." *Bestfoods*, 524 U.S. at 62. This doctrine has several descriptors, including "piercing the corporate veil," an "alter ego" theory, and the "instrumentality" rule. *See Strategic Outsourcing, Inc. v. Stacks*, 625 S.E.2d 800, 804–05 (N.C. Ct. App. 2006) (describing these concepts and authorizing veil-piercing "in reverse" to make the corporation liable for its officer's actions, rather than the officer being liable for the corporation's obligations).¹⁰

Regardless of the name ascribed to it, the issue of whether it's appropriate to hold a corporate parent responsible for the conduct of its subsidiary arises *only* when a plaintiff has *named* the corporate parent as a defendant in the action and it can be done *only* after

¹⁰ North Carolina describes its "instrumentality rule" as "the basis for disregarding the corporate entity or 'piercing the corporate veil.'" *Glenn v. Wagner*, 329 S.E.2d 326, 330 (N.C. 1985). It states: "A corporation which exercises actual control over another, operating the latter as a mere instrumentality or tool, is liable for the torts of the corporation thus controlled. In such instances, the separate identities of parent and subsidiary or affiliated corporations may be disregarded." *Id.* Liability may be imposed upon satisfaction of three elements. Several factors demonstrate whether the elements are meant, such as the level of control exercised and whether there's "[i]nadequate capitalization," "[n]on-compliance with corporate formalities," "[c]omplete domination and control of the corporation so that it has no independent identity," or "[e]xcessive fragmentation of a single enterprise into separate corporations." *Id.* at 330–31.

the plaintiff satisfies the distinct principles applicable to this basis of liability. Put differently, while North Carolina “courts will disregard the corporate form or ‘pierce the corporate veil,’ and extend liability for corporate obligations beyond the confines of a corporation’s separate entity . . . to achieve equity,” they will do so only after making the necessary factual findings demonstrating the propriety of doing so. *Glenn*, 329 S.E.2d at 330–31.

In this case, brought against Murphy-Brown alone, Plaintiffs did not seek to hold WH Group, Smithfield Foods, Inc., or any other corporate parent liable for Murphy-Brown’s allegedly tortious conduct. Moreover, the district court made no specific factual findings supporting the conclusion that Murphy-Brown was the “mere instrumentality or tool” of its corporate parents, or vice versa. And, indeed, the district court’s *judgment* does not violate any of these principles because it holds Murphy-Brown alone liable for the nuisance and associated damages. It does not purport to be a judgment against WH Group or Smithfield Foods, Inc.

But the trial record demonstrates that the district court improperly allowed Plaintiffs to introduce evidence about and argue for Murphy-Brown’s liability based on the conduct and characteristics of its non-party corporate parents. The above principles of due process and corporate law do not authorize this sort of implicit veil-piercing between a party subsidiary and a non-party corporate parent. *See Estate of Hurst ex rel. Cherry v. Moorehead I, LLC*, 748 S.E.2d 568, 575 (N.C. Ct. App. 2013) (affirming a judgment imposing liability on the corporate parent—who was a party to the case—because the facts supported piercing the corporate veil under the instrumentality rule); *accord Broussard v.*

Meineke Discount Muffler Shops, Inc., 155 F.3d 331, 349 (4th Cir. 1998) (applying North Carolina law to reverse district court’s ruling that “[d]isregard[ed] the corporate form” to impose liability on a corporate parent); *Continental Indus., Inc. v. Integrated Logistics Sols., LLC*, 211 F.R.D. 442, 444–45 (N.D. Okla. 2002) (denying discovery request about defendant’s corporate parent because the parent was “not even before the [c]ourt” as a named defendant, so the issue of whether the non-party corporate parent could be held liable by piercing the corporate veil was not before the court). The district court’s disregard for these bedrock principles was error and affected the entire trial because it led to the admission of irrelevant and highly prejudicial evidence about Murphy-Brown’s corporate parent as a means to hold Murphy-Brown liable.

Without question, different analyses are involved in the decision about when a corporate parent can be held liable for the acts of its subsidiary and when evidence about a corporate parent can be admitted into evidence in a trial involving its subsidiary. But as described next, these principles necessarily inform a district court’s decisions about admissibility of evidence related to a corporate parent under Rules 401 and 403 of the Federal Rules of Evidence. In short, these principles of due process and corporate liability provide the framework for understanding why—in a trial against the subsidiary alone—evidence about its parent corporations is usually irrelevant and runs a high likelihood that its probative value is substantially outweighed by the risk of prejudice. This case presents a quintessential example of why those Rules are in place.

Murphy-Brown challenges the district court’s rulings allowing the admission of its corporate parents’ executive compensation and profits, which Plaintiffs used to argue that

Murphy-Brown should be held liable for a nuisance and assessed corresponding compensatory and punitive damages. On this issue, I agree with the majority opinion's conclusion that this evidence was inadmissible for the purpose of calculating punitive damages because it ran an unacceptable risk that the jurors would rely on the corporate parents' financial information in assessing an appropriate amount to award Plaintiffs. But I disagree with the majority opinion's conclusion that this evidence was admissible for purposes of determining *liability* for either compensatory or punitive damages in the first instance. The wall the majority opinion draws between liability and damages is illusory: the prejudice permeates the entire case. Plaintiffs specifically argued that this evidence should be used for both purposes, and its admission allowed the jury to hold Murphy-Brown liable based on irrelevant and highly prejudicial evidence about its corporate parents' financial information. The district court abused its discretion in allowing admission of this evidence, which was not harmless.

As pertinent here, evidence is admissible under the Federal Rules if it is relevant, Fed. R. Evid. 401, but the court "may exclude relevant evidence if its probative value is substantially outweighed by a danger of" "unfair prejudice, confusing the issues, [or] misleading the jury," among other things, Fed. R. Evid. 403; *Spring/United Mgmt. Co. v. Mendelsohn*, 552 U.S. 379, 384 (2008) (recognizing district courts have latitude to balance the "probative value and prejudice" of all evidence, including the decision to "exclude as unduly prejudicial some evidence that has already been found to be factually relevant"). The test for relevant evidence is both straightforward and permissive: "Evidence is relevant if it has any tendency to make a fact more or less probable than it would be without the

evidence; and the fact is of consequence in determining the action.” Fed. R. Evid. 401; *Minter v. Wells Fargo Bank, N.A.*, 762 F.3d 339, 349 (4th Cir. 2014) (“To be admissible, evidence must be relevant—a low barrier requiring only that evidence be worth consideration by the jury.”). In addition, “unfair prejudice” is “the possibility that the evidence will excite the jury to make a decision on the basis of a factor unrelated to the issues properly before it.” *Mullen v. Princess Anne Volunteer Fire. Co.*, 853 F.2d 1130, 1134 (4th Cir. 1988); *see also Morgan v. Foretich*, 846 F.2d 941, 945 (4th Cir. 1988) (describing it as the “genuine risk that the motions of the jury will be excited to irrational behavior, and that this risk is disproportionate to the probative value of the offered evidence”). Applying these principles to this case leaves the firm conviction that the district court erred in allowing the admission and use of the challenged financial information about Murphy-Brown’s parent corporations to establish Murphy-Brown’s liability.

At the outset, it’s worth reiterating that under the principles of due process and corporate law discussed above, a non-party corporate parent’s profitability and executive compensation typically would be irrelevant to determining a subsidiary’s liability. Absent a properly presented case brought against the corporate parent in which the plaintiff demonstrates the propriety of piercing the corporate veil (which is not present in this case), the corporate parent is a stranger to the litigation, cannot be held liable, and is not a pertinent actor for establishing the subsidiary’s tort liability. *See Estate of Hurst ex rel. Cherry*, 748 S.E.2d at 575; *Broussard*, 155 F.3d at 349. As such, that evidence would not matter to the jury’s determination of what the subsidiary did and whether to hold it liable. Likewise, information about a parent corporations’ substantial profitability and executive

compensation runs a real risk of unfair prejudice to the subsidiary as well as confusing the issue of a parent corporation's conduct and ability to pay with the subsidiary's own culpability and ability to pay. *E.g.*, *O'Dell v. Hercules, Inc.*, 904 F.2d 1194, 1208 (8th Cir. 1990) (affirming the district court's exclusion of evidence about a non-party corporate parent's conduct because it would have been unfairly prejudicial to the subsidiary).

Both the district court's and the majority's opinions incorrectly conclude that something about Murphy-Brown's specific trial arguments made this highly prejudicial evidence relevant to establishing liability. To the contrary, the record shows that throughout the trial *Plaintiffs* repeatedly and intentionally conflated Murphy-Brown and its corporate parents, treating Murphy-Brown as if it had unfettered control over how Smithfield Foods, Inc. compensated its executives and how WH Group and Smithfield Foods, Inc. spent their profits. In truth, nothing in the record suggests that Murphy-Brown had such authority. Moreover, nothing Murphy-Brown advanced at trial made WH Group or Smithfield Foods, Inc.'s financial information so probative that its admission was not substantially outweighed by the risk of unfair prejudice, confusing the issues, and misleading the jury.

Recognizing that part of the nuisance analysis was a determination that any intrusion was *unreasonable*, Murphy-Brown argued that any hog odors emanating from Kinlaw Farms were *reasonable* because it operated in accord with its state-imposed obligations. It advanced this argument in several ways, including contentions that North Carolina law authorized Kinlaw Farms' lagoon-and-sprayfield system, that Kinlaw Farms possessed and complied with all necessary state operating permits, and that the 2000 AG Agreement did

not impose any additional unfulfilled obligations on how Kinlaw Farms operated. In addition, Murphy-Brown argued it had voluntarily implemented additional economically feasible odor-reducing technologies, and acted reasonably in deciding not to impose the ones Plaintiffs now advocated as additional actions because those were not economically viable. Plaintiffs cite—and the majority opinion accepts—the last two arguments as reasons why Murphy-Brown’s arguments opened the door to admission of its corporate parents’ financial information. A closer look reveals why the majority opinion errs.

Murphy-Brown invoked the 2000 AG Agreement as proof that its operations did not unreasonably intrude on Plaintiffs’ properties. This agreement required Smithfield Foods, Inc. to cooperate with the state’s studies of potential odor-reducing technologies and to implement any of those technologies that an independent designee determined to be economically feasible. Part of Smithfield Foods, Inc.’s contractual obligation was to fund implementation of those technologies on any of the farms it operated or contracted with, which would include funding them at Kinlaw Farms. So when Plaintiffs argued that Murphy-Brown should have been using such technologies as super soils or lagoon covers, Murphy-Brown pointed to Smithfield Foods, Inc.’s obligations under the 2000 AG Agreement to assert that had those technologies been deemed economically feasible, they would have been put into effect. Murphy-Brown was correct at least insofar as the independent designee determined not to require these measures.

Thus, while it is true that Murphy-Brown cited Smithfield Foods, Inc.’s conduct related to the 2000 AG Agreement as something to be imputed to it for purposes of arguing it operated Kinlaw Farms in a reasonable manner, it did so because Smithfield Foods, Inc.

was the relevant signatory. But Smithfield Foods, Inc. had agreed to be liable *only* for implementing any odor-reducing technologies required by the designee. Its obligation to pay for anything on Kinlaw Farms or anywhere else extended no further. Notably, Plaintiffs do *not* contend Murphy-Brown failed to implement any action required by the 2000 AG Agreement. Further, nothing in the record indicates any additional binding obligations or commitments on the part of Smithfield Foods, Inc. By relying on Smithfield Foods, Inc.'s obligation under the 2000 AG Agreement, Murphy-Brown did not open the door to admission of evidence of all of Smithfield Foods, Inc.'s profits because they are irrelevant to assessing the obligations under that agreement.¹¹

Separate from the 2000 AG Agreement, Murphy-Brown also argued that it had voluntarily implemented economically feasible odor-reducing technologies. And it's true that Smithfield Foods, Inc. developed the odor-reducing technologies that Murphy-Brown pointed to as proof that it (Murphy-Brown) had implemented economically viable technologies and continued to develop and explore other options. Once again, however, no evidence showed that Murphy-Brown, the subsidiary, could have required or obligated WH Group, Smithfield Foods, Inc., or any other entity to devote more of their resources to developing or implementing additional odor-reducing technologies for use at Kinlaw Farms. So this argument did not open the door to evidence about the corporate parents' financial information either.

¹¹ WH Group's profits are even further removed from the realm of relevant evidence. It was not a party to the 2000 AG Agreement, so it never undertook any obligation at all with respect to Kinlaw Farms.

The testimony of Murphy-Brown's executives does not suggest otherwise. Schmidt agreed that "Smithfield" would "pay to put technology on contract growers' operations to better deal with the waste from Smithfield's hogs on those operations" if such a technology was identified and economically viable. J.A. 7880. Plaintiffs' use of "Smithfield" during questioning blurs which company—Smithfield Foods, Inc. or Murphy-Brown—would have paid or was under any obligation to do so. J.A. 7880. ("Q. . . . And Smithfield could pay for it if Smithfield wanted to pay for it, correct? A. If it was economically viable."). Even assuming Schmidt was referring to Smithfield Foods, Inc.'s theoretical ability to pay, there's nothing in the record suggesting Schmidt—Murphy-Brown's president—could have obligated Smithfield Foods, Inc. to pay for anything or had unrestricted access to the parent company's money. Thus, the door to admitting Smithfield Foods, Inc.'s financial information should have been closed.

The majority opinion also takes Schmidt's later testimony out of context. During one exchange, Schmidt agreed that if Murphy-Brown decided to cover the lagoons on contract farmers' properties "it could go ask Smithfield or WH Group for the money to do it" because "[t]hat would be the procedure" and "that would be where [Murphy-Brown would] get the money." J.A. 7908. Once again, nothing in this testimony suggests that WH Group or Smithfield Foods, Inc. would have agreed to incur any costs at Murphy-Brown's request; instead, Schmidt's testimony was purely about the hypothetical procedure

Murphy-Brown could have pursued to obtain funding outside its own resources.¹² Neither this exchange—nor any other trial evidence—shows Schmidt had any authority to bind any party but Murphy-Brown. By admitting that Murphy-Brown could *ask* its corporate parents for money, Schmidt was not testifying that Murphy-Brown could *obtain* its corporate parents' funds for any purpose. Therefore, this testimony does not make any evidence regarding the corporate parents' finances relevant.

At bottom, Murphy-Brown's arguments at trial and the testimony of its executives focused on the decisions that Murphy-Brown made about why it chose to implement some new technologies and not implement others. Its arguments did not change whose conduct was relevant to the jury's consideration of Murphy-Brown's decisions. Nor did its arguments open the door to information about its corporate parents' profits as evidence of what more *it* could have afforded. Thus, contrary to the district court and the majority opinion's view, neither the "integrated" nature of Smithfield Foods, Inc.'s corporate structure nor the specific arguments Murphy-Brown made to defend its decisions made information about the non-party corporate parents relevant. As such, that evidence was inadmissible.

Even were Smithfield Foods, Inc.'s financial information somehow marginally relevant as a result of Murphy-Brown's arguments, a proper Rule 403 analysis would still

¹² The same conclusion can be drawn from Butler's testimony, who testified that "Smithfield" would not choose to "implement a technology that we know would render farms economically nonviable," J.A. 7571, and that it based those determinations on North Carolina law and Smithfield Foods, Inc.'s contractual obligations as opposed to considering whether it had money to pursue additional technologies.

require exclusion of evidence of \$245 million in non-party executive compensation and \$2 billion in non-party profit because of the resulting unfair prejudice, confusion of the issues, and risk of misleading the jury. The record shows that Murphy-Brown often operated at a loss or was barely profitable despite having significant annual revenues. But the district court's ruling effectively allowed Plaintiffs to avoid haling the corporate parents into federal court as a defendant to this action and proving their liability by association alone. Under this short-circuited approach, Plaintiffs were permitted to argue that Murphy-Brown—the sole defendant at issue in this case—actually had \$2 billion at its disposal and had elected to spend \$245 million to compensate four executives. Viewed another way, they argued that WH Group and Smithfield Food, Inc. acted unreasonably by not doing more on behalf of their subsidiary, Murphy-Brown, despite WH Group and Smithfield Food, Inc.'s conduct not being at issue in the case because they were not named parties.

The resulting unfair prejudice to Murphy-Brown could not be more readily apparent. Had the evidence been limited to Murphy-Brown's financial information, which was nowhere near these amounts, the jury may well have reached a much different determination of the financial feasibility of implementing odor-reducing technologies when it was deciding Murphy-Brown's liability for a nuisance. Instead, it heard—repeatedly—that “Smithfield” operated at a \$2 to \$3 billion profit, leaving the jury with an entirely skewed idea of whether Murphy-Brown's decisions unreasonably intruded on Plaintiffs' properties. And it was invited to hold Murphy-Brown liable based on the financial capability of its non-party corporate parents. Where evidence runs such a high risk of leading the jury to base its verdict on improper grounds, it should be excluded under

Rule 403. *E.g.*, *Carnell Constr. Corp. v. Danville Redev't & Hous. Auth.*, 745 F.3d 703, 719–21 (4th Cir. 2014) (holding that the district court abused its discretion in admitting evidence of marginal probative value); *Utility Control Corp. v. Prince William Constr. Co.*, 558 F.2d 716, 721 (4th Cir. 1977) (holding that the district court abused its discretion in admitting evidence that an employee “once previously executed an express guarantee” because “its relevancy was so slight” that it was substantially outweighed by the danger that the jury would think it served as evidence that the employee signed in that capacity in the contract at issue).

At this point, it scarcely requires any additional discussion of why the improper admission of evidence about WH Group and Smithfield Foods, Inc.’s financial information affected Murphy-Brown’s substantial rights during the trial. As noted earlier, Plaintiffs disregarded basic principles of corporate law by bringing their case against Murphy-Brown alone and yet arguing that this one subsidiary should be held liable based on evidence related to the entire “Smithfield” corporate structure. Plaintiffs plainly timed their questions about Murphy-Brown’s decision not to implement additional odor-reducing technologies to immediately precede questions about Smithfield Foods, Inc.’s executive compensation and WH Group and Smithfield Foods, Inc.’s profits. Moreover, they admitted that “[the] point” of their focus on “Smithfield’s” \$2 billion profits was to demonstrate that *Smithfield Foods, Inc.* spent only “about a thousandth of one year’s profit” on researching and developing odor-reducing technologies. J.A. 7610. Plaintiffs repeatedly referred to a \$2 billion profit during opening and closing statements, arguing to the jury that “[t]echnological solutions have been found. . . . Super soils and covers. *Smithfield*

refuses to implement them despite profits of \$2 billion every year. *They* say it's too expensive." J.A. 9005 (emphases added); *see also* J.A. 9050 ("They willfully cho[]se not to do anything about it . . . but yet *they* pay \$245 million to four people over four years." (emphases added)). And in reminding the jury of its duty to determine an appropriate amount of damages arising from a nuisance, Plaintiffs specifically urged the jury to consider the corporate parents' executive compensation and profitability:

There is no fixed formula for placing a value on these alleged harms. It's up to the ten of you to make your decision what is the appropriate value. We know how *Smithfield* values the harm. *Smithfield* values the harm in their own dollars. *Murphy-Brown* revenue, \$3 billion every year. *WH Group* after tax profit, \$2 billion every year. *Smithfield* after tax profit, \$1 billion every year. The cost of covering all North Carolina lagoons, \$500 million. The pay for just four *Smithfield* executive [sic], from 2010 to 2015, \$245 million.

J.A. 9051–52 (emphases added). The financial information about *Murphy-Brown's* corporate parents was a focal point of Plaintiffs' argument that *Murphy-Brown* could have afforded to do more to reduce odors at Kinlaw Farms and for assessing both compensatory and punitive damages. Its admission was not harmless because it cannot be said "with fair assurance, after pondering all that happened without stripping the erroneous action from the whole, that the judgment was not substantially swayed by the error." *Smith v. Balt. City Police Dep't*, 840 F.3d 193, 201 (4th Cir. 2016); *see Macsherry v. Sparrows Point, LLC*, 973 F.3d 212, 225–26 (4th Cir. 2020) (vacating and remanding for a new trial where evidentiary error harmed the defendants—despite other evidence supporting plaintiff's claim—because of its likelihood of swaying the jury's consideration of the evidence and determination of damages).

Unlike the majority opinion, I see no basis in common sense or the law for concluding that this evidence was not equally prejudicial for both compensatory and punitive liability purposes. Accordingly, I would hold that the district court abused its discretion in allowing admission of the corporate parents' financial information as the basis for holding Murphy-Brown liable. And because this error affected Murphy-Brown's substantial rights and guarantee of a fundamentally fair trial, I would hold that it requires a new trial on both liability and damages.¹³

2. Evidence of Chinese Ownership Led to Improper Xenophobic Appeals

The district court also abused its discretion by allowing Plaintiffs to introduce and emphasize testimony that a *Chinese* corporation with \$2 billion profits owned Murphy-Brown. This evidence was largely irrelevant and—as it was used at trial—created an unacceptable risk that the jury's verdict would be based on anti-China bias.

¹³ The error was not limited to the liability stage and, as the majority opinion correctly concludes, the prejudicial nature of this evidence is readily apparent in the jury's calculation of punitive damages. *See* Maj. Op. II.G.2. As that opinion recognizes, juries must assess the *defendant's* ability to pay and determine what might deter the *defendant* when calculating a proper amount of punitive damages. *See TXO Prod. Corp. v. Alliance Res. Corp.*, 509 U.S. 443, 462 n.28 (1993) (plurality opinion) (observing the “well-settled” principle that a defendant’s “net worth” is one factor “typically considered in assessing punitive damages”); N.C. Gen. Stat. § 1D-35(2)(i) (allowing consideration of the defendant’s ability to pay “as evidenced by *its* revenues or net worth” (emphasis added)); *Watson v. Dixon*, 532 S.E.2d 175, 178 (N.C. 2000) (same). In sum, I agree with this part of the majority opinion’s decision because evidence of the corporate parents’ financial information should not have been part of the determination of punitive damages, but I disagree that the harm only arose in that context because it equally poisoned the determination of liability.

In 2013, WH Group became Murphy-Brown's owner, seven corporate levels removed. Nothing in the record indicates that WH Group was ever actively involved in any aspect of North Carolina's industrial hog farms, let alone in the management of Kinlaw Farms. More particularly, WH Group's Chinese identity had no bearing on whether Murphy-Brown substantially and unreasonably interfered with Plaintiffs' use and enjoyment of their property. *See supra* Part I.A (discussing a plaintiff's burden in establishing a *per accidens* nuisance). Its irrelevance to any issue before the jury meant that it plainly served only to facilitate Plaintiffs' arguments to provoke passions against foreign big business, and incite anti-China sentiment specifically. As such, its admission was irreparably prejudicial.

To be sure, the district court's pre-trial ruling ostensibly struck a balance between allowing admission of the mere fact of Chinese ownership and prohibiting Plaintiffs from "emphasiz[ing]" or "stress[ing]" that fact at trial. J.A. 5724, 5727. But whatever theoretical balance had been contemplated was abandoned during opening statements and continued to be exploited repeatedly throughout the trial. As the earlier factual recitation makes plain, Plaintiffs immediately set out to tear down any distinction between Murphy-Brown and its corporate parents, explaining that it would refer to "this corporate organization"—i.e., any company from Murphy-Brown to WH Group—as "Smithfield." J.A. 5814. Doing so simultaneously allowed Plaintiffs to emphasize defendant Murphy-Brown's foreignness in arguments that can only be described as encouraging xenophobia amongst the jurors. *E.g.*, J.A. 5852–53 ("[A]ll this profit goes to the owners of Smithfield, *that foreign company*, WH Group." (emphasis added)).

During opening and closing statements, Plaintiffs characterized the entire case as one where the profits from North Carolina's hog farms ended up in China while the hog waste generated on them was left in-state. J.A. 5814 ("Using the cheapest waste disposal method available makes it cheaper to grow hogs in North Carolina than it is in China. 30 percent of Smithfield's hogs are exported. The waste stays here."); J.A. 9010 (same). They also highlighted WH Group's acquisition of Smithfield Foods, Inc. as "the largest ever purchase of an American company by the Chinese." J.A. 5813, 9010. Plaintiffs elicited testimony on WH Group's purchase of Smithfield Foods, Inc., including WH Group's having to go through a congressional process overseeing "proposed foreign acquisitions," J.A. 7432, and no longer being required to disclose certain information as a "matter of public record" because it was listed on the Hong Kong stock exchange rather than the New York Stock Exchange, J.A. 7882. And Plaintiffs asked Butler about Murphy-Brown's profits to confirm that all of Murphy-Brown's profits flowed solely to "Smithfield," J.A. 7438, a response they used to argue that all of Murphy-Brown's endeavors occur so "that the foreign owner, WH Group, can make a profit" in the neighborhood of \$2 billion. J.A. 5814; J.A. 9011 ("The Smithfield Hog Production Division creates the hogs that Smithfield turns into the profit for the WH Group. And last year, in a single year, WH Group made \$2 billion in profit.").

"The Supreme Court has long made clear that statements that are capable of inflaming jurors' racial or ethnic prejudices degrade the administration of justice." *United States v. Runyon*, 707 F.3d 475, 494 (4th Cir. 2013); *see also United States v. Blankenship*, 382 F.3d 1110, 1127 (11th Cir. 2004). Further, the Supreme Court has cautioned about the

prejudice that can arise from the admission of evidence of corporations deemed to be “other.” *E.g.*, *State Farm Mut. Auto. Ins. Co. v. Campbell*, 538 U.S. 408, 417 (2003) (noting that the bias created from evidence about a large corporation’s wealth is particularly acute when that business lacks a “strong local presence[.]”). In fact, many courts have recognized the prejudice that easily arises from evidence about—and repeated references to—an entity’s foreignness when compared to the local entities and issues in a case. *E.g.*, *Boyle v. Mannesmann Demag Corp.*, 991 F.2d 794, *3 (6th Cir. 1993) (unpublished table decision) (“[R]epeated references to a party’s citizenship or nationality can be unduly prejudicial to that party. *See Gearhart v. Uniden Corp. of Am.*, 781 F.2d 147 (8th Cir. 1986) (on retrial, remarks relating to Far Eastern parent corporations should not be permitted because of xenophobia and because wealth of parent corporations is irrelevant to the issues in the case).”). Trial courts have been repeatedly cautioned to guard against such bias-baiting arguments. Although the district court’s pre-trial ruling implicitly acknowledged this very real risk, it did nothing at trial to enforce its pretrial order or restrain Plaintiffs from inflaming the passions of the jury against Chinese big business despite Murphy-Brown’s motion in limine.

By emphasizing that *Smithfield* was a Chinese corporation, Plaintiffs fostered a genuine likelihood that the verdict was influenced by anti-China bias. Their arguments and the admitted evidence speak for themselves, but did not occur in a vacuum. This trial occurred from April 3 to 26, 2018, at a time when escalating concern and inflammatory rhetoric concerning this precise matter of Chinese big business and United States–China economic relations dominated the news, and had done so for some time. Rebecca Tan, *The*

U.S.-China Trade War Has Begun. Here's How Things Got to This Point, Wash. Post: Worldviews (July 6, 2018, 10:20 AM), <https://www.washingtonpost.com/news/worldviews/wp/2018/07/05/a-timeline-of-how-the-u-s-china-trade-war-led-us-to-this-code-red-situation/> (chronicling trade relations since 2015) (saved as ECF opinion attachment); White House, *National Security Strategy of the United States of America 2* (2017), <https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf> (“China . . . challenge[s] American power, influence, and interests, attempting to erode American security and prosperity.”) (saved as ECF opinion attachment). When Donald J. Trump announced his candidacy for the U.S. presidency, his speech “mentioned China 21 times, arguing that the country was taking American jobs and ‘ripping’ the U.S. economy.” Tan, *supra*; see also Berkley Sanders-Velez, *Cold War Rhetoric: China and the US Today*, Colum. Pol. Rev., Mar. 31, 2018 (quoting then-candidate Trump as saying, “We can’t allow China to rape our country anymore. . . . We need to stop them from taking our jobs.”). And beginning in January 2018, the “trade war” was official, with both countries implementing certain measures targeting the other’s goods while also threatening to implement harsher measures. See Tan, *supra*; Jethro Mullen, *The US and China Are in Talks to Try to Avoid a Trade War*, CNN: Money (Mar. 26, 2018, 8:06 AM), <https://money.cnn.com/2018/03/26/news/economy/china-us-trade-war-talks/index.html> (saved as ECF opinion attachment). The week this trial began, China responded to the decision of the United States to introduce new tariffs, increase certain import taxes, and threaten additional tariffs on Chinese products by proposing its own tariffs on United States

exports, including pork. *See* Tan, *supra*; David J. Lynch & Emily Rauhala, *Trump Pushes Back on Fears of a Trade War with China*, Wash. Post (Apr. 4, 2018 9:32 PM), https://www.washingtonpost.com/world/asia_pacific/china-fires-back-at-trump-with-tariffs-on-106-us-products-including-soybeans-cars/2018/04/04/338134f4-37d8-11e8-b57c-9445cc4dfa5e_story.html (“President Trump showed no sign Wednesday of backing down from an escalating trade confrontation with China, even as financial markets wobbled and American farmers and manufacturers warned that he was inviting a damaging commercial clash.”) (saved as ECF opinion attachment).

Running parallel to these actions, and thus to the trial, President Trump posted many statements on Twitter critical of United States-China economic relations, such as:

- “We are not in a trade war with China, that war was lost many years ago by the foolish, or incompetent, people who represented the U.S. Now we have a Trade Deficit of \$500 Billion a year, with Intellectual Property Theft of another \$300 Billion. We cannot let this continue!” Donald Trump (@realDonaldTrump), Twitter, (Apr. 4, 2018, 7:22 AM), <https://twitter.com/realDonaldTrump/status/981492087328792577> (saved as ECF opinion attachment).
- “China, which is a great economic power, is considered a Developing Nation within the World Trade Organization. They therefore get tremendous perks and advantages, especially over the U.S. Does anybody think this is fair. We were badly represented. The WTO is unfair to U.S.” Donald Trump (@realDonaldTrump), Twitter, (Apr. 6, 2018, 10:32 AM), <https://twitter.com/realDonaldTrump/status/982264844136017921> (saved as ECF opinion attachment).
- “The United States hasn’t had a Trade Surplus with China in 40 years. They must end unfair trade, take down barriers and charge only Reciprocal Tariffs. The U.S. is losing \$500 Billion a year, and has been losing Billions of Dollars for decades. Cannot continue!” Donald Trump (@realDonaldTrump), Twitter, (Apr. 7, 2018,

2:03 PM), <https://twitter.com/realDonaldTrump/status/982680387116781568> (saved as ECF opinion attachment).

- “When a car is sent to the United States from China, there is a Tariff to be paid of 2 1/2 %. When a car is sent to China from the United States, there is a Tariff to be paid of 25%. Does that sound like free or fair trade. No, it sounds like STUPID TRADE – going on for years!” Donald Trump (@realDonaldTrump), Twitter, (Apr. 9, 2018, 6:03 AM), <https://twitter.com/realDonaldTrump/status/983284198046826496> (saved as ECF opinion attachment).

It is perhaps reflective of these ongoing national tensions that a survey conducted by the Pew Research Center in April 2017 found that 44% of Americans had a favorable opinion of China and 47% an unfavorable opinion of China. Richard Wike, *Americans’ Views of China Improve as Economic Concerns Ease*, Pew Rsch. Ctr. (Apr. 4, 2017), <https://www.pewresearch.org/global/2017/04/04/americans-views-of-china-improve-as-economic-concerns-ease/> (saved as ECF opinion attachment). In contrast, a survey released sixteen months later showed that although the unfavorable opinion remained the same (47%), six percent fewer Americans (38%) viewed China favorably. Richard Wike & Kat Devlin, *As Trade Tensions Rise, Fewer Americans See China Favorably*, Pew Rsch. Ctr. (Aug. 28, 2018), <https://www.pewresearch.org/global/2018/08/28/as-trade-tensions-rise-fewer-americans-see-china-favorably/> (saved as ECF opinion attachment).

All this to say, Plaintiffs tapped into a leading issue of the nation’s economy (and, as some viewed it, an issue of national security) at the time. They capitalized on anti-China sentiment by calling jurors’ attention to evidence concerning Murphy-Brown’s Chinese corporate parent and stressing that the profits from North Carolina’s hog farm industries went overseas, while the waste remained in-state. Because the district court allowed the

evidence of Chinese ownership to be introduced for this purpose without curtailing Plaintiffs' xenophobic rhetoric, the result was to sanction anti-China bias as a basis for a verdict against Murphy-Brown. This is not harmless error; it is reversible error on its face.

* * * *

The combined effect of admitting the challenged evidence about Murphy-Brown's corporate parents, coupled with the unfettered way in which Plaintiffs emphasized this information in a case brought solely against Murphy-Brown, constituted an abuse of discretion. It affected the trial as a whole. Therefore, I would vacate the entire judgment and remand for a new trial on both liability and damages.

III. Expert Witnesses

A. Admission of Dr. Rogers' Testimony

Murphy-Brown also challenges three aspects of the district court's decisions regarding Plaintiffs' expert witness Dr. Shane Rogers: (1) its failure to hold a hearing or otherwise exercise its gatekeeping obligation under *Daubert*, (2) its decision to allow Dr. Rogers to testify about matters that appear to have been beyond his expertise, and (3) its decision to allow the admission of unreliable testimony that the presence of pig2bac meant that hog odor had been present on Plaintiffs' property. A brief overview of the relevant record is again in order.

1. Factual Background and District Court Rulings

Before trial, Plaintiffs proposed to have Dr. Rogers testify as an expert witness about the environmental impact of Kinlaw Farms' operations. They obtained permission for Dr.

Rogers and his associates to take air, manure, and lagoon samples at Kinlaw Farms. Dr. Rogers' team also collected physical samples at some of Plaintiffs' properties.

One aspect of Dr. Rogers' proposed testimony derived from testing samples taken from the exteriors of three Plaintiffs' homes "for the presence of the genetic sequence known as pig2bac." J.A. 4104.¹⁴ Dr. Rogers stated that this genetic marker is "unique to pig feces," and thus its presence identifies "the presence of pig feces" in an environment. J.A. 4104–05. In his view, finding pig2bac on the exterior of a residence indicated that hog feces had been present there, and that the presence of hog feces served as a "physical representation of odor" given that the chemical properties associated with pig feces were well-documented to be odorous. J.A. 4110. In short, Dr. Rogers opined that evidence of pig2bac served as a reliable proxy for evidence of odor. Moreover, he asserted that because "pig feces has to be in relatively high concentrations to facilitate . . . detection" of pig2bac, a detectable presence of pig2bac indicated the presence of comparatively higher levels of pig feces and resulting odor. J.A. 4105. Based on this data, Dr. Rogers opined "within a reasonable degree of scientific certainty, that [Kinlaw Farms had] the ability to cause and the effect of causing a substantial interference with Plaintiffs' use and enjoyment of their property in the form of significant annoyance and material physical discomfort." J.A. 4110.

¹⁴ Dr. Rogers took samples from Tammy Lloyd's residence in October 2016; in addition, samples were taken from Joyce McKiver and Delois Lewis' joint residence in November 2016 and from the McKoy home sometime later. All of the samples contained pig2bac. Samples were not taken from the residences of the remaining Plaintiffs.

In other words, Dr. Rogers represented that pig2bac was an objective measure of the presence of hog odor on Plaintiffs' property.

Murphy-Brown moved to exclude Dr. Rogers' testimony from trial, arguing that he lacked the qualifications to be certified as an odor expert, that he had used flawed methods to collect field samples, and that he lacked the scientific foundation needed to offer his opinion about the existence of a nuisance because of his reliance on the unreliable and unproven proposition that pig2bac could serve as a proxy for hog odor. In support of its motion, Murphy-Brown offered a 66-page declaration from its microbiology expert, Dr. Jennifer Clancy, in which she identified flaws in Dr. Rogers' sample collection protocols and questioned the validity of his use of pig2bac as a proxy for hog odor. Murphy-Brown requested a hearing to address whether Dr. Rogers was *Daubert* qualified.

The district court denied the motion without a hearing, observing that it "simply [could not] honor" a request for oral argument on the motion and that it had reviewed the parties' written submissions related to the motion. J.A. 6183. Reiterating that it had "read all [the] materials that [had] been submitted with regard to this issue" that morning, it found Dr. Rogers to be "an expert in environmental engineering, . . . animal waste management engineering and technology[,] and microbiology." J.A. 6185. The sum total of its explanation for its decision was:

that in carrying out its *Daubert* responsibilities, that [Dr. Rogers'] proposed testimony is both reliable and relevant and that the objections and questions regarding his testimony go to the weight and may be covered on cross-examination except insofar as defendant contends that some questions are being – that he may be asked questions outside of the field of his expertise, and the Court obviously is confronted with that question with every expert witness and there will be questions that will be posed to the witness that

defendant will contend do not fit the area of expertise which the Court has found him to be in.

J.A. 6185–86.

Benefiting from this ruling, Plaintiffs called Dr. Rogers “to talk about odor from industrial hog operations.” J.A. 6194. While his testimony covered a host of topics, of particular relevance to this appeal, Dr. Rogers testified that what humans perceive as “hog odor” is actually “a very large mixture, very complex mixture of chemicals that are in [hog] waste treatment systems. So several hundred volatile organic compounds – hydrogen sulfide gas, ammonia gas, for example – and the particles that might carry them.” J.A. 6194. He described the relationship between his expertise and hog odor as knowing “how those [chemicals] are generated from waste management systems . . . and also how those types of particles and gases might move in the environment” until a person “experience[d] them.” J.A. 6194.

In Dr. Rogers’ view, testing for hog odor directly is a subjective and unreliable assessment for two reasons. First, humans experience odor differently and therefore measure and perceive it differently. For this reason, he asserted that self-reports and even measurements taken from an olfactometer were too subjective because they required someone to “smell something and then they make a call on it.” J.A. 7204. Second, he opined that testing for the presence of a particular chemical to confirm the presence of hog odor ran its own risks given that hog odor is a complex chemical compound and no one representative chemical could be tested so as to reliably confirm the presence of hog odor. He explained that “any one of [the chemicals comprising hog odor] is extremely smelly”

and if one or more are removed, “it’s not likely to change the odor.” J.A. 6206. Consequently, chemicals known to be *sometimes* present in hog odor may not be present on a particular occasion despite the presence of something identifiable as hog odor.

Given these perceived problems with measuring hog odor directly, Dr. Rogers instead elected to rely on the presence of the DNA sequence pig2bac as a means of objectively—but indirectly—testing for the presence of hog odor. Consistent with the view set out in his expert report, Dr. Rogers explained his basis for using pig2bac as a proxy for odor, the results of his investigation of Plaintiffs’ properties outlined earlier, and his opinion that Kinlaw Farms was operating as a nuisance under North Carolina law. When asked to provide “the one thing” he wanted the jurors to take away from his testimony, he replied that he “brought [them] physical evidence that shows that the feces from this operation is moving out into the neighborhood and is impacting – it is a physical marker that shows this operation is impacting the neighbors.” J.A. 7246–47.

Of course, Dr. Rogers did not testify without resistance from Murphy-Brown. He was subject to extensive cross-examination that delved into the novelty of his using pig2bac as a proxy for odor. He was also questioned about his decision not to test for certain odorous chemicals in the air despite the ability to do so, about the lack of data documenting the presence and quantity of pig2bac at each plaintiff’s residence, and about the lack of data concerning pig2bac’s general prevalence in the region considering the number of hog farms in eastern North Carolina. In addition, Murphy-Brown called its counter-expert, Dr. Clancy, to testify about some of the flaws she’d identified in Dr. Rogers’ collection protocols, which she said may have led to contaminated results.

Murphy-Brown again challenged the admission of Dr. Rogers' testimony in its motion for a new trial, and the district court summarily denied the motion.

2. Analysis

On appeal, Murphy-Brown reiterates its challenges to the admission of Dr. Rogers' expert testimony, arguing that (1) the district court abandoned its *Daubert* gatekeeping function by failing to ensure that Dr. Rogers' testimony about pig2bac was reliable and relevant, (2) the district court improperly admitted him as an expert to opine on how Kinlaw Farms was an odor nuisance when his background did not qualify him as an odor expert, and (3) the district court abused its discretion in allowing Dr. Rogers to testify about the results of his pig2bac testing because this novel theory failed to satisfy *Daubert* and Rule 702's reliability standards. Each of these challenges has merit, and the district court erred in ruling otherwise, just as the majority opinion errs in affirming those decisions.

Daubert and Federal Rule of Evidence 702 govern the admissibility of scientific evidence through an expert witness. In short, individuals qualified "by knowledge, skill, expertise, training, or education may testify in the form of an opinion or otherwise if" their opinion is based on "specialized knowledge [that] will help the trier of fact to understand the evidence or determine a fact in issue" and "sufficient facts or data," "the testimony is the product of reliable principles and methods," and "the expert has reliably applied the principles and methods to the facts of the case." Fed. R. Evid. 702. "Implicit in the text of Rule 702 . . . is a district court's gatekeeping responsibility to 'ensur[e] that an expert's testimony both rests on a *reliable* foundation and is *relevant* to the task at hand.'" *Nease v. Ford Motor Co.*, 848 F.3d 219, 229 (4th Cir. 2017) (quoting *Daubert*, 509 U.S. at 597

(emphases added)). Reliability focuses on the expert's knowledge and methodology, while relevance looks to whether the evidence "helps the trier of fact to understand the evidence or to determine a fact in issue." *Id.* A court that abandons its gatekeeping function necessarily abuses its discretion in allowing the expert to testify. *Id.* at 228; see *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 149 (1999) (observing that when an expert's "testimony's factual basis, data, principles, methods, or their application are called sufficiently into question, . . . the trial judge must determine whether the testimony has a reliable basis in the knowledge and experience of the relevant discipline").

a. Abdication of the Gatekeeping Function

The record reveals the district court's abdication of its responsibility under *Daubert* to serve as a gatekeeper before allowing Dr. Rogers to testify about the results of his pig2bac testing. Even a cursory review of the record demonstrates that the court abandoned this required function. After a passing reference to "its *Daubert* responsibilities," the court summarily concluded without analysis or explanation that Dr. Rogers' "proposed testimony is both reliable and relevant and that the objections and questions regarding his testimony go to the weight and may be covered on cross-examination[.]" J.A. 6185. It rejected Murphy-Brown's multiple challenges as going to weight, not admissibility, without providing *any* reason and it failed to mention a single aspect of the proposed testimony that supported its conclusion.

Faced with a similarly broad and generic admissibility ruling in *Nease*, we held that the court had abandoned its gatekeeping function, and the majority opinion offers no justification for reaching a different result in this case. Specifically, in *Nease*, the district

court's ruling "simply dismissed every argument raised by [the defendant] as going to the weight, not admissibility, of [the expert's] testimony." 848 F.3d at 230. So too here. Further, in *Nease* the district "court did not use *Daubert*'s guideposts or any other factors to assess the reliability of [the expert's] testimony, and the court did not make any reliability findings." *Id.* Here, the record is equally undeveloped, addressing none of the guideposts or other considerations and making no factual findings. Lastly, in *Nease* "the district court referred neither to Rule 702 nor to *Daubert*." *Id.* On this front, the record here differs just slightly: the district court gave lip service to "its *Daubert* responsibilities," but failed to provide any description of what those responsibilities entailed or any analysis applying them. J.A. 6185. The *Nease* ruling and those here are substantively similar and equally flawed. In both, the district court abandoned its gatekeeping function of "mak[ing] certain that an expert . . . employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field." *Kumho Tire Co.*, 526 U.S. at 152.

The district court's failure to exercise its gatekeeping function was not cured by Murphy-Brown's robust cross-examination and introduction of a counter-expert witness's testimony. As this Court recognized in *Nease*, cross-examination does *not* serve as a substitute for the district court's failure to make the threshold gatekeeping decision as to the reliability and relevance of expert testimony. 848 F.3d at 231. Similarly, Murphy-Brown's counter-expert, Dr. Clancy, challenged Dr. Rogers' protocols for collecting samples, raising concerns about his testing methods that should have been addressed in determining whether to admit his testimony about the results of his testing before it could

be heard by the jury. In sum, the whole point of *Daubert*'s gatekeeping function is "to protect juries from being swayed by dubious scientific testimony" in the first instance, and that purpose is not served by admitting the untested evidence and relying on the jury to determine its reliability. *Id.* at 231. To do so is to ignore *Daubert*, which demands that district courts undertake their gatekeeping function role *before* expert testimony reaches the jurors' ears. *Id.*

b. Disconnect Between the Scope of Dr. Rogers' Testimony and His Expertise

The second problem with Dr. Rogers' testimony occurred because the district court allowed him to testify about a wide range of topics that appear to be outside his expertise without adequately inquiring into his qualifications to do so. Part of the court's gatekeeping function is to ensure that an expert witness is qualified to testify about each component of his testimony. *Cf. Belk, Inc. v. Meyer Corp., U.S.*, 679 F.3d 146, 162 (4th Cir. 2012) ("In undertaking its role as gatekeeper to ensure that proffered evidence is reliable pursuant to Fed. R. Evid. 702, the district court must decide whether the expert has sufficient specialized knowledge to assist the jurors in deciding the particular issues in the case.").

At Plaintiffs' request, the district court designated Dr. Rogers as an expert in the fields of environmental engineering, animal waste management engineering and technology, and microbiology. But the court then allowed Dr. Rogers to testify extensively about odors and how humans perceive odors without any factual findings that his fields of expertise qualified him to testify about this broader topic. Instead, the jurors were asked to follow and accept Dr. Rogers' explanation about why his particular training qualified him to opine about hog odor. Plaintiffs respond to Murphy-Brown's challenges to Dr. Rogers'

expertise by focusing on the fact that he was not designated as an expert on odor; the majority opinion follows suit, pointing out that Dr. Rogers never purported to be an expert on how humans perceive odor. But these are red herrings, distracting from the substance of Dr. Rogers' testimony, because he in fact opined at length on these very matters.

Dr. Rogers testified about how an industrial hog farm such as Kinlaw Farms generates odors, why testing for pig2bac on Plaintiffs' residences "proves" that odors also traveled to their properties, and what led to his opinion Kinlaw Farms substantially interfered with the enjoyment of their property. All these representations—and more—necessarily entailed testimony about odors and human perception of hog odors. For example, at the outset of Dr. Rogers' substantive testimony, Plaintiffs' counsel quickly transitioned to the observation that "[w]e're here obviously with the members of the jury to talk about odor from industrial hog operations." J.A. 6194. Counsel then asked Dr. Rogers a series of questions about how his training and background were relevant to the issue of hog odor's effect on the environment. He did so by explaining the "way *we*"—obviously, humans—"perceive a very large mixture, very complex mixture of chemicals" such as "hog odor." J.A. 6194 (emphases added). Throughout his testimony, Dr. Rogers described the primary sources of odor on a hog farm, and how their design affects odor. He discussed what "particles and gases [in hog operations] have to do with odor" and explained that when "we perceive [something] as odor or whatever, what we're doing is sensing these different chemicals." J.A. 6195. And he summarized various studies on why people perceive hog odors with greater "intensity and offensiveness . . . after rainfall or when humidity increases." J.A. 6917. It's no surprise, then, that Dr. Rogers agreed that his

background made him “an expert” in “whether and how industrial hog odor gets to the neighbors,” which was the issue the jurors would be asked to decide “at the end of the case.” J.A. 6195.

Dr. Rogers also testified at length about how hog odor is generated at Kinlaw Farms specifically, basing that testimony on both his knowledge of how industrial hog farms work generally and his site inspection. He labeled particles ventilated from the Kinlaw buildings where the hogs live as “very odiferous” and described at some length for the jury “what’s entering [someone’s] nose” when she “smell[s] hog odor” emanating from those buildings. J.A. 6914. He later provided similar descriptions of how odors transported from the lagoons during storage and decomposition of waste as well as from the spraying of waste onto Kinlaw Farms’ fields. He described “odor tests” he and his team performed on samples from the lagoons to “determine how many dilutions it takes of the material before it no longer has an odor to it,” testifying that it “can take between 800 and even up to nearly 16,000 dilutions before the odors are no longer noticeable” to humans. J.A. 6944, 6957; *see also* 6954–57. Throughout his testimony, he reiterated that he had experienced the odors he spoke of while at Kinlaw Farms and on Plaintiffs’ property. And he ultimately opined that Kinlaw Farms was “not a good location for this type of a hog operation,” providing additional testimony about various odor-reducing technologies that could be implemented at Kinlaw Farms. J.A. 6985–95.

At bottom, notwithstanding Dr. Rogers’ formal designation as an expert in other fields, Plaintiffs presented him to the jury as an expert in odor and human perception of odor, and thus qualified to offer expert opinions on when hog odors create a nuisance. Any

assertion to the contrary ignores the substance of his testimony. At a minimum, the district court failed to adequately consider and explain why Dr. Rogers' background and qualifications were sufficient to permit him to speak about all the aspects of odors touched on in his testimony. And if he was not qualified to testify about these matters, it erred in allowing him to do so. *See* Fed. R. Evid. 702 (requiring expert's testimony to be qualified based on "knowledge, skill, experience, training, or education"); *Thomas J. Kline, Inc. v. Lorillard, Inc.*, 878 F.2d 791, 799 (4th Cir. 1989) (observing that although "the test for exclusion is a strict one," an expert lacking the requisite qualifications should be excluded). Allowing an expert witness to testify outside the areas in which he is qualified leads to the admission of testimony that has the potential to be "both powerful and quite misleading" when it should never have been presented to the jury. *Daubert*, 509 U.S. at 595.

Perhaps Dr. Rogers could have adequately assured the district court of his qualifications to opine on the spectrum of odor-related issues he testified about, but the connection to his qualifications and areas of expertise is not readily apparent in this record. With that in mind, it's also possible that the discrepancy between Dr. Rogers' designation and his testimony may not have been sufficient on its own to prejudice Murphy-Brown to such an extent so as to require reversal. But it compounds the district court's other gatekeeping errs, detailed earlier. The combined effect is error "so fatally infect[ing] the trial" that it violated Murphy-Brown's substantial rights. *Ward*, 958 F.3d at 273.

c. Unreliability of Dr. Rogers' Pig2bac Testimony

Lastly, the district court's abdication of its gatekeeping function matters because it led to the improper admission of Dr. Rogers' unreliable testimony that physical evidence

of pig2bac was physical evidence that odors from Kinlaw Farms were traveling to Plaintiffs' properties.¹⁵ See *Bresler v. Wilmington Trust Co.*, 855 F.3d 178, 195 (4th Cir. 2017) (“In fulfilling its gatekeeping function, a district court must conduct a preliminary assessment to determine whether the methodology underlying the expert witness’ testimony is valid.”). As such, Dr. Rogers’ testimony did not satisfy *Daubert* or Rule 702, and the court abused its discretion in allowing its admission.

In considering the reliability of proposed expert witness testimony, district courts may consider several “guideposts” as well as any other relevant factor. *Daubert*, 509 U.S. at 593; *Nease*, 848 F.3d at 229. The guideposts are, first, “whether [a theory or technique] can be (and has been) tested.” *Daubert*, 509 U.S. at 593. Second, “whether the theory or technique has been subjected to peer review and publication.” *Id.* Third, “the known or potential rate of error,” as well as “the existence and maintenance of standards controlling the technique’s operation.” *Id.* at 594. Fourth, whether the theory or technique is generally accepted because “[w]idespread acceptance” hues in favor of admissibility, while “a known technique which has been able to attract only minimal support with the community may properly be viewed with skepticism.” *Id.* At its core, *Daubert*’s guideposts are designed to ensure that expert opinion is admitted only when it is reliable, i.e., that it is “based on scientific, technical, or other specialized knowledge and not on belief or

¹⁵ Murphy-Brown does not challenge the admissibility of other aspects of Dr. Rogers’ testimony.

speculation, and inferences must be derived using scientific or other valid methods.” *Oglesby v. Gen. Motors Corp.*, 190 F.3d 244, 250 (4th Cir. 1999).

A foundational concern about Dr. Rogers’ pig2bac testimony is the novelty of its use as a proxy for odor, which was the basis of his testing and for much of his testimony. For example, Dr. Rogers admitted that he was unaware of anyone who used pig2bac as a surrogate for odor in the way he had done for purposes of forming his opinion in this case. J.A. 7221 (Q: “No one ever reports Pig2bac used the way you use it, do they?” A: “Not that I’m aware.”). Further, he admitted that the pig2bac proxy theory and the methodology for detecting “odor” that he used in this case had never been published (by him or anyone else). J.A. 7222. And he acknowledged that no one had suggested in “the peer-reviewed literature” that his approach was “an appropriate scientific method . . . to measure odor leaving the farm.” J.A. 7222. While it is not clear from the record that he developed his method strictly for purposes of this litigation, it is indisputably new—and unique to Dr. Rogers—and does not have any credence in the broader scientific community. *See United States v. Crisp*, 324 F.3d 261, 268 (4th Cir. 2003) (observing that although *Daubert* “enabled the courts to entertain new and less conventional forms of expertise” than the prior “uncompromising general acceptance test,” it nonetheless “attempted to ensure that courts screen out junk science”); *see also Daubert v. Merrell Dow Pharms., Inc.*, 43 F.3d 1311, 1317 (9th Cir. 1995) (observing that a “significant fact to be considered” as part of the *Daubert* analysis is whether an expert is testifying “about matters growing naturally and directly out of research they have conducted independent of the litigation, or whether they have developed their opinions expressly for purposes of testifying”). Although the

novelty of a methodology and theory is not dispositive to the *Daubert* analysis, it is relevant and prompts giving additional attention to whether other indicia of reliability exist. *See Daubert*, 509 U.S. at 594; *Daubert*, 43 F.3d at 1317–18 (observing that “other objective, verifiable evidence that the testimony is based on scientifically valid principles” that have “been subjected to normal scientific scrutiny through peer review and publication” is a means of demonstrating reliability despite novelty of a theory).

Working from this blank slate, Dr. Rogers developed what appears to be an unsupported and untested hypothesis and opinion that the existence of pig2bac serves as physical evidence of hog odor also having been present at that location such that Kinlaw Farms “is impacting” the Plaintiffs. J.A. 7247. At bottom, his underlying hypothesis satisfies neither *Daubert* nor Rule 702 because it lacks reliability. Dr. Rogers’ hypothesis was not based on the belief that pig2bac, by itself, was odorous. Instead, he testified that pig2bac was “*associated* with odor” because it’s a “segment of DNA that’s in fecal bacteria aldolase so that’s bacteria aldolase that come[s] out of feces of the hog and it’s a particle that is in feces of a hog. So that Pig2bac DNA is a very good indicator of the odor that comes along with that feces of the hog.” J.A. 7200 (emphasis added); *see also* J.A. 6981 (describing the 100 percent correlation between pig2bac and pig feces). At its core, Dr. Rogers’ testimony about pig2bac requires the assumption that detecting pig2bac is a valid surrogate, or proxy, for detecting hog odor.¹⁶

¹⁶ Dr. Rogers was contradictory in his testimony about whether pig2bac had any independent odor, at first stating it “probably” did not smell, and then reversing course that because pig2bac is found in bacteria located in pig feces, and because “[o]ften when I’m (Continued)

But Dr. Rogers had not performed—and was unaware of any other—tests demonstrating that pig2bac and hog odor actually traveled *together*. Although he described how “[g]ases, fecal particles and other things” formed and transported from the farm onto neighboring properties, J.A. 6914, he never explained a basis for believing that pig2bac and odor traveled so coterminously that the presence of pig2bac always served as physical evidence of hog odor. In fact, he had never tested whether pig2bac and hog odor were *ever* present at the same time, let alone run such testing on Plaintiffs’ properties. Further, Dr. Rogers acknowledged that he had not tested whether pig2bac was present at the same time as *any* chemical typically associated with hog odor, let alone tested for some combination of the complex chemical compound that would be described as “hog odor.”¹⁷ Nor could he testify to how much pig2bac was present, or what correlation—if any—existed between a certain amount of pig2bac and a certain amount or concentration of hog odor. And, of course, because his testing was limited to the presence or absence of pig2bac, he could not testify to the amount of pig2bac present on the properties or provide any correlation between its presence and any particular level of odor that would assist the jury in determining whether it rose to the level of a nuisance. All in all, the association at the core

growing bacteria I can smell them,” pig2bac would have the same odor, although he “couldn’t say” what it would smell like or if that smell resembled hog odor. J.A. 7199. Regardless, his testimony centered on this proxy hypothesis.

¹⁷ Dr. Rogers’ testimony that he smelled a strong hog odor while collecting the sample from Tammy Lloyd’s house was anecdotal lay testimony rather than scientific evidence demonstrating the reliability of his core hypothesis about pig2bac for *Daubert* purposes.

of Dr. Rogers' hypothesis was—at least to date and for purposes of this trial—based on pure conjecture rather than scientifically reliable evidence of an odor nuisance.

Other aspects of Dr. Rogers' pig2bac testimony highlight its speculative nature: Dr. Rogers could not be sure that the pig2bac he recovered originated at Kinlaw Farms or was simply the result of its prevalence throughout the region given the number of hog farms in eastern North Carolina. He admitted he'd done no comparative testing of nearby areas such as Elizabethtown to determine whether pig2bac was commonly detected in field samples. Also, Dr. Rogers was unable to provide data about how far pig2bac could travel, instead offering his "susp[icion]" that it could travel at least half-a-mile and could not travel ten miles. J.A. 7189–90. He was similarly uncertain about how long pig2bac could persist in an environment, noting that he'd tested its presence in soil samples "on the order of days" and that it was his "opinion" that it could last "in the air or on a building or on a car" "on the order of weeks." J.A. 7190–91.

Without any scientific evidence to reliably establish a connection between the presence of pig2bac and the presence of hog odor and without any broader acceptance of this hypothesis in the scientific community, the only proffer for the reliability of Dr. Rogers' method for detecting odors on Plaintiffs' properties was his own *ipse dixit*. That's neither expert testimony nor a sufficient basis for admissibility. *Gen. Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997) (observing that courts should not admit an expert opinion supported only by "the *ipse dixit* of the expert"); *Small v. WellDyne, Inc.*, 927 F.3d 169, 177 (4th Cir. 2019) ("Without testing, supporting literature in the pertinent field, peer reviewed publications or some basis to assess the level of reliability, expert opinion

testimony can easily, but improperly, devolve into nothing more than proclaiming an opinion is true ‘because I say so.’”).

While strength as to one of the *Daubert* factors may overcome a deficiency as to another, the totality in this instance leads to the conclusion that Dr. Rogers’ pig2bac testimony lacks the requisite indicia of reliability to be admissible as opposed to simply being subject to cross-examination to test its weight. The admission of Dr. Rogers’ testimony introduced speculation under the guise of science and expertise. That error strikes at the core of what *Daubert* and Rule 702 are designed to avoid given that “expert witnesses have the potential to be both powerful and quite misleading.” *Westberry*, 178 F.3d at 261. Based on how it was described and defended in the record, this evidence should never have reached the jury’s ears. For these reasons, the district court abused its discretion in admitting Dr. Rogers’ testimony about pig2bac.¹⁸

* * * *

For the reasons stated, the district court abused its discretion with respect to Dr. Rogers’ testimony in three respects. First, it abandoned its gatekeeping duty by offering a cursory and rote explanation of its admissibility decision, in violation of the inquiry required by *Daubert* and *Nease*. Second, it failed to ensure that Dr. Rogers’ expertise and testimony adequately aligned. Third, it admitted Dr. Rogers’ expert testimony on pig2bac

¹⁸ Because I reach this conclusion, it is not necessary to consider whether the district court was required to hold a hearing before ruling on Murphy-Brown’s motion in limine. At a minimum, these concerns demonstrate why the district court abused its discretion in not engaging in a more probing review of Dr. Rogers’ pig2bac testimony, regardless of the method the district court should have undertaken to perform that review.

when that testimony falls well short of *Daubert*'s guidance for ensuring that expert testimony is reliable. The admission of Dr. Rogers' testimony clearly harmed Murphy-Brown given that it was the only purportedly "scientific" on-site testing admitted to support Plaintiffs' case, making it impossible to say that it did not affect the jury's liability finding. As such, it meets the criteria for reversal, leaving not only the "definite and firm conviction" of a wrong evidentiary ruling, *Westberry*, 178 F.3d at 261, but also the conclusion that it affected Murphy-Brown's right to a fundamentally fair trial, *Ward*, 958 F.3d at 273–74.

B. Improper Exclusion of Dr. Dalton's Olfactometer Readings Evidence

Murphy-Brown sought to introduce expert testimony from Dr. Pamela Dalton, but the district court restricted that testimony so that Murphy-Brown elected not to call her as a witness at trial. On appeal, Murphy-Brown challenges the court's ruling limiting Dr. Dalton's testimony, arguing that it abused its discretion by excluding evidence of an objective measure of odor, which the jury should have been permitted to consider.

1. Factual Background and District Court Rulings

Dr. Dalton¹⁹ and her associates tested the frequency, intensity, and duration of odors in the air at and near Kinlaw Farms. Her approach was based on her "opinion that in

¹⁹ Dr. Dalton has a M.S. and Ph.D in Experimental Psychology from New York University and a Master of Public Health from Drexel University. For over two decades, she has conducted olfactory research at the Monell Chemical Senses Center in Pennsylvania. Her research has focused on a range of odor-related topics, including "the human perception of odor, irritation and acute health symptoms from odorous chemical exposures, especially as this perception is influenced by cognitive factors." J.A. 4713.

order to establish whether odors from a facility occur at a nuisance level it is necessary to independently monitor the frequency, intensity and duration of odors that have the potential to be perceived offsite or at Plaintiffs' homes over an extended period of time." J.A. 4720. In her view, this was required because an "often unconscious bias in how people respond to the expectation of an odor," which causes "self-report[s] [to] generally [be] unreliable." J.A. 4720.

Dr. Dalton collected data on two sites at Kinlaw Farms over a four-week period and at one site off the farm over a one-week period in late 2016. Her study entailed recruiting six monitors who met her criteria for odor detections, were trained on topics relevant to odor observation techniques and field procedures, and were provided practice using a field olfactometer²⁰ known as the Nasal RangerTM.²¹ "To familiarize them with the relevant odors, monitors were taken to various locations at [Kinlaw Farms] to experience the quality of odor emanating from the barns and the lagoons." J.A. 4714.

During the testing period, "[m]onitors worked in two or five hour shifts," during which time their activities and preparations were regulated to avoid contaminating results by the introduction of other scents. J.A. 4714. Working in pairs, monitors took readings "every 15 minutes from dawn until dusk for the duration of the study." J.A. 4715. When the monitors disagreed, the higher intensity level was recorded.

²⁰ An olfactometer is an instrument that detects and measures odor dilution.

²¹ Dr. Dalton described the Nasal RangerTM as "the 'gold standard' for conducting field olfactometry assessments in studies such as" hers. J.A. 4714.

The Nasal Ranger™ “allows ambient air to be sniffed at varying dilutions with clean air in order to quantify the intensity of any odor.” J.A. 4715. Dr. Dalton explained in her expert report that “[i]n states where odor regulations exist based on the use of a Nasal Ranger™ or similar device, the threshold for flagging objectionable odor (along with other temporal requirements) has been commonly determined to be 7:1 or above.” J.A. 4715. She cited “general[] agree[ment]” that a lower dilution ratio would not constitute an “objectionable odor.” J.A. 4715.

Dr. Dalton reported that in the testing on Kinlaw Farms property, monitors detected a dilution level of 7:1 or greater a total of sixty-five times over the course of the four weeks, and detected a dilution level of 7:1 or greater only once during the course of the one week of testing off-site. She explained that this disparity “confirm[ed] that distance from the barns/lagoons drastically reduces odor impact.” J.A. 4719.

Based on the results of her testing, Dr. Dalton opined, “to a reasonable degree of scientific certainty,” that Kinlaw Farms’ normal operations “do not produce odors that travel offsite at an intensity, frequency or duration that would be considered a nuisance level at Plaintiffs’ properties.” J.A. 4716. Dr. Dalton also provided several reasons why subjective reports of odors often do not align with objective measurements of odor, particularly when “individuals . . . are motivated to complain about a putative odor source.” J.A. 4716.

At her deposition, Dr. Dalton provided some clarifying comments about her opinion. For example, when asked if “smelling hog odor at any concentration can cause annoyance,” she replied, “[i]t depends on the individual.” J.A. 4753. And she

acknowledged that “[t]he annoyance one might experience [from breathing hog odor] could happen whether or not the odor is strong.” J.A. 4754. She reiterated that “there’s incredible individual variation in what people can smell and how they react to what they smell.” J.A. 4755. But she opined that she would not consider “a hog odor at a 4 all day at [someone’s] house” to be a nuisance “because it would be a weak odor” regardless of how that person personally experienced it or responded. J.A. 4568–69. Lastly, Dr. Dalton admitted North Carolina had not adopted an objective measurement, and described instead that “there really isn’t a standard” because it’s subjective, based on individual complaints. J.A. 4771.

Plaintiffs sought to exclude Dr. Dalton’s olfactometer testing and the opinion she formed from those results.²² The district court agreed to do so on the ground that it “would have a strong likelihood of confusing or misleading the jury” and “would not be helpful to the jury.” J.A. 8596. The district court explained that, unlike the jurisdictions Dr. Dalton referenced in her expert report, North Carolina had not adopted a dilution to threshold ratio or other objective measure for determining when an odor nuisance exists. In its view, this evidence would not aid the jury in determining whether an odor nuisance existed, and it would confuse them by equating a nuisance with an objective measure that North Carolina did not require.

²² Plaintiffs did not object to Dr. Dalton testifying about “the biology of olfaction and factors that influence individual perception of and response to odor,” J.A. 8596 n.2, and the district court held that Dr. Dalton could testify about the “unreliability of self-report of odor” without invading the province of assessing Plaintiffs’ credibility about the odors they smelled and their source, J.A. 8596.

2. Analysis

The district court abused its discretion in excluding Dr. Dalton's testimony about the olfactometer tests, the commonly used 7:1 dilution ratio, and her opinion that the test results did not show that Kinlaw Farms operated as a nuisance. None of the grounds the district court articulated is an appropriate reason to exclude this testimony.

Expert opinion is admissible to help the factfinder "determine a fact in issue," Fed. R. Evid. 702, and Dr. Dalton's testimony was probative of a central issue before the jury: whether a reasonable person would conclude Kinlaw Farms' operations constituted an odor nuisance. As described earlier, North Carolina's nuisance law required the jury to assess whether a "substantial" and "unreasonable" interference had occurred. *See supra* Part I.A. One aspect of that determination involves considering "the degree of intensity and disagreeableness of the [odors], their times and frequency, and their effect, not on peculiar and unusual individuals but on ordinary, normal and reasonable persons of the locality." *Hooks v. Int'l Speedways, Inc.*, 140 S.E.2d 387, 392 (N.C. 1965).

Dr. Dalton's testimony was plainly relevant, and helpful, to this factual determination. Her test objectively scored the disagreeableness of the odors emanating from Kinlaw Farms. Its results demonstrated that most of the readings fell far short of a common standard for assessing the existence of an odor nuisance. And rather than being anecdotal in nature, Dr. Dalton's testimony would have provided the jury with objective, scientific evidence about the frequency, intensity, and duration of odors detected on and near Kinlaw Farms. The jury could have weighed this data when considering whether

Plaintiffs proved the existence of an unreasonable and substantial interference to the use and enjoyment of their property.

For this reason, Dr. Dalton's testimony is a classic example of the relevant and reliable expert testimony that is admissible under *Daubert* and Rule 702. *Westberry*, 178 F.3d at 261 (stating that Rule 702 "was intended to liberalize the introduction of relevant expert evidence"); *id.* (stating evidence admissible under Rule 702 should be excluded under Rule 403 only if it "has a greater potential to mislead [or confuse] than to enlighten"). In contrast to Dr. Rogers' testimony, no *Daubert* concerns arose about the methodology Dr. Dalton used to conduct her test and form her opinion. While Dr. Rogers' testimony was based on a novel proxy theory of odor that provided no information about the intensity, frequency, or duration of either the proxy pig2bac or actual odors, Dr. Dalton's testimony was based on tests conducted using gold-standard equipment and methods widely accepted and used in the industry to test the actual intensity, frequency, and duration of odors at and near Kinlaw Farms. As such, Dr. Dalton's test results were admissible, but subject to traditional methods of challenging its weight for purposes of establishing the ultimate issue before the jury. *See Daubert*, 509 U.S. at 596 ("Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence."); *Bresler*, 855 F.3d at 195 ("[Q]uestions regarding the factual underpinnings of the expert witness' opinion affect the weight and credibility of the witness' assessment, not its admissibility.").

To be sure, North Carolina has not adopted an objective standard for establishing a nuisance. But that is not the same thing as North Carolina having rejected the admissibility

of evidence about such an objective standard as one part of the decision-making process—subject to cross-examination and proper instruction—about whether an odor nuisance exists. Indeed, no North Carolina odor nuisance cases have required the exclusion of olfactometer readings for the factfinder’s consideration. Moreover, one part of North Carolina hog-odor regulation *has* adopted objective standards that rely on the 7:1 dilution ratio as a basis for assessing compliance with the state’s odor-control objectives. Specifically, in deciding whether to issue or modify permits related to hog farms that use the lagoon-and-sprayfield waste management system, the relevant authorities are required to determine that the “system will meet or exceed” certain performance standards, including that it will “[s]ubstantially eliminate the emission of odor that is detectable beyond the boundaries of the parcel or tract of land on which the swine farm is located.” N.C. Gen. Stat. § 143-215.10I(b)(2).²³ And the implementing regulations for this provision state that one way to satisfy this requirement “at new or modified swine farms” is by obtaining a field olfactometer test documenting that “the measured dilution-to-threshold ratio [is] less than or equal to 7:1.” 15A N.C. Admin. Code § 2D.1808(d)(1).²⁴ Thus, North

²³ This is the current location of the statute, as amended and made effective June 12, 2020. The identical requirement was previously codified at § 143-215.10I(b)(3), and this prior location is cross-referenced in the cited regulations.

²⁴ Plaintiffs’ suggestion that North Carolina does not currently rely on this standard relies on shaky support (an agency PowerPoint), but is ultimately beside the point. The relevant inquiry is whether it would have been so inconsistent with North Carolina law as to prejudice Plaintiffs if it were admitted. North Carolina officials charged with promulgating standards in related areas of the law have recognized this objective measure of odor may be relevant to the analysis.

Carolina has accepted this objective measure in other, closely related, areas even if it has not been specifically adopted in civil nuisance claims. Its having done so bolsters the conclusion that it would not be inconsistent with North Carolina's understanding of industrial hog farm odors to put Dr. Dalton's testimony before the jury for it to assess the evidence's weight for purposes of determining whether an odor nuisance existed.

In addition, methods well short of exclusion could have been used to alleviate any concern about confusing or misleading the jury. For example, Dr. Dalton's testimony would have been subject to cross-examination, where Plaintiffs could have urged that the jury should afford the testimony little weight for any reason, including that North Carolina nuisance law uses a different, lower standard for establishing liability. The court could have tailored a cautionary instruction to remind the jury of Plaintiffs' burden under North Carolina law so as to limit how Dr. Dalton's testimony would be used in assessing whether a nuisance existed. Relatedly, the district court could have prohibited Dr. Dalton from opining on the ultimate issue of the existence of a nuisance and instead limit her testimony to the results of the olfactometer tests, which provided an objective measure of the dilution ratio quite apart from any legal conclusions Dr. Dalton arrived at from interpreting them. *E.g., Kopf v. Skyrn*, 993 F.2d 374, 378 (4th Cir. 1993) (observing that even if a district court determines the expert should not opine on the ultimate opinion, that "does not necessarily banish him from the stand altogether, because his specialized knowledge may still assist the trier of fact in other ways").

Lastly, the exclusion of this evidence was not harmless because the ruling prevented *Murphy-Brown* "from fully developing evidence relevant to a material issue." *Schultz v.*

Butcher, 24 F.3d 626, 632 (4th Cir. 1994). Specifically, the court’s ruling prevented Murphy-Brown from presenting scientific evidence about the absence of frequent and intense odors on Plaintiffs’ property for the jury to weigh against Plaintiffs’ anecdotal evidence about what they experienced on a regular basis. In addition, although there’s no equivalent to Newton’s Third Law respecting expert witnesses requiring that every trial involve “an equal and opposite expert” from the opposing side, *Harrington v. Richter*, 562 U.S. 86, 111 (2011), it’s nonetheless relevant that the district court’s decision to exclude Dr. Dalton created an imbalance in the parties’ presentation of evidence. As noted, the district court admitted Dr. Rogers’ unreliable pig2bac testimony, which allowed Plaintiffs to present a novel and unfounded hypothesis that the presence of pig2bac served as a proxy for hog odor being on Plaintiffs’ property. But it excluded Dr. Dalton’s olfactometer testimony, which prevented Murphy-Brown from presenting a reliable and tested method of assessing the intensity and frequency of odors actually recorded. If jurors had heard just Dr. Dalton’s testimony (because Dr. Rogers’ testimony was improperly admitted) or both Dr. Dalton and Dr. Rogers’ testimony (upon finding him *Daubert* qualified), they may have reached a different verdict based on the totality of the evidence before them. Because there’s “a high probability that the error affected the judgment,” *Huskey v. Ethicon, Inc.*, 848 F.3d 151, 160 (4th Cir. 2017), the improper exclusion of Dr. Dalton’s testimony warrants vacatur and a new trial.

* * * *

Based on the foregoing, the district court abdicated its gatekeeping function before allowing Dr. Rogers to testify. Regardless of how a remand for the district court to perform

its proper *Daubert* role would play out with respect to the rest of Dr. Rogers' testimony, it was an abuse of discretion to admit his testimony as to pig2bac as a proxy for odor given that—at least as presented in the record—it does not satisfy *Daubert* or Rule 702. Further, the district court abused its discretion in excluding Dr. Dalton's testimony about the olfactometer tests she performed at and near Kinlaw Farms. These prejudicial errors require a new trial.

IV.

While Plaintiffs may have cognizable nuisance claims, their pursuit of victory through overtly irrelevant, prejudicial, and unreliable evidence makes the resulting verdict invalid. For the reasons discussed, it is impossible to know that these errors did not materially affect the decisions to hold Murphy-Brown liable for compensatory damages in the first instance, to assess any punitive damages award, and in setting the amount of those damages. *See Sparks v. Gilley Trucking Co.*, 992 F.2d 50, 53 (4th Cir. 1993) (recognizing that error in admitting evidence is not harmless if the court cannot determine whether the error affected the outcome of the case).²⁵ Accordingly, the district court's evidentiary errors

²⁵ Although these errors relate solely to Plaintiffs' allegation of a hog odor nuisance, there can be no doubt from the record that this aspect formed the core of Plaintiffs' case even though they also presented evidence of other alleged interferences in the form of pests and noise. Given that the jury's verdict form did not require information about what type of interference occurred, it is safe to conclude that these evidentiary errors affected the entire verdict. *See* J.A. 9177 (indicating jurors responded "yes" to the broad question, "Did the defendant substantially and unreasonably interfere with the plaintiff's use and enjoyment of his or her property?" as to each plaintiff).

Relatedly, because I believe these errors require a new trial, I do not join—nor need I express a view regarding—the remaining issues Murphy-Brown has raised on appeal.

constitute reversible error as to both liability and damages. I therefore respectfully dissent from those parts of the majority opinion reaching a different conclusion.

Exhibit 2

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**RE: Comments on Draft Air Quality Permit Number 10644R00 for Align
Renewable Natural Gas, LLC Grady Road upgrading facility**

Director Abraczinskas and Mr. Carroll:

On behalf of the Rural Empowerment Association for Community Help (“REACH”), Center for Biological Diversity, North Carolina Conservation Network, Clean Air Carolina, Sound Rivers, Environment North Carolina, Waterkeeper Alliance, Cape Fear River Watch, Crystal Coast Waterkeeper, White Oak-New Riverkeeper Alliance, Winyah Rivers Alliance, Clean Water for North Carolina, Lawyers’ Committee for Civil Rights Under Law, and Public Justice, the Southern Environmental Law Center (“SELC”) offers these comments to the N.C. Department of Environmental Quality - Division of Air Quality (“DAQ” or “the Agency”) regarding air quality permit 10644R00 for a proposed biogas upgrading facility (“Grady Road Facility” or “the upgrading facility”) under construction by Align Renewable Natural Gas (“Align RNG” or “the company”) as part of the BF Grady Road biogas project (“Grady Road

Project” or “the project”).¹ Thank you for the opportunity to offer these written comments.

SELC renews its request for a public hearing regarding this project; SELC originally made this request in January 2020.² A public hearing on this matter should be delayed until it is safe for communities impacted by the COVID-19 pandemic to attend.

The undersigned organizations are opposed to swine-waste-to-energy biogas projects that rely on the harmful and outdated lagoon and sprayfield waste management system currently used by all industrial hog operations that are part of the Grady Road Project.³ Over 20 years ago Smithfield Foods, Inc. (“Smithfield”), one of the two entities that make up Align RNG, committed to develop and install waste management technology at its industrial hog operations that would drastically reduce the devastating water quality, air quality, and public health impacts resulting from the use of the lagoon and sprayfield system. To date, Smithfield has refused to do so, and as a result its operations continue to pollute rivers and streams, burden neighbors with noxious odors, and lead to adverse public health impacts in surrounding communities. Rather than invest in cleaning up its decades-old mess, Smithfield has now found significant resources

¹ SELC supports the comments submitted by the Lawyers’ Committee for Civil Rights Under Law, which provides thorough support for SELC’s request that DAQ deny the draft permit until it conducts a full environmental justice analysis, including consideration of cumulative impacts, and provides for public participation on a new draft permit addressing any disparate impacts.

² See Letter from Blakely Hildebrand to Michael Abraczinskas, Jan. 6, 2020 (on file with SELC). SELC objects to DAQ’s refusal to extend the deadline for public comments regarding Align RNG’s draft permit. DAQ’s refusal to extend the public comment period conflicts with the Department of Environmental Quality’s (“DEQ”) May 2020 Public Participation Plan guidelines, which states that citizens should have “meaningful involvement” in Department decision-making. See N.C. Dep’t of Env’tl Quality, Public Participation Plan (May 4, 2020) <https://files.nc.gov/ncdeq/EJ/AttachJ-Public-Participation-Plan.pdf>. In January 2020, on behalf of Waterkeeper Alliance, Cape Fear River Watch, Clean Air Carolina, and the Center for Biological Diversity, SELC submitted a written request for a public hearing and a draft permit for the Grady Road Facility. *Id.* SELC communicated regularly with the Agency between January and April 2020 regarding this request and received no response to this request. On May 29, 2020, SELC received notification of the comment period via email, 13 days *after* a public notice was published in the print edition of a local newspaper. Neither SELC nor the organizations on behalf of which it requested a public comment period received notification of the public comment period prior to May 29. Thirty days is an insufficient amount of time for the public to meaningfully respond to this highly technical draft permit for a novel type of facility. Sixteen days, which is what SELC and its partners requesting the public comment period have been afforded, is entirely inadequate. Given its January 2020 request, SELC should have been timely notified of the public comment period.

³ NC community groups biogas statement (Oct. 24, 2018) (Attachment 1).

to invest in biogas development in the State, entrenching the use of this primitive waste management system and benefitting financially from the resulting harm to people and the environment.

As described in detail below, the draft permit poses substantial risks to both the environment and public health and fails to meet the requirements of state clean air statutes and regulations and the federal Clean Air Act. In summary, the draft permit is deficient because it:

- excludes 19 industrial hog operations as part of the pollution source;
- underestimates sulfur dioxide (“SO₂”) emissions;
- fails to account for future expansion of the upgrading facility; and
- lacks enforceable monitoring and other provisions.

Because this permit would introduce a substantial and novel pollution source into North Carolina, while locking in a harmful and outdated pollution source, DAQ must scrutinize every aspect of this permit. Align RNG admits that its proposal—to cover industrial hog waste lagoons, capture methane from that waste at 19 locations, and pipe it to a centralized facility to refine and sell in natural gas pipelines—is “unlike any other project.”⁴ Align RNG is a joint venture of Dominion Energy (“Dominion”) and Smithfield with plans to invest \$500 million in biogas projects in North Carolina, Virginia, Utah, Arizona and California.⁵ The project currently under consideration is only the first of many planned by Align RNG. Align RNG has already announced that the 19 individual hog operations slated to be tapped for biogas by the Grady

⁴ Application of Align RNG North Carolina, LLC, d/b/a/ Align Renewable Natural Gas for Approval to Participate in Pilot Program in Docket No. G-9, Sub 698 Docket No. G-9, Sub 764, 5 (Jan. 17, 2020). [hereinafter “Align RNG Application to NCUC”].

⁵ PR Newswire, *Dominion Energy and Smithfield Foods Invest Half Billion Dollars to Become Largest Renewable Natural Gas Supplier in U.S.*, <https://www.prnewswire.com/news-releases/dominion-energy-and-smithfield-foods-invest-half-billion-dollars-to-become-largest-renewable-natural-gas-supplier-in-us-300944053.html>. (last visited June 5, 2020). (Attachment 2).

Road Project will soon be joined by 30 more.⁶ Align RNG will aggressively pursue additional biogas development in North Carolina.⁷ DAQ should therefore carefully consider the impacts of biogas generally, in addition to the specific issues with the current project, before finalizing this permit for Align RNG's first major facility in the State.

For this project, Align RNG proposes to construct a facility that will emit sulfur dioxide ("SO₂") and other harmful compounds into the air breathed by communities of color in Duplin and Sampson Counties, which are already disproportionately burdened by the environmental and health impacts caused by the hog industry. Align RNG's air permit application comes at a time when the health impacts associated with long-term air pollution exposure—experienced disproportionately by Black Americans—have been brought into stark focus by the COVID-19 pandemic.⁸

Align RNG's permit application fails to disclose the true extent of the proposed facility's air quality impact by omitting emissions from existing hog operations that are part of the Grady Road Project. Align RNG's application also underestimates the SO₂ emissions by making unreasonable and unsupported assumptions regarding the composition of the incoming biogas, the frequency at which the upgrading facility's candlestick flares will be operated, and the rate at which both flares will convert biogas into SO₂. In addition, DAQ failed to conduct sufficient inquiry into Align RNG's intentions regarding future expansion of the upgrading facility.

⁶ John Downey, *How Dominion Energy, Smithfield Foods plan to make NC a leader in renewable natural gas*, CHARLOTTE BUS. J. (Dec. 2, 2019) <https://www.bizjournals.com/charlotte/news/2019/12/02/how-dominion-energy-smithfield-foods-plan-to-make.html>. (Attachment 3).

⁷ See <https://www.alignrng.com>. (last visited June 5, 2020) (noting Align RNG plans to include 48 hog operations in its biogas projects in North Carolina).

⁸ Michelle A. Williams & Jeffrey Sanchez, *Racism is Killing Black People. It's Sickening them, too*, THE WASH. POST (June 4, 2020) https://www.washingtonpost.com/opinions/racism-is-killing-black-people-its-sickening-them-too/2020/06/04/fe004cc8-a681-11ea-b619-3f9133bbb482_story.html. (Attachment 4).

Finally, the draft permit contains weak monitoring provisions which render the draft permit unenforceable.

For all these reasons, the undersigned organizations urge DAQ to reject Align RNG's permit application, revoke the draft permit issued to Align RNG, and request additional information from Align RNG consistent with the recommendations outlined below. In issuing any new draft permit, DAQ should redefine the source to include the upgrading facility and individual hog operations associated with the project, re-evaluate the SO₂ potential to emit, update the SO₂ emissions equations to reflect any changes, re-model the upgrading facility's SO₂ emissions, and clarify Align RNG's intention to expand the upgrading facility to accept biogas from additional industrial hog operations. In addition, DAQ must update any new permit to include enforceable conditions to limit emissions from the upgrading facility and associated industrial hog operations. Finally, DAQ must comply with its obligations under Title VI of the Civil Rights Act of 1964 in issuing any new draft permit for the upgrading facility.

I. Factual Background

A. Align RNG submitted applications to several state agencies and commissions for the Grady Road Project

1. Align RNG's air quality permit application to DAQ

Align RNG submitted an application for a synthetic minor air permit to DAQ on December 6, 2019.⁹ On January 17, 2020, DAQ asked Align RNG to submit a revised permit application providing additional information regarding the impacts of sulfur dioxide ("SO₂") emissions to the surrounding properties in the area.¹⁰ In response, on February 26, 2020, Align

⁹ BF Grady Rd. Revised Air Quality Permit Application, App. B at 1 (Feb. 26, 2020). [hereinafter "Align RNG Air Permit Application"].

¹⁰ *Id.*

RNG submitted a letter providing detail on the proposed facility's SO2 emissions and a revised permit application.¹¹

In its revised air quality permit application, Align RNG represented the hog operations located throughout Duplin and Sampson Counties that will be producing and transmitting gas to the upgrading facility as “independently owned and operated hog farms.”¹² The application explains that the biogas will be produced by installing anaerobic digesters over hog waste lagoons, dried on site, and transported through a new, low-pressure biogas pipeline to the upgrading facility.¹³

Align RNG's application to DAQ explains that the upgrading facility will upgrade the biogas to renewable natural gas quality and inject it into the existing Piedmont Natural Gas pipeline for offsite consumption.¹⁴ The non-methane constituents of the biogas, referred to as tail gas, will be scrubbed for hydrogen sulfide (“H2S”) using an iron sponge system, then oxidized using one enclosed hybrid flare.¹⁵ However, during facility commission and startup, during times when the upgrading system's operation is temporarily down for maintenance and/or repairs, or during unexpected emergency events, an elevated candlestick flare will be used to combust biogas.¹⁶ The application explains that the candlestick flare will also be used to combust product gas when product gas does not meet pipeline specifications.¹⁷

2. Smithfield's applications to modify associated industrial hog operations' certificates of coverage under the North Carolina swine general permit

In December 2019, a representative of Align RNG submitted several applications to the N.C. Department of Environmental Quality – Division of Water Resources for major

¹¹ *Id.*

¹² *Id.* at 4.

¹³ *Id.*

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ *Id.*

¹⁷ *Id.*

modifications of the certificates of coverage under the state swine general permit for each of the industrial hog operations that will supply the upgrading facility with captured biogas.¹⁸ Through these applications, Smithfield seeks to modify nutrient management plans for each of the individual hog operations involved in the Grady Road Project. Align intends to install anaerobic digesters over hog waste lagoons; anaerobic digesters are the primary means of producing biogas at these operations.¹⁹ As discussed in more detail below, capping hog waste lagoons for biogas production may somewhat reduce the odors which stem from these lagoons. However, none of the other public health or environmental impacts of the lagoon and sprayfield system will be mitigated by capping lagoons. In fact, capping hog waste lagoons exacerbates water pollution resulting from the lagoon and sprayfield system and odors from barn-flushing.²⁰

3. Align RNG's application to the North Carolina Utilities Commission

On January 17, 2020, Align RNG filed an application with the North Carolina Utilities Commission (“NCUC” or “Commission”) requesting to participate in a three-year pilot program for providing natural gas to Piedmont Natural Gas Company, Inc.’s (“Piedmont”) distribution system.²¹ Align RNG is a wholly owned subsidiary of Align RNG, LLC, a multi-state joint venture between Dominion and Smithfield. Dominion RNG Holdings, Inc. an unregulated subsidiary of Dominion, and Murphy-Brown, LLC, d/b/a/ Smithfield Hog Production (“Murphy Brown”), a subsidiary of Smithfield, are equal owners of Align RNG.²²

¹⁸ See, e.g., Permit Tracking Slip for Permit AWS310039: Benson Farm (Dec. 23, 2019), at 7 (on file with N.C. Dep’t of Env’tl Quality – Div. of Water Res.) (noting that Kraig Westerbeek, VP for Environmental and Manufacturing at Align RNG as the owner of the facility) (Attachment 5) [hereinafter Benson Farm application]; see also Align RNG Application Review at 1 (May 2020) (listing Kraig Westerbeek as BP for Environmental and Manufacturing at Align RNG) [hereinafter “Application Review”].

¹⁹ See, e.g., AgSTAR: Livestock Anaerobic Digester Database, EPA (Jan. 2019), <https://www.epa.gov/agstar/livestock-anaerobic-digester-database> (noting that of the 10 voluntarily reported biogas projects in North Carolina, six use covered lagoon technology).

²⁰ See *infra* notes 45-48 (explaining how waste stored in covered lagoons retains more nutrients than waste in uncovered lagoons).

²¹ Align RNG Application to NCUC, *supra* note 4, at 2.

²² *Id.* at 1.

Align RNG described the proposed operation as a “unique ‘hub and spoke’ business model [that] facilitates the creation of a large-scale Alternative Gas project that is unlike any other project.”²³ Align RNG explained in this application that it would construct a centralized gas upgrading facility located near the intersection of Old Courthouse Road and NC Hwy 24 between the Towns of Warsaw and Turkey, and approximately 30 miles of gathering pipeline to interconnect each participating hog operation to the centralized gas upgrading facility.²⁴ Align RNG represented to the Commission “that it plans to construct [a]lternative [g]as gathering facilities on 19 farms in Duplin and Sampson Counties to supply methane generated from swine manure for the production of alternative gas.”²⁵ Alternative gas gathering facilities refer to the anaerobic digesters that Align RNG intends to install over hog waste lagoons. Align RNG explained that the project “will leverage Smithfield’s relationship with local contract farmers, who raise and care for Smithfield’s hogs.”²⁶ Align RNG represented that its “unique business model provides a new revenue stream for local North Carolina farmers, by allowing these farmers to harvest an additional resource grown on their farms (biomethane), which is currently undervalued, into a new source of revenue.”²⁷ Align RNG further stated that “Align RNG has accomplished the design and financing” of the project.²⁸ Finally, Align RNG stated that the project “provides a waste management solution that enhances environmental protection of North Carolina’s resources. Employing covered lagoon systems to capture methane can mitigate

²³ *Id.* at 5.

²⁴ Order Approving Participation in Pilot Program with Conditions, N.C. Utilities Comm., Dkt. No. G-9, Sub 764 at 2 (Apr. 3, 2020). [hereinafter “NCUC Order”]. (Attachment 6).

²⁵ Align RNG Application to NCUC, *supra* note 4, at 2 (“Align RNG’s Alternative Gas production facilities will be located on 19 farms in Duplin and Sampson Counties, North Carolina.”).

²⁶ *Id.* at 5.

²⁷ *Id.* at 7-8.

²⁸ *Id.* at 2.

potential waste management issues (such as flooding) associated with severe weather events by shielding traditionally open-air waste lagoons from destructive elements.”²⁹

On April 3, 2020, the Commission conditionally approved Align RNG’s participation in the pilot program.³⁰

B. Biogas development will exacerbate the hog industry’s harmful impacts on the environment and public health

1. The lagoon and sprayfield system pollutes the environment and harms public health

Biogas is produced at industrial hog operations by installing anaerobic digesters and covers over existing hog waste lagoons.³¹ In North Carolina, these lagoons are part of the outdated and environmentally unsustainable lagoon and sprayfield system used for animal waste management. Under this system, hog feces and urine are stored in often unlined pits and the liquid waste is subsequently sprayed onto nearby cropland. This waste management system pollutes the State’s waterways, air, and the ecosystems that rely on them; harms the public health of communities that live nearby or downstream of industrial hog operations; and creates noxious odors that impact the livelihoods of people living near these operations, with a disproportionate impact on Native Americans, Latinx, and Black Americans.³²

Liquid swine waste can intrude into groundwater via cracks in lined lagoons, or by seeping directly through lagoons.³³ When wastewater from hog waste lagoons is sprayed on

²⁹ *Id.* at 7. This claim does not appear to be supported by any academic literature or reports analyzing the impacts of severe weather events on hog waste lagoons.

³⁰ NCUC Order, *supra* note 24, at 4.

³¹ *See supra* note 19.

³² Letter from Lilian Dorka, Director of External Civil Rights Compliance with U.S. Env’tl. Protection Agency, to William Ross, Acting Secretary of N.C. DEQ (Jan. 12, 2017), https://www.epa.gov/sites/production/files/2018-05/documents/letter_of_concern_to_william_g_ross_nc_deq_re_admin_complaint_11r-14-r4_.pdf (expressing “deep concern about the possibility that African Americans, Latinos, and Native Americans have been subjected to discrimination as the result of NC DEQ’s” permitting system for industrial hog operations) [hereinafter “Letter from Lilian Dorka”]. (Attachment 7).

³³ *See* ROBBIN MARKS, NAT. RES. DEF. COUNCIL, CESSPOOLS OF SHAME: HOW FACTORY FARM LAGOONS AND SPRAYFIELDS THREATEN ENVIRONMENTAL AND PUBLIC HEALTH 33 (2001),

fields, over-application or improper irrigation techniques can result in nutrient-laden swine waste discharging directly into nearby streams and rivers.³⁴ Once hog waste infiltrates surface or groundwater, the large amounts of nitrogen and phosphorus contained in the waste can wreak ecological havoc and cause harmful algal blooms; fish kills; acidification of soils and aquatic ecosystems; heavy metal accumulation in sediments, aquatic life, and plant and animal tissue; excessive salt buildup; eutrophication of rivers and estuaries; and consequent species and ecological community changes.³⁵

The human impacts of the lagoon and sprayfield waste management system are similarly devastating. A 2018 study published in the *North Carolina Medical Journal* found that residents who live near industrial hog operations in eastern North Carolina that use the lagoon and sprayfield system have higher death rates from causes such as anemia, kidney disease, tuberculosis, and low birth weight than residents who live further away from such operations.³⁶ The study also found higher rates of low birth weight and infant hospitalization among residents who live near industrial hog operations.³⁷ Duke University researchers noted that these impacts are not the cause of multiple demographic, behavioral, or socioeconomic factors present, but rather are “due to the additional impact of multiple industrial hog facilities located in this area.”³⁸ Other research found that the same heavy metal and salt accumulation that affects wildlife can

<https://www.nrdc.org/sites/default/files/cesspools.pdf>; see also Steve Wing et al., *Environmental Injustice in North Carolina's Hog Industry*, 108 ENVTL. HEALTH PERSP. 225, 225 (2000) (noting that this is a particular problem in eastern North Carolina, where a high water table allows for easy groundwater intrusion). In fact, just a few days ago 3.5 million gallons of hog waste spilled from a hog lagoon in Sampson County. Lisa Sorg, *Partial hog lagoons breach spills 3 million gallons of feces, urine in Sampson County*, N.C. POLICY WATCH (June 15, 2020) <http://pulse.ncpolicywatch.org/2020/06/15/partial-hog-lagoon-breach-spills-3-million-gallons-of-feces-urine-in-sampson-county/>. (Attachment 8).

³⁴ MARKS, *supra* note 33, at 29.

³⁵ *Id.*

³⁶ Julia Kravchenko et al., *Mortality and Health Outcomes in North Carolina Communities Located in Close Proximity to Hog Concentrated Animal Feeding Operations*, 79 N.C. MED. J. 278, 278 (2018).

³⁷ *Id.*

³⁸ *Id.* at 286.

cause cancer, hair loss, liver dysfunction, and anemia in humans.³⁹ Ammonia emissions from lagoons cause eye irritation and are partially responsible for noxious smell.⁴⁰ Gaseous hydrogen sulfide also causes eye irritation, in addition to irritation of the nose and throat, as well as loss of consciousness, seizures, and even death.⁴¹ Airborne particulate matter and swine waste effluent are also associated with a host of respiratory ailments.⁴² Near constant exposure to pollution and odors are linked to mental health impacts, such as greater levels of self-reported depression and anxiety among residents living near these facilities.⁴³

As discussed in more detail below, communities located near industrial hog operations—and therefore exposed to the environmental and health impacts associated with the outdated lagoon and sprayfield system—are disproportionately communities of color.⁴⁴

2. Biogas production will entrench the harmful impacts of the lagoon and sprayfield system

Align RNG has repeatedly stated that that biogas development is “great for the environment.”⁴⁵ But simply covering existing swine waste lagoons for biogas production does little to address the environmental and health impacts associated with the lagoon and sprayfield system. To the contrary, capping hog waste lagoons for biogas production *exacerbates* water pollution resulting from the lagoon and sprayfield system and only minimally reduces odor at these operations.

³⁹ MARKS, *supra* note 33, at 32–33.

⁴⁰ *Id.* at 18. As mentioned below, there is evidence that the anaerobic digestion required to produce biogas dramatically increases output of ammonia from waste lagoons. *See infra* note 51.

⁴¹ MARKS, *supra* note 3333, at 18.

⁴² *See, e.g.,* Peter S. Thorne, *Environmental Health Impacts of Concentrated Animal Feeding Operations: Anticipating Hazards--Searching for Solutions*, 115(2) ENVTL.HEALTH PERSP. 296, 296–97 (2007).

⁴³ Susan S. Schiffman et al., *The Effect of Environmental Odors Emanating from Commercial Swine Operations on the Mood of Nearby Residents*, 37(4) BRAIN RES. BULL. 369, 371 (1995).

⁴⁴ Wing et al., *supra* note 33, at 231.

⁴⁵ Downey, *supra* note 6.

Biogas is produced from animal waste lagoons through the process of anaerobic digestion, which causes methane to build up under a lagoon cover.⁴⁶ Hog waste lagoon covers cause the liquid manure stored in a covered facility to have 3.5 times more nitrogen compared to manure slurry in an open lagoon.⁴⁷ This means that *less* liquid waste from a covered lagoon is needed to fertilize crops relative to an uncovered lagoon.⁴⁸ When a covered lagoon's contents are subsequently sprayed onto fields, the risk of over-application of nitrogen is heightened, increasing the risk of excess pollution in nearby surface waters and groundwater. Furthermore, the risks posed by leakage from both lined and unlined lagoons increase as the waste within the lagoons becomes increasingly concentrated by anaerobic digestion.

Covered animal waste lagoons also produce methane at higher rates than uncovered lagoons.⁴⁹ A small portion—up to 3.1%⁵⁰—of the methane generated by covered lagoons “leaks” into the atmosphere, potentially negating any of the climate benefits of biogas.⁵¹

⁴⁶ *Anaerobic Digestion and its Applications*, U.S. ENVTL. PROTECTION AGENCY (Oct. 2015), <https://www.americanbiogascouncil.org/pdf/AD%20and%20Applications-finalcls.pdf>; *How Does Anaerobic Digestion Work?*, U.S. ENVTL. PROTECTION AGENCY, AGSTAR, <https://www.epa.gov/agstar/how-does-anaerobic-digestion-work>.

⁴⁷ S.G. LUPIS, N. EMBERTSON & J.G. DAVIS, COLORADO STATE UNIVERSITY EXTENSION, BEST MANAGEMENT PRACTICES FOR REDUCING AMMONIA EMISSIONS, <https://extension.colostate.edu/topic-areas/agriculture/best-management-practices-for-reducing-ammonia-emissions-lagoon-covers-1-631b/>

⁴⁸ Joe H. Harrison et al., *Transformation and Agronomic Use of Nutrients from Digester Effluent*, EXTENSION.ORG (May 17, 2013), <http://articles.extension.org/pages/67900/transformation-and-agronomic-use-of-nutrients-from-digester-effluent>.

⁴⁹ See DARMAWAN PRASODJO ET AL., NICHOLAS INST. FOR ENVTL. POLICY SOLUTIONS, A SPATIAL-ECONOMIC OPTIMIZATION STUDY OF SWINE WASTE-DERIVED BIOGAS INFRASTRUCTURE DESIGN IN NORTH CAROLINA A-34 (2013).

⁵⁰ See, e.g., Thomas K. Flesch, Raymond L. Desjardins, & Devon Worth, *Fugitive Methane Emissions from an Agricultural Biodigester*, 35 BIOMASS & BIOENERGY 3927, 3927 (2011). This figure only captures leakage from anaerobic digesters alone, and does not include any additional leakage associated with the transport and storage of biogas.

⁵¹ William H. Schlesinger, *Natural Gas or Coal: It's All About the Leak Rate*, Nature.org, June 24, 2016, <https://blog.nature.org/science/2016/06/24/natural-gas-coal-leak-rate-energy-climate/> (explaining that “any leakage rate above about 1 percent of gross production negates the advantages of [using methane versus coal] with respect to mitigating climate change” primarily due to the higher global warming potential of methane.). (Attachment 9). Ammonia (NH₃) emissions also increase during the process of anaerobic digestion. Michael A. Holly et al., *Greenhouse Gas and Ammonia Emissions From Digested and Separated Dairy Manure During Storage and After Land Application*, 239 Agric., Ecosystems, & Env't. 410, 418 (2017). “[anaerobic digestion] could also significantly increase NH₃ emissions from manure . . .”).

Additionally, installation of anaerobic digesters over hog waste lagoons does not address the significant risk of pollution from industrial hog operations during major rain events, which are becoming more frequent and intense because of climate change.⁵² The lagoon and sprayfield system is extremely vulnerable to flooding during major rain events, which was evident during Hurricane Matthew in 2016 and Hurricane Florence in 2018 when dozens of hog waste lagoons were inundated, overflowed, or breached.⁵³ There is no evidence suggesting that covered lagoons are less vulnerable to inundation as uncovered lagoons, and covering lagoons has no impact on the susceptibility of sprayfields to flooding during major storm events.

At best, capping hog waste lagoons for biogas production may marginally reduce the odors which stem from hog waste lagoons. However, none of the other air quality impacts of the lagoon and sprayfield system would be mitigated by capping lagoons. Confinement barns, where swine are raised, will continue to emit airborne contaminants, including gases, odors and microorganisms stemming from manure decomposition even when lagoons are capped with anaerobic digesters.⁵⁴ Odors from the land application of swine waste will also continue to pose the same risks to human health when lagoons are covered.

Without the inclusion of additional technology—such as advanced denitrification systems or barn scrapers,⁵⁵ for example—covering hog waste lagoons does not improve, and will in fact

⁵² See K.E. KUNKEL ET AL., N. CAROLINA INST. FOR CLIMATE STUDIES, NORTH CAROLINA CLIMATE SCIENCE REPORT 6 (March 2020), https://ncics.org/pub/nccsr/NC%20Climate%20Science%20Report_ExecSummary_Final_March2020.pdf. (“[T]here is an upward trend in the number of heavy rainfall events (3 inches or more in a day), with the last four years (2015–2018) having seen the greatest number of events since 1900.”).

⁵³ See e.g., Kendra Pierre-Louis, *Lagoons of Pig Waste Are Overflowing After Florence. Yes, That’s as Nasty as It Sounds*, NY TIMES (Sept. 19, 2018) <https://www.nytimes.com/2018/09/19/climate/florence-hog-farms.html> (noting that at the time of writing, 110 hog waste lagoons had released or were imminently going to release hog waste into rivers and streams in eastern North Carolina). (Attachment 10).

⁵⁴ See, e.g., Kristen James et. al., *Characterizing Ammonia Emissions From a Commercial Mechanically Ventilated Swine Finishing Facility and an Anaerobic Waste Lagoon in North Carolina*, 3 ATMOSPHERIC POLLUTION RESEARCH 279, 283–84 (2012).

⁵⁵ See *infra* Part V.A (explaining how barn scrapers reduce odor and minimize waste volume).

exacerbate and entrench the lagoon and sprayfield system’s devastating environmental and public health impacts.

II. Legal Background

A. N.C. Air Pollution Control Act & Clean Air Act

In North Carolina, “the water and air resources of the State belong to the people.” N.C. Gen. Stat. § 143-211(a); *see also* N.C. Const. art. XIV, § 5 (“It shall be the policy of this State . . . to control and limit the pollution of our air and water . . .”). The North Carolina Air Pollution Control Act was enacted “to achieve and to maintain for the citizens of the State a total environment of superior quality” and to ensure that standards and programs are:

designed to protect human health, to prevent injury to plant and animal life, to prevent damage to public and private property, to insure the continued enjoyment of the natural attractions of the State, to encourage the expansion of employment opportunities, to provide a permanent foundation for healthy industrial development and to secure for the people of North Carolina, now and in the future, the beneficial uses of these great natural resources.

N.C. Gen. Stat. §§ 143-211, 143-215.105 (2019) (explaining that the declaration of public policy set forth in § 143-211 applies to the Air Pollution Control Act provisions).

Through the Air Pollution Control Act and its regulations, DAQ also implements the federal Clean Air Act (“CAA”) in North Carolina, as approved by the U.S. Environmental Protection Agency (“EPA”) in North Carolina’s State Implementation Plan (“SIP”). *See, e.g.*, 15A N.C. Admin. Code 2Q .0500 (implementing the Clean Air Act’s Title V program). North Carolina’s SIP must ensure compliance with the CAA, and incorporates significant portions of CAA’s implementing regulations directly. *Id.*; *see* 42 U.S.C. § 7410.

Pursuant to the CAA, the EPA has set National Ambient Air Quality Standards (“NAAQS”) for six criteria pollutants, including sulfur dioxide (“SO₂”). 40 C.F.R. § 50.17. The

purpose of NAAQS is to “define levels of air quality which the [EPA] Administrator judges are necessary, with an adequate margin of safety, to protect the public health.” *Id.* § 50.2(b). North Carolina’s federally approved SIP sets ambient air quality standards in line with the federal NAAQS, *compare* 40 C.F.R. Part 50, *with* 15A N.C. Admin. Code 2D .0400 *et seq.*, and provides that “[n]o facility or source of air pollution shall cause any ambient air quality standard in this Section to be exceeded or contribute to a violation of any ambient air quality standard,” 15A N.C. Admin. Code 2D .0401(c); *see also* 15A N.C. Admin. Code 2D .0501(c) (“[A]ny source of air pollution shall be operated with such control or in such manner that the source shall cause the ambient air quality standards . . . to be exceeded at any point beyond the premises on which the source is located.”). Compliance with the NAAQS is often demonstrated through dispersion model during the permitting process of a new facility.

Title V of the Clean Air Act sets forth a federal operating permit program. 42 U.S.C. § 7661 *et seq.* Any stationary source that is considered a “major” source for purposes of Title V must apply for a Title V operating permit within 12 months of the facility commencing operation, and no source subject to Title V “may operate after the time that is required to submit a timely and complete application except in compliance with a permit” issued under Title V. 40 C.F.R. § 70.7(b); 15A N.C. Admin. Code 2Q .0501(e). The purpose of the Title V program is to identify all of a source’s CAA obligations and specify monitoring, recordkeeping, and reporting requirements sufficient to assure that the source is meeting those obligations and is otherwise operating in compliance with the Act.⁵⁶ *See* 40 C.F.R. § 70.1

⁵⁶ *See* 1990 Clean Air Act Amendment Summary: Title V, EPA (Oct. 19, 2016), <https://www.epa.gov/clean-air-act-overview/1990-clean-air-act-amendment-summary-title-v>.

B. Source Aggregation

Pursuant to CAA regulations, a stationary source means “any building, structure, or installation which emits or may emit a regulated [New Source Review] pollutant.” 40 C.F.R. § 52.21(b)(i). Generally, “entities may be considered part of the same stationary source . . . if they (1) belong to the same industrial grouping; (2) are located on one or more contiguous or adjacent properties and (3) are under the control of the same person (or persons under common control).”⁵⁷ However, EPA has interpreted the requirements for this three prong test broadly. For example, even if entities do not belong to the same industrial grouping, EPA guidance considers that prong of the source aggregation test satisfied if one of the entities is a “support entity” to the other.⁵⁸ Similarly, EPA guidance explains that common control can be established “through ownership of multiple sources by the same parent corporation or by a parent and a subsidiary of the parent corporation” or if an entity “has the power to direct the management and policies of a second entity . . . through a contractual agreement or voting interest.”⁵⁹

C. Potential to Emit

Under Title V of the CAA, 42 U.S.C. § 7661 *et seq.*, a stationary source is considered a major source if it emits or has the potential to emit (“PTE”) 100 tons per year or more of any regulated pollutant. 40 C.F.R. § 70.2; *see* 15A N.C. Admin. Code 2Q .0103(22) (defining

⁵⁷ Letter from William L. Wehrum, Assistant Administrator, EPA, to Patrick McDonnell, Secretary of the Pennsylvania Department of Environmental Protection at 1 (Apr. 30, 2018), https://www.epa.gov/sites/production/files/2018-05/documents/meadowbrook_2018.pdf (internal quotations omitted) [hereinafter “Letter from William L. Wehrum”]; *see also* 40 C.F.R. § 52.21(b)(6)(i).

⁵⁸ Letter from JoAnn Heiman, Chief Air Permitting and Compliance Branch, EPA, to James Pray 3 (Dec. 6, 2004), <https://www.epa.gov/sites/production/files/2015-07/documents/lincoln.pdf> (explaining that a “support facility” such as the grain elevator “may be considered to be a part of the same major group as the primary facility [the ethanol plant] supports even if the support facility would be classified in a separate group when operated independently.”) [hereinafter “Letter from JoAnn Heiman”].

⁵⁹ Letter from Richardson Long, U.S. EPA Region 8, to Julie Wrend, Colorado Dep’t of Public Health & Environment re: Single Source Determination for Coors/Trigen (Nov. 12, 1998) <https://19january2017snapshot.epa.gov/sites/production/files/2015-07/documents/coorstri.pdf> [hereinafter “Letter from Richardson Long”].

“major facility” in accordance with 40 C.F.R. § 70.2). A facility’s “potential to emit” is defined as “the maximum capacity of a stationary source to emit any air pollutant under its physical and operational design.” 40 C.F.R. § 70.2; *see* 15A N.C. Admin. Code 2Q .0103(28) (defining “potential emissions” as “the rate of emissions of any air pollutant that would occur at the facility’s maximum capacity to emit any air pollutant under its physical and operational design”).

Furthermore,

Any physical or operational limitation on a capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation is enforceable by the Administrator.

40 C.F.R. § 70.2. Thus, a facility’s “potential to emit” is based on the maximum amount of pollutants the facility could emit if it operated at full capacity 24 hours per day, 365 days per year, taking into account enforceable permit restrictions or conditions. A facility’s potential to emit is meant to represent a “worst case” emissions calculation. EPA, *Draft New Source Review Workshop Manual*, at A19 (Oct. 1990) (discussing “methods for determining potential to emit”); *see also Voigt v. Coyote Creek Mining Co.*, 329 F. Supp. 3d 735, 772 (D. N.D. 2018) (citing *In re Peabody W. Coal Co.*, 12 E.A.D. 22, 2005 WL 428833 (EAB Feb. 18, 2005)).⁶⁰

III. DAQ’s draft permit for Align RNG’s upgrading facility violate state and federal clean air statues and regulations

The draft permit issued by DAQ violates state and federal clean air laws and fails to protect the environment and the public.

⁶⁰ Although these materials relate specifically to the New Source Review and Prevention of Significant Deterioration contexts, the regulatory definition of “potential to emit” under these programs is essentially identical to the definition provided under the Title V context. *Compare* 40 C.F.R. § 51.166(b)(4) (New Source Review), *with* 40 C.F.R. § 70.2 (Title V).

A. The upgrading facility and industrial hog operations where biogas is collected should be permitted as one stationary source

The evidence available indicates that DAQ should consider the upgrading facility and the industrial hog operations from which it draws biogas as one stationary source for purposes of permitting under the federal Clean Air Act. Align RNG's assertion that the upgrading facility's emissions should not be aggregated with the emissions of anaerobic digesters at associated hog operations is incorrect.⁶¹ It is clear from the information available that the components of the Grady Road Project—the upgrading facility and individual hog operations—meet at least two of the factors needed to qualify as a single stationary source.⁶² The individual hog operations are support facilities and all components of the Grady Road Project are under common ownership. Furthermore, based on Align RNG's representations to the NCUC, the individual hog operations and upgrading facility, which are connected by more than 30 miles of pipelines, should be considered contiguous or adjacent and thus meet the third criteria for a single source. Conversely, Align RNG represents to DAQ that the upgrading facility and individual hog operations supplying biogas are distinct and not part of the same source. DAQ must resolve inconsistencies between Align RNG's representations about the nature of the Grady Road Project to DAQ and the NCUC before finalizing a permit for the upgrading facility.

1. DAQ must resolve Align RNG's inconsistent statements regarding the scope of the Grady Road Project

As an initial matter, DAQ must resolve the inconsistencies in Align RNG's characterizations of the Grady Road Project to DAQ and the NCUC before moving forward with permitting. In its air permit application, Align RNG disclaims all knowledge of and control over anaerobic digester systems at individual hog operations and gas gathering equipment. Align

⁶¹ See Align RNG Air Permit Application, *supra* note 9, at 19.

⁶² Letter from William L. Wehrum, *supra* note 57 (internal quotations omitted); see also 40 C.F.R. § 52.21(b)(6)(i).

RNG states that the upgrading facility is “a separate and distinct source” from the anaerobic digester systems at individual hog operations that provide it with biofuel.⁶³ Align RNG also states that it “will not own the on-farm anaerobic digester systems of the individual hog farming operations.”⁶⁴

These statements contradict Align RNG’s representations to the NCUC, where Align RNG stated that its proposed operation was a “unique ‘hub and spoke’ business model” that involved a centralized alternative gas upgrading facility and approximately 30 miles of gathering pipeline to interconnect each participating hog operation to the centralized gas upgrading facility.⁶⁵ Align RNG further explained that “it plans to construct [a]lternative [g]as gathering facilities on 19 farms in Duplin and Sampson Counties to supply methane generated from swine manure for the production of alternative gas.”⁶⁶ In other words, in its filings before the NCUC Align RNG not only characterized the upgrading facility as just one component of a multi-part system, but also claimed that Align RNG itself would be constructing the on-farm “alternative gas gathering facilities,” *i.e.* the anaerobic digesters, that service the upgrading facility.

These inconsistencies matter because under the federal rules governing source aggregation for purposes of the CAA, “entities may be considered part of the same stationary source if they (1) belong to the same industrial grouping; (2) are located on one or more contiguous or adjacent properties and (3) are under the control of the same person (or persons under common control).”⁶⁷ Align RNG’s changing representations about the relationship between itself, Smithfield, and the individual hog operations that would be supplying biogas to

⁶³ Align RNG Air Permit Application, *supra* note 9 at 18.

⁶⁴ *Id.*

⁶⁵ NCUC Order, *supra* note 24, at 2.

⁶⁶ Align RNG Application to NCUC, *supra* note 4 at 2; NCUC Order, *supra* note 24 at 2; *see also*, Redacted Receipt Interconnect Agreement at 7 (Attachment 11) (demonstrating that Align RNG would own the pipeline).

⁶⁷ Letter from William L. Wehrum, *supra* note 57, at 1 (internal quotations omitted); *see also* 40 C.F.R. § 52.21(b)(6)(i).

the upgrading facility make it impossible for DAQ—with the information it currently has before it—to determine whether the upgrading facility and the anaerobic digester systems at each industrial hog operation must be permitted as one stationary source.

This is significant because if these facilities are in fact one stationary source, then emissions of these facilities must be combined when calculating potential to emit, ensuring compliance with the NAAQS, and determining the applicability of various CAA provisions, including Title V, Prevention of Significant Deterioration, and Section 112. 42 U.S.C. § 7661 *et seq.*; 42 U.S.C. §§ 7470–7479; 42 U.S.C. § 7412. Therefore, DAQ must conduct further inquiry into these relationships prior to issuing a final air permit for the Grady Road Facility.

2. Anaerobic digesters at associated industrial hog operations are “support facilities” for the Grady Road facility

EPA has frequently held that “support facilities” may satisfy the first prong of the source aggregation test even when facilities do not share a common industrial grouping.⁶⁸ For instance, in the context of grain elevators and ethanol plants (each classified under different two-digit SIC codes), EPA stated that a “support facility” such as the grain elevator “may be considered to be a part of the same major group as the primary facility [the ethanol plant] even if the support facility would be classified in a separate group when operated independently.”⁶⁹ This means that even though the on-farm anaerobic digesters do not belong to the same industrial grouping as the upgrading facility, they may still qualify as a support facility.⁷⁰

Generally speaking, EPA has stated that “where more than 50% of the output or services provided by a facility is dedicated to another facility that it supports, then a support facility

⁶⁸ Letter from JoAnn Heiman, *supra* note 58, at 3.

⁶⁹ *Id.*

⁷⁰ See Align RNG Air Permit Application, *supra* note 9, at 19.

relationship is presumed to exist[.]”⁷¹ According to Align RNG’s stated business plan, all of the biogas produced by the anaerobic digesters at these individual operations would be transported through Align RNG’s pipeline to the upgrading facility for processing and injection.⁷² The industrial hog operations are installing new technology and in effect creating a new output stream to exclusively supply the upgrading facility. Because virtually all of the output—in this case, biogas—from the individual hog operations is dedicated to the upgrading facility, the individual hog operations should be considered support facilities.

Furthermore, additional factors support a finding that the anaerobic digester systems are support facilities. EPA has issued guidance stating that “[e]ven where this 50% test is not met ... other factors may lead the permitting authority to make a support facility determination.”⁷³ EPA set forth these additional criteria as such:

[s]upport facility determinations can depend upon a number of financial, functional, contractual, and/or other legal factors. These include, but are not limited to: (1) the degree to which the supporting activity receives materials or services from the primary activity (which indicates a mutually beneficial arrangement between the primary and secondary activities); (2) the degree to which the primary activity exerts control over the support activity’s operations; (3) the nature of any contractual arrangements between the facilities; and (4) the reasons for the presence of the support activity on the same site as the primary activity (e.g., whether the support activity would exist at that site but for the primary activity). Where these criteria indicate a support relationship, permitting authorities may conclude that a support activity contributing more or less than 50% of its output may be classified as a support facility and aggregated with the facility it supports as part of a single source.”⁷⁴

Based on the limited information available to DAQ and the public regarding the relationship between Align RNG and the “alternative gas gathering facilities”—i.e. anaerobic digesters to be

⁷¹ Letter from JoAnn Heiman, *supra* note 58, at 3.

⁷² Align RNG Air Permit Application, *supra* note 9, at 11 (“Biogas will be delivered to the BF Grady Rd facility via dedicated pipeline from anaerobic digester systems located at various hog farms located in Duplin and Sampson Counties.”).

⁷³ Letter from JoAnn Heiman, *supra* note 58, at 3-4.

⁷⁴ *Id.*

constructed on existing hog operations—it appears that many of the factors discussed in EPA’s guidance are satisfied.

First, there is a close “contractual arrangements between the facilities.”⁷⁵ Smithfield—an equal owner of Align RNG—has existing contracts with or owns many (and likely all) of the 19 hog operations that would provide biogas to the upgrading facility through its subsidiary Murphy Brown.⁷⁶ Align RNG alluded to this relationship in its NCUC filings, stating that the project “will leverage Smithfield’s relationship with local contract farmers, who raise and care for Smithfield’s hogs.”⁷⁷ Align RNG proposes to further deepen this relationship by “partnering” with these same hog operations “to supply methane generated from swine manure for the production of Alternative Gas.”⁷⁸ This situation is a far cry from an “arms-length” arrangement between independent commercial entities.⁷⁹

Second, the upgrading facility and the associated hog operations are engaged in a “mutually beneficial arrangement”⁸⁰—by providing hog operations a way of disposing and even monetizing animal waste byproducts, the upgrading facility provides a significant service to the individual hog operations. Align RNG alluded to these benefits in its application to the NCUC, where it explained: that its “unique business model provides a new revenue stream for local North Carolina farmers, by allowing these farmers to harvest an additional resource grown on

⁷⁵ *Id.* at 4.

⁷⁶ Pursuant to a public records request filed with DEQ in December 2014, SELC received copies of applications for major modifications of certificates of coverage under the North Carolina swine general permit for several industrial hog operations associated with the Grady Road Project. All of these operations are owned by Murphy Brown, a subsidiary of Smithfield. *See, e.g.*, Benson Farm application, *supra* note 18 (showing Kraig Westerbeek, an executive at Align RNG, as the owner of Benson Farm, one of the industrial hog operations supplying biogas to the upgrading facility).

⁷⁷ Align RNG Application to NCUC, *supra* note 4, at 5.

⁷⁸ *Id.*

⁷⁹ *Contra* Letter from William L. Wehrum, *supra* note 57.

⁸⁰ Letter from JoAnn Heiman, *supra* note 58, at 4.

their farms (biomethane), which is currently undervalued, into a new source of revenue.”⁸¹

Therefore, according to Align RNG’s own filings, there is “a mutually beneficial arrangement between the primary and secondary activities[.]”⁸²

Third, Align RNG proposes that the upgrading facility would “exert[] control”⁸³ over hog operations by virtue of Smithfield’s ownership of or existing contracts with the facilities for hog production.⁸⁴ This control is also illustrated by Align RNG’s requirement that the hog facilities produce biogas that meets certain chemical parameters.⁸⁵

Finally, while the 19 industrial hog operations predate the upgrading facility, these operations are only proposing to cover currently operational hog waste lagoons and install on-farm anaerobic digester systems capable of producing and delivering biogas in order to serve the upgrading facility. In other words, but for the upgrading facility, these operations would not install anaerobic digesters and supply Align RNG with biogas.⁸⁶

For all these reasons, the alternative gas gathering facilities that produce biogas for the upgrading facility must be considered support facilities and should be permitted as a single source.

3. The Grady Road Facility and on-farm anaerobic digesters are under control of the same corporations

Entities may be considered part of the same stationary source if they “are under the control of the same person (or persons under common control).”⁸⁷ EPA guidance explains that common control can be established two ways:

⁸¹ Align RNG Air Permit Application, *supra* note 9, at 7-8.

⁸² Letter from JoAnn Heiman, *supra* note 58, at 4.

⁸³ *Id.*

⁸⁴ *See infra* pp. 23-25.

⁸⁵ Align RNG Air Permit Application, *supra* note 9, at 4.

⁸⁶ *See* Letter from JoAnn Heiman, *supra* note 58, at 4.

⁸⁷ Letter from William L. Wehrum, *supra* note 57, at 1 (internal quotations omitted); *see also* 40 C.F.R. § 52.21(b)(6)(i).

First, common control can be established through ownership of multiple sources by the same parent corporation or by a parent and a subsidiary of the parent corporation. Second, common control can be established if an entity such as a corporation has the power to direct the management and policies of a second entity, thus controlling its operations, through a contractual agreement or a voting interest.⁸⁸

The upgrading facility owned by Align RNG and the hog operations owned by Smithfield or one of its subsidiaries are under common control because Align RNG is equally owned by Dominion and Smithfield.⁸⁹ Smithfield is Align RNG’s parent corporation and controls its operations through a 50% voting interest. Align RNG or its primary project developer, Cavanaugh & Associates, have applied for major modifications of certificates of coverage under the state swine general permit for several of the individual hog operations involved in the Grady Road Project—all owned by Smithfield or one of its subsidiaries—which would allow those individual operations to cover hog waste lagoons and install the equipment necessary to gather biogas to be conveyed to the upgrading facility.⁹⁰ Therefore, Align RNG’s representation that “Align will not own the on-farm anaerobic digester systems or the individual hog farming operations”⁹¹ obscures the fact that the same entity that owns these facilities—Smithfield or one of its subsidiaries—exercises control over the upgrading facility.⁹² This conclusion is underscored by the fact that the applications filed with the N.C. Department of Environmental

⁸⁸ Letter from Richardson Long, *supra* note 59, at 2.

⁸⁹ 45 Fed. Reg. 59,878 (defining control as “the possession, direct or indirect, of the power to direct or cause the direction of the management and policies of a person (or organization or association) whether through the ownership of voting shares, contract, or otherwise.”) (quoting 17 C.F.R. § 210.1-02(g)); *see Mt. Adams Veneer Co. v. United States*, 896 F.2d 339 (9th Cir. 1990) (upholding the Forest Service’s determination that equally split interests in a venture did create affiliates).

⁹⁰ *See, e.g.*, Letter from Jeff Cappadonna, Cavanaugh & Associates, to Christine Lawson, N.C. Dep’t of Env’tl Quality – Div. of Water Res. (Dec. 23, 2019) (submitting an application for a modification of certificate of coverage number AWS310035 under the North Carolina swine general permit for M&M Waters Farm for the installation of an anaerobic digester) (on file with DWR and SELC).

⁹¹ Align RNG Air Permit Application, *supra* note 9, at 19.

⁹² *Mt. Adams Veneer Co. v. U.S.*, 896 F.2d at 342 (holding that “negative control”, or veto power, of each joint venturer was a sufficient basis to say that each “controlled” the venture.”).

Quality - Division of Water Resources (“DWR”) *on behalf of the Smithfield-owned hog operations were made by Kraig Westerbeek, a Vice President at Align RNG.*⁹³

Moreover, even hog operations not owned by Smithfield or its subsidiaries are under common control because Smithfield exercises control over these facilities through contractual agreements that allow Smithfield “direct the management and policies” of the “independent” hog operations.⁹⁴ For example, contract farmers are required to feed hogs—which belong to Smithfield—very specific diets.⁹⁵ Since diet significantly impacts the quality of biogas obtained from pig manure,⁹⁶ Smithfield’s policies control not only the production of pigs, but also the production of biogas.

Finally, according to EPA guidance, common control is often characterized by “mutually beneficial contractual arrangements” including output contracts, where one entity was obligated to purchase all, or a portion, of another entity’s output, and requirements contract, where one entity was obligated to produce all, or a portion, of a product another entity requires.⁹⁷ As

⁹³ See DEQ Environmental Application Tracker, <https://deq.nc.gov/permits-regulations/permit-guidance/environmental-application-tracker> (listing Kraig Westerbeek as the individual signing the applications for major modifications for Kilpatrick Farm, Merritt Farm, Waters Farm, and M&M Rivenbark) (last visited June 14, 2020); Benson Farm application, *supra* note 18 (showing Kraig Westerbeek as the owner of Benson Farm, one of the industrial hog operations supplying biogas to the upgrading facility); Application Review, *supra* note 18, at 1.

⁹⁴ Lisa Sorg, *A federal appeals court judge’s remarkable speech is the latest surprise in NC’s hog nuisance law*, NC POLICY WATCH (Feb. 3, 2020) <http://www.ncpolicywatch.com/2020/02/03/a-federal-appeals-court-judges-remarkable-speech-is-the-latest-surprise-in-ncs-hog-nuisance-lawsuits/>. (“Through its contracts with farmers, Murphy-Brown dictates every aspect of the operations, down to the amount and type of feed the pigs receive.”) (Attachment 12); See *Public Health and Natural Resources: A Review of the Implementation of Our Environmental Laws – Parts I and II: Hearing before S. Comm. on Governmental Affairs*, 107th Cong. 235 (2002).

⁹⁵ See *McKiver v. Murphy-Brown, LLC*, No. 19-1019 (4th Cir. 2020), JA-8128–29 (quoting a 2013 Smithfield shareholder report as saying, “We develop breeding stock, optimize diets for our hogs at each stage of the growth process, process feed for our hogs, and design hog containment facilities.”); *2014 Sustainability & Financial Report*, SMITHFIELD, <https://www.smithfieldfoods.com/integrated-report/2014/animal-care/value-creation-3/independent-contract-growers#independent-contract-growers> (last visited Jun. 12, 2020).

⁹⁶ See, e.g., Guillaume Jarret et. al, *Impact of Pig Diets With Different Fibre Contents on the Composition of Excreta and Their Gaseous Emissions and Anaerobic Digestion*, 160 AGRIC., ECOSYSTEMS & ENVT. 51, 57 (2012) (noting that “fibre-rich diets will result in increased CH₄ [methane] emissions [that] . . . in the case of anaerobic treatment of manure . . . will contribute to optimise energy production as heat and/or electricity, having a positive environmental impact.”).

⁹⁷ Letter from William L. Wehrum, *supra* note 57, at 1.

discussed above, Align RNG itself repeatedly has characterized the relationship between the Grady Road Facility and hog facility operators as “mutually beneficial.”⁹⁸

4. Align RNG’s proposed 30 miles of pipeline may render the individual hog operations and upgrading facility contiguous or adjacent

Align RNG insists that the Grady Road Facility and individual hog operations should not be considered part of the same stationary source because these components of the Grady Road Project are not on contiguous or adjacent properties.⁹⁹ This assertion runs contrary to the description of the project Align RNG filed with the NCUC: “the project’s “unique ‘hub and spoke’ approach will interconnect each participating farm to RNG’s centralized gas upgrading facility.”¹⁰⁰ In other contexts, this kind of “hub and spoke arrangement” is permitted as a single stationary source. For example, in *MacClarence v. E.P.A.*, the Ninth Circuit Court of Appeals upheld the Alaska Department of Environmental Conservation’s use of a “‘hub-and-spoke’ aggregation model” in permitting a crude oil production facility as one stationary source with the drill sites that supplied that facility. 596 F.3d 1123, 1128 (9th Cir. 2010).¹⁰¹

At this point in time, DAQ lacks sufficient evidence to determine that the upgrading facility and the hog operations supplying it with biogas are not adjacent or contiguous. For example, the permit review does not include any determinations regarding the dimensions of the “surface sites” for the upgrading facility or the individual hog operations—without this information it is impossible to determine whether the surface sites are located close enough to

⁹⁸ See *supra* p. 23; Align RNG Application to NCUC, *supra* note 4, at 7-8.

⁹⁹ Align Air Permit Application, *supra* note 9, at 19.

¹⁰⁰ Align RNG Application to NCUC, *supra* note 4, at 5.

¹⁰¹ This permit was later litigated because a plaintiff asserted that the *entire* 300 square mile production site—not just the individual production facility and drill sites it sourced from—should have been aggregated as one stationary source. The Ninth Circuit Court of Appeals held that EPA has not acted arbitrarily or capriciously in concluding that the plaintiff has “failed to provide adequate information to support his claim that the *entire* [site] should be aggregated.” *MacClarence v. U.S. E.P.A.*, 596 F.3d at 1132. Critically, neither the plaintiff nor EPA critiqued the Alaska Department of Environmental Conservation’s decision to permit the individual production facility (known as GC 1) and the drill sites as a stationary source.

each other to be considered adjacent or contiguous. 40 C.F.R. § 51.166(b)(6)(ii) (2016) (“Pollutant emitting activities shall be considered adjacent if they are located on the same surface site; or if they are located on surface sites that are located within ¼ mile of one another (measured from the center of the equipment on the surface site) and they share equipment.”). These determinations are particularly critical given that the upgrading facility and the biogas-producing facilities will clearly be sharing equipment—the pipeline— satisfying half of C.F.R. § 51.166(b)(6)(ii)’s definition of “adjacent.” Relatedly, the permit review also fails to consider whether the pipeline Align RNG proposes to construct and operate, which would connect the upgrading facility with the individual hog operations supplying it, would render the facilities adjacent or contiguous.

In sum, the individual hog operations supplying biogas are support facilities to the upgrading facility; are under control of the same corporate entities as the upgrading facility; and are connected to the upgrading facility through a pipeline constructed and owned by Align RNG, rendering them co-located or contiguous. Therefore, the individual hog operations and the upgrading facility are a single stationary source and air emissions from these components of the Grady Road Project must be combined and considered under the pending permit. DAQ must revoke the existing draft permit and properly define the stationary source to include both the individual hog operations and the upgrading facility.

B. The Grady Road Facility’s potential SO₂ emissions likely exceed the Title V major-source threshold

Under Title V of the Clean Air Act, 42 U.S.C. § 7661 *et seq.*, a stationary source is considered a major source if emits or has the potential to emit (“PTE”) 100 tons per year or more of any regulated pollutant. 40 C.F.R. § 70.2; *see* 15A N.C. Admin. Code 2Q .0103(22). A

facility's "potential to emit" ("PTE") is defined as "the maximum capacity of a stationary source to emit any air pollutant under its physical and operational design." 40 C.F.R. § 70.2; *see* 15A N.C. Admin. Code 2Q .0103(28). Accordingly, PTE is meant to represent a "worst case" emissions calculation.¹⁰²

Here, Align RNG calculated its PTE for sulfur dioxide ("SO₂") at 193.24 tons per year, but has accepted specific avoidance conditions to keep its SO₂ emissions below the Title V major-source threshold of 100 tons per year, including the installation of an H₂S scrubber.¹⁰³ Accordingly, DAQ is permitting the Align RNG facility as a synthetic minor source for purposes of Title V applicability. *See* 15A N.C. Admin. Code 2Q .0315. Align RNG's application materials, upon which DAQ relied in issuing the draft permit; however, underestimate the upgrading facility's potential SO₂ emissions in several key ways. This is due to numerous, unsupported assumptions made by Align RNG in its application materials. Unless these assumptions are accompanied by enforceable permit conditions that can in some way limit SO₂ emissions, DAQ must assume a "worse case" scenario and calculate the potential to emit SO₂ when the Grady Road Facility operates at full design capacity. Furthermore, as discussed above, the individual hog operations and the upgrading facility are a single stationary source and DAQ must consider the combined emissions of the entire Grady Road Project when calculating potential SO₂ emissions under the pending permit. When these additional emissions are properly accounted for, the PTE for SO₂ likely exceeds the Title V major-source threshold of 100 tons per year.

¹⁰² EPA, *Draft New Source Review Workshop Manual*, at A19 (Oct. 1990) (discussing "methods for determining potential to emit").

¹⁰³ Application Review, *supra* note 18, at 8; Align RNG Draft Permit No. 10644R00 at Condition A.6 (May 2020) [hereinafter "Draft Permit"].

DAQ must revoke the draft permit until it can accurately assess and model SO₂ emissions. Specifically, DAQ must re-evaluate SO₂ emissions in light of the information discussed below, re-do the SO₂ dispersion modeling to ensure that permitting the Grady Road Project will not lead to an exceedance of the relevant NAAQS, update the SO₂ emissions equations provided for in the draft permit, and make other modifications in line with the below comments.

1. Align RNG underestimated the amount of gas the facility could receive from the industrial hog operations

Align RNG's application does not address the amount of gas to be generated by each industrial hog operation supplying biogas to the upgrading facility. As discussed in more detail above, the upgrading facility and the hog operations are inextricably interlinked—the upgrading facility cannot operate without biogas from the hog operations, and the hog operations would not cap and capture their lagoon gas but for the presence of the upgrading facility—and therefore these operations should be permitted as one stationary source. Accordingly, the amount of biogas produced at the hog operations is directly relevant to the combined sources' potential SO₂ emissions.

The amount of biogas produced by an anaerobic digester is highly variable and depends on numerous factors.¹⁰⁴ Align RNG's application, however, assumes that the flow of biogas to the Grady Road Facility will be 996 standard cubic feet per minute (“scfm”) on average with a maximum flow of 1,200 scfm.¹⁰⁵ This assumption does not address the amount of biogas that will be produced at the individual hog operations nor how generation rates may vary over time due to factors such as external temperature. Although monitoring at the upgrading facility

¹⁰⁴ See Faith Tufaner & Yavuz Demirci, *Prediction of Biogas Production Rate from Anaerobic Hybrid Reactor by Artificial Neural Network and Nonlinear Regressions Models*, CLEAN TECH. & ENVTL. POL'Y 22, 713–24 (Jan. 2020) (biogas production can vary based on: digester fill ratio, pH, feedstock, and other factors).

¹⁰⁵ Align RNG Air Permit Application, *supra* note 9, at 11.

should be able to keep the incoming gas flow within the assumed parameters, neither Align RNG nor DAQ have considered what will happen to the excess biogas that may be produced by the hog operations. In reality, this excess biogas will likely be flared off at the hog operations, resulting in additional SO₂ emissions that are not contemplated or accounted for in the draft permit. Since the entire Grady Road Project should be permitted as one stationary source, DAQ must consider the variation in biogas flow from the hog operations and the resulting emissions from flaring excess biogas when calculating potential SO₂ emissions.

2. Align RNG underestimated the H₂S concentration of the gas entering the facility

In calculating its potential SO₂ emissions, Align RNG assumes that the maximum daily concentration of hydrogen sulfide (“H₂S”) of the incoming biogas will be 3,500 parts per million (“ppm”).¹⁰⁶ Align RNG; however, offers no support for this assumption. Data from other biogas projects indicates that H₂S concentrations can routinely exceed this amount, with some operations experiencing H₂S concentrations in excess of 5,000 ppm.¹⁰⁷ Since H₂S yields SO₂ when combusted the concentration of H₂S in the biogas entering the upgrading facility is directly related to the facility’s potential SO₂ emissions.

The draft permit contains no condition limiting the daily H₂S concentration of the incoming biogas. Even with such a limit, concentrations throughout the day would vary, and a daily average limit would still allow for periodic concentrations in excess of that limit. This, in turn, would mean that SO₂ emissions throughout the day could be higher than what is currently contemplated by Align RNG. Without some enforceable permit condition directly limiting the H₂S concentrations, the facility’s PTE for SO₂ must be based on the maximum possible H₂S

¹⁰⁶ *Id.* at 15

¹⁰⁷ Cheng-Chang Lien et al., *Water Scrubbing for Removal of Hydrogen Sulfide (H₂S) Inbiogas from Hog Farms*, 3 J. AGRIC. CHEMISTRY AND ENV’T, 1, 1–6 (2014); *see also* LORIMOR, J. & J. SAWYER, SWINE USA ANAEROBIC DIGESTER PERFORMANCE ANALYSIS REPORT, NATURAL RESOURCES CONSERVATION SERVICE IOWA STATE UNIVERSITY (2004).

concentration. DAQ must therefore recalculate the potential SO₂ emissions of the upgrading facility based on H₂S concentrations of at least 5,000 ppm, unless Align RNG can provide additional information supporting the assumption that the maximum H₂S concentration of the incoming biogas cannot exceed 3,500 ppm.

3. Align RNG failed to consider the seasonal variability of H₂S concentrations of the gas entering the facility

Align RNG calculated its potential SO₂ emissions without considering seasonal variability of H₂S concentrations and other compounds in the biogas from the individual hog operations. Instead, as discussed above, Align RNG assumes a constant H₂S concentration of 3,500 ppm. As illustrated below, emissions data collected from North Carolina hog operations demonstrate that H₂S and other sulfur compounds are generated in higher concentrations during the summer months.¹⁰⁸

Table 5
Seasonal H₂S, DMS and DMDS lagoon fluxes and emissions, and the environmental parameters during canister sampling.

Season	Flux ($\mu\text{g m}^{-2} \text{min}^{-1}$)/Emission ($\text{g day}^{-1} \text{AU}^{-1}$)			Lagoon temperature ($^{\circ}\text{C}$)	Lagoon pH	Wind speed (m s^{-1})	Air temperature ($^{\circ}\text{C}$)
	H ₂ S ^a	DMS	DMDS				
Summer	3.81^b (3.24) ^c N = 705 ^d 0.11 ^e	0.26 (0.08) n = 10 ^f 0.0073	0.22 (0.04) n = 8 0.0063	27.0 (3.34) n = 10	7.33 (0.16) n = 5	2.23 (0.87) n = 10	26.7 (3.32) n = 10
Fall	1.17 (1.62) N = 646 0.033	0.11 (0.08) n = 10 0.0031	0.04 (0.01) n = 10 0.0011	23.3 (1.67) n = 10	7.63 (0.16) n = 10	3.07 (2.03) n = 10	25.5 (3.01) n = 10
Winter	0.08 (0.09) N = 631 0.0023	0.05 (0.04) n = 11 0.0014	0.02 (0.02) n = 11 0.00071	12.3 (2.50) n = 11	8.08 (0.11) n = 11	2.38 (0.77) n = 11	8.59 (1.23) n = 11
Spring	0.27 (1.71) N = 478 0.0081	0.06 (0.03) n = 10 0.0017	0.11 (0.03) n = 10 0.0033	19.6 (1.77) n = 10	8.03 (0.07) n = 10	4.37 (1.80) n = 10	18.3 (6.24) n = 10

^a H₂S flux data from Rumsey and Aneja (2014).
^b Mean flux value.
^c ± 1 standard deviation.
^d N represents the number of 15 min averaged data points.
^e Emission value.
^f n is the number of canister samples.

During this time, the higher concentrations of H₂S and other sulfur compounds in the gas stream will require increased flaring at upgrading facility and, as a result, increased SO₂

¹⁰⁸ Ian C. Rumsey et al., *Characterizing Reduced Sulfur Compounds Emissions From a Swine Concentrated Animal Feeding Operation*, 94 *ATMOSPHERIC ENV'T* 458, Table 5 (2014).

emissions. Unless Align RNG can provide assurances regarding the concentration of H₂S and other sulfur compounds entering the upgrading facility, and such assurances are made enforceable through permit conditions, then DAQ must calculate the upgrading facility's potential SO₂ emissions based on the worst case scenario—the higher concentrations of H₂S and other organic sulfur compounds present during the summer months.

4. Align RNG ignores several other organic sulfur compounds that directly impact the upgrading facility's SO₂ emissions

Align RNG's potential SO₂ emission calculation is based solely on the combustion of H₂S and fails to account for (or even acknowledge) other organic sulfur compounds that will be present in the biogas sent to the upgrading facility.¹⁰⁹ Sampling from North Carolina hog operations demonstrate that, at the very least, there are two other organic sulfur compounds in the biogas—dimethyl sulfide (“DMS”) and dimethyl disulfide (“DMDS”).¹¹⁰ Moreover, studies of hog operations outside of North Carolina show the presence of additional organic sulfur compounds, some of which actually exceeded the concentration of H₂S. For example, a study of Iowa hog operations showed significantly higher levels of “odor H₂S” than H₂S (5,000 ppm compared to 3,800 ppm).¹¹¹ Additionally, a study of hog operations in Denmark showed two non-H₂S compounds, dimethyl sulfide and methanethiol.¹¹²

These additional compounds will significantly contribute to the production of SO₂ when combusted at the upgrading facility, yet they are not considered at all in Align RNG's application and are therefore not taken into account in the SO₂ emissions modeling or PTE calculations for this facility. Although the specific levels of these organic sulfur compounds may vary from what

¹⁰⁹ See e.g., Lorimor, *supra* note 109; Rumsey, *supra* note 108, at 463 tbl. 5.; Anders Feilberg et. al., *Contribution of Livestock H₂S to Total Sulfur Emissions in a Region With Intensive Animal Production*, 8 NATURE COMM. 1, 2 (2017).

¹¹⁰ Rumsey, *supra* note 108.

¹¹¹ Lorimor, *supra* note 109.

¹¹² Feilberg, *supra* note 109, at 3 tbl. 2.

was demonstrated in other states or countries, based on the available data it is unreasonable to assume that there will be zero concentrations of these compounds in the biogas entering the upgrading facility. Accordingly, Align RNG has significantly underestimated the potential SO₂ emissions for the upgrading facility. DAQ must request additional information from Align RNG in order to determine the maximum concentration of these other organic sulfur compounds, and DAQ must then use this information to recalculate the facility's PTE.

Furthermore, Align RNG's omission of other sulfur compounds from its analysis also impacts the efficacy of its proposed control devices. These devices—especially the iron-sponge scrubbers—should be validated against a complete and accurate set of biogas composition data, in order to ensure that they will function properly in the presence of non-H₂S organic sulfur compounds. Such validation must occur before DAQ issues an updated draft permit for this facility.

5. Align RNG assumes that only 98% of H₂S will be converted to SO₂

Finally, DAQ has accepted Align RNG's assumption that only 98% of H₂S will be converted to SO₂ via flaring. The conversion rate of the facility's flares is directly linked to the temperature of the flare and the amount of oxygen mixing at the flare. If Align RNG intends to limit the conversion of H₂S (and other sulfur compounds) to a maximum of 98%, then they must provide support for this conversion rate as well as the operating parameters of the flare that will ensure such a conversion rate. These parameters can then be enforced, at least for the hybrid mixed flare, through continuous emissions monitoring. It should be noted, however, that the design of the candlestick flare does not provide any mechanism for monitoring operating parameters, and therefore there is no way to enforce a specific conversion rate as it relates to the candlestick flare.

While a 98% conversion rate (or even lower) is possible with the operation of this facility, a conversion rate of up to 100% is also possible. A facility's PTE is meant to represent the "worst case" emissions scenario. For the upgrading facility a representative worst case flaring scenario is that all of the H₂S and other sulfur compounds when flared is converted to SO₂ emissions. Accordingly, DAQ must recalculate the potential SO₂ emissions based on a 100% conversion rate and re-model SO₂ emissions based on this higher conversion rate.

Given the number of ways Align RNG has underestimated its SO₂ emissions, DAQ cannot be sure the upgrading facility's potential emissions are less than the 100-ton per year Title V threshold, even with the inclusion of the scrubber technology to control such emissions. Moreover, DAQ cannot be sure that the facility will not cause or contribute to an exceedance of the NAAQS for SO₂. DAQ must therefore revoke the draft permit until it can accurately assess and model SO₂ emissions. Specifically, DAQ must re-evaluate SO₂ emissions in light of the information discussed above and reassess whether the scrubber technology is sufficient to limit SO₂ emissions to below the Title V threshold. DAQ must also re-do the SO₂ dispersion modeling to ensure that construction of the upgrading facility (and the entire Grady Road Project) will not result in an exceedance of the NAAQS and must update the SO₂ emissions equations provided for in the draft permit.

C. Align RNG may not circumvent the CAA by seeking piecemeal permitting for a facility it plans to expand

Align RNG has proposed to build this biogas project in an area with one of the densest concentrations of industrial hog operations in the country. There are 633 hog operations within

19 miles¹¹³ of the upgrading facility. Given this reality and Align RNG's public statements about its next biogas project, it is reasonable to expect that Align RNG intends to expand the upgrading facility to receive biogas from additional industrial hog operations. DAQ must investigate this issue and ensure that Align RNG is not attempting to circumvent state and federal permitting requirements.

Where a source that *intends* to operate at major source levels in the future, applies for minor source permits to avoid the CAA's New Source Review ("NSR") requirements, EPA considers such "sham" permitting to be unlawful circumvention of the Act.¹¹⁴ The rationale provided in EPA's guidance relating to sham permitting for purposes of NSR should apply equally to facilities attempting to evade Title V major-source requirements. EPA has identified a non-exhaustive list of criteria to determine whether a facility is engaging in sham permitting, including the following: (1) filing of more than one minor source or minor modification applications within a short time period; (2) applications for funding indicating that further projects are necessary; (3) reports of consumer demand and projected production levels; (4) authorized statements regarding plans for operations; and (5) EPA's analysis of the economic realities of the project / facility.¹¹⁵ Additionally, EPA considers documentation or statements by the applicant to shareholders, investors, permitting agencies, and others regarding the projected operation and production levels of the facility as indicative of potential sham permitting when

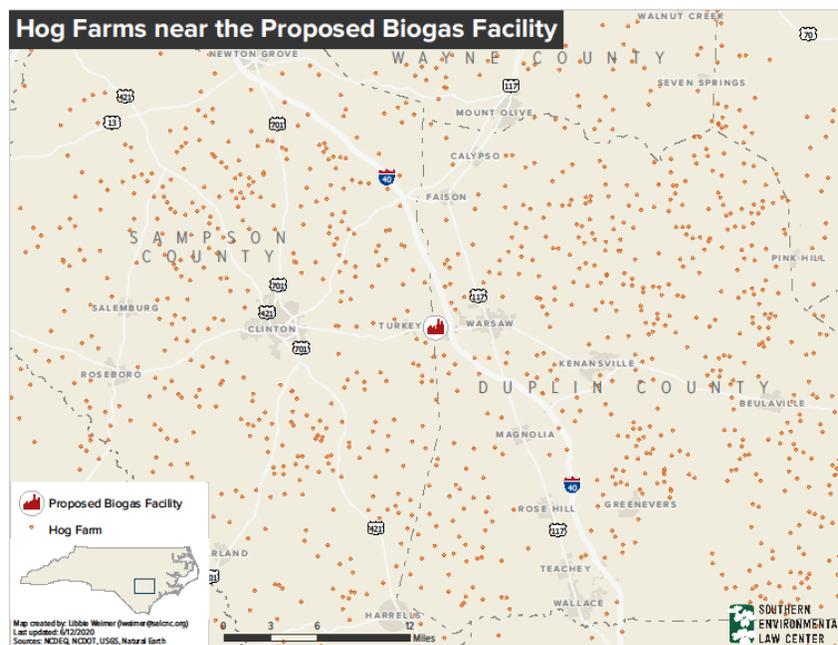
¹¹³ Nineteen miles is the distance as the furthest hog facility already proposed as a biogas supply for the Grady Road facility. Application Review, *supra* note 18, at 2.

¹¹⁴ EPA Memorandum, Guidance on Limiting Potential to Emit in New Source Permitting at 10 (June 13, 1989).

¹¹⁵ EPA Memorandum, Applicability of: New Source Review Circumvention Guidance to 3M – Maplewood, Minnesota at 3-4 (June 17, 1993).

the company’s plans for production and operation extend beyond what is contemplated by the permit application.¹¹⁶

Align RNG has made several public statements indicating its intent to expand its biogas operations far beyond the “roughly 19”¹¹⁷ hog operations covered in the draft permit for the upgrading facility.¹¹⁸ It is not entirely clear based on these statements whether Align RNG intends to propose the construction of additional biogas upgrading facilities, or whether the additional individual hog operations installing anaerobic digesters would be connected to the Grady Road upgrading facility as well. If Align RNG intends the latter outcome, its plans for production and operation would be higher than what is contemplated in this draft permit. This would be indicative of potential sham permitting if the expansion is done in a way to avoid additional CAA requirements that the expanded facility would otherwise be subject to.



¹¹⁶ *Id.* at 3-4. This includes “[s]tockholder reports, reports to the Securities and Exchange Commission, utility board reports, or business permit applications” as well as “[s]tatements by representatives of the source to EPA or to state or local permitting agencies about the source’s plans for operation.” *Id.*

¹¹⁷ Application Review, *supra* note 18, at 1.

¹¹⁸ Downey, *supra* note 6. (“After Grady Road, Align’s next project in North Carolina will comprise more than 30 farms in Duplin County.”).

If Align RNG plans to expand the upgrading facility's sourcing of biogas to draw from the additional industrial hog operations nearby, then a minor source air permit may not be appropriate. Relying on the CAA's Source Obligation Rule and EPA's guidance on sham permitting, as discussed above, a court in Minnesota recently held:

All of the parties agree, and the federal regulations provide, that, if, subsequent to permit issuance, [the company] decides to expand [the facility] such that it becomes a major source, [the company] will be required to comply with PSD requirements—including BACT requirements—at that time. *But if the expansion is the current intent, the time to comply with PSD requirements is now.* Of course, once a project is operating, expansion proposals may be viewed more favorably by regulators. If that is the true course being charted by [the company], there is merit to [plaintiff's] argument that the synthetic-minor permit is a sham.¹¹⁹

Accordingly, DAQ must scrutinize Align RNG's intent and ensure that the company is not attempting to circumvent CAA permitting requirements through any of the methods discussed above.

D. DAQ should include enforceable permit conditions to limit emissions

In order to avoid Title V applicability, the draft permit limits the upgrading facility's SO₂ emissions to less than 100 tons per year and requires operation of a scrubber to reduce emissions. As discussed above, even with the operation of this scrubber the facility's potential SO₂ emissions likely exceed this emission limitation because Align RNG calculated its PTE based on unsupported assumptions relating to the facility's operating parameters. If Align RNG and DAQ actually intend for the upgrading facility to be bound within the presumed operating parameters, then conditions sufficient to ensure compliance with the SO₂ limit must be included as explicit and enforceable conditions of the permit. Furthermore, in order for the emissions limits

¹¹⁹ *In re* Issuance of Air Emissions Permit No. 13700345-101 for Polymet Mining, Inc., A19-0115 & 119-0134, at 20 (Minn. Ct. App., March 23, 2020) (emphasis added) (internal citations and parentheticals omitted).

contemplated in the draft permit to be federally enforceable, and thereby avoid Title V requirements, DAQ must require far more robust monitoring provisions.

Under North Carolina law, when a permit includes operational restrictions in order to avoid Title V requirements it must be “federally enforceable.” *See* 15A N.C. Admin. Code 2Q .0503(4) (“Emissions allowable under the permit’ means an emissions limit (including a work practice standard) established by a federally enforceable permit term or condition, or a federally enforceable emissions cap that the facility has assumed to avoid an applicable requirement to which the facility would otherwise be subject.”); 15A N.C. Admin. Code 2Q. 0.0314(b) (“Emissions limitations, controls, and requirements contained in permits issued pursuant to this Section shall be permanent, quantifiable, and otherwise enforceable as a practical matter . . .”). For a permit term to be “federally enforceable” it must be “enforceable as a practical matter,”¹²⁰ meaning that the permit must contain monitoring, recordkeeping, and reporting requirements “sufficient to enable regulators and citizens to determine whether the limit has been exceeded and, if so to take appropriate enforcement action.”¹²¹

As stated in the draft permit, the Grady Road facility is subject to operational restrictions in order “to avoid the applicability of 15A NCAC 02Q .0501,” as “requested by the permittee.” In other words, Align RNG has taken on an emissions cap “to avoid an applicable requirement to which [it] would ¹²²otherwise be subject.” 15A N.C. Admin. Code 2Q.0503(4). But the draft permit’s operational limitations and monitoring conditions are too vague to be federally enforceable and therefore cannot shield Align RNG from Title V requirements.

¹²⁰ *In re* Orange Recycling and Ethanol Production Facility, Pencor-Masada Oxynol, LLC, Order on Petition No. II-2001-05 (April 8, 2002) at 4-7; see also *In re* Shell Offshore, Inc., Kulluk Drilling Unit and Frontier Discoverer Drilling Unit, 13 E.A.D. 357, 394 n.54 (Sept. 14, 2007) (practical enforceability is a component of federal enforceability).

¹²¹ *In re* Yuhuang Chemical Inc. Methanol Plant, Order on Petition No. VI-2015-03 (Aug. 31, 2016) at 14 (quoting *In re* Orange Recycling and Ethanol Production Facility, Pencor-Masada Oxynol, LLC, Order on Petition No. II-2001-05, 7 (April 8, 2002)).

¹²² *See* Draft Permit, *supra* note 103, at 5.

1. CD-4 candlestick flare

In its application to DAQ, Align RNG explains that multiple facility flares will be utilized as control devices by the upgrading facility.¹²³ For example, the enclosed hybrid flare (CD-3) will oxidize tail gas.¹²⁴ The application further explains that during times when the “product gas produced by the [facility] does not meet pipeline specifications and therefore cannot be injected into the natural gas pipeline . . . the product gas will be combusted . . . in the candlestick flare (CD4).”¹²⁵

The draft permit states that,

As required by 15A NCAC 02D .0516 “Sulfur Dioxide Emissions from Combustion Sources,” sulfur dioxide emissions from one Gas Upgrading System (ID No. ES-1 GUS) and the facility flares (CD-3 and CD-4) shall not exceed 2.3 pounds per million Btu heat input.”¹²⁶

However, the subsequent draft permit conditions exclusively focus on CD-3, the enclosed hybrid flare.¹²⁷ There is no discussion throughout the permitting record of how this requirement will be met for CD-4, the candlestick flare. As a result, it would be difficult or impossible for regulators to determine if the CD-4 flare has exceeded the emissions limits based on recorded data. In order to make this provision federally enforceable, DAQ must revise the permit to require recordkeeping and monitoring obligations that ensure the CD-4 flare will meet this limit. If the design of the open-flame design of the candlestick flare prevents the necessary recordkeeping and monitoring, as noted above, then DAQ must consider whether alternative designs more in line with the enclosed hybrid flare would be more appropriate to ensure continuing compliance.

¹²³ Align RNG Air Permit Application, *supra* note 9, at 6.

¹²⁴ *Id.*

¹²⁵ *Id.*

¹²⁶ Draft Permit, *supra* note 103, at 2 (emphasis added).

¹²⁷ *Id.* at 8-9.

2. Monitoring

The permit also provides that monitoring of the H₂S concentration and flow from the outlet of the Gas Upgrading System (“GUS”), the iron sponge scrubbers, and the tail gas bypassing the iron sponges shall take place “...once every 8 hours (three times per day / minimum of once per operating day)...” for the specified flow and concentrations.¹²⁸ However, there is no support in the record, including DAQ’s permit review, for this frequency of monitoring. DAQ has not established that this minimal frequency of monitoring is commensurate with the variability of the flows and concentrations expected from these outlets. Instead, DAQ must make a determination regarding the expected variability in flows and concentrations from the outlets and determine the appropriate frequency of monitoring based on the degree of variability. If the associated flows and concentrations noted in this condition are highly variable, then continuous monitoring of the concentrations and flows should be required.

3. Key terms

Similarly, several key terms on which the draft permit relies are devoid of concrete definitions and are therefore vague and unhelpful to regulators or the public in determining if the facility is complying with permit conditions. For example, in Condition 4, “malfunction” and “abnormal condition” are not defined.¹²⁹ Throughout Condition 6(b) the draft permit makes numerous references to manufacturer’s recommendations, however these recommendations are completely unspecified.¹³⁰ This lack of specificity or explanation makes it impossible for the public and regulators to determine if Align RNG is properly complying with these requirements.

¹²⁸ *Id.* at 3.

¹²⁹ *Id.* at 4.

¹³⁰ *Id.* at 5–6.

4. Inaccurate equations

Furthermore, as previously noted, Align RNG's emissions calculations for SO₂ are based solely on H₂S and do not include other organic sulfur compounds that may be present in the raw biogas sent to the processing facility such as DMS and DMDS. Furthermore, the conversion of H₂S and other sulfur compounds to SO₂ (noted as "oxidation efficiency") should assume 100%, not 98% conversion.

If left uncorrected, these oversights would result in Align RNG's records not accurately reflecting its actual emissions and would render the records useless to regulators and citizens attempting to assess the facility's compliance with SO₂ limits required by the permit.

In order for the permit's conditions to be federally enforceable, as required by federal and state law, DAQ must address the deficiencies described above.

IV. Align RNG's Grady Road Project disproportionately burdens communities of color in Duplin and Sampson Counties

As discussed above, the lagoon and sprayfield system has substantial and harmful impacts on the environment and public health and disproportionately impacts communities of color in eastern North Carolina. Emissions from the proposed upgrading facility would only add to this burden. DAQ must fulfill its obligation to consider the direct and cumulative impacts of the proposed facility upon environmental justice communities in this permitting decision or risk violating Title VI of the Civil Rights Act of 1964.

Title VI of the Civil Rights Act provides that:

No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, denied the benefits of, or be subjected to

discrimination under any program or activity receiving Federal financial assistance.

42 U.S.C. § 2000d (2018). EPA regulations prohibit a recipient of federal funds from using criteria or methods of administering a program or activity which have the effect of subjecting individuals to discrimination. 40 C.F.R. § 7.35(b). “Title VI imposes on states an affirmative obligation to include consideration of Title VI criteria in permitting decisions.”¹³¹ Therefore, DAQ—as a recipient of federal funds—is required to administer its permitting regime in a manner that does not have the effect of subjecting individuals to discrimination or risk losing those funds.

A. EPA has expressed “deep concern” regarding North Carolina’s permitting of industrial hog operations

The N.C. Department of Environmental Quality (“DEQ”) has already been subject to one Title VI investigation by the EPA related to the siting of industrial hog operations.¹³² In 2014, the North Carolina Environmental Justice Network, Rural Empowerment Association for Community Help, and Waterkeeper Alliance filed a Title VI complaint with EPA alleging that the state swine general permit, which covers more than 2,000 industrial hog operations in the State, lacked sufficient measures to control, dispose of, and monitor animal waste from industrial swine feeding operations and subjected Black Americans, Latinx, and Native Americans to discriminatory impacts, including health issues and noxious odors.¹³³ Pursuant to its investigation, EPA sent DEQ a letter expressing “deep concern about the possibility that African

¹³¹ *S. Camden Citizens in Action v. New Jersey Dept. of Env'tl. Protection*, 145 F. Supp. 2d 446, 476 (D. N.J. 2001).

¹³² North Carolina Environmental Justice Network et al., Complaint Under Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, 40 C.F.R. Part 7 (Sept. 3, 2014), <https://earthjustice.org/sites/default/files/files/North-Carolina-EJ-Network-et-al-Complaint-under-Title-VI.pdf>.

¹³³ *Id.* at 15–18.

Americans, Latinos, and Native Americans have been subjected to discrimination as the result of NC DEQ's" swine facility permitting and oversight regime.¹³⁴

Residents interviewed by EPA described myriad issues associated with air emissions from industrial hog operations, including odors so strong that they caused gagging, nausea, and vomiting; increased incidence and severity of asthma and other respiratory diseases, headaches, and other health conditions; and emotional and psychological harm.¹³⁵ Discriminatory siting of industrial hog operations in proximity to communities of color has imposed significant burdens upon these communities that remain unresolved to this day.

B. Align RNG's proposed siting of the upgrading facility likely disproportionately burdens communities of color and may violate Title VI

DAQ's approval of the upgrading facility would continue this shameful legacy. If finalized as drafted, the air permit for the upgrading facility is likely to have an adverse and disproportionate impact on communities of color, in violation of Title VI. As such, the draft permit should be rejected and any future air permit for the upgrading facility should be modified to protect public health and the environment.

As proposed, the upgrading facility would emit large quantities of SO₂. Acute exposure to this compound can harm the human respiratory system and impair breathing.¹³⁶ People with asthma, particularly children, are especially sensitive to these effects of SO₂.¹³⁷ Furthermore, SO₂ emissions that lead to high concentrations of the compound in the air generally also lead to the formation of other sulfur oxides ("Sox"), which can react with other compounds in the

¹³⁴ Letter from Lilian Dorca, Director, *supra* note 32.

¹³⁵ *Id.* at 14.

¹³⁶ *Particle Pollution*, AM. LUNG. ASSOC. (updated Apr. 20, 2020), <https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/particle-pollution>.

¹³⁷ "Sulfur Dioxide Basics," EPA, <https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects>.

atmosphere to form small particles which contribute to particulate matter pollution.¹³⁸ Data shows that people who live for years in counties with high levels of fine particulate matter pollution are more likely to experience respiratory health problems,¹³⁹ and more likely to die from COVID-19,¹⁴⁰ than people who live in regions with even slightly less of such pollution.

Even Align RNG's Environmental Justice Report acknowledges that the proposed siting of the upgrading facility would disproportionately impact communities of color.¹⁴¹ Align RNG identifies the project area—defined by a one mile radius around the facility—as 50% Black or African American and 19% Hispanic or Latinx.¹⁴² In comparison, the rest of the census tracts in which the project would be located are 47.76% Black or African American and 17.43% Hispanic or Latinx in the Duplin County census tract and 25.85% Black or African American and 24.59% Hispanic or Latinx in the Sampson County census tract.¹⁴³ In other words, according to Align RNG's own analysis, the vast majority of the people living in the project area—at least 69%—are people of color. For comparison, people identifying as Black or African American and Hispanic or Latinx make up 29.57% of the population of the State.¹⁴⁴

¹³⁸ *Id.*

¹³⁹ *Particle Pollution*, *supra* note 136.

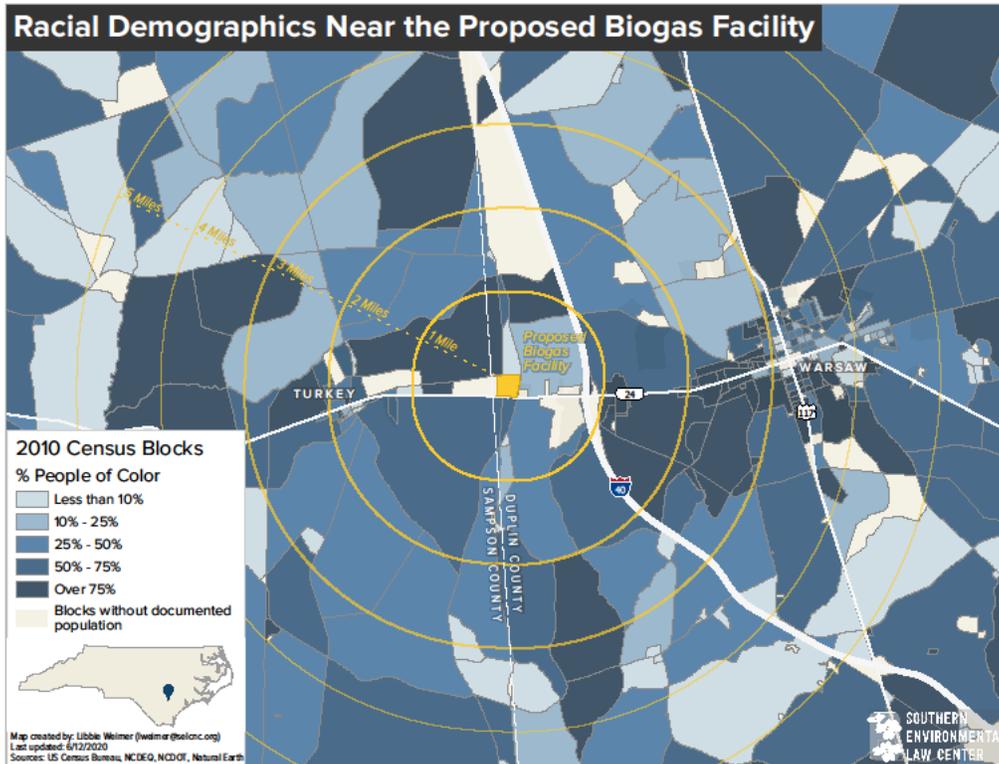
¹⁴⁰ *Air Pollution Linked With Higher COVID-19 Death Rates*, HARV. T.H. CHAN SCH. OF PUB. HEALTH (updated May 5, 2020), <https://www.hsph.harvard.edu/news/hsph-in-the-news/air-pollution-linked-with-higher-covid-19-death-rates/>. (Attachment 13). This concern is underscored by the fact that Duplin and Sampson Counties have COVID-19 infection rates that are far higher than the North Carolina average. Duplin County's rate is 206.5 per 10,000 people and Sampson County's rate is 122.6 per 10,000. For frame of reference, Mecklenberg County, which has been considered the epicenter of the disease in North Carolina, has an infection rate of only 65.9 per 10,000 people. Adam Wagner and David Raynor, *The White House is worried about COVID-19 in these North Carolina counties*, THE NEWS & OBSERVER (June 10, 2020), <https://www.newsobserver.com/news/coronavirus/article243421351.html>.

¹⁴¹ Draft Environmental Justice Report, Align RNG Proposed Project (May 16, 2020) at 7.

¹⁴² *Id.*

¹⁴³ *Id.* at 6.

¹⁴⁴ *Id.*



Title VI demands more than a passing acknowledgment of disproportionate impact followed by inaction. Instead, it imposes on states “an affirmative obligation to include consideration of Title VI criteria in permitting decisions.”¹⁴⁵ This includes assessing, and reducing or eliminating adverse cumulative impacts to communities of color “wherever possible.”¹⁴⁶ Title VI requires DAQ to seriously consider *and actually address* the fact that the upgrading facility, as proposed, would impose significant environmental and public health impact upon communities of color.

DAQ has altogether failed to meet its obligations under Title VI. For example, Align RNG representatives conceded that the company could further limit SO₂ emissions from the upgrading facility, but chose not to include further reductions in the facility design because “the

¹⁴⁵ *S. Camden Citizens in Action*, 145 F. Supp. 2d at 476.

¹⁴⁶ *See* 65 Fed. Reg. 39,650, 39,656 (June 27, 2000).

operating cost [of doing so] . . . is very high.”¹⁴⁷ DAQ failed to require these additional reductions as part of the draft permit, and in doing so failed to reduce adverse impacts to communities of color. If DAQ proceeds with granting this permit, as proposed, under these circumstances, grounds will exist to substantiate an Administrative Complaint against the DEQ for discriminating in the use of federal funding

Moreover, pursuant to a settlement agreement in connection with the 2014 Title VI complaint, DEQ has created a Public Participation Plan which strives for the “fair treatment” and “meaningful involvement” of underserved and minority communities.¹⁴⁸ “Fair treatment” means that “no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies.”¹⁴⁹ DAQ’s issuance of an air permit for the upgrading facility would directly conflict with the Public Participation Plan and force communities that are already bearing “a disproportionate share of the negative environmental consequence” from the hog facility to unfairly shoulder the additional burdens caused by the upgrading facility itself and exacerbation of pollution concerns resulting from capping of hog waste lagoons to produce biogas.

Moreover, DAQ’s procedures for notifying the public about and soliciting public comment on the draft permit failed to meet the clear guidance of the Public Participation Plan, depriving the communities most impacted by this project an adequate opportunity to participate in the Department’s decision-making process.¹⁵⁰ DAQ announced a 30-day public comment period on the draft permit in a local newspaper only, which the Public Participation Plan itself

¹⁴⁷ Email from Ben Cauthen, Cavanaugh & Associates, to Dean Carroll, DAQ (Dec. 12, 2019) (Attachment 14).

¹⁴⁸ See Public Participation Plan, *supra* note 2.

¹⁴⁹ *Id.*

¹⁵⁰ *Id.*; Title VI also requires that federal grant recipient “use[] communications methods likely to reach the affected community (*e.g.*, insert information with utility bills; place public service announcements on local radio shows; and place notices on bulletin boards in grocery stores, houses of worship, community newspapers *and* community centers).” 65 Fed. Reg. 39,658. (emphasis added).

acknowledges are “declining in popularity, rendering them *less effective as a single point of noticing information.*”¹⁵¹ Two weeks later—and with only 16 days left in the comment period—DAQ distributed an email reminding the recipients of the public comment period.¹⁵² DAQ did not use any of the public engagement and outreach steps provided for in the Public Participation Plan to timely notice the public comment period.¹⁵³ The May 29, 2020 email was the first notification received by SELC and many of the undersigned, some of whom requested the issuance of a draft permit and public comment period in the first instance.¹⁵⁴ Sixteen days is hardly sufficient to allow for review and comment on a highly technical permit application and draft permit for a novel project.

V. **Absent a more holistic approach, the Grady Road Project will undermine the Smithfield Agreement**

The permit application before DAQ—and the project that Align RNG presented to the North Carolina Utilities Commission—contemplate a multi-million dollar investment in the North Carolina hog industry. Align RNG’s proposal to expend these resources on biogas development directly conflicts with its parent company, Smithfield’s, insistence over the last two decades that alternatives to the lagoon and sprayfield system are financially infeasible. Yet now, Smithfield—through Align RNG—is investing significant resources into biogas production that could otherwise be used to clean up decades-old pollution and proposing alterations to hog operations’ waste management practices that will financially benefit both corporations.

Smithfield cannot have it both ways. *If Smithfield is going to produce biogas, it must do so*

¹⁵¹ See Public Participation Plan, *supra* note 2 (emphasis added).

¹⁵² Email from Zaynab Nasif, DAQ, to Blakely Hildebrand, SELC (May 29, 2020) (on file with SELC).

¹⁵³ See Public Participation Plan, *supra* note 2.

¹⁵⁴ *Id.*

through the inclusion of Environmentally Superior Technologies as contemplated by the Smithfield Agreement.

A. Smithfield agreed to install cleaner technology at its hog operations in North Carolina, but has failed to do so

In 1997, following a decade of rapid growth in the hog industry that caused a series of environmental disasters,¹⁵⁵ the North Carolina General Assembly instituted a moratorium on new and expanded industrial hog operations. Clean Water Responsibility Act, N.C.S.L. 1997-458, § 1.1. Shortly afterwards, in 2000, Smithfield entered into an agreement with the North Carolina Attorney General (“the Smithfield Agreement”) that required Smithfield-owned hog operations to adopt Environmentally Superior Technologies (“ESTs”).¹⁵⁶ ESTs, as defined by the Agreement and later codified by the General Assembly,¹⁵⁷ substantially reduce nutrient pollution, groundwater contamination, pathogens, and odors among other harms as compared to the primitive lagoon and sprayfield animal waste management system. Furthermore, the legislative moratorium—originally enacted in 1997 and made permanent in 2007—prohibits the construction of new or expanded hog operations unless those facilities adopt ESTs. N.C. Gen.

¹⁵⁵ See e.g., Joby Warrick, *Hog Waste Spill Fouls Land, River in Onslow*, NEWS & OBSERVER (Raleigh, N.C.), June 23, 1995, at A1 (reproduced at <https://www.ncpedia.org/anchor/impact-hog-farms>). (Attachment 15); NAT. RES. DEF. COUNCIL, CESSPOOLS OF SHAME: HOW FACTORY FARM LAGOONS AND SPRAYFIELDS THREATEN ENVIRONMENTAL AND PUBLIC HEALTH 23 (2001), <http://www.nrdc.org/water/pollution/ffarms.asp>. (Attachment 16).

¹⁵⁶ Agreement between the Attorney General of North Carolina, Smithfield Foods, Inc., Brown’s of Carolina, Inc., Carroll’s Foods, Inc., Murphy Farms, Inc., Carroll’s Foods of Virginia, Inc., and Quarter M Farms, Inc. July 25, 2000. (Attachment 17). [hereinafter *Smithfield Agreement*].

¹⁵⁷ The metrics outlined in the Agreement for ESTs were later codified as environmental performance standards by the N.C. General Assembly. See N.C. Gen. Stat. § 143-215.10I.

Stat. § 143-215.10C.¹⁵⁸ By 2006, eleven ESTs were identified, but none were found to be economically feasible.¹⁵⁹

B. Cost-effective alternatives to the lagoon and sprayfield system are available and have been implemented by Smithfield

Much has changed in the last two decades. Researchers and industry itself have developed and implemented cost-effective waste management technology that avoids the pollution problems associated with the lagoon and sprayfield system.

For example, in 2010, pursuant to a consent decree entered into Premium Standard Farms (“PSF”) and the State of Missouri, all PSF-owned hog operations in Missouri were required to adopt barn-scrapers technology that significantly reduced the environmental impacts associated with hog waste disposal.¹⁶⁰ Smithfield acquired PSF and its obligations under the consent decrees in 2007.¹⁶¹ By 2012, PSF had installed cost-effective barn scraper systems in all 366 of its Class 1A operations.¹⁶²

Barn scrapers are an alternative to barn “flushing.” Both methods address the first phase of waste management by removing hog waste from the compartment beneath barns’ slatted floors. But instead of flooding the sloping underfloor with recycled lagoon water to wash the

¹⁵⁸ On June 12, 2020, Governor Roy Cooper signed S315, the Farm Act, into law, which amends the moratorium on new and expanded hog operations for operations producing biogas. This legislation does not change Smithfield’s contractual obligations under the Smithfield Agreement.

¹⁵⁹ Williams, C. M., Ph.D., Development of Environmentally Superior Technologies: Phase 3 Report for Technology Determinations Report Summary, Animal and Poultry Waste Management Center, NC State University, (Mar. 8 2006) https://www.cals.ncsu.edu/waste_mgt/smithfield_projects/phase3report06/phase3report.htm.

¹⁶⁰ PSF, *State, Reach Agreement*, NEWS-PRESS NOW (Sept. 2, 2010), https://www.newspressnow.com/news/psf-state-reach-agreement/article_0f128ff1-a79f-5ab8-8535-636fc22244e0.html. (Attachment 18).

¹⁶¹ *Smithfield will honor Missouri-Premium Standard settlement*, Kansas City Business Journal (June 13, 2007), <https://www.bizjournals.com/kansascity/stories/2007/06/11/daily21.html>. (Attachment 19).

¹⁶² PSF ahead of schedule on odor-reduction plans (Aug. 11, 2011) <https://www.meatpoultry.com/articles/5687-psf-ahead-of-schedule-on-odor-reduction-plans>. (Attachment 20).

waste toward lagoons, scrapers push the waste toward storage units at the ends of barns using blades operated by motors and cables.¹⁶³

While the barn scraper technology implemented in Missouri has not been evaluated for compliance with the environmental performance standards, studies suggest that the technology does address some of the standards. Studies have found that barns cleaned by scrapers experience odor reduction between 59 and 87 percent relative to traditional flush barns.¹⁶⁴ Furthermore, barn scrapers eliminate the spikes in odor that occur during the flushing process.¹⁶⁵ Barn scraper systems can be incorporated into existing deep-pit and shallow-pit barns¹⁶⁶—North Carolina hog barns are shallow-pit barns.¹⁶⁷ In fact, some hog operations in North Carolina are already using barn scrapers.¹⁶⁸ For example, at Storms Farms in Bladenboro, NC, barn scrapers have allowed the 28,000-hog operation to reduce its lagoon usage from six lagoons to just one, because of the substantially reduced liquid content and lower volume of the waste product rendered by barn scrapers.¹⁶⁹

This scraper technology is cheaper to install and operate than, and more effective than other alternatives to traditional barn-flushing systems.¹⁷⁰ Missouri's requirement that PSF use this technology has not negatively impacted the hog industry's economic viability—indeed, between 2011 and 2017, Missouri's hog industry added more production than any state except

¹⁶³ See BRIAN STROBEL ET AL, DAILY CLEANING OPTIONS FOR SLOPED MANURE PITS IN SWINE FINISHING 3 (2009). Strobel, the lead author, was employed by PSF/Murphy-Brown at the time.

¹⁶⁴ TENG TEEH LIM & DAVID B. PARKER, AN AUTOMATED SCRAPER SYSTEM FOR SWINE CONFINEMENT FACILITIES 2 (October 2011).

¹⁶⁵ *Id.*

¹⁶⁶ *Id.* at 1.

¹⁶⁷ Wing et al., *supra* note 33, at 225.

¹⁶⁸ *McIver v. Murphy-Brown, LLC*, Case No. 19-1019 (4th Cir. 2019), JA-8544–45. Expert testified that Storms Farms (presumably of Bladenboro, North Carolina) uses scrapers in its barns.

¹⁶⁹ Scott Bigelow, *Farm finds power in hogs*, BLADEN JOURNAL/CIVITAS MEDIA (April 28, 2017), <https://www.bladenjournal.com/news/11803/farm-finds-power-in-hogs>. (Attachment 21).

¹⁷⁰ See STROBEL ET AL, *supra* note 163, at 3.

Iowa and Minnesota.¹⁷¹ In 2018, Michael Rainwater, a Smithfield-Missouri executive, was quoted as saying, “we’ve been on a growth path for the last five years.”¹⁷²

Furthermore, the widespread adoption of the scraper system by Smithfield facilities in Missouri helped industry-sponsored biogas projects flourish.¹⁷³ In addition to offering a practical alternative to flushing for odor control, a scraper system aids in collecting manure for biogas production by anaerobic digestion.¹⁷⁴ Indeed, Smithfield’s 2012 Annual Report described the scraper technology as producing manure “highly suitable for conversion to energy due to its reduced water content, making our farms attractive partners for energy developers.”¹⁷⁵ Experts agree that barn scrapers and the efficient separation of solids and liquids they make possible are “key to finding alternative uses for the materials, both solids and liquids, to recover nutrients and energy.”¹⁷⁶ Align RNG—and DAQ—must at least consider the availability of new technology that may meet the environmental performance standards outlined in the Smithfield Agreement and facilitate the production of biogas while significantly reducing reliance on the harmful and out-of-date lagoon and sprayfield system.

Despite the availability and the advantages associated with adopting this barn scraper technology and other cleaner technology, the Grady Road Project relies on the primitive lagoon

¹⁷¹ Christopher Walljasper, *Large animal feeding operations on the rise*, MIDWEST CENTER FOR INVESTIGATIVE REPORTING (June 7, 2018), <https://investigatamidwest.org/2018/06/07/large-animal-feeding-operations-on-the-rise/> (Attachment 22); see also SMITHFIELD FOODS, INC. 2012 INTEGRATED REPORT 25 (2012), <https://www.smithfieldfoods.com/pdf/past-reports/smithfield-integrated-report-2012.pdf>. [hereinafter “2012 SMITHFIELD ANNUAL REPORT”].

¹⁷² Betsy Freese, *How Smithfield Saved the Worst Hog Farm in America*, SUCCESSFUL FARMING (Jan. 4, 2018) <https://www.agriculture.com/livestock/pork-powerhouses/how-smithfield-saved-the-worst-hog-farm-in-america>, (Attachment 23).

¹⁷³ See *id.* (“I told [Rudi Roeslein of Roeslein Alternative Energy] he could have whatever gas he captured for the next 10 years if he put new covers on the lagoons and scrapers in the barns,” [Smithfield’s Michael] Rainwater says.”).

¹⁷⁴ TENG TEEH LIM & DAVID B. PARKER, *supra* note 164 at 2. (emphasis added).

¹⁷⁵ SMITHFIELD ANNUAL REPORT 2012 at 27.

¹⁷⁶ Rachel Lewis Hilburn, *CoastLine: Hog Waste Management Alternatives*, WHQR (May 18, 2016), <https://www.whqr.org/post/coastline-hog-waste-management-alternatives#stream/0> (interview with John Classen). (Attachment 24).

and sprayfield system, which is little more than a pit in the ground storing untreated hog waste.¹⁷⁷ Given the availability of cost-competitive and less environmentally devastating technology, Align RNG’s proposal install anaerobic digesters over polluting hog waste lagoons—without addressing the additional pollution this process will cause—is unacceptable.¹⁷⁸ Barn scrapers and other cleaner technology could help move the hog industry away from widespread reliance on the primitive and harmful lagoon and sprayfield system, and towards a more environmentally sustainable model of waste management.¹⁷⁹

Given Smithfield’s successful implementation of barn scrapers in Missouri and the technology’s compatibility with biogas production, there is no reasonable explanation for Align RNG’s failure to consider other options for mitigating the environmental and health impacts of biogas production. Allowing Smithfield and its subsidiaries to subvert the intent of the Smithfield Agreement by altering existing waste management practices to facilitate biogas production without taking any measures to address water pollution, odors, or other harms associated with the outdated lagoon and sprayfield system—that the company has already taken in other states—is unacceptable. North Carolinians are entitled to the same environmental protections that the people of Missouri have received for almost a decade.

VI. Conclusion

For all the reasons set above, the draft air permit for the upgrading facility is deeply flawed and does not comply with the N.C. Air Pollution Control Act, Federal Clean Air Act, or Title VI of the Civil Rights Act. Moreover, Align RNG’s biogas project will entrench a harmful

¹⁷⁷ Application Review, *supra* note 18, at 1.

¹⁷⁸ *See id.* (“The biogas (raw material) will be dried using biogas dehydration and compression systems (and a glycol chiller system) . . .”); Align RNG Air Permit Application, *supra* note 9 at 4 (“The biogas will be dried at each farm.”).

¹⁷⁹ *See* Bigelow, *supra* note 169.

and primitive waste management system that has devastated the environment and nearby communities for decades. Therefore, the undersigned urge DAQ to revoke this permit and re-write any air quality permit for Align RNG's upgrading facility consistent with the comments herein.

Thank you for your consideration of these comments.

Sincerely,



Maia Hutt
Associate Attorney
Southern Environmental Law Center



Heather Hillaker
Associate Attorney
Southern Environmental Law Center



Sam Hicks
Associate
Southern Environmental Law Center



Blakely Hildebrand
Staff Attorney
Southern Environmental Law Center

Submitted on behalf of:

Devon J. Hall
Executive Director
Rural Empowerment Association for Community Help

Larry Baldwin
Waterkeeper
Crystal Coast Waterkeeper

Larry Baldwin
Advocacy Director
White Oak-New Riverkeeper Alliance

Drew Ball
Director
Environment North Carolina

[signature page continues]

Kemp Burdette
Cape Fear Riverkeeper
Cape Fear River Watch

Hannah Connor
Senior Attorney
Center for Biological Diversity

Jessica Culpepper
Food Project Director
Public Justice

Jefferson Currie
Lumber Riverkeeper
Winyah Rivers Alliance

Christine Ellis
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Winyah Rivers Alliance

Elizabeth Haddix
Managing Attorney
Lawyers' Committee for Civil Rights Under Law

Will Hendrick
Senior Attorney
Waterkeeper Alliance

Jillian Howell
Pamlico-Tar Riverkeeper
Sound Rivers

Katy Hunt
Lower Neuse Riverkeeper
Sound Rivers

Joel Porter
Policy Manager
Clean Air Carolina

Amanda Stawderman
Polluter Accountability Program Manager
Clean Water for North Carolina

[signature page continues]

Sherrri White-Williamson
Environmental Justice Coordinator
NC Conservation Network

CC: Sheila Holman, Assistant Secretary for the Environment, DEQ
Michael Pjetraj, Deputy Director, DAQ
Renee Kramer, Title VI and Environmental Justice Coordinator, DEQ

Exhibit 3



September 19, 2020

VIA EMAIL

Michael Abraczinskas, Director
Michael Pjetraj, Deputy Director
N.C. Department of Environmental Quality – Division of Air Quality
Wilmington Regional Office
127 Cardinal Drive Ext.
Wilmington, NC 28405
Michael.Abraczinskas@ncdenr.gov
Michael.pjetraj@ncdenr.gov

Dear Director Abraczinskas and Deputy Director Pjetraj:

On behalf of the Rural Empowerment Association of Community Help (“REACH”), the North Carolina Environmental Justice Network (“NCEJN”), Waterkeeper Alliance, Cape Fear River Watch, Center for Biological Diversity, Duke Environmental Law & Policy Clinic, Coastal Carolina River Watch, Crystal Coast Waterkeeper, White Oak-New Riverkeeper Alliance, Clean Water for North Carolina, and Public Justice, the Southern Environmental Law Center and the Lawyers’ Committee for Civil Rights Under Law respectfully request that the N.C. Department of Environmental Quality - Division of Air Quality (“DAQ”) postpone the October 20, 2020 virtual public hearing for the draft air quality permit for the Align Renewable Natural Gas (“Align RNG”) biogas upgrading facility (Permit 10644R00) for *at least 30 days* for the reasons outlined below. The public hearing is scheduled at the same time as another Department of Environmental Quality (“the Department”) virtual public hearing involving many of the same interested parties and regarding similar pollution issues. In addition, the 32 days’ notice provided by DAQ is insufficient to ensure meaningful participation by impacted community members in a virtual public hearing in an area with limited broadband access and during a pandemic. DAQ should follow the community engagement guidelines outlined in the Department’s Public Participation Plan to facilitate meaningful involvement of impacted community members as it proceeds with the permitting processes for this proposed facility.

On Friday, September 4, 2020, the Division of Water Resources noticed an October 20, 2020 public hearing regarding a proposal by Waterkeeper Alliance and Cape Fear River Watch to remove the Swamp waters supplemental classification for a portion of the Lower Cape Fear River.¹ Waterkeeper Alliance and Cape Fear River Watch were among over a dozen

¹ Email from A. Gurney, N.C. Dep’t of Env’tl Quality, to B. Hildebrand, SELC (Sept. 4, 2020) (providing details about the virtual public hearing on October 20, 2020 at 6:00 pm and public comment period ending November 2, 2020 regarding the removal of the Swamp waters supplemental classification for the Lower Cape Fear River). Waterkeeper and Cape Fear River Watch’s petition was initially granted in November 2019, and a hearing on the matter was originally planned for May 2020. The Division of Water Resources postponed the hearing on the matter

organizations to submit public comments on Align RNG’s draft air quality permit in June 2020.² Waterkeeper Alliance, Cape Fear River Watch, and their members—in addition to members of impacted communities—cannot participate in two simultaneous hearings scheduled by two different divisions of the Department. Moreover, the two hearings will address a similar issue: pollution from industrial hog operations in the Cape Fear River basin. Waterkeeper Alliance and Cape Fear River Watch proposed the reclassification of the Lower Cape Fear River in large part because of nutrient pollution from approximately 2,000 industrial hog operations located in the Cape Fear River basin. Likewise, the Align RNG facility subject to DAQ’s draft air quality permit would process methane captured at 19 industrial hog operations in the Cape Fear River basin. This project, if permitted, would exacerbate nutrient pollution in the Cape Fear River basin. The Department’s double-booking of a hearing date on its own is reason to postpone the hearing for Align RNG’s air quality permit.

We further request that DAQ postpone the hearing for 30 days to provide community members sufficient time to organize participation in the public hearing. DAQ regulations require a *minimum* 30 days’ notice for public hearings for air quality permits. *See* 15A N.C. Admin. Code 2Q.0307(e). The regulations do not prohibit additional notice time ahead of a public hearing. More lead time ahead of the public hearing regarding the Align RNG permit is necessary given the challenges inherent in encouraging attendance at a virtual hearing in an area with limited broadband internet access³ and that has been significantly impacted by the global pandemic.⁴

Importantly, pursuant to a settlement agreement in connection with the 2014 Title VI complaint brought by REACH, NCEJN, and Waterkeeper Alliance to address environmental justice concerns related to the permitting of swine operations, the Department adopted a Public Participation Plan (“PPP”) which strives for the “fair treatment” and “meaningful involvement” of underserved and minority communities. The PPP provides that the Department make special efforts to “coordinate with community . . . organizations to implement public engagement strategies specifically for members of historically underserved communities.”⁵ The residents of Duplin and Sampson Counties who will be most adversely impacted by Align RNG’s proposed

until October due to the ongoing pandemic. Notably, the Division of Water Resources gave the public *two weeks more* notice than DAQ for its October 20 hearing.

² Letter from B. Hildebrand, SELC, to M. Abraczinskas, DAQ (June 16, 2020) (commenting on behalf of Rural Empowerment Association for Community Help (“REACH”), Center for Biological Diversity, North Carolina Conservation Network, Clean Air Carolina, Sound Rivers, Environment North Carolina, Waterkeeper Alliance, Cape Fear River Watch, Crystal Coast Waterkeeper, White Oak-New Riverkeeper Alliance, Winyah Rivers Alliance, Clean Water for North Carolina, Lawyers’ Committee for Civil Rights Under Law, and Public Justice regarding the Align RNG permit) and Letter from E. Haddix, LCCRUL, to M. Abraczinskas, DAQ (June 16, 2020) (commenting on behalf of NCEJN, Advance Carolina, Clean Air Carolina, Clean Water for North Carolina, Toxic Free NC and the West End Revitalization Association)

³ Sampson County ranks 71st and Duplin County ranks 96th among North Carolina’s 100 counties for broadband access. *See* N.C. Dep’t of Information Technology, *Broadband Indices: Availability*, <https://bi.nc.gov/t/DIT-Broadband/views/2017CountyIndices/BBABVStory?%3AisGuestRedirectFromVizportal=y&%3Aembed=y> (last visited Sep. 17, 2020).

⁴ Hayler Fowler, *Four Counties in the Carolinas are becoming COVID-10 hot spots, data show. Here’s why*, NEWS & OBSERVER (June 23, 2020). <https://www.newsobserver.com/news/coronavirus/article243733462.html>.

⁵ N.C. Dep’t of Env’tl Quality, *Public Participation Plan* (Feb. 2020) <https://files.nc.gov/ncdeq/EJ/Public-Participation-Plan.pdf>.

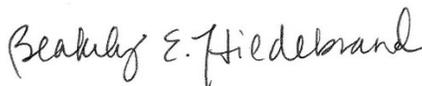
facility are precisely the type of historically underserved communities that the Department committed to reach out to and engage through the PPP. DAQ should make every effort to follow the guidelines outlined in the PPP when facilitating public engagement related to the Align RNG biogas project, including but not limited to the air quality permit for the Align RNG facility.

NCEJN informed DAQ on June 10, 2020⁶ and REACH informed the Department staff in August that DAQ must act consistent with the PPP regarding underserved communities and that a digital public hearing would not be accessible to many residents most adversely impacted by Align RNG's proposed facility.⁷ Not only do many residents in Duplin and Sampson Counties not have broadband access, even those with access do not have the technology needed to participate in a virtual hearing. Additional time is needed (and should be provided consistent with the PPP) to make arrangements in Duplin and Sampson Counties where Align RNG's project is proposed for residents who will be most negatively affected by Align RNG's project to be provided with the necessary access and ability to participate in the hearing.

For these reasons, we urge DAQ to at a minimum postpone the virtual public hearing for the Align RNG air permit for 30 days. We also reiterate our request that DAQ make an on-site visit to speak with those underserved residents who may not have access to the hearing and consider their input before making a decision on the draft permit.

Please do not hesitate to reach out to us (bhildebrand@selcnc.org or 919-967-1450; ehaddix@lawyerscommittee.org or 919-521-8333) to discuss this matter further. Thank you for your prompt attention to this request.

Sincerely,



Blakely E. Hildebrand
Staff Attorney
Southern Environmental Law Center



Elizabeth Haddix
Managing Attorney
Lawyers Committee for Civil Rights Under Law

[signature page continues]

⁶ Letter from E. Haddix, LCCRUL, to M. Abraczinskas, DAQ (June 10, 2020) (submitted on behalf of NCEJN).

⁷ SELC also expressed these concerns in a phone call with DAQ and requested additional notice time, among other things, for the hearing in follow-up communications with DAQ. See Email from B. Hildebrand, SELC, to M. Pjetraj (Sept. 15, 2020) (requesting 60 days' notice for a virtual public hearing, inquiring about access to the hearing for impacted community members, and suggesting that DAQ conduct an on-site visit at the proposed site and with impacted community members).

Submitted on behalf of:

Devon Hall, Executive Director
Rural Empowerment Association for Community Help

Naeema Muhammed, Organizing Director
North Carolina Environmental Justice Network

Sherri White-Williamson, Environmental Justice Policy Director
North Carolina Conservation Network

Will Hendrick, Senior Attorney
Waterkeeper Alliance

Kemp Burdette, Cape Fear Riverkeeper
Cape Fear River Watch

Hannah Connor, Senior Attorney, Environmental Health
Center for Biological Diversity

Ryke Longest, Co-Director
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Larry Baldwin
Coastal Carolina River Watch
Crystal Coast Waterkeeper
White Oak-New Riverkeeper Alliance

Amanda Strawderman, Polluter Accountability Program Manager
Clean Water for North Carolina

Jessica Culpepper, Food Project Director
Public Justice

CC:

Sheila Holman, Assistant Secretary for the Environment, N.C. Department of Environmental
Quality

Darryl Childers, Policy Adviser, Office of the Governor

Renee Kramer, Title VI and Environmental Justice Coordinator, N.C. Department of
Environmental Quality

Zaynab Nasif, Public Information Officer, N.C. Department of Environmental Quality - Division
of Air Quality

Asher Spiller, Assistant Attorney General, N.C. Department of Justice

Exhibit 4



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 7
901 N. 5th STREET
KANSAS CITY, KANSAS 66101

AIR PERMITTING AND
COMPLIANCE BRANCH

December 6, 2004

James Pray
Brown, Winick, Graves, Gross,
Baskerville and Schoenebaum, P.L.C.
666 Grand Avenue, Suite 2000
Des Moines, Iowa 50309-2510

Dear Mr. Pray:

During a recent visit in Des Moines, and in a subsequent letter dated October 15, 2004, you asked EPA Region 7 to carefully consider whether the “support facility” concept should be applied to country grain elevators that are located near value-added agricultural industries such as ethanol plants. The concern is that if a new ethanol plant locates too closely to an existing country grain elevator or series of elevators throughout the local grain supply network, the owners and operators of the grain cooperatives may inadvertently be drawn into the PSD (Prevention of Significant Deterioration) permitting program or may otherwise be co-located with the ethanol plant for permitting purposes. If PSD is triggered, you suggest that the result can be economically devastating for a country elevator because it may have to install hundreds of thousands of dollars of control equipment that would never otherwise be required.

As an alternative to a “support facility” finding, you asked EPA to consider a common sense approach that would factor in the historical relationship between elevators and their local farmers and the notion that grain and other ethanol feed stocks are commodities which can be bought, sold, and traded on the open market. Since corn and other commodity feed stocks are available anywhere there is a production network (e.g. farms, elevators, and transportation), you suggest that it is not necessary to tie an ethanol plant to any one or more of these entities, thus preserving the independence of the country elevator system.

While we understand the elegance of a simple, straightforward determination that independent country elevators should not universally be considered a support facility for a new ethanol plant locating nearby, such a general finding is not possible given the unique circumstances that may exist at each installation. The determination of whether two activities are within the scope of a single source is a case-by-case determination that depends on several criteria set forth in regulations and the facts of each situation.

The SIP-approved PSD regulations of the Iowa Department of Natural Resources adopt the EPA’s PSD regulation by reference [Iowa Administrative Code § 567-22.4(455B)]. Thus, even though Iowa operates a SIP-approved PSD program, the

regulations at 40 C.F.R. § 52.21 (as amended through March 12, 1996) are applicable to sources in attainment or unclassifiable areas in Iowa. The determination of the scope of a stationary source subject to the PSD program in Iowa is therefore governed by the definitions in sections 52.21(b)(5) and 52.21(b)(6). In accordance with these definitions, a stationary source is a building, structure, facility or installation, which is, in turn, defined as follows:

All of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control). Pollutant-emitting activities shall be considered as part of the same industrial grouping if they belong to the same “Major Group” (i.e. which have the same first two digit code) as described in the Standard Industrial Classification Manual.

Thus, pollutant-emitting activities are generally considered part of a single stationary source when these activities are (1) part of the same industrial grouping (as determined by applicable SIC codes), (2) contiguous or adjacent, and (3) under common control. In several guidance documents, EPA has recognized that one or more of these criteria can be satisfied when an emissions unit is a “support facility” or serves in a supporting role for a primary activity at a nearby location.

One approach to separating sources is to find that they are neither adjacent or contiguous to each other. In the general scenario you present, it is unclear whether this is a typical circumstance or not. Generally, the closer two facilities are the more likely they may be considered contiguous or adjacent. In addition, the existence of a dedicated pipeline or transportation link for moving materials between two facilities may also be relevant to this determination.

Once two sources are found to be contiguous or adjacent by virtue of their proximity and interaction with one another, the focus may shift to the nature of that interaction and how they may control or support each other. This usually requires a case by case evaluation to determine if common control is present. Even where facilities have separate legal owners, EPA has found that common control may be established on the basis of a contract which creates a support or dependency relationship between the facilities.¹

In a related example, we would not typically connect a fuel oil supplier to an adjacent industrial site just because the company fires oil, another widely-traded commercial product, in its boilers. Instead, we would first determine whether “common control” exists between the two entities. As long as the oil supply vendor and industrial facility do not “exercise restraining or directing influence over,” “have power over,”

¹ Letter from Richard R. Long, EPA Region 8 to Julie Wrend, Colorado Department of Public Health regarding “Single Source Determination for Coors/TriGen” (Nov. 12, 1998)
<<http://www.epa.gov/Region7/programs/artd/title5/t5memos/coorstri.pdf>>

"have power of authority to guide or manage," or "regulate economic activity over" each other², based on the various factors described in previous EPA guidance, it is likely that the common control link would be broken and the two sources would not be considered a single source for permitting purposes.

Similarly, based on the general scenario you present, we agree that if an ethanol plant is purchasing grain on the open market and accepts delivery from a number of different suppliers in minority proportions, then there would typically be no basis for a common control determination. Therefore, as long as the traditional commodity transactions between the country elevators and the ethanol plant occur at arms length, the grain suppliers would likely not be considered to be under common control for permitting purposes. On the other hand, if a grandfathered grain elevator executes a contractual agreement with an adjacent or contiguous greenfield ethanol plant to provide the bulk of its output, then it may be more difficult to demonstrate that the two entities are not under common control.

If the facts of a case-by-case evaluation show the common control of two contiguous or adjacent plants, we would then turn our attention to whether the installations share a common standard industrial classification code. In most cases where they operate independently, the ethanol plants and grain suppliers are not likely to share a common standard industrial classification (SIC) code. Ethanol plants are typically found in Group 28 for chemical manufacturing. Grain handling is typically found in Groups 20 or 51 depending on the nature of the operation. However, a support facility may be considered to be a part of the same major group as the primary facility it supports even if the support facility would be classified in a separate group when operated independently.³ Thus, in the case of a grain elevator and an ethanol plant, the single source determination could hinge on a determination of whether one facility was a support facility for another.

EPA's August 25, 1999, "Oscar Meyer"⁴ determination, while not directly relevant to the circumstances you describe, looks at whether the placement of emergency backup generators by the local utility on the Oscar Meyer property constitutes a support facility. EPA notes that it

² Letter from William Spratlin, EPA Region 7 to Peter Hamlin, Iowa Department of Natural Resources re Common Control(September 18, 1995).

<<http://www.epa.gov/Region7/programs/artd/air/title5/t5memos/control.pdf>>

³ 45 Fed. Reg. 52695 (Aug. 7, 1980); Letter from Robert B. Miller, EPA Region 5 to William Baumann, Wisconsin Department of Natural Resources regarding Oscar Mayer and Madison Gas & Electric (Aug. 25, 1999) ["Oscar Meyer"]; Memorandum from John S. Seitz, EPA OAQPS entitled "Major Source Determinations for Military Installations under the Air Toxics, New Source Review, and Title V Operating Permit Programs of the Clean Air Act" (Aug. 2, 1996)

<<http://www.epa.gov/Region7/programs/artd/air/nsr/nsrmemos/dodguide.pdf>>

⁴ Letter from Robert B. Miller, EPA Region 5 to William Baumann, Wisconsin Department of Natural Resources cited above.

... has provided a great deal of guidance to States and sources regarding support activities since 1980, in which the Agency has emphasized that determinations of this nature are very fact-specific. USEPA provided a detailed summary of the Agency's existing policy in a recent public draft of a proposed rulemaking. See Draft preamble to the Part 70 revisions (notice of availability published June 3, 1997, (62 FR 30289)). In short, where more than 50% of the output or services provided by one facility is dedicated to another facility that it supports, then a support facility relationship is presumed to exist. Even where this 50% test is not met, however, other factors may lead the permitting authority to make a support facility determination. Support facility determinations can depend upon a number of financial, functional, contractual, and/or other legal factors. These include, but are not limited to: (1) the degree to which the supporting activity receives materials or services from the primary activity (which indicates a mutually beneficial arrangement between the primary and secondary activities); (2) the degree to which the primary activity exerts control over the support activity's operations; (3) the nature of any contractual arrangements between the facilities; and (4) the reasons for the presence of the support activity on the same site as the primary activity (e.g., whether the support activity would exist at that site but for the primary activity). Where these criteria indicate a support relationship, permitting authorities may conclude that a support activity contributing more or less than 50% of its output may be classified as a support facility and aggregated with the facility it supports as part of a single source.

Finally, it is important to note that what an ethanol plant can do and what it actually does when making its grain purchase decisions may affect whether common control or a support facility relationship exists or not. For example, if an ethanol plant purchases grain from an array of local country grain elevators, such transactions appear to occur within the commodity scheme you suggest. However, if an ethanol plant has many supply choices but instead opts to enter into contracts to purchase only from the elevator next door, then such transactions may appear to be more like two sources acting as one.

In summary, because of the unique details that each installation presents it is not possible to pre-determine all the circumstances under which a grain supply elevator may be a single source by itself or an included part of a larger stationary source. Nor is it possible to grant a broad commodity-based exception when determining PSD source applicability. In that regard, we encourage you to work closely with your state and local air pollution control agencies to evaluate these site-specific factors. As a final note, even though we encourage SIP-approved PSD states like Iowa to follow EPA guidance to ensure consistency in implementation of the program, such guidance is not legally binding and does not substitute for the controlling regulations. EPA and the states retain the discretion to apply the regulations and to reach different conclusions where appropriate based on differing specific circumstances of particular cases. Further, the

methodology described above is not intended to imply that the three key criteria for a single source determination must be evaluated in any particular order. All three criteria must be satisfied at the same time in order for activities to be considered part of a single source.

We have coordinated this response with EPA's Office of Regional Counsel, Office of General Counsel, Office of Enforcement and Compliance Assurance, and Office of Air Quality, Planning & Standards. If you have any questions, please contact Jon Knodel at (913) 551-7622 or knodel.jon@epa.gov.

Sincerely,

/s/

JoAnn Heiman
Chief
Air Permitting and Compliance Branch

cc: Catherine Fitzsimmons, Iowa Department of Natural Resources
Dave Phelps, Iowa Department of Natural Resources

Exhibit 5



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8**

1595 Wynkoop Street
Denver, CO 80202-1129
Phone 800-227-8917
www.epa.gov/region8

Ref: 8ARD-PM

Mr. Danny Powers
Air Quality Program Manager
Southern Ute Indian Tribe
P.O. Box 737
Ignacio, Colorado 81137

Dear Mr. Powers:

On April 22, 2019, you transmitted a letter on behalf of the Southern Ute Indian Tribe's (the Tribe) Air Quality Program (AQP) to the U.S. Environmental Protection Agency (EPA) requesting the EPA's position on the AQP's preliminary determination that equipment at the Jaques Compressor Station owned by Red Cedar Gathering Company (Red Cedar) and Red Willow Production Company (Red Willow) should be considered to be under common control. This request concerns whether these two entities should be considered part of the same "major source" for the operating permit program under Title V of the Clean Air Act (CAA).¹ The EPA commonly refers to these types of questions as "source determinations." As the AQP recognized in its April 22, 2019 letter, given that the Tribe's Title V program has been approved by the EPA, the AQP has the primary responsibility to make this determination based on its EPA-approved rules. This letter does not constitute a source determination by the EPA regarding Red Cedar or Red Willow. The EPA appreciates the AQP's thoughtful analysis to date and hopes the following information is helpful as the AQP makes its final permitting decision.

BACKGROUND

The Jaques Compressor Station, located within the Southern Ute Indian Reservation, processes coal-bed methane gas from several wells to transmission pipeline specifications. The Jaques Compressor Station includes six compressor engines, two dehydrators, and multiple produced water storage tanks, tank heaters, and pump engines, all co-located at the Jaques Compressor Station site. Although this equipment was originally owned by a single company, following recent changes in ownership, equipment at the Jaques Compressor Station is currently owned and operated by two entities: Red Cedar owns and operates the gas compression and dehydration equipment, and Red Willow owns and operates the tanks, heaters and pump engines. Notably, 51% of Red Cedar is owned by the Tribe, while Red Willow is wholly-owned by the Tribe.

¹ Under the federal, state, and tribal rules governing the Title V permitting program, entities must be considered part of the same "major source" if they (1) belong to the same major industrial grouping (2-digit Standard Industrial Classification [SIC] code); (2) are located on one or more contiguous or adjacent properties; and (3) are under the control of the same person (or persons under common control). *See* 42 U.S.C. § 7661(2) (Title V statutory definition); 40 CFR §§ 70.2 and 71.2 (Title V regulations). The Tribe's Title V regulations mirror the EPA's regulations in relevant part. *See* Southern Ute Reservation Air Code § 1-103(38). Although the Tribe's request only solicits feedback in the context of a current Title V permit, similar principles would guide the EPA's analysis in the context of New Source Review (NSR) preconstruction permits issued under Title I of the CAA in determining whether these entities must be considered part of the same "stationary source." *See* 40 C.F.R. § §§ 52.21(b)(5) and (6), 51.165(a)(1)(i) and (ii), and 51.166(b)(5) and (6) (NSR regulations).

The AQP has historically treated all of the activities at the Jaques Compressor Station as a single major source for Title V purposes (the current permit is issued to Red Cedar). However, on August 23, 2018, Red Cedar applied for a permit revision to remove the emission units owned and operated by Red Willow from the Red Cedar Title V permit on the basis that they are not part of same major source. It is uncontested that all of the equipment at Jaques Compressor Station continues to be located on one or more contiguous or adjacent properties and shares the same 2-digit SIC code. Thus, determining whether these emission-generating activities should continue to be considered part of the same major source for Title V purposes depends on whether these activities are under the control of the same person (or persons under common control) in light of the recent changes in ownership described above.

After evaluating the relevant statutory and regulatory provisions, EPA guidance, and information submitted by Red Cedar, the AQP preliminarily determined that Red Cedar and Red Willow are “persons under common control” by virtue of the common ownership of the Tribe over both entities. In order to evaluate this, the AQP examined the ownership and management structures of Red Cedar and Red Willow, the details of which are outlined in the AQP’s April 22, 2019 letter. In sum, the AQP determined that the Tribe, through its majority ownership interest in Red Cedar, could direct its representatives on the Red Cedar Management Committee (which constitute a majority of the committee) to vote on matters that could affect Red Cedar’s compliance with its air quality permits. Similarly, the Tribe, through its ownership of Red Willow, could direct Red Willow’s management to take actions relative to Red Willow’s compliance with air quality permits. Based on the AQP’s understanding of recent EPA guidance regarding common control, the AQP determined that this was sufficient to establish that Red Cedar and Red Willow are under the common control of the Tribe. The AQP explained that it understood that Red Cedar’s and Red Willow’s respective managers have been delegated authority over day-to-day decision-making but did not consider day-to-day operational control necessary to establish “common control” where there is common ownership.

Notwithstanding the Tribe’s common ownership of both Red Cedar and Red Willow, Red Cedar claims that Red Cedar and Red Willow are not “persons under common control” because no true operational control exists between the facilities, different individuals control day-to-day operations and major decision-making, and the entities do not share the same officers or management committees. Red Cedar contends that “the highest level of control over air pollution-emitting activities that trigger permitting requirements and affect compliance with those requirements for Red Cedar and Red Willow occurs at the President and COO level of each company.” Red Cedar argues that the management committees through which the Tribe has a more direct presence can only influence (but not control) the relevant activities at Red Cedar and Red Willow. Red Cedar acknowledges that the Tribe, through its management committees, could direct Red Cedar or Red Willow to take certain actions that could affect air permit compliance, but nonetheless asserts that any exercise of this hypothetical power could “potentially” run afoul of other constraints on the Tribe’s authority relative to the Red Willow operations.²

The AQP’s April 22, 2019 letter seeks the EPA’s input on whether the AQP’s interpretation of the relevant regulations and its understanding of the EPA’s guidance is consistent with the EPA’s interpretation and understanding. Specifically, the letter seeks the EPA’s input on whether “common

² These other constraints on the Tribe’s authority were not fully explained or supported by Red Cedar. Red Cedar also argues that neither Red Cedar nor Red Willow can dictate the relevant activities of the other entity. However, given that the issue here depends on whether Red Cedar and Red Willow are “persons under common control” by virtue of a third entity’s (the Tribe) control over *both* Red Cedar and Red Willow, this argument is not determinative of whether this criterion is met and thus this letter does not address this argument.

control” should be interpreted to require practical day-to-day operational control (as Red Cedar suggests), or whether the EPA continues to follow its historical interpretation equating common ownership with common control.

DISCUSSION

In the EPA’s April 30, 2018, *Meadowbrook* Letter,³ the EPA reevaluated its historical “multi-factor” approach to common control, revised its regulatory interpretation and articulated a revised policy for assessing questions of “control” or “common control” in the context of source determinations. *See Meadowbrook* Letter at 4–7. The EPA explained its intention to focus on “the power or authority of one entity to dictate decisions of the other that could affect the applicability of, or compliance with, relevant air pollution regulatory requirements.” *Meadowbrook* Letter at 6. Notably, the EPA explained its view that control “includes only the power to dictate a particular outcome and does not include the mere ability to influence.” *Id.*⁴ The EPA further explained its view that this inquiry should focus on “whether the control exerted by one entity would determine whether a permitting requirement applies or does not apply to the other entity, or whether the control exerted by one entity would determine whether the other entity complies or does not comply with an existing permitting requirement.” *Id.* at 8.

In the October 16, 2018, *Ameresco* Letter,⁵ the EPA further clarified its view of the relationship between “control” over a certain activity and whether multiple entities should be considered “persons under common control.”⁶ The EPA explained:

In EPA’s view, the phrase “persons under common control” suggests that the entities themselves are controlled from a central, unified position, such as through parent-subsidary or other forms of corporate management relationships. Permitting authorities could also consider entities that are separate in the sense that they lack a formal organizational link of this type, but where one entity nevertheless exerts enough control over a substantial portion of the other’s relevant operations, to be “persons under common control” in certain situations. However, where the overlap of control is limited to only a small portion of each entity’s otherwise separate operations, EPA does not believe such entities should themselves be considered “persons under common control” simply by virtue of this limited nexus.

Ameresco Letter at 6.

³ Letter from William L. Wehrum, Assistant Administrator, Office of Air and Radiation, EPA, to the Honorable Patrick McDonnell, Secretary, Pennsylvania Department of Environmental Protection (April 30, 2018), available at https://www.epa.gov/sites/production/files/2018-05/documents/meadowbrook_2018.pdf (*Meadowbrook* Letter).

⁴ *See also id.* at 7 (“While distinguishing control from the ability to merely influence will necessarily be a fact-specific inquiry, the key difference is that EPA interprets ‘control’ to exist at the point where one entity’s influence over another entity effectively removes the autonomy of the controlled entity to decide whether or how to pursue a particular course of action.”).

⁵ Letter from Anna Marie Wood, Director, Air Quality Policy Division, Office of Air Quality Planning and Standards, EPA, to Ms. Gail Good, Director, Bureau of Air Management, Wisconsin Department of Natural Resources (October 16, 2018), available at https://www.epa.gov/sites/production/files/2018-10/documents/ameresco_jcl_letter.pdf (*Ameresco* Letter).

⁶ As explained in the *Ameresco* Letter, determining whether two entities are “persons under common control” is important, because if so, all the pollutant-emitting activities controlled by either entity would be “under the control of . . . persons under common control” and (provided the other two source determination criteria are met) would therefore be considered part of the same source. *See id.* at 6.

In sum, the *Meadowbrook* Letter explained the EPA’s interpretation of the term “control” as reflecting something beyond influence and provided the EPA’s policies regarding the considerations most relevant to a common control inquiry—focusing on compliance and applicability of permitting requirements. The *Ameresco* Letter further clarified the EPA’s view of the interaction between an entity’s “control” over an activity and determining whether multiple entities are themselves “persons under common control.” Those two letters involved evaluation of case-specific factual circumstances different than those present here. Nonetheless, the principles the EPA articulated in these letters support the AQP’s preliminary determination that Red Cedar and Red Willow are “persons under common control” by virtue of their common ownership by the Tribe.

The EPA has neither articulated nor intended to suggest that decision-making authority with respect to day-to-day operations is necessary to establish the requisite type or amount of “control.” Rather, as explained in the *Meadowbrook* Letter, the ability to dictate any decision that could impact compliance with or the applicability of permitting requirements—including higher-level decisions removed from day-to-day operations—can be sufficient to establish the relevant type of “control.”

As stated in the *Ameresco* Letter and consistent with longstanding EPA positions, the EPA considers common ownership by a parent company sufficient to establish that two wholly or majority-owned subsidiaries are “persons under common control” and thus meet that criterion for source determinations. Additionally, the EPA expects that common ownership inherently involves the parent company’s ability to dictate, at a certain level, a substantial portion of the activities of its subsidiaries in a manner that could impact compliance with, or the applicability of, air permitting requirements. Thus, based on the principles outlined in the *Meadowbrook* and *Ameresco* letters, common ownership is a sufficient basis for determining that multiple entities are “persons under common control.”

The EPA appreciates the AQP’s efforts to explain the precise process by which the Tribe could, through its management committees, dictate (i.e., control) both Red Cedar’s and Red Willow’s actions in a way that could impact compliance or applicability of air permitting requirements. However, given that common ownership inherently involves a significant amount of control, the EPA thinks it would be reasonable for permitting authorities to rely on the existence of common ownership when determining entities are “persons under common control” rather than undertaking a more detailed analysis.⁷

Overall, the EPA considers the AQP’s conclusions regarding Red Cedar and Red Willow, supported by its thoughtful analysis, to be reasonable and generally consistent with the EPA’s current interpretations and policies concerning “common control.” Given that all pollutant-emitting activities at the Jaques Compressor Station share the same 2-digit SIC code and are on one or more contiguous or adjacent properties, the EPA considers it reasonable for the AQP to continue treating all of Red Cedar’s and Red Willow’s operations as a single major source for Title V purposes.

⁷ The EPA understands that the *Meadowbrook* letter said that “the focus is not on *how* control is established (through ownership, contract, or otherwise), but on *whether* control is established,” *Meadowbrook* Letter at 7. However, it was not the EPA’s intention in the *Meadowbrook* letter to suggest that permitting authorities should engage in this analysis even in cases of common ownership.

This response was coordinated with the EPA's Office of Regional Counsel, Office of General Counsel and Office of Air Quality Planning and Standards. If you have any additional questions please contact Patrick Wauters, of my staff, at 303-312-6114 or wauters.patrick@epa.gov.

Sincerely,

7/23/2019

 Carl Daly

Signed by: CARL DALY

Carl Daly
Acting Director
Air and Radiation Division



SOUTHERN UTE INDIAN TRIBE

April 22, 2019

Delivered via email: morales.monica@epa.gov

Monica S. Morales
Director, Air Program (8P-AR)
U.S. Environmental Protection Agency – Region 8
1595 Wynkoop Street
Denver, Colorado 80202-1129

Re: Request for Review and Comment on Jaques Compressor Station “Common Control” Determination

Dear Ms. Morales:

On behalf of the Southern Ute Indian Tribe’s Air Quality Program, which administers the Clean Air Act’s Title V Operating Permit Program on the Southern Ute Indian Reservation (“Reservation”), I am writing to respectfully request your review and comment on our preliminary “common control” determination for the Jaques Compressor Station.

As further explained below, the Tribe’s Air Quality Program (a program within the Tribe’s Environment Programs Division, to which the Southern Ute Indian Tribal Council has delegated authority to administer the Title V Operating Permit Program on the Tribe’s behalf), is considering whether it should continue to collectively permit as a single source certain produced water storage tanks, their associated heaters, and two small pump engines with other emission units at the Jaques Compressor Station. The permittee, Red Cedar Gathering Company (“Red Cedar”), has submitted an application for an administrative permit revision to remove the tanks, heaters, and two small pump engines from the facility’s Title V permit because the tanks, heaters and two small pump engines are separately owned by another company (i.e., the Southern Ute Indian Tribe doing business as Red Willow Production Company (“Red Willow”)).

We have researched and carefully considered EPA’s “common control” letters and memoranda in an attempt to understand and correctly apply EPA’s source determination principles, in particular EPA’s “common control” determination principles. We have also requested and received detailed factual information from the permittee.

In making a preliminary source determination, we have evaluated the information received from the permittee and analyzed the complicated ownership structure and operational control structure of Red Cedar and Red Willow. Before finalizing our determination, we respectfully request your review and comment.

I. Background

A. Jaques Compressor Station location and process summary

The Jaques Compressor Station is located in the south-central part of the Reservation on non-Indian owned fee land. The facility includes six compressor engines and two dehydrators that compress and dehydrate coal-bed methane gas from several wells to transmission pipeline specifications. Among other insignificant emission units are ten produced water storage tanks (grouped as one insignificant emission unit (“IEU”)), twelve tank heaters (grouped as one IEU), and two pump engines (classified as two separate IEUs) that are associated with and used in connection with certain production wells. These tanks, heaters, and pump engines are collocated with the other emission units at the Jaques Compressor Station and all of the emission units at the Jaques Compressor Station share the same two-digit SIC code. As explained in Red Cedar’s response to our additional information request (*see* Attachment 3), Red Cedar’s gas compression and dehydration equipment (i.e., gas gathering system) is interconnected with Red Willow’s produced water system (i.e., tanks, heaters, and pump engines) at the Station. Under a contract between the parties, Red Cedar’s inlet separators are connected to Red Willow’s storage tanks so Red Cedar can dispose of water separated from its gas stream. Additionally, Red Cedar provides fuel gas to power Red Willow’s produced water system. *See* Attachment 3, together with attached simplified process flow diagrams.

B. Ownership and permitting history

On information or belief, Samson Resources Company (“Samson”) built the Jaques Compressor Station in 2005. Samson commenced operation in 2006 and EPA issued an initial Title V operating permit for the facility in 2007. In 2011, Samson applied for and obtained a synthetic minor source permit for the facility from EPA. The Tribe replaced EPA’s Part 71 permit with a tribal-issued Part 70 permit in 2015.¹

In November 2016, after Samson filed for bankruptcy, the Southern Ute Indian Tribe, doing business as Red Willow Production Company, acquired Samson’s assets located on or near the Reservation. Red Willow’s bid for Samson’s assets was authorized by the Southern Ute Indian Tribal Council. The acquisition included the Jaques Compressor Station. The U.S. Bankruptcy Court for the District of Delaware approved the transaction and authorized Red Willow to allocate the acquired assets among Red Willow’s affiliates. Upon acquiring Samson’s on-Reservation assets, Red Willow entered an agreement with Red Cedar under which Red Cedar would operate the gas gathering and processing facilities Red Willow had acquired from Samson, including the gas gathering system at the Jaques Compressor Station. On January 9, 2017, we approved an administrative permit revision reflecting the change of ownership from Samson to Red Willow and reflecting the designation of Red Cedar as the facility’s operator.

¹ In 2012, EPA delegated authority to the Southern Ute Indian Tribe to administer the Clean Air Act’s Title V operating permit program on the Southern Ute Indian Reservation. 77 Fed Reg. 15267 (March 15, 2012). EPA has also delegated authority to the Tribe to implement and enforce certain federal National Emissions Standards for Hazardous Air Pollutants and New Source Performance Standards that apply to the oil and gas industry and are intended to reduce hazardous air pollutant emissions and criteria air pollutant emissions, respectively. 78 Fed. Reg. 40635 (July 8, 2013).

In October 2017, Red Willow sold the Jaques Compressor Station (and other gas gathering pipelines, compressor stations, and processing facilities Red Willow acquired from Samson) to Red Cedar. Upon recommendation by the Tribe's Growth Fund Management Committee, the Southern Ute Indian Tribal Council authorized Red Willow to sell the assets. Importantly, at the Jaques Compressor Station, Red Willow retained ownership of the equipment needed for Red Willow's gas production activities including ten produced water tanks with twelve associated heaters and two small pump engines (<50hp). In our Part 70 operating permit for the Jaques Compressor Station, the two small pump engines retained by Red Willow are subject to the 40 CFR Part 63, Subpart ZZZZ, National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines. The tanks and heaters are subject to no permit requirements.

C. Red Cedar's 2019 application for an administrative permit revision

On August 23, 2018, Red Cedar submitted an application for an administrative permit revision, requesting removal of Red Willow's tanks, heaters, and pump engines from Red Cedar's Title V Permit for the Jaques Compressor Station. The basis for Red Cedar's request was that Red Cedar does not, and has not ever, owned or operated the tanks, heaters, and pump engines.

As an initial response, we sought and received confirmation that Red Cedar included the potential emissions from the tanks, heaters, and pump engines in its initial permit application for the Jaques Compressor Station. Suspecting the Jaques Compressor Station might satisfy the three-part test for a single source determination, we asked Red Cedar to explain why we should not continue to consider the station as one major source. On October 8, 2018, Red Cedar responded to our request. *See* Attachment 1. Red Cedar agreed the emission-emitting activities at the facility meet the collocation and same major industrial grouping criteria for single source determinations but asserted that Red Cedar and Red Willow are not under common control.

Subsequently, we requested additional information from Red Cedar. In mid-December 2018, we met with Red Cedar to discuss our additional information request, Red Cedar's assertion of a claim of confidentiality, and to preliminarily review some of the documents that Red Cedar felt were responsive to our request. We received more information and documents on February 11, 2019. *See* Attachment 2.

II. Summary of Red Cedar's position – no common control because, notwithstanding common ownership by the Tribe, Red Cedar and Red Willow are separately managed

Red Cedar contends that collocated at the Jaques Compressor Station are two separate facilities – one owned and operated by Red Cedar (for gas dehydration and compression purposes) and one owned and operated by Red Willow (for gas production purposes, including producing and disposing of water coming from wells served by the Jaques Compressor Station). Even though the entities are related, with the Southern Ute Indian Tribe owning 51% of Red Cedar and Red Willow being a wholly owned division of the Tribe, no true operational control exists between the two facilities because the entities have separate management structures. According to Red Cedar, different individuals control day-to-day operations, the entities do not

share the same officers or management committees, and major decision-making for the facilities is by different individuals.

III. The three-part test for source determinations

The Southern Ute Indian Tribe/State of Colorado Environmental Commission's ("Environmental Commission") Reservation Air Code ("RAC"), in the establishment of the Title V program for the Reservation, incorporates EPA's definition of "major source" found at 40 C.F.R. § 70.2. The Environmental Commission restates this definition in § 1-103(38), RAC, defining "major source," in relevant part, as any stationary source or any group of stationary sources that is:

located on one or more contiguous or adjacent properties, and is under control of the same person (or persons under common control) belonging to a single, major industrial grouping. . . . For purposes of this definition, a stationary source or group of stationary sources shall be considered part of a single industrial grouping if all of the pollutant emitting activities at such source or group of sources on contiguous or adjacent properties belong to the same Major Group (i.e., all have the same two-digit code) as described in the Standard Industrial Classification Manual, 1987.

Under the three-part test established in federal and Environmental Commission regulations, to be considered a single stationary source on the Reservation, the pollutant-emitting activities in question must be:

1. located on one or more contiguous or adjacent properties;
2. under the control of the same person (or persons under common control); and
3. in the same industrial grouping as described by their two-digit SIC code.

All three of these conditions must be met for otherwise separate emission units to be considered part of the same stationary source for Title V purposes under both EPA and Environmental Commission regulations. *Compare* 40 C.F.R. §§ 70.2, 71.2 *with* § 1-103(38), RAC (definitions of major source for Title V purposes). Correspondingly, if any one of the three conditions of the test is not met, the emission units are, by definition, not part of the same stationary source.

In addition to the three source determination criteria in the federal regulations, EPA has adopted the limits placed upon its ability to aggregate pollutant-emitting activities established by the court in *Alabama Power v. Costle*, 636 F.2d 323 (D.C. Cir. 1979), including that the source must approximate a "common sense notion of a plant." Letter from William L. Wehrum, Asst. Administrator U.S. EPA, to Patrick McDonnell, Secretary, Penn. Dept. of Env. Protection, Attachment p. 3, (April 30, 2018) (referencing EPA's intention for *Alabama Power's* "common sense notion of a plant requirement" to apply to Title V permitting).

IV. The common control element of the three-part test

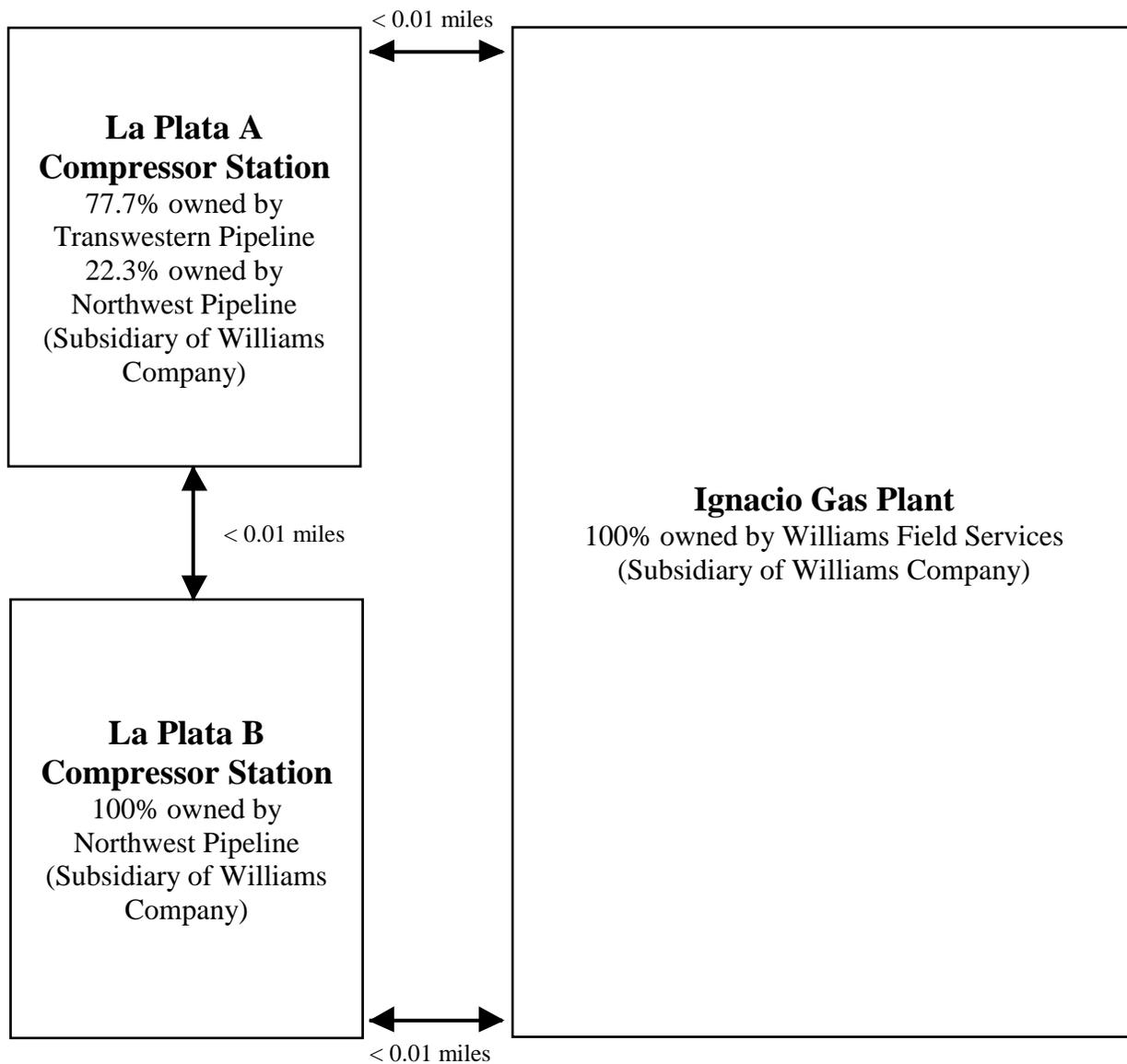
A. Under EPA’s historic common control guidance letters and memoranda, common ownership has always constituted common control

Over the years, EPA has issued letters and memoranda in order to provide regional EPA administrators and state permitting authorities with guidance in applying source determination criteria to designate stationary sources. Regarding the “common control” criteria, EPA has long recognized that common ownership equals common control. *See e.g.*, Memorandum from Edward Reich, Director, Division of Stationary Source Enforcement, U.S. EPA, to Diana Dutton, Director, Enforcement Division, U.S. EPA Region 6 (March 16, 1979) (found at https://www.epa.gov/sites/production/files/2015-07/documents/def_srce.pdf) (determining a company owning as much as 50% voting interest in an entity should be considered to control the entity); Memorandum from Edward Reich, Director, Division of Stationary Source Enforcement, U.S. EPA, to Allyn M. Davis, Director, Air & Hazardous Materials Division, U.S. EPA Region 6 (July 17, 1980) (found at <https://www.epa.gov/sites/production/files/2015-07/documents/tex-uss.pdf>) (discussing control common in a partnership and concluding a partner’s co-management and veto power gives it control). The concept that common ownership equals common control continued as the most obvious example of common control when EPA broadened the definition of common control to include indirect control (e.g., other evidence of control such as common workforces, equipment sharing, contractual arrangements, and interdependency). *See e.g.*, Letter from William A. Spratlin, Director, Air, RCRA, and Toxics Division, U.S. EPA Region 7, to Peter R. Hamlin, Chief, Air Quality Bureau, Iowa Department of Natural Resources (Sept. 18, 1995) (found at <https://www.epa.gov/sites/production/files/2015-07/documents/control.pdf>) (stating “[o]bviously, common ownership constitutes common control”); *see also* Letter from Judith M. Katz, Director, Air Protection Division, U.S. EPA Region 3 to Gary E. Graham, Environmental Engineer, Virginia Department of Environmental Quality (May 1, 2002) (separate source determination, in part, because there was no indication of common ownership).

B. Region 8 determinations for sources on the Reservation equate common ownership with common control

The principle that common ownership equals common control has been cited by EPA – Region 8 in Reservation source determinations. In August 1999, EPA Region 8 evaluated whether Transwestern Pipeline Company’s La Plata A compressor station should be considered under common control with and a part of Northwest Pipeline Corporation’s La Plata B compressor station and Williams Field Services’ Ignacio gas processing plant, all of which are co-located (i.e., adjacent). Region 8 found that (1) Northwest Pipeline Corporation (the owner of La Plata B compressor station) and Williams Field Services (owner of the Ignacio gas plant) were both owned by the same parent company, Williams Company. Because Northwest Pipeline Corporation was part owner (22.3%) in the La Plata A station, Region 8 concluded that the three facilities were under common control of the same person (or persons under common control). Below is a figure illustrating the ownership structure considered by Region 8 in 1999 as establishing common control:

Permitting authority: EPA



EPA Region 8 again considered the term “common control” in August 2000 when determining whether Red Cedar Gathering Company’s Diamondback and Sidewinder Compressor Stations should be aggregated together as a single source. Red Cedar asserted the facilities were not under common control, despite Red Cedar’s ownership of both facilities, “because the flow of natural gas to each source is controlled by separate entities [i.e., separate wells that are operated by different companies], neither of which is the owner.” Dennis Myers (who, on information and belief, was an EPA Region 8 employee at the time) concluded “[c]ommon ownership equates to common control, and since the same company owns both sources they are under common control [and should be viewed as a single source].” *See* Email from Dennis Myers, EPA Region 8, to Callie Videtich, EPA Region 8 (Aug. 31, 2000).

C. Under EPA’s reinterpretation of “common control,” it appears common ownership still equals common control

(1) *The Meadowbrook Letter*

On April 30, 2018, EPA published a letter reevaluating and revising its interpretation of the meaning of the “common control” criteria for source determinations. Letter from William L. Wehrum, Asst. Administrator U.S. EPA, to Patrick McDonnell, Secretary, Penn. Dept. of Env. Protection (April 30, 2018) (“Meadowbrook Letter”). The Meadowbrook Letter was in response to a request by the Pennsylvania Department of Environmental Protection for assistance in determining whether a biogas facility owned by Meadowbrook Energy, LLC (Meadowbrook) should be aggregated with an existing landfill owned by Keystone Sanitary Landfill Inc. (KSL) for air quality permitting purposes. The Meadowbrook Letter notes EPA’s historical practice of making common control determinations on a case-by-case basis. Further, EPA stated its previous interpretation of “common control,” equating a support or dependency relationship with common control, might support the permitting authority viewing Meadowbrook and KSL facilities as a single source. According to EPA, however, because the two sources would be owned by separate entities, and each entity would lack direct control of the other, there was no “common control” of the sources. EPA emphasized that its “narrower interpretation” of common control, focusing on *“the power or authority of one entity to dictate decisions of the other that could affect the applicability of, or compliance with, relevant air pollution regulatory requirements,”* will promote clarity, consistency and more practical outcomes in source determinations.

(2) *The Wisconsin Letter*

In its first post-Meadowbrook Letter interpretive letter, EPA further clarified the scope of “common control.” Importantly, in this letter, EPA affirmed that two otherwise separate entities that are controlled from a central, unified position, such as through a parent-subsidary relationship, are “under common control.” Letter from Anna Marie Wood, Director, Air Quality Policy Division, Office of Air Quality Planning and Standards, EPA, to Gail Good, Director, Bureau of Air Management, Wisconsin Department of Natural Resources (October 16, 2018) (“Wisconsin Letter”). In its Wisconsin Letter, EPA considered a source determination for a landfill (owned by “JCL”) and a collocated electrical generating station (owned by “Ameresco”). In this letter, EPA explained the difference between two separate aspects of the “common control” regulatory language – “under the control of the same person” and “persons under common control.” The second part of the regulatory test for common control, EPA explains, is “whether multiple persons [i.e., entities] are *themselves* “under common control.” Wisconsin Letter p. 5. “In EPA’s view, the phrase ‘persons under common control’ suggests that the entities themselves are controlled from a central, unified position, such as through parent-subsidary or other forms of corporate management relationships.” Wisconsin Letter p. 6.

EPA concluded that JCL and Ameresco were not entities under common control. Rather, EPA found that one emission-emitting activity (i.e., landfill gas treatment) was arguably controlled by both otherwise separate entities. When an activity is controlled by otherwise separate entities, EPA advised that, rather than considering the activity part of multiple stationary sources, it is probably more appropriate for permitting authorities to determine that only one entity “controls” the shared activity. Furthermore, the permitting authority could reasonably

allocate the activity for source determination purposes, to the entity with regulatory responsibility for the activity.

(3) ***Region 8's North Dakota Letter***

In a November 14, 2018 letter, EPA – Region 8 advised the North Dakota Department of Health (“NDDH”) on whether a coal-fired power plant and a lignite coal mine should be considered under “common control.” Letter from Monica Mathews-Morales, Director, Air Program, Office of Partnerships and Regulatory Assistance, U.S. EPA Region 8, to Terry O’Clair, Director, Division of Air Quality, North Dakota Department of Health (Nov. 14, 2018). In this letter, EPA recommended NDDH carefully consider if a lignite sales agreement between the parties (under which the power plant owner has authority to disapprove and modify the mine owner’s mining plans and capital expenditures) could impact the applicability of air pollution control regulations to the mine or cause the mine not to comply with existing permitting obligations.

V. Our preliminary analysis – determining whether the emission-emitting activities at the Jaques Compressor Station are owned or controlled by entities under common control.

Our determination depends in large part on the breadth of “common control” under EPA’s reinterpretation. We understand that, in its recent reinterpretation, EPA narrowed the approach permitting authorities should follow in making source determinations. As we read and synthesize EPA’s historical precedents and recent reinterpretation, we understand that:

- Our focus should be on whether one entity has the power or authority to dictate a specific outcome to the other entity, not just the ability to influence. The question is not how control is established (e.g., it could be by ownership, organizational structure, or contractually), but whether control exists.
- Our focus should be restricted to matters concerning air pollution and the ability to comply with permitting or compliance requirements.
- Interdependency does not always equate to common control.
- To constitute a single source, the facility must approximate a common-sense notion of a plant.

Accordingly, our foremost consideration has been whether either Red Cedar and Red Willow has the power or authority to dictate actions to the other entity related to air quality permitting or compliance requirements. Our analysis has focused on the identity of the owners of each entity and their ownership and management structures.

What we have found is that Red Cedar and Red Willow are separately managed business entities that are under the common ownership control of the Southern Ute Indian Tribe:

Red Cedar findings:

(1) Ownership structure: Red Cedar is a joint venture between the Southern Ute Indian Tribe (51%) and Kinder Morgan Operating L.P. “A” (“Kinder Morgan”)

(49%). The Tribe accounts for and treats its ownership interest in Red Cedar as a component of the Southern Ute Indian Tribe Growth Fund, the Tribe's business diversification division.

(2) Management structure: Under the Red Cedar Joint Venture Agreement, Red Cedar is managed by a seven-member Red Cedar Management Committee, four members of which are appointed by the Tribe, and three members of which are appointed by Kinder Morgan. Under the Joint Venture Agreement, "[a]ll determinations, decisions, approvals, and actions affecting Red Cedar and its business and affairs shall be determined, made, approved, or authorized by the Management Committee." Decisions are made by a majority vote of the Management Committee. The Red Cedar Management Committee, in turn, has hired a company president who serves as the chief operating officer of Red Cedar and who, subject to the Management Committee's control, is responsible for the management of the day-to-day business of Red Cedar.

(3) Primary business operations: Red Cedar is engaged in the business of gathering and treating natural gas within the boundaries of the Reservation and transporting the treated gas to interstate pipelines on or near the Reservation.

(4) Authority for establishing air pollution control compliance policies and day-to-day decisions regarding compliance with permitting and regulatory requirements: The Red Cedar Management Committee is empowered, under the Red Cedar Joint Venture Agreement, to establish policies including environmental compliance policies. The President and COO has the delegated authority (from the Red Cedar Management Committee) to make day-to-day decisions about Red Cedar's compliance with air pollution control permitting and compliance requirements.

(5) Budget. The Southern Ute Indian Tribe Growth Fund provides input into Red Cedar's budget (including Red Cedar's capital budget) through the Tribe's appointed representatives on the Red Cedar Management Committee. The Tribe's Growth Fund Management Committee approves the Red Cedar budget on behalf of the Tribe, and Kinder Morgan approves the Red Cedar budget on behalf of Kinder Morgan.

Red Willow findings:

(1) Ownership structure: Red Willow Production Company is owned entirely by the Tribe and is a division of the Tribe.

(2) Management structure: The Southern Ute Indian Tribal Council retains ultimate decision-making authority over Red Willow but has delegated certain decision-making authority over Red Willow to the Growth Fund Operating Director – Energy and to the president and COO of Red Willow, subject to review by the Tribe's Growth Fund Management Committee. All of the members of the Growth Fund Management Committee are appointed by the Southern Ute Indian Tribal Council.

(3) Primary business operations: Red Willow is engaged in the business of oil and gas exploration and development operations, including drilling, producing

and disposing of associated water, and producing and selling natural gas from lands within the Southern Ute Indian Reservation.

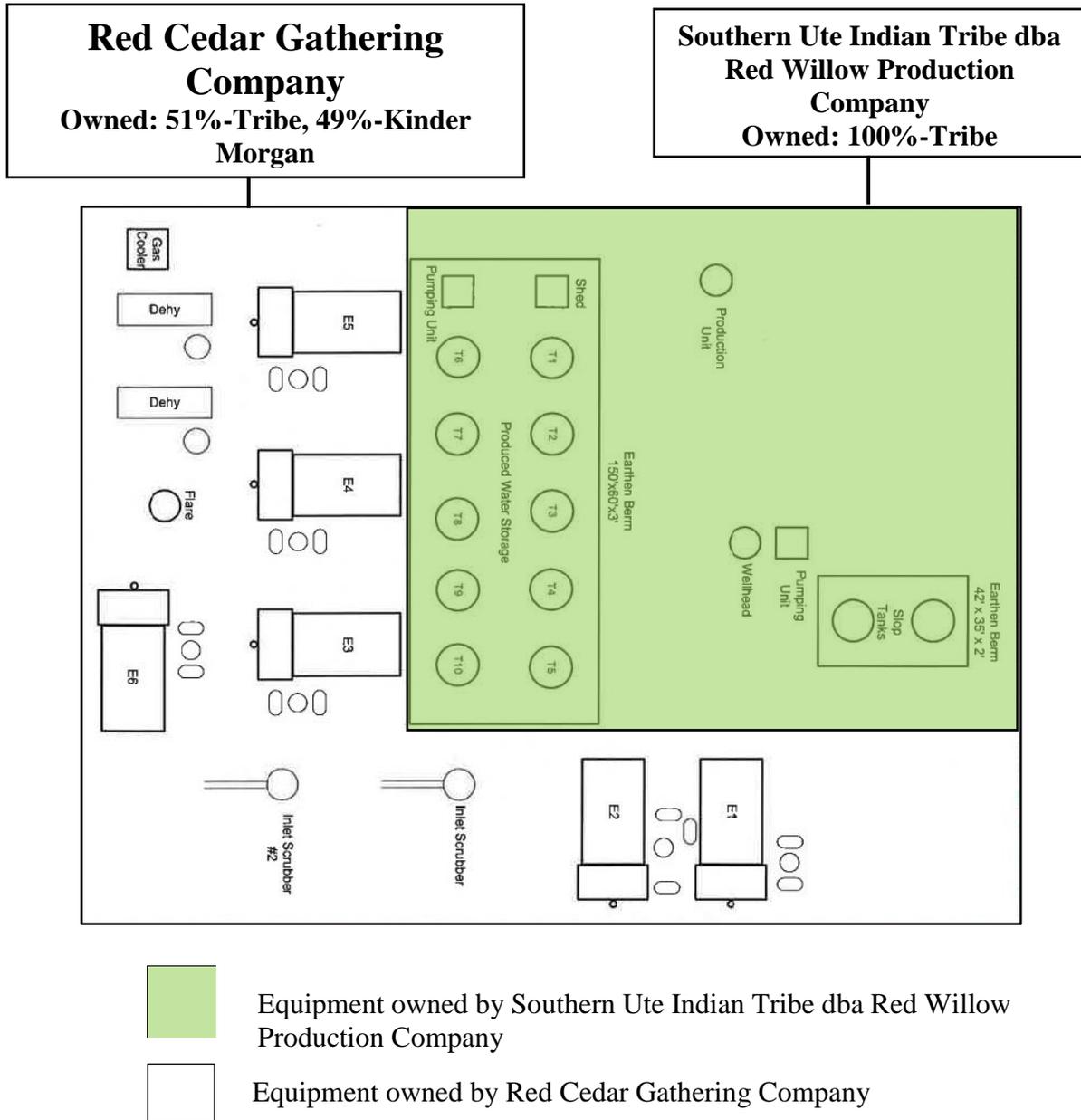
(4) Authority for establishing air pollution control compliance policies and day-to-day decisions regarding compliance with permitting and regulatory requirements: On information and belief, the Growth Fund Management Committee is empowered by the Southern Ute Indian Tribal Council to establish policies including environmental compliance policies. Red Willow's President and COO has the delegated authority to make day-to-day decisions about Red Willow's compliance with air pollution control permitting and compliance requirements.

(5) Budget. On information and belief, Red Willow's President and COO prepares Red Willow's annual budget which is subject to approval by the Growth Fund Management Committee.

Jaques Compressor Station illustration:

Based on information obtained from Red Cedar and information we obtained independently, below is an illustration of the Jaques Compressor Station:

Permitting authority: Southern Ute Indian Tribe



Unless separate management structures within commonly-owned entities is sufficient to avoid a common control designation between two emission-emitting activities, we have preliminarily determined that the Jacques Compressor Station is a single source. We do not read EPA’s interpretive letters, including its recent reinterpretation of “common control,” as endorsing owners subdividing entity management structures to show separation between two operations that are under common ownership control. In its Wisconsin Letter discussion of “entities under common control,” EPA makes that point.

Applying EPA’s guidance from the Wisconsin Letter, we believe Red Cedar has focused its analysis on the first aspect of the common control regulatory text (i.e., whether the pollutant-

emitting activities are under the control of the same person) and neglected the second aspect (i.e., whether entities that are under common control, control an activity). It is undisputed that the Southern Ute Indian Tribe is the 100% owner of Red Willow and the 51% owner of Red Cedar. As the majority owner of the venture, the Tribe holds voting control over Red Cedar's operations. For example, as conceded by Red Cedar, notwithstanding its delegation of authority for day-to-day decision-making, the Tribal Council could order Red Willow's management to take actions relative to Red Willow's compliance with air quality permits. Likewise, the Tribal Council could direct its representatives on the Red Cedar Management Committee to vote on matters that could affect Red Cedar's compliance with its air quality permits. In our view, the Tribe's majority ownership rights in Red Cedar, that can be exercised through its appointees to the Red Cedar Management Committee, give it a measure of control over Red Cedar that we can reasonably characterize as common control for Title V permitting purposes.² The entities, therefore, are under the common control of the Southern Ute Indian Tribe and together they control the pollutant-emitting activities at the Jaques Compressor Station.

We are mindful of the Meadowbrook Letter's direction that we should focus on whether one entity can expressly or effectively force another entity to take a specific air quality action, which the other entity cannot avoid through its own independent decision-making. Importantly, however, the owner of the landfill and the owner of the biogas facility discussed in the Meadowbrook letter are unaffiliated. The landfill and the biogas facility are owned by separate entities. We construe EPA's Wisconsin Letter as affirming the continued applicability of EPA's historic interpretation equating common ownership with common control. If we are misconstruing EPA's interpretation in that regard, please let us know.

We understand Red Cedar's perspective and its concern about compliance liability for the Red Willow-owned tanks, heaters, and pump engines at the Jaques Compressor Station. The lack of operational control along with potential liability for Red Willow's operations creates a very tenuous situation for Red Cedar. In recognition of Red Cedar's concern about the Air Quality Program potentially holding Red Cedar responsible for violations associated with the Red Willow-owned tanks, the Air Quality Program is inclined to offer to issue two permits for the one facility.

After analyzing Red Cedar's application in light of EPA's "common control" reinterpretation, we have preliminarily determined that it is appropriate to deny Red Cedar's administrative permit revision based on our determination that the pollutant-emitted activities at the Jaques Compressor Station meet the three single-source criteria, including that the activities are owned by entities under common control. If you advise that EPA's "common control" reinterpretation means practical operational control and EPA has done away with the overt ownership concept referenced in many previous interpretive letters, then our determination probably would be different.

VI. Conclusion

² Red Cedar asserts "[t]he Red Cedar Management Committee controls the business decisions of Red Cedar, subject to the influence of the Tribe through its designated representatives on the committee." We reject that characterization. Under EPA's interpretative letters and memoranda, including EPA's recent Wisconsin Letter, an entity's ownership interest in another entity (in at least one case, even less than a majority interest) has been viewed as a power sufficient to constitute "common control."

We have carefully analyzed Red Cedar's application in relation to EPA's recent "common control" reinterpretation and the interpretive letters EPA has issued over the years. We understand our responsibility and authority for making source determinations given that the Reservation's Title V program (adopted by the Southern Ute Indian Tribe/State of Colorado Environmental Commission and administered by the Tribe) has been approved by EPA. Based on our analysis, we have preliminarily determined that Red Cedar and Red Willow are entities under common control. Therefore, we have determined the Jaques Compressor Station should be considered a single stationary source. However, in an effort to avoid one of the inequities that led to EPA's reinterpretation of "common control" (i.e., exposing one entity (in this case, Red Cedar) to possible liability for an operation over which the entity, in practice, has little or no day-to-day control), we are inclined to determine the Jaques Compressor Station is a single source for emission aggregation purposes but issue two separate Title V permits – one to Red Cedar and one to Red Willow.

We respectfully request your review and comment on our source determination. We understand it is our responsibility to ensure that source determinations are made consistently with minimum Title V program requirements. It is our hope that by requesting your review and comment, we might better ensure we are applying the correct source determination principles and our analysis is well-reasoned and supportable.

We look forward to hearing from you.

Sincerely,



Danny Powers, Air Quality Program Manager
Southern Ute Indian Tribe

- Attachments: 1 Letter from Ethan Hinkley, Air Quality Compliance Manager, Red Cedar Gathering Company to Matt Wampler, Air Quality Scientist, Southern Ute Indian Tribe (Oct. 8, 2018)
- 2 Letter from Kyle Hunderman, Environmental Compliance II – Air Quality, Red Cedar Gathering Company to Matt Wampler, Air Quality Scientist, Southern Ute Indian Tribe (Feb. 8, 2019)
- 3 Email from Ethan Hinkley, Air Quality Compliance Manager, Red Cedar Gathering Company to Matt Wampler, Air Quality Scientist, Southern Ute Indian Tribe (April 12, 2019)

Attachment 1

to

Letter from Danny Powers, Air Quality Program Manager,
Southern Ute Indian Tribe, to Monica S. Morales, Director, Air
Program (8P-AR), U.S. Environmental Protection Agency –
Region 8 (April 22, 2019)

October 8, 2018

Matt Wampler, Air Quality Scientist
Environmental Programs Division
Southern Ute Indian Tribe
P.O. Box 737
Ignacio, CO 81137

Re: Jaques Compressor Station, #V-SUIT-0043-2015.02
Source Determination – Part 70 Operating Permit

Dear Mr. Wampler:

On August 23, 2018, Red Cedar Gathering Company submitted to the Air Quality Program (“AQP”) an administrative permit revision application to remove several insignificant emission units (“IEUs”) that have inadvertently remained listed on Jaques Compressor Station permit #V-SUIT-0043-2015.02. As part of your review of Red Cedar’s application, on September 14, 2018, you requested that Red Cedar explain why the compressor station should not continue to be considered as one major source for purposes of the Clean Air Act’s Part 70 air program. This letter responds to that request.

Background

The Jaques Compressor Station was previously owned by Samson Resources Corporation (“Samson”). In mid-November of 2016, the Southern Ute Indian Tribe (“Tribe”), doing business as Red Willow Production Company (“Red Willow”), acquired the assets of Samson located on or near the Southern Ute Indian Reservation. Because Samson was a debtor in bankruptcy proceedings pending in the U.S. Bankruptcy Court for the District of Delaware, the acquisition by Red Willow required Court approval. The Court Order approving the sale to Red Willow, entered on October 28, 2016, specifically authorized Red Willow to allocate the Assets among its affiliates and to assign, transfer or otherwise dispose of the Assets to its affiliates, designees, assignees or successors in its sole discretion. ECF Doc. 1614, Order ¶ 10, Case 15-11934-CSS (Bankr. D. Del., Oct. 28, 2016). The Samson-to-Red Willow acquisition was a large transaction involving hundreds of properties and wells, including many interests involving tribal trust lands and allotted properties.

Commencing in the spring of 2017, Red Willow entered into discussions with Red Cedar, an affiliated company, to sell certain of its Samson-acquired assets to Red Cedar. Red Willow is owned entirely by the Tribe and is a division of the Tribe; however, Red Cedar’s ownership is divided: 51% - Tribe; 49% - Kinder Morgan Operating L.P. “A”. Red Willow is engaged in the business of oil and gas exploration and development operations, including drilling, producing and disposing of associated water, and producing and selling natural gas. Red Cedar’s business relates to gathering and treating natural gas within the boundaries of the Southern Ute Indian Reservation

and transporting the treated gas to interstate pipelines on or near the Reservation. Some of the Samson-acquired assets, such as gas pipelines and compressor stations or portions of them, relate directly to Red Cedar's business. Accordingly, in compliance with the authorization included in the Bankruptcy Court's order mentioned above, on October 31, 2017, Red Willow and Red Cedar closed a sales transaction transferring certain of the Samson-acquired assets from Red Willow to Red Cedar, subject to post-closing governmental approvals, some of which are still pending.

With respect to the Jaques Compressor Station, Red Willow has sold certain permitted equipment to Red Cedar while retaining other equipment at the station needed for production operations. You have indicated that the Jaques Compressor Station, including both the Red Willow retained and Red Cedar purchased equipment, should be treated as a single major source because: 1) the sources are located within ¼ mile of each other on contiguous or adjacent properties, 2) the sources belong to the same "major industrial grouping," and 3) the sources are "under common control of the same person (or persons under common control." We agree that the first two elements of the single source determination are met, but contend that, in light of the specific circumstances, the AQP should treat the purchased equipment and the rest of the Jaques Compressor Station as separate sources.

Recent EPA Guidance

In recently reviewing the relationship of a landfill operator and the operator of a neighboring biogas processing facility, the Environmental Protection Agency ("EPA") confirmed that application of the three-part test for determining whether activities should be considered as a single source or separate sources should be undertaken "on a case-by-case basis." *See* Attachment to Letter from William L. Wehrum, Asst. Administrator U.S. EPA, to Patrick McDonnell, Secretary, Penn. Dept. of Env. Protection, 3 (April 30, 2018) ("Wehrum Letter"). As to the third element, neither the Clean Air Act nor EPA's regulations define "common control," however, in approaching the "common control" concept, EPA historically has reviewed the relative power and influence between parties in making such determinations. *Id.* (citing Memorandum from John S. Seitz, Director, OAQPS, to EPA Regional Offices, Major Source Determinations for Military Installations under the Air Toxics, New Source Review, and Title V Operating Permit Programs of the Clean Air Act, 9-10 (Aug. 2, 1996)). Factors that EPA has looked to have included, "shared workforces, shared management, shared administrative functions, shared equipment, shared intermediates or byproducts, shared pollution control responsibilities, and support/dependency relationships," in what has been characterized "the multi-factor approach."

After outlining these historical approaches, the Wehrum Letter announced new guidance to be employed in making "common control" determinations "in order to better reflect a 'common sense notion of a plant,' and to minimize the potential for entities to be held responsible for decisions of other entities over which they have no power or authority." *Id.* at 6 (emphasis added). Under the new guidance, "common control" should focus on "*the power or authority of one entity to dictate decisions of the other that could affect the applicability of, or compliance with, relevant air pollution regulatory requirements.*" *Id.* (emphasis in original). "Power" means the authority to "dictate a particular outcome," not "the mere ability to influence." *Id.* "Ultimately, the focus is not on *how* control is established (through ownership, contract, or otherwise), but on *whether* control is established—that is, whether one entity can expressly or effectively force another entity to take

a specific course of action which the other entity cannot avoid through its own independent decision-making.” *Id.* at 7. The type of “control” that is relevant is the “control over air pollution-emitting activities that trigger permitting requirements and affect compliance with those requirements.” *Id.* at 8. If “each entity has autonomy with respect to its own permitting obligations . . . such entities should be treated as separate sources,” rather than be treated as one source. *Id.*

The Tribe, Red Willow, and Red Cedar

The Tribe is organized under the Indian Reorganization Act of 1934 (“IRA”), and it conducts its activities as a constitutional government under Section 16 of the IRA. 25 U.S.C. § 5123 (formerly codified as 25 U.S.C. § 476). While certain members of the Tribe own individual Indian allotments, like many tribes, the principal assets of the Tribe are held communally and have historically centered around tribal trust lands restored to the Tribe in 1938 following the Tribe’s adoption of an IRA constitution in 1936. Unlike the Federal government or State and local governments, where individual land ownership and business activity serve as a tax base that can sustain governmental activities and services, the Tribe has always been in the position of having to exploit its communally owned assets for commercial purposes while also maintaining a regulatory role in exercise of its inherent power to protect the health and welfare of its members. In recent decades, Congress has also delegated Federal regulatory powers to the Tribe, including, for example, under the Clean Air Act.

Oil and gas development on the Reservation began in the late 1940s and early 1950s, and the Tribe received revenue from that development through mineral lease bonus compensation and lease royalties. In 1992, the Tribe used eight million dollars held by the Secretary of the Interior from water claims settlements for the Tribe’s economic development to form its wholly-owned oil and gas company, Red Willow, and to purchase mineral leasehold interests that had been created on its lands under federally approved leases. The establishment of Red Willow was a major initial step in the Tribe’s efforts to diversify economically on the Reservation.

In the summer of 1994, the Tribe joined with a financial investment company, Stephens, Inc., to purchase all of the stock of a subsidiary corporation of Public Service Company of Colorado, WestGas, Inc., which owned and operated a gas gathering and treating company on the Reservation. Following the acquisition, the ownership interests of the company, renamed Red Cedar Gathering Company, were divided and distributed 75% to a Stephens affiliate, and 25% to the Tribe. Management of Red Cedar was and remains vested in a board, known as Red Cedar Management Committee. Over time, as the Tribe’s interests in Red Cedar have grown to a 51% interest, four of the seven members of the Management Committee may be designated by the Tribe. The Red Cedar Management Committee controls the business decisions of Red Cedar, subject to the influence of the Tribe through its designated representatives on the committee. Red Cedar is the employer of its personnel, including company executive officers.

In 1999-2000, the Southern Ute Indian Tribal Council, the governing body of the Tribe, adopted a Financial Plan and a Growth Fund Implementation Plan. The purposes of the plans were to move day-to-day control of Red Willow, and future businesses, to a separate group of business managers with technical expertise and to embark on off-Reservation business diversification.

The Tribes' ownership interest in Red Cedar is accounted for and treated as a component of the Growth Fund; however, management of Red Cedar remains with the Red Cedar Management Committee. While the Tribal Council retains ultimate decision-making authority over Red Willow, substantial decision-making authority is delegated to the Growth Fund Operating Director-Energy and to the President and COO of Red Willow, subject to review by the Growth Fund Management Committee.

While business decisions for each company are directed by the respective management committees, with ultimate authority retained by the Tribal Council, it is the President and COO of each company that has the concurrent and immediate power to direct actions to the extent they affect the applicability of, and compliance with, permitting requirements (e.g., the power to direct the construction or modification of air pollution-emitting equipment, the manner in which such emission units operate, the installation or operation of pollution control equipment, and monitoring, testing, recordkeeping, and reporting obligations). Red Cedar contends that, as described above, the highest level of control over air pollution-emitting activities that trigger permitting requirements and affect compliance with those requirements for Red Cedar and Red Willow occurs at the President and COO level of each company, with influence by the Red Cedar Management Committee and Growth Fund Management Committee, respectively.

Just as the Tribal Council has the ultimate power to order the Environmental Programs Division to take particular actions, it could also order Red Willow's management to take actions relative to Red Willow's compliance with air quality permits. The Tribal Council could also direct its representatives on the Red Cedar Management Committee to vote on matters that could affect Red Cedar's compliance with its air quality permits. However, these hypothetical examples of Tribal Council control also potentially involve the Tribe ignoring the constraints inherent in EPA's delegation of air quality programs to the Tribe, the established protocols of the Growth Fund Implementation Plan, and covenants related to major credit agreements preserving the fundamental operational parameters of Red Willow and the Growth Fund. As most pertinent to the "common control" determination between Red Cedar and Red Willow, neither company has the power to direct the actions of the other to the extent that they affect the applicability of and compliance with permitting requirements. Red Cedar cannot dictate how Red Willow conducts its activities and Red Willow cannot exercise controlling authority over Red Cedar. This is further enforced by the fact that the responsible official, as defined in the Reservation Air Code, is completely separate for the two companies.

The Jacques Compressor Station

Because Red Willow and Red Cedar do not control the respective air quality compliance activities of each other, their respective activities and facilities should not be considered as the same source with respect to the Jaques Compressor Station. *See Wehrum Letter.* It should be noted that the pieces of equipment to be retained by Red Willow and removed from the Red Cedar permit, 10 produced water tanks with associated heaters and two small (<50hp) pump engines, are all IEUs, and removing them from the Title V permit would have no effect on the applicability of the Title V program or other regulations with regard to the facility or the removed equipment. The equipment in question is part of Red Willow's produced water system and is separately operated from Red Cedar's gas gathering system. It should also be noted that the gas that flows through the

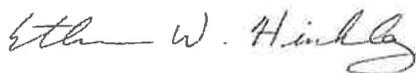
Jaques Compressor Station comes from multiple sources, including, but not limited to wells operated by Red Willow.

A determination that Red Willow and Red Cedar are ultimately under common control by the Tribe would indicate that the Title V permit should be issued to the Tribe. Having a permit issued by and issued to the Tribe has the potential to raise other significant questions about conflicting interests that are suitably unnecessary if the separate lines of control established by and maintained by the Tribal Council are honored. The relationships involved in this case are unique to the Tribe and should be considered as part of the cases-by-case review contemplated by EPA. It is in the best interests of the Environmental Commission's Part 70 Operating Permits Program and the Tribe to continue to recognize the current autonomy of Red Cedar and Red Willow to make independent decisions that affect the applicability of and compliance with relevant air pollution regulatory requirements.

Should you have any questions or need additional information, please do not hesitate to contact me at (970) 764-6495 or, Kyle Hunderman at (970) 764-6921.

Sincerely,

Red Cedar Gathering Company



Ethan Hinkley
Air Quality Compliance Manager

Attachment 2

to

Letter from Danny Powers, Air Quality Program Manager,
Southern Ute Indian Tribe, to Monica S. Morales, Director, Air
Program (8P-AR), U.S. Environmental Protection Agency –
Region 8 (April 22, 2019)

February 8, 2019

Matt Wampler
Air Quality Scientist
Environmental Programs Division
Southern Ute Indian Tribe
P.O. Box 737
Ignacio, CO 81137

Via email: mwampler@southernute-nsn.gov

**Re: Jaques Compressor Station, #V-SUIT-0043-2015.02, Source Determination –
Part 70 Operating Permit – Response to Request for Additional Information**

Dear Mr. Wampler:

This letter responds to your written request of October 31, 2018 to Red Cedar Gathering Company for additional information to be used in your consideration of Red Cedar's request to remove several insignificant emissions units ("IEUs") from the scope of Red Cedar's Title V operating permit for the Jaques Compressor Station. The IEUs acquired by Red Willow Production Company from Samson Resources Corporation ("Samson") are owned and operated by Red Willow, a wholly owned division of the Southern Ute Indian Tribe ("Tribe"). Samson, the former permittee and operator of the Jaques Compressor Station, was involved in both initial gathering activities and production activities, including producing and disposing of water coming from wells served by the Jaques Compressor Station. Shortly after acquiring the Samson assets, Red Willow transferred those Samson assets related to gathering activities to Red Cedar, but Red Willow retained the assets related to production activities, including the produced water storage tanks and heaters and pump engines used in water production and disposal over which Red Cedar has no operational control. Because Red Cedar has no operational control over the water production and disposal undertaken by Red Willow, Red Cedar submitted its request on August 23, 2018, to remove the IEUs from the scope of its Part 70 operating permit for the Jaques Compressor Station.

Summary of Status

To quickly summarize the status of this pending matter, after receiving Red Cedar's request for removal on August 23, 2018, you made several requests for additional information. On September 4, 2018, you requested that Red Cedar explain in more detail why the IEUs should not continue to be considered as part of one major source. By letter of October 8, 2018, Red Cedar provided the requested justification, which, in addition to outlining the different histories and governance structures of Red Cedar and Red Willow, also addressed the critical element at issue in case-by-case source determinations of this nature, i.e. "common control."

By letter dated October 31, 2018, you asked Red Cedar to supply a broad compilation of additional information identified in 11 separate categories. At the outset, we appreciate your

acknowledgment that the scope of additional information requested is sizeable as well as your extension of the due date for its production until February 15, 2019. As you know, in the course of assembling the information, Red Cedar has become increasingly concerned about the serious business injury it could suffer from the disclosure of the information it is producing that we feel should be protected from subsequent disclosure by the Tribe's Air Quality Program ("AQP") under the standards established under 5 U.S.C. § 552(b)(4), 18 U.S.C. § 1905, and 40 C.F.R. Chapter I, Subchapter A, Part 2, Subparts A and B, all of which are incorporated directly or indirectly in the confidentiality provisions of Section 2-124 of the Tribe's Reservation Air Code. If AQP submits this information to EPA for guidance, we respectfully request that you provide us prior notice so that we may prepare a formal confidentiality claim to EPA.

At our meeting of December 19, 2018, representatives of Red Cedar and the AQP had a preliminary opportunity to examine documents assembled by Red Cedar and to discuss the sensitive nature of information contained in those documents, at least some of which also include express confidentiality provisions. Of particular sensitivity, Red Cedar expressed concern about potential disclosure of gathering agreements and provisions describing volume amounts and treatment commitments, pricing information, and maps or descriptions of its gathering and treatment system. Information of this nature, if disclosed to competitors or potential competitors, could undermine Red Cedar's business. Importantly, that same information is of no direct relevance to the common control analysis currently being undertaken by AQP. As an interim way for proceeding, and without waiving AQP's right to request additional information, you agreed that Red Cedar could redact sensitive, non-related information from the materials submitted to the AQP, but would make available for your inspection the unredacted materials. If AQP subsequently requests delivery of redacted information, however, Red Cedar reserves the right to submit such information under a formal claim of confidentiality. We greatly appreciate your efforts in working with Red Cedar on the confidentiality issues. To be clear, the documents transmitted with this response that are marked as confidential are being submitted under a formal claim of confidentiality.

Information Produced

Attached to this letter you will find information responsive to each of your numbered requests. The information has been Bates-numbered, and a description of each document is set forth in each response.

Request 1) *A copy of the Red Cedar joint venture agreement. This will assist us in evaluating the extent to which, from an ownership and organizational structure perspective, the Southern Ute Indian Tribe has the power or authority to dictate the decisions of Red Cedar, including but not limited to dictating the outcome of decisions regarding relevant air pollution control-related aspects of Red Cedar's operations.*

Response 1:

Documents produced:

1.a. Joint Venture Agreement Red Cedar Gathering Company KN Gas Gathering, Inc. and The Southern Ute Indian Tribe dated March 30, 1998. Bates Nos. 001-025.

1.b. Agreement with Attachment “A” Amendment No. 1 to Joint Venture Agreement dated August 20, 2003. Bates Nos. 026-033.

1.c. Amendment [Second Amendment] to Joint Venture Agreement of Red Cedar Gathering Company dated August 2, 2016. Bates Nos. 034-035.

Comments: As set forth in Section 7.1 of the Joint Venture Agreement, “[a]ll determinations, decisions, approvals, and actions affecting Red Cedar and its business and affairs shall be determined, made, approved, authorized by the Management Committee.” The Management Committee is a seven-member Management Committee. Four of the committee members are to be appointed by the Tribe, and three committee members are to be appointed by Kinder Morgan Operating, L.P. “A,” the successor to KN Gas Gathering, Inc.

Request 2) *Information pertaining to the processes for approval and management of Red Cedar’s capital budget, capital costs, and capital expenditures (e.g., what is the process for approval of Red Cedar’s capital budget, capital costs, and capital expenditures). Specifically, who approves Red Cedar’s purchases and budgets? What roles do the Southern Ute Indian Tribal Council, the Red Cedar Management Committee, the President of Red Cedar, and other persons or entities play in those processes?*

Response 2:

Documents produced:

2.a. Delegation of Authority Tables, Red Cedar Gathering, 2018. Bates Nos. 036-037.

Comments: Annual budget preparation is conducted by the President of Red Cedar, with input from Red Cedar staff and each of the partners. Kinder Morgan Operating, L.P., is a subsidiary of the parent Kinder Morgan organization, which provides direction through its Management Committee representatives. On the Tribe’s side, interests in Red Cedar fall under the control of the Southern Ute Indian Tribe Growth Fund (“Growth Fund”), a division of the Tribe established in 2000 to oversee commercial diversification for the Tribe. The Growth Fund provides input to Red Cedar’s budget through the Tribe’s appointed representatives on the Red Cedar Management Committee. The Growth Fund has its own Management Committee, appointed by the Southern Ute Indian Tribal Council. The Growth Fund Management Committee is authorized to develop and approve annual budgets, inclusive of capital expenditures, for its divisions, subsidiaries and affiliates, without the requirement of approval of the Southern Ute Indian Tribal Council. The Growth Fund Management Committee ultimately approves the Red Cedar budget on behalf of the Tribe, and Kinder Morgan ultimately approves the Red Cedar

budget on behalf of Kinder Morgan Operating, L.P. "A." Any specific expenditures within the budget related to air quality and emission controls are approved according to Red Cedar's Delegation of Authority Matrix. Any capital expenditures, in excess of the maximum limits in the Delegation of Authority Matrix, require approval by the Red Cedar Management Committee. To reiterate, however, the Tribal Council does not approve either the Red Cedar or the Red Willow budget.

Request 3) *The surface land ownership status (e.g., tribal trust, tribal fee, private, federal) of the land on which the Jaques Compressor Station is located.*

Response 3: The property on which the Jaques Compressor Station and the IEUs are located is privately owned. To the best of our knowledge, neither the Tribe nor the United States has any ownership interest in the surface of the land on which the compressor station is located.

Request 4) *A copy of any lease and rights-of-way between Red Cedar and the landowner for use of the landowner's property for the Jaques Compressor Station, including any attachments and stipulations, including any environmental compliance stipulations. This will assist us in evaluating the extent to which, from a lessor and lessee perspective, the Southern Ute Indian Tribe has the power or authority to dictate the decisions of Red Cedar.*

Response 4:

Documents produced:

4.a. Compressor Site Contract, Cordy M. Jaques, et. al. and SG Interests, April 1, 1997. Bates Nos. 038-041.

4.b. Amendment to Compressor Site Agreement, Cordy M. Jaques, et. al. and SG Interests, October 11, 2002. Bates Nos. 042-043.

4.c. Compressor Site Contract, Danny R. and Barbara L. Jaques and SG Interests, June 17, 2005. Bates Nos. 044-048.

Comments: In view of the fact that the Tribe does not own the land on which the Jaques Compressor Station is located, the Tribe has no role as a landowner in controlling the activities at that location. However, the Tribe is not just a landowner; it is also a governmental authority with significant legislative, regulatory, adjudicatory powers within the Southern Ute Indian Reservation ("Reservation"). The scope of the Tribe's regulatory authority within the Reservation is complex, as reflected in the law passed by Congress in 1984 defining the Reservation boundaries and allocating jurisdiction based on the ownership of land on which activities occur and on the Indian/non-Indian status of the actors. See Act of May 21, 1984, Pub. L. No. 98-290, 98 Stat. 201. In its governmental role, the Tribe arguably possesses extensive regulatory control over both Red Willow and Red Cedar on both Indian land and non-Indian land within the Reservation. In evaluating "common control" for purposes of source determinations,

however, we are not aware of any instance in which the governmental regulatory power to set standards for conduct has been equated with the proprietary control over the specific decisions on how and whether to comply with those governmental standards. We believe it is the power to dictate how and whether to comply with governmental standards—not just in a remote theoretical sense, but in the normal course of conduct of the regulated party—that is the relevant point of inquiry. See Attachment to Letter from William L. Wehrum, Asst. Administrator U.S. EPA, to Patrick McDonnell, Secretary, Penn. Dept of Env. Protection (April 30, 2018). To hold otherwise would elevate the Tribe to a “control” position over all actors subject to its governmental jurisdiction, and would also have significant federal policy implications related to the economic development of Indian tribes through commercial divisions and subsidiaries with subordinate day-to-day governance authority. Accordingly, even if the Tribe has the power to affect conduct through exercise of its regulatory powers, we do not believe that such regulatory power should factor into the “common control” analysis unless the Tribe has also demonstrated direct control over the compliance decisions of its commercial divisions, subsidiaries, and affiliates. In other words, we do not believe that the existence of the Tribe’s Air Quality Program and its implementation of a Title V Program should be deemed as negating the actual control of Red Cedar over its compliance with “relevant air pollution regulatory requirements.” *Id.* at 6.

Request 5) *A copy of any lease and rights-of-way between Red Willow and the landowner for use of the landowner’s property for the emission units for which Red Willow retained ownership.*

Response 5: Red Cedar’s right to own and operate its assets located at the Jaques Compressor Station is derived from the assignment of certain rights and interests under the documents produced in response to Request 4. It is our understanding that Red Willow’s use of the land owners property for the emission units was reserved by Red Willow in the assignments to Red Cedar under the Purchase and Sale Agreement between the Southern Ute Indian Tribe, d/b/a/ Red Willow Production Company (Seller) and Red Cedar Gathering Company (Buyer) dated as of October 31, 2017 (Bates Nos. 154-308) produced in response to Request 7.

Request 6) *A copy of any current contracts or agreements, formal or informal, between Red Cedar and Red Willow, including but not limited to agreements pertaining to the removal or storage of produced water and maintenance of engines and equipment related to but not limited to ownership or operation of all or parts of the Jaques Compressor Station. This will assist us in evaluating the extent to which, from a contractual perspective, the Southern Ute Indian Tribe has the power or authority to dictate the decisions of Red Cedar.*

Response 6:

Documents produced:

6.a. Firm Gas Gathering, Compression and Treating Agreement, Red Cedar Gathering and SG Interests, May 1, 2009. Bates Nos. 049-078 (Confidential).

- 6.b.** Amendment to Firm Gas Gathering, Compression and Treating Agreement, Red Cedar Gathering and Samson Resources, October 1, 2011. Bates Nos. 079-079 (Confidential).
- 6.c.** Amendment to Firm Gas Gathering, Compression and Treating Agreement, Red Cedar Gathering and Samson Resources, January 1, 2012. Bates Nos. 080-081 (Confidential).
- 6.d.** Miscellaneous Work or Service Agreement, Red Cedar Gathering and Red Willow Production, October 11, 2016. Bates Nos. 082-095 (Confidential).
- 6.e.** Midway Valve High Pressure CDP Interconnect Agreement, Red Cedar Gathering and Samson Resources, July 1, 2008. Bates Nos. 096-100 (Confidential).
- 6.f.** Midway Valve High Pressure CDP Interconnect Agreement, Red Cedar Gathering and Samson Resources, June 6, 2011. Bates Nos. 101-101 (Confidential).
- 6.g.** Trail Canyon CDP Interconnect Agreement, Red Cedar Gathering and Samson Resources, October 6, 2011. Bates Nos. 102-105 (Confidential).
- 6.h.** Consent to Assign, Red Cedar Gathering and Samson Resources, October 24, 2016. Bates Nos. 106-107 (Confidential).
- 6.i.** South Ignacio Gathering System Operating Agreement, Red Cedar Gathering and Red Willow Production, November 15, 2016. Bates Nos. 108-123 (Confidential).
- 6.j.** First Amendment to South Ignacio Gathering System Operating Agreement, Red Cedar Gathering and Red Willow Production, March 9, 2017. Bates Nos. 124-124 (Confidential).
- 6.k.** Second Amendment to South Ignacio Gathering System Operating Agreement, Red Cedar Gathering and Red Willow Production, September 27, 2017. Bates Nos. 125-126 (Confidential).
- 6.l.** Third Amendment to South Ignacio Gathering System Operating Agreement, Red Cedar Gathering and Red Willow Production, November 20, 2017. Bates Nos. 127-148 (Confidential).
- 6.m.** Letter Agreement (addition of Maralex Resources, Red Cedar Gathering and Red Willow Production, May 1, 2009. Bates Nos. 149-149 (Confidential).
- 6.n.** Midstream Term Sheet, Red Cedar Gathering and Red Willow Production, June 13, 2017. Bates Nos. 150-153 (Confidential).

Comments:

a. Confidentiality Concerns – As set forth above in the Summary of Status, Red Cedar reiterates its concern for maintaining the confidentiality of its business agreements with any producer for whom it conducts services. The natural gas treating and gathering business is extremely competitive, and the information available in the agreements between Red Cedar and Red Willow, as one the producers for whom Red Cedar provides services, is extremely sensitive. For that reason, the interim process for protecting information, including but not limited to rates, fees, volumes, dedicated areas, and durational terms has been redacted, subject to the conditions and access described above. As previously indicated in this letter, in those cases in which a contract contains an express confidentiality provision, we are submitting that contract under a formal claim of confidentiality as identified after the Bates number.

b. Purpose – Red Cedar reiterates its comments in Response 4, above. We do not believe that these contracts are probative of the “Southern Ute Indian Tribe[‘s] . . . power or authority to dictate the decisions of Red Cedar” related to applicability or compliance with the relevant air pollution regulatory requirements.

Request 7) *A copy of the purchase and sale agreement between Red Willow and Red Cedar under which Red Cedar purchased the Jaques Compressor Station from Red Willow and Red Willow retained ownership of certain emission units.*

Response 7:**Documents produced:**

7.a. Purchase and Sale Agreement between the Southern Ute Indian Tribe, d/b/a/ Red Willow Production Company (Seller) and Red Cedar Gathering Company (Buyer) dated as of October 31, 2017. Bates Nos. 154-308 (Confidential).

Request 8) *A copy of any and all Southern Ute Indian Tribal Council resolutions, Red Cedar Management Committee resolutions, and Southern Ute Indian Tribe Growth Fund Management Committee resolutions related to Red Cedar’s acquisition of the Jaques Compressor Station and the retention of ownership of certain emission units by Red Willow.*

Response 8:**Documents produced:**

8.a. Southern Ute Indian Tribal Council Resolution No. 2017-121 (June 27, 2017) including as attachments the Red Cedar Management Committee Resolution with Term Sheet (Aug. 3, 2012) and the Growth Fund Management

Committee Memo recommending Tribal Council approval of Red Willow asset sale to Red Cedar (June 27, 2017). Bates Nos. 309-324 (Confidential).

Comments: The Tribe's Financial Plan and Growth Fund Implementation Plan, while delegating substantial day-to-day responsibility over operations and activities to the Growth Fund Directors, the Growth Fund Management Committee, and affiliated companies, still requires Tribal Council approval of sales of assets within the Growth Fund that exceed specific materiality thresholds. Accordingly, the Growth Fund Management Committee's recommendation to proceed with this transaction on behalf of Red Willow was subject to the Tribal Council's approval as set forth in Tribal Council Resolution No. 2017-121.

Request 9) *Information pertaining to the extent to which Red Cedar shares work forces, shares management, shares administrative functions, shares equipment, shares intermediates or byproducts, shares or collaborates on pollution control responsibilities, and the extent to which Red Cedar and Red Willow depend on and support each other.*

Response 9: Red Cedar and Red Willow do not directly share services or functions; however, they each obtain similar services from other divisions of the Tribe. For example, they both obtain information technology support from Southern Ute Shared Services. They also rely upon the Growth Fund's Human Resources Department in administering each of their separate human resources policies and compliance with applicable laws and regulations. Additionally, the Southern Ute Indian Tribe's Payroll Department provides payroll services to each. Management of each company is separate from the president level down, with oversight from the Growth Fund Management Committee. There are no shared work forces, shared equipment, shared intermediate products or byproducts, or shared pollution control equipment or responsibilities.

Request 10) *Information pertaining to the extent to which Red Cedar is supported by and works with the Southern Ute Indian Tribe Growth Fund's Safety and Environmental Compliance Management Group.*

Response 10: Red Cedar utilizes the services provided by the Safety and Environmental Compliance Management Group ("SECMG"), a department within the Growth Fund. These services include:

- Periodic compliance audits of facilities
- Assistance with compliance activities as requested (completing draft reports, gathering data, developing draft compliance plans, etc.)
- Development of draft policies, guidelines, and standard operating procedures for consideration and use by Red Cedar as requested
- Providing regulatory and compliance updates

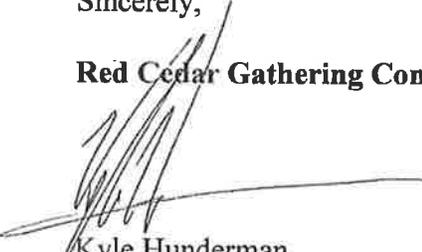
Request 11) *Information pertaining to the extent to which Red Cedar is economically or operationally interconnected or mutually dependent on Red Willow through contracts or other business arrangements.*

Response 11: Other than through established contractual relationships (see Response 6) Red Cedar is not economically or operationally interconnected or mutually dependent on Red Willow.

We hope that the information provided in conjunction with this letter is helpful in granting Red Cedar's request. Should you have any questions or need additional information, please do not hesitate to contact me at (970) 764-6921.

Sincerely,

Red Cedar Gathering Company



Kyle Hunderman
Environmental Compliance II – Air Quality

Attachment 3

to

Letter from Danny Powers, Air Quality Program Manager,
Southern Ute Indian Tribe, to Monica S. Morales, Director, Air
Program (8P-AR), U.S. Environmental Protection Agency –
Region 8 (April 22, 2019)

Sam W Maynes

From: Hinkley, Ethan <Ehinkley@redcedargathering.com>
Sent: Friday, April 12, 2019 3:52 PM
To: Wampler, Matt
Cc: Hunderman, Kyle; Powers, Daniel; Sam W Maynes
Subject: FW: Request for Additional Information - Red Cedar Gathering Company - Jaques Compressor Station
Attachments: JAQ_PFD_water.pdf; JAQ_PFD_GAS.pdf

Matt,

Below are responses to your questions, along with simplified process flow diagrams. We are still working on verifying some of this information, as there were no detailed process flow or P&ID diagrams from Samson. If we find any additional or updated information we will send it to you as soon as possible.

If you have any questions, please do not hesitate to give us a call.

Thanks,

Ethan Hinkley

Air Quality Compliance Manager



Office: (970) 764-6495

Cell: (970) 759-9891

Email: ehinkley@redcedargathering.com

- 1) Please provide information explaining any physical and operational connectivity between Red Cedar's separation, compression, and dehydration equipment at the Jaques Compressor Station with any of Red Willow's equipment, including the produced water collection system.
Physical or operational connectivity between Red Cedar's Jaques Compressor Station and Red Willow's co-located water transfer facility is limited to the direction of fuel gas, for tank heaters, and produced water, from the inlet separators, to the water transfer facility (needs confirmation). The use of Red Willow's produced water tanks for disposal of Red Cedar's water at this facility is part of the contractual agreement between the two companies.
 - a. If available, please provide a detailed process flow diagram to support this request
Red Cedar does not have a detailed process flow diagram for Jaques Compressor Station but is providing the attached simplified water and gas process flow diagrams.
- 2) Please affirm if Red Cedar uses Red Willow's produced water storage tanks for disposal of water from Red Cedar's operations at Jaques Compressor Station.
Yes, the water from the inlet separators is stored in the water transfer facility tanks.
 - a. If not, please explain how Red Cedar disposes of produced water at Jaques Compressor Station.

Thanks,

~Kyle

From: Wampler, Matt <mwampler@southernute-nsn.gov>
Sent: Friday, March 29, 2019 12:15 PM
To: Hinkley, Ethan <ehinkley@redcedargathering.com>
Cc: Hayes, Oakley <ohayes@southernute-nsn.gov>; Hunderman, Kyle <khunderman@redcedargathering.com>
Subject: Request for Additional Information - Red Cedar Gathering Company - Jaques Compressor Station

Mr. Hinkley,

On August 23, 2018, the AQP requested additional information from Red Cedar following an administrative permit revision request from Red Cedar to remove insignificant emission units from the Title V Operating Permit for Jaques Compressor Station. On October 31, 2018, the AQP sent a letter to Red Cedar requesting additional information in order to make a source aggregation determination. Red Cedar completed that request on February 8, 2019. The AQP is currently reviewing the information to make a source aggregation determination. The AQP plans to request EPA review and comment of the determination prior to taking final action.

The AQP is requesting additional information to support Red Cedar's response to item #11 of the AQP's October 31, 2018 letter. Item # 11 of the letter requested Red Cedar provide: "Information pertaining to the extent to which Red Cedar is economically or operationally interconnected or mutually dependent on Red Willow through contracts or other business arrangement ." Red Cedar stated in their response: "Other than through established contractual relationships (see Response 6) Red Cedar is not economically or operationally interconnected or mutually dependent on Red Willow."

Please provide information explaining any physical and operational connectivity between Red Cedar's separation, compression, and dehydration equipment at the Jaques Compressor Station with any of Red Willow's equipment, including the produced water collection system. If available, please provide a detailed process flow diagram to support this request. Secondly, please affirm if Red Cedar uses Red Willow's produced water storage tanks for disposal of water from Red Cedar's operations at Jaques Compressor Station. If not, please explain how Red Cedar disposes of produced water at Jaques Compressor Station.

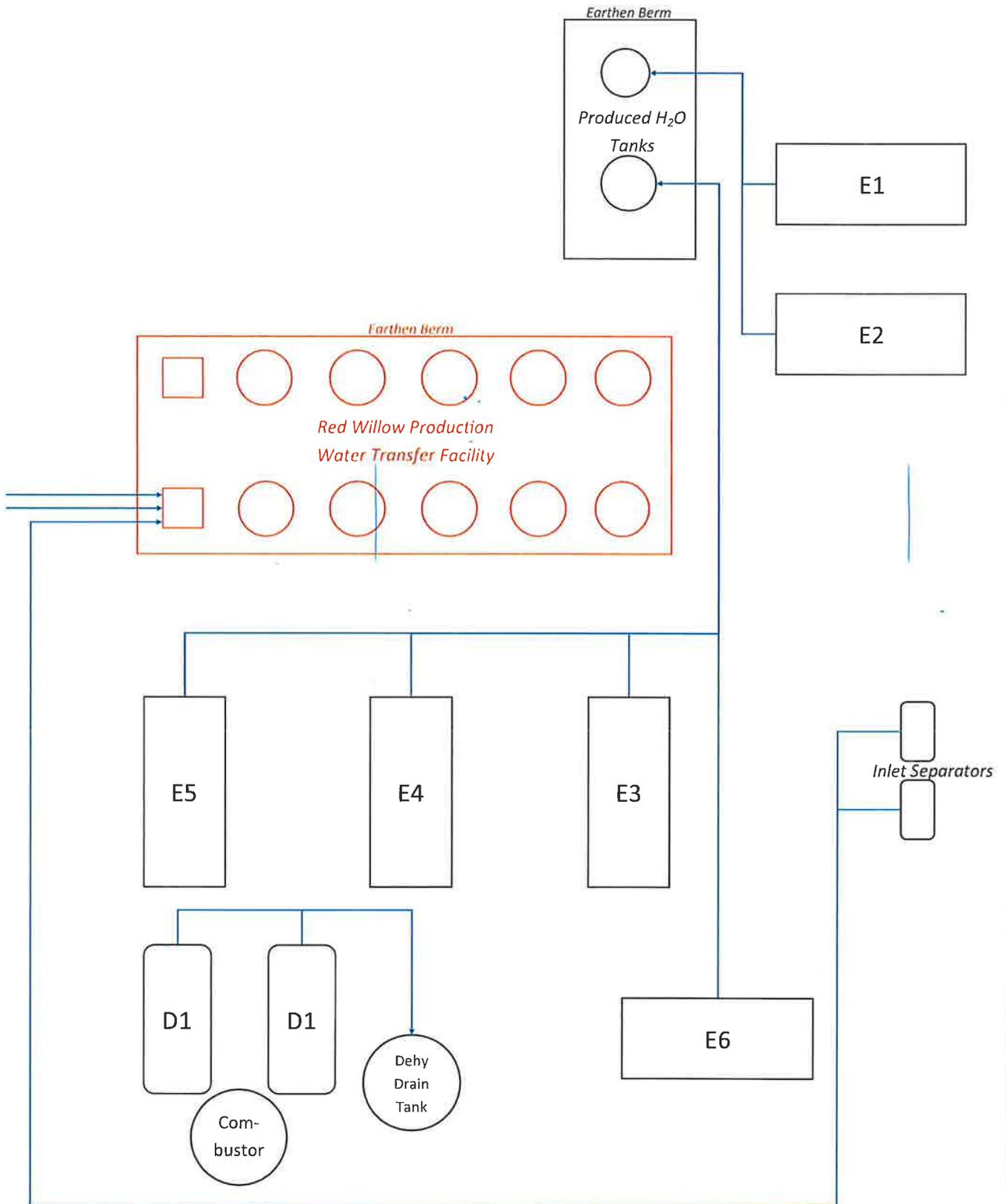
Please supply the requested information by **April 12, 2019**. If you have any questions or if this is not a reasonable amount of time, feel free to contact me.

Thank you,

Matt Wampler
Air Quality Scientist
Environmental Programs Division
Southern Ute Indian Tribe
Phone: (970) 563-2202
Fax: (970) 563-0384



Red Cedar Gathering Company: Jaques Compressor Station Simplified Process Flow Diagram, Produced Water



Red Cedar Gathering Company: Jaques Compressor Station Simplified Process Flow Diagram, Natural Gas

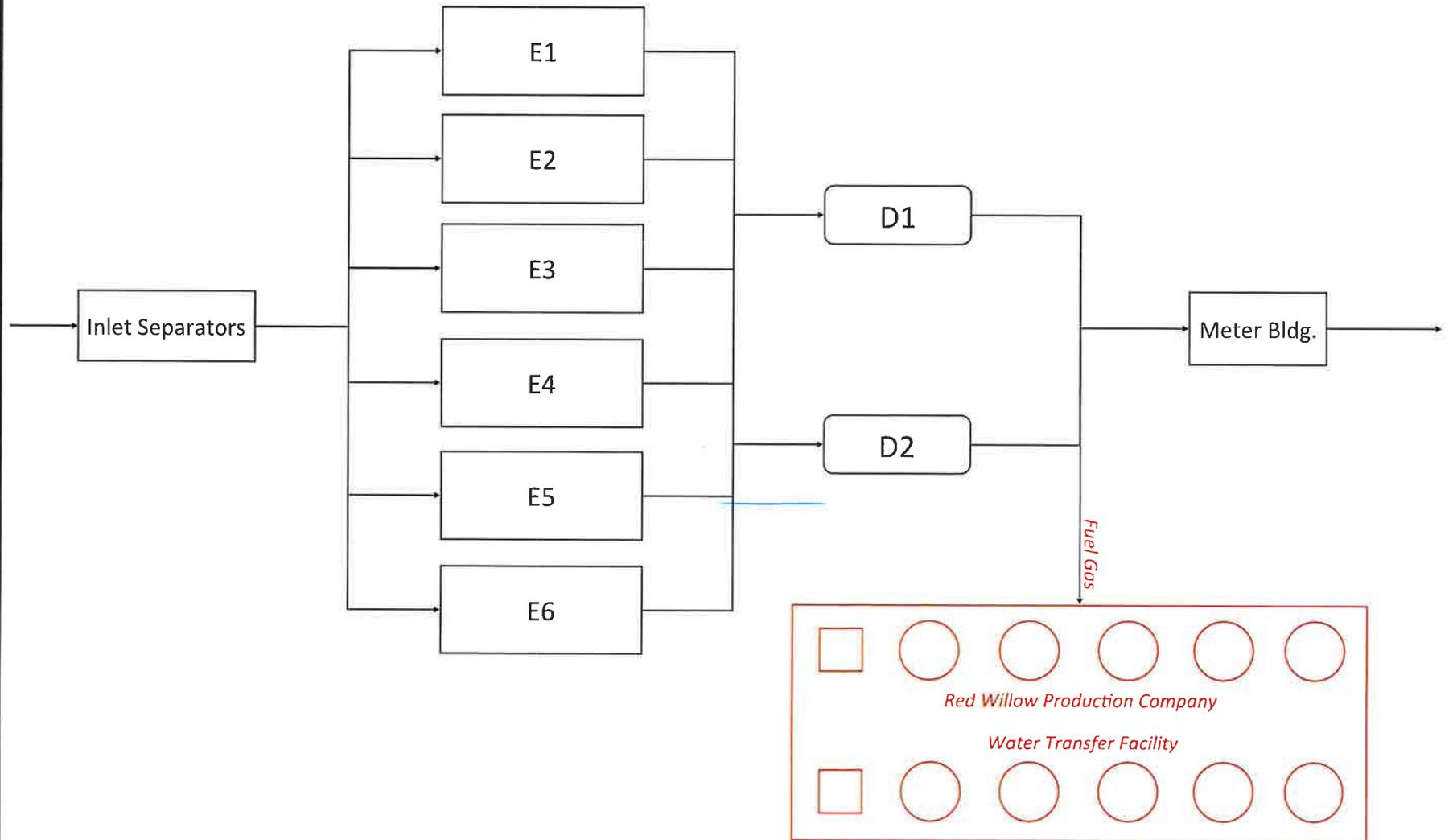


Exhibit 6

Align RNG Grady Road Project Biogas Pipeline and Potentially Connected Hog Operations

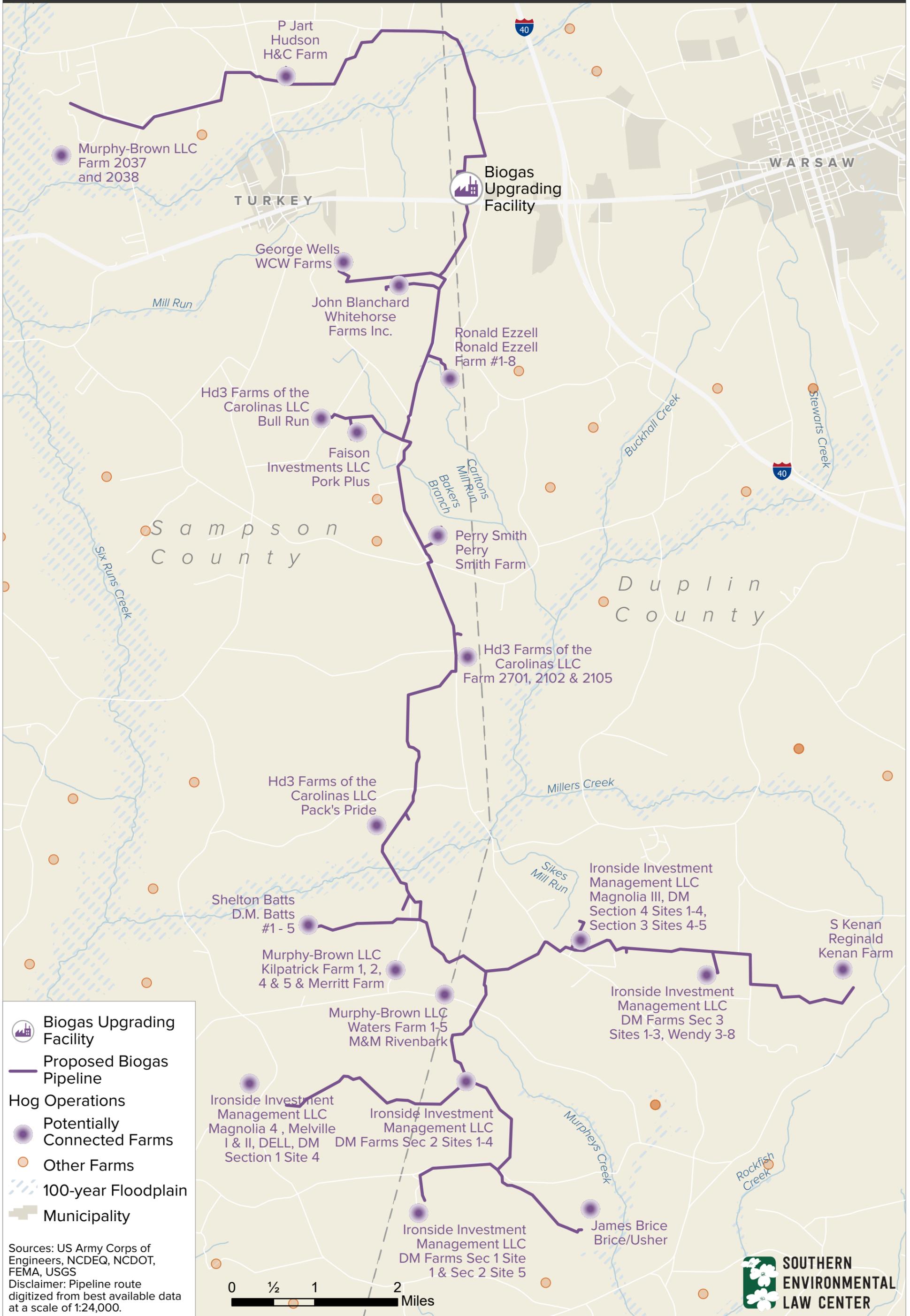


Exhibit 7

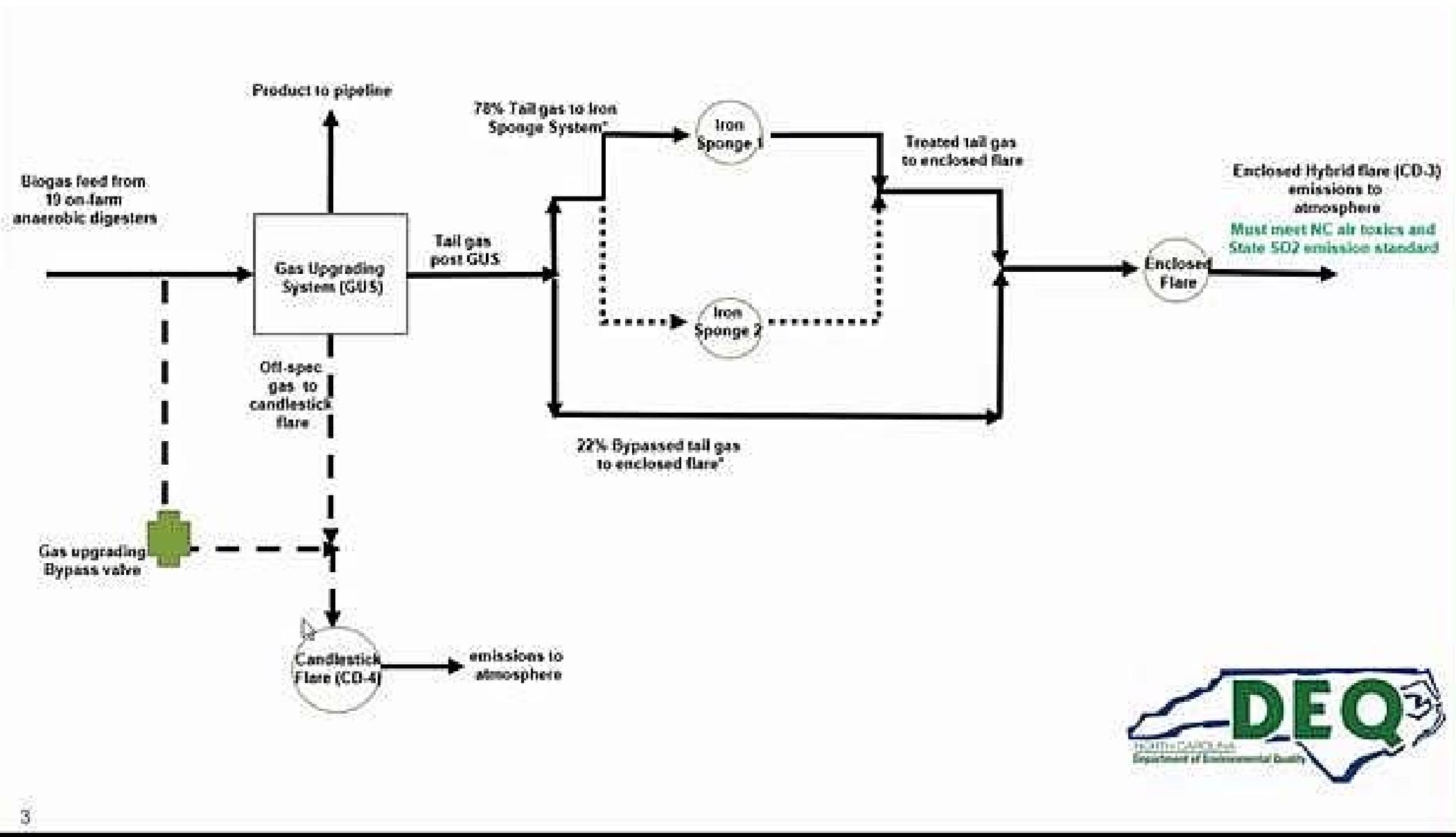


Exhibit 8

Mortality and Health Outcomes in North Carolina Communities Located in Close Proximity to Hog Concentrated Animal Feeding Operations

Julia Kravchenko, Sung Han Rhew, Igor Akushevich, Pankaj Agarwal, H. Kim Lyerly

BACKGROUND Life expectancy in southeastern North Carolina communities located in an area with multiple concentrated animal feeding operations (CAFOs) after adjusting for socioeconomic factors remains low. We hypothesized that poor health outcomes in this region may be due to converging demographic, socioeconomic, behavioral, and access-to-care factors and are influenced by the presence of hog CAFOs.

METHODS We studied mortality, hospital admissions, and emergency department (ED) usage for health conditions potentially associated with hog CAFOs—*anemia, kidney disease, infectious diseases, and low birth weight (LBW)*—in North Carolina communities located in zip codes with hog CAFOs (Study group 1), in zip codes with > 215 hogs/km² (Study group 2), and without hog CAFOs (Control group). We compared cause-specific age-adjusted rates, the odds ratios (ORs) of events in multivariable analyses (adjusted for 6 co-factors), and the changes of ORs relative to the distance to hog CAFOs.

RESULTS Residents from Study groups 1 and 2 had higher rates of all-cause mortality, infant mortality, mortality of patients with multimorbidity, mortality from *anemia, kidney disease, tuberculosis, and septicemia*, and higher rates of ED visits and hospital admissions for LBW infants than the residents in the Control group. In zip codes with > 215 hogs/km², mortality ORs were 1.50 for *anemia* ($P < 0.0001$), 1.31 for *kidney disease* ($P < 0.0001$), 2.30 for *septicemia* ($P < 0.0001$), and 2.22 for *tuberculosis* ($P = 0.0061$).

LIMITATIONS This study included a lack of individual measurements on environmental contaminants, biomarkers of exposures and co-factors, and differences in residential and occupational locations.

CONCLUSION 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.

Among North Carolina communities, including both high-income and low-income communities, the lowest life expectancy was observed in southeastern North Carolina [1]. Higher risks of chronic kidney disease and low birth weight (LBW) infants have also been reported for this region [2, 3]. These geographic variations in life expectancy and health outcomes have been suggested to correlate with region-specific health behaviors, access to care, and environmental characteristics [1]. One unique environmental characteristic of southeastern North Carolina is the presence of multiple hog concentrated animal feeding operations (CAFOs) [4]. The average number of hogs per farm in North Carolina is much higher than in the areas with hog CAFOs in 2 other US leaders in hog industry—the states of Iowa and Minnesota. Because the population density in southeastern North Carolina is substantially higher than in the areas with hog CAFOs in Iowa and Minnesota, the population of the communities adjacent to hog CAFOs is much greater. Consequently, the proximity of multiple high-density hog CAFOs to a large population makes this region uniquely suited to studying the potential impact of CAFOs on environment and human health.

Previous studies of the potential relationship between health and hog CAFOs were mostly focused on the occupational health risks among CAFO workers [3, 5, 6]. The residents living in close proximity to hog CAFOs may also be at risk as they are chronically exposed to contaminants from land-applied wastes and their overland flows, leaking lagoons, and pit-buried carcasses, as well as airborne emissions, resulting in higher risks of certain diseases [3, 6, 7-20]. In fact, previous survey based studies of residential communities reported significant health risks for residents, including higher risks of bacterial infections, higher frequencies of symptoms of respiratory and neurological disorders, and depression [3, 6, 7, 12, 14, 19, 20-22].

We identified the established health conditions and indicators that were previously used to evaluate community health, including the known medical conditions associated

Electronically published September 10, 2018.

Address correspondence to Julia Kravchenko, DUMC 2850, Durham, NC 27710 (Julia.krauchanka@duke.edu).

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with occupational or residential exposure to CAFOs. These included an increased risk of anemia and kidney disease (which may serve as an indicator of chronic exposure to toxins) [23-26], miscarriage [27], and LBW infants (which may serve as an indicator of maternal and fetal health) [2]. In addition, a higher prevalence and broader spectrum of antibiotic-resistant microorganisms in areas adjacent to hog CAFOs [28-30] has raised concerns about infections in both occupational and residential settings [31]. Therefore, the outcomes of anemia and kidney disease, acute infection (septicemia) and chronic communicable infection (tuberculosis), and LBW infants were analyzed as indicators of health in communities adjacent to hog CAFOs.

We focused our study on assessing the outcomes of these specific disorders in residential communities in southeastern North Carolina. Our objective was to determine whether, or to what extent, poor health outcomes are associated with the additional impact of hog CAFOs beyond disparities associated with demographics, socioeconomic characteristics, behavioral risks factors, or access to medical care. Furthermore, these health conditions served as potential opportunities for interventions if the determined health outcomes were poor.

Materials and Methods

Data. Data on disease-specific mortality were obtained from a publicly available data source at the State Center for Health Statistics for 2007-2013 [32]. Data on emergency department (ED) visits and hospital admissions were obtained from the Healthcare Cost and Utilization Project's (HCUP) State Emergency Department Database (SEDD) [33] and State Inpatient Database (SID) [34] for 2007-2013. The North Carolina analysis represents part of the larger study on health outcomes in the communities adjacent to hog CAFOs that includes other US states with commercial hog production (eg, Iowa and Minnesota). Therefore, we used the HCUP's state-specific database containing the data in a uniform format facilitating multi-state comparisons and analyses of geographic patterns and time trends in health care utilization, access, and outcomes across multiple US states. The SEDD captures discharge information on all ED visits that do not result in an admission and contains more than 100 clinical and non-clinical variables. Information on patients that are initially seen in the ED and then admitted to the hospital is included in SID, which encompasses almost 97% of all US hospital discharges. The SID and SEDD data for North Carolina for the period analyzed in this study had several issues that were addressed in performed analysis. For example, the 2011-2012 North Carolina SEDD included 2 types of erroneous records, such as duplicated records for ED visits that did not result in an admission to the same hospital and records for ED visits that did result in an admission to the same hospital. The SID dataset for North Carolina for 2007-2008 had problems with the coding of discharge disposition. These issues were identified and resolved accord-

ing to the guidelines provided by the HCUP Data Center.

The list of swine animal operations registered in North Carolina contained information on geographic locations and the number of swine in each CAFO facility. Information was obtained from the North Carolina Division of Water Resources (NC DWR) for the year 2009. The animal operations are defined by General Statute 143-215.10B as feedlots involving 250 or more swine with a liquid waste management system.

Zip-code-level data on median household income (scaled by \$10,000) and education level (defined as a percentage of people aged 25+ who attained an educational level higher than a bachelor's degree) were obtained from the 2010-2014 American Community Survey. County level data on the numbers of primary care providers (per 100,000 residents) and the percent of uninsured individuals was obtained from the Area Health Resources Files (AHRF) for 2008 and 2010-2013. County level data on prevalence of current smokers in age-specific groups were obtained from the Behavioral Risk Factor Surveillance System (BRFSS, CDC) for 2008-2013.

Methods. We studied the health outcomes in two study groups. Study group 1 included the residents of North Carolina communities located in zip codes with hog CAFO(s): 221 zip codes with approximately 2,260,000 residents. Study group 2 represented a subset of Study group 1. This group included North Carolina communities located in zip codes with the highest upper quartile of hog density (with > 215hogs/km²): 56 zip codes with approximately 400,000 residents. North Carolina communities located in zip codes without hog CAFOs represented the Control group: 601 zip codes with approximately 7,200,000 residents. Geographic locations of zip codes for two Study groups and the Control group are shown in Figure 1.

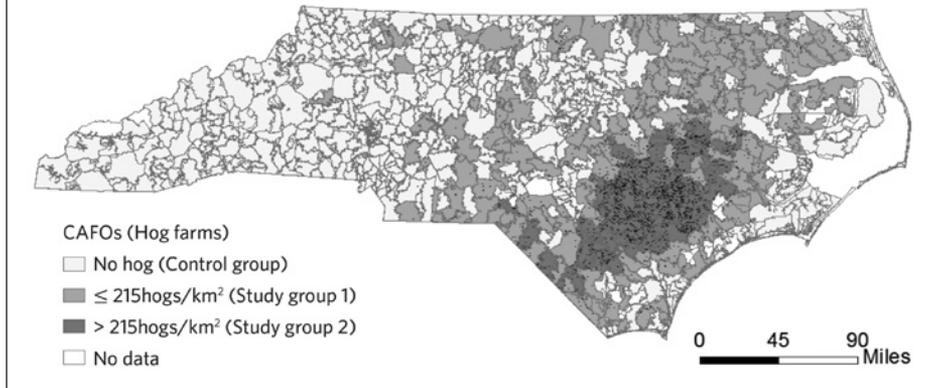
We compared disease-specific mortality, hospital admissions, and ED visits in these groups for the 2007-2013 period. All-cause, infant mortality, and outcomes of anemia, kidney disease, tuberculosis, septicemia, and LBW infants (see Appendix for respective ICD codes) were studied as the health indicators, with disease-specific mortality as primary outcome. The main predictor was the presence of a hog CAFO in a given zip code. Analyses were performed for underlying cause of death/primary diagnosis and for underlying-plus-secondary causes of death/primary-plus-secondary diagnoses. The illustration of the relations in assessment of potential impact factors/outcome associations used in multivariable analysis is shown in Supplemental Figure S1 in the Appendix.

Age-adjusted rates. We empirically estimated disease-

APPENDIX 1. The International Classification of Diseases (ICD) codes used in the analysis

This appendix is available in its entirety in the online edition of the NCMJ.

FIGURE 1.
Density of Hogs in Zip Codes in Study Group 1 and Study Group 2, Locations of Registered at NC DWR Hog CAFOs in NC, and Locations of Zip Codes without Registered at DWR Hog CAFOs (Control Group), 2009



specific, age-adjusted rates of mortality, hospital admission, and ED visits (per 100,000). 95% confidence intervals (CIs) were estimated based on the approximation suggested by Keyfitz [35]. We compared these rates between Study groups 1 and 2 and the Control group, and additionally to North Carolina and the US average (for mortality rates).

Logistic regression analysis. We used logistic regression analysis (adjusted by age, median household income, education, health insurance coverage, numbers of primary care providers, and smoking prevalence) to evaluate whether a proportion of disease-specific deaths (as well as a proportion of disease-specific hospital admissions and ED visits) statistically differed between the studied groups. The Control group was a referent group for calculating ORs. This analysis allowed for minimization of potential bias due to uncertainties in population counts in North Carolina zip codes over the study period. SAS Proc Logistic (the SAS 9.4 statistical package; SAS Institute, Cary, NC) was used to evaluate ORs, 95% CIs, and p-values.

The DiSC analysis. We developed and applied an approach we termed the Distance from the Source of potential Contamination (DiSC) analysis to investigate the changes in ORs for all studied health outcomes with closer proximity to the CAFO. The core of this analysis is the new zip-code-specific continuous measure of potential exposures from hog CAFOs constructed using the exact address of each CAFO and the population counts in all census blocks in each zip code. We hypothesized that the risk of mortality (or hospital admission or ED visit) is proportional to the number of hogs in a CAFO, maximal at the location of a CAFO, and decreases

with remoteness from a CAFO according to two-dimensional normal distribution (ie, “bell-shaped” distribution) of potential contaminants. Its standard deviation σ is the measure of the distance from the CAFO at which the level of potential contaminants drops 2-fold. The functional form is justified by the theory of diffusion from a point source [36]. The zip-code-specific measures of potential contaminants from CAFOs were modeled by summing the contributions of all census block groups in a given zip code:

$$E_z(\sigma) = \frac{\sum_i p_{iz} \sum_n N_n f(d_{niz}, \sigma)}{\sum_i p_{iz}}$$

where n enumerates all CAFOs; N_n is the number of hogs in the CAFO n ; i enumerates all census block groups in a zip code z ; p_{iz} is population of census block group i in zip-code z ; and

$$N_n f(d_{niz}, \sigma); \text{ where } f(d_{niz}, \sigma) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left(-\frac{d_{niz}^2}{2\sigma^2}\right)$$

is the modeled contaminant level from a specific CAFO in a census block group (where d_{niz} is the distance between them). Since there are no direct measurements that allow for estimating σ , we performed radius-specific analyses corresponding to 4 values of σ : ie, at 2, 5, 10, and 20 kilometers (km). A zip-code-specific value of $E_z(\sigma)$ was then used in the logistic regression analysis to evaluate the associations with disease-specific outcomes in multivariable analysis. The evaluated ORs are per a unit of $E_z(\sigma)$. The OR estimates for different σ are comparable because the measures are normalized equally: sums of contaminant levels over all zip-codes equal the total number of hogs in all CAFOs for any σ .

Sensitivity analyses. Because hog CAFOs are predominantly located in rural North Carolina, and access to medical care likely differs in urban and rural areas, we i) excluded zip codes of the cities of Charlotte and Raleigh, and also ii) excluded 18 urbanized areas defined in the US Census Bureau criteria for urban-rural areas as having $\geq 50,000$ residents.

FIGURE S1.
Illustration of the Relations in the Assessment of Potential Impact Factors-Outcome Associations

This figure is available in its entirety in the online edition of the NCMJ.

We also used the generalized estimating equation (GEE) method to account for possible correlations between records in specific zip codes.

We used the greedy matching algorithm [37] to perform propensity score-based matching of zip codes from Control group to zip codes in Study group 2 by demographic and socioeconomic characteristics (see Appendix for detailed description of the matched groups and their characteristics presented in Table S1).

Ethics statement. All data analyses were designed and performed in accordance with the ethical standards of a responsible committee on human studies and with the Helsinki Declaration (of 1975, revised in 1983) and have been approved by the Duke University Health System Institutional Review Board.

Results

Demographic and socioeconomic characteristics. The residents of communities adjacent to hog farms were more diverse than the average North Carolina community. There were more African-American (28.8% vs. 19.3%, $P < 0.001$) and American-Indian (2.4% vs. 0.8%, $P < 0.05$) residents in zip codes with hog CAFOs (Study group 1) compared to the Control group (see Supplemental Tables S2 and S3 in Appendix). Study group 1 also had a lower median household income (\$39,005 vs. \$46,414, $P < 0.001$), fewer college-educated people with bachelor's or higher degrees (16.5% vs. 24.2%, $P < 0.001$), and a lower number of primary care health providers (54 vs. 76 per 100,000 residents, $P < 0.001$). The differences were even more pronounced for the residents of communities located in zip codes with > 215 hogs/km² (Study group 2): 31.3% ($P < 0.001$) of the residents were African Americans and 4.1% were American Indians ($P < 0.001$). People from Study group 2 had the low-

TABLE S1.
Characteristics of Matched Group A, Matched Group B,
and Study Group 2, NC, 2007-2013

This table is available in its entirety in the
online edition of the NCMJ.

¹Means are evaluated without weights representing zip-code populations.
n/a, non-applicable.

TABLE S2.
Descriptive Table of the 3 Studied Groups of NC
Communities with and without Hog Concentrated Feeding
Animal Operations (CAFOs): Race-Specific Population
Groups, Socioeconomic Characteristics, Smoking Prevalence,
and Access-To-Care Characteristics, NC, 2007-2013

This table is available in its entirety in the
online edition of the NCMJ.

* $P < 0.05$.
** $P < 0.001$.

TABLE S3.
Person-Years of Observations in Race-Specific Groups
of the Residents of NC Communities from the 3 Studied
Groups, NC, 2007-2013

This table is available in its entirety in the
online edition of the NCMJ.

est (among the studied groups) median household income (\$36,520, $P < 0.001$), percent of residents with bachelor's or higher degrees (13.7%, $P < 0.001$), and number of primary care providers (51/100,000, $P < 0.001$) (see Supplemental Tables S2 and S3).

Mortality rates. Cause-specific mortality rates of all studied diseases were higher in North Carolina communities located in zip codes with > 215 hogs/km² (Study group 2) compared to the North Carolina and US averages (see Table 1). The all-cause mortality rate in Study group 2 was as high as 934/100,000.

The residents from Study group 2 aged ≤ 24 years old had much higher all-cause mortality rates (92.7/100,000) than mortality rates in North Carolina (69.8/100,000) and the US (62.2/100,000) for this age group (see Table 1). Conditions originating in the perinatal period may have substantially contributed to the differences in mortality at younger ages; the mortality rate among infants under 1 year old in Study group 2 was as high as 495/100,000. This is much higher than both the US average (317/100,000) and the North Carolina average (398/100,000). The groups that contributed the most to increased mortality rates due to perinatal conditions were newborns affected by maternal trauma and by disorders related to length of gestation and fetal growth (see Table 1). The rates of infant death related to maternal trauma were much higher in North Carolina communities located in zip codes with > 215 hogs/km² (149/100,000) than the United States and North Carolina averages. The rates of death related to the length of gestation and fetal growth were higher in both North Carolina (North Carolina average) and Study group 2 compared to the US average.

Patients from Study group 2 with multimorbid conditions such as co-existing septicemia and kidney disease, septicemia and anemia, or septicemia and kidney disease and anemia had mortality rates 1.5-2.2 times greater than North Carolina and 1.8-1.9 times greater than the US average mortality rates for patients with the same respective co-existing diseases (see Supplemental Figure S2 in Appendix). For all studied diseases, the age-adjusted mortality rates were higher in Study group 1 than in the Control group, but lower than in Study group 2 (see Table 2), except for tuberculosis: its mortality did not significantly differ between Study groups 1 and 2.

To highlight the magnitude of higher mortality in the region, we modeled Study group 2 as an independent geo-

TABLE 1.
Age-Adjusted Mortality Rates (Per 100,000) in NC Communities with > 215hogs/km² (Study Group 2) Compared to the NC and US Average, 2007-2013. (95% Confidence Intervals are Shown in the Parentheses)

Disease	Age and race group	The US average ¹	The NC average ^a	NC communities with > 215hogs/km ²
All-cause mortality	All ages, all races	750 (749.5-750.2)	803 ^a (801.3-805.6)	934 ^{ab} (922.7-944.8)
	White, all ages	745 (744.5-745.2)	780 ^a (777.9-782.6)	858 ^{ab} (844.7-871.2)
	AA, ² all ages	903 (901.6-904.1)	923 ^a (917.4-928.4)	969 ^{ab} (947.9-989.4)
	Age ≤ 24 years old, all races	62.2 (62.0-62.4)	69.8 ^a (68.7-70.9)	92.7 ^{ab} (86.3-99.1)
Conditions of perinatal period	All races, age < 1 year old	317 (314.4-318.6)	398 ^a (381.1-408.5)	495 ^{ab} (420.7-569.5)
Newborns affected by maternal trauma	All races, age < 1 year old	74.6 (73.6-75.6)	102 ^a (95.7-109.1)	149 ^{ab} (110.6-195.3)
Disorders related to length of gestation and fetal growth	All races, age < 1 year old	112 (110.6-113.1)	163 ^a (154.8-171.8)	169 ^a (128.3-218.4)
Anemia (underlying cause)	All races, all ages	1.5 (1.5-1.5)	1.9 ^a (1.8-2.0)	2.6 ^{ab} (2.1-3.2)
	AA, all ages	3.0 (2.9-3.0)	3.6 ^a (3.3-4.0)	5.3 ^{ab} (3.9-7.1)
Kidney disease (underlying cause)	All races, all ages	14.6 (14.5-14.6)	18.3 ^a (18.0-18.6)	24.8 ^{ab} (23.0-26.6)
	White, all ages	13.3 (13.3-13.4)	14.8 ^a (14.5-15.2)	18.3 ^{ab} (16.3-20.2)
	AA, all ages	28.1 (27.9-28.3)	34.9 ^a (33.8-36.0)	37.7 ^a (33.6-41.8)
Tuberculosis (underlying + secondary cause)	All races, all ages	0.31 (0.30-0.32)	0.30 (0.26-0.35)	0.63 ^{ab} (0.32-0.81)
Septicemia (underlying cause)	All ages, all races	10.8 (10.7-10.8)	13.5 ^a (13.2-13.67)	16.6 ^{ab} (15.1-18.1)

¹Mortality rates are obtained from the Centers for Disease Control and Prevention Multiple Cause of Death data (<https://wonder.cdc.gov/mcd.html>).

²African-American.

^aStatistically significant difference compared to the US average.

^bStatistically significant difference compared to NC average.

graphic unit and compared its overall and disease-specific mortality rates to the US states with the highest mortality rates (see Supplemental Table S4 in Appendix). In this model, the geographic area encompassing Study group 2 would be ranked number 4 in the United States for the highest all-cause mortality, number 1 in the United States for mortality from anemia as underlying cause, number 1 for kidney disease, number 2 for septicemia, and number 3 for tuberculosis as underlying-plus-secondary cause.

The rates of hospital admissions and ED visits. For most of the studied diseases, the rates of hospital admissions and

ED visits (see Table 2) were higher in Study group 1 than in the Control group, but lower than in Study group 2. Rates did not differ between Study groups 1 and 2 for anemia hospital admissions and ED visits (as primary diagnosis), ED visits for tuberculosis, and LBW hospital admissions (as primary-plus-secondary diagnosis); however, these rates were still higher than in the Control group.

Logistic regression analysis. After adjustment for 6 co-

FIGURE S2.
Mortality Rates among Patients with Co-Existing Anemia, Kidney Disease, and Septicemia: The US Average, NC Average, and NC Communities with > 215hogs/km² (Study Group 2), 2007-2013. (95% Confidence Intervals Are Shown in the Parentheses)

This figure is available in its entirety in the online edition of the NCMJ.

TABLE S4.
Age-Adjusted Mortality Rates (Per 100,000) in NC Communities with > 215hogs/km² (Study Group 2): Ranks of This Area among the US States and District of Columbia with the Highest Mortality, 2007-2013. (95% Confidence Intervals Are Shown in the Parentheses)

This table is available in its entirety in the online edition of the NCMJ.

^aMortality rates were calculated using the Multiple Cause of Death data from the Centers for Disease Control and Prevention (<https://wonder.cdc.gov/mcd.html>).

factors, the ORs for death, hospital admissions, and ED visits for most of the studied diseases in Study group 1 were > 1.0 (see Table 3). The ORs in Study group 2 were significantly higher than in Study group 1 for kidney disease (all 3 outcomes), tuberculosis (hospital admissions), anemia (all 3 outcomes), tuberculosis (ED visits), septicemia (mortality), and LBW (ED visits) (see Table 3).

DiSC analysis. After adjustment for 6 co-factors, the studied outcomes had similar distance-related patterns: the ORs were higher in close proximity to a hog CAFO than in more distant communities (see Table 4). For example, mortality ORs for kidney disease were the highest in communities located within 2 km of a CAFO (OR = 1.14, $P < 0.0001$), then decreased to 1.02 ($P < 0.0001$) at 20 km. For hospital admissions, the OR for kidney disease was 1.22 ($P < 0.0001$) at 2 km, 1.08 at 5 km ($P < 0.0001$), 1.04 at 10 km ($P < 0.0001$), and

1.03 at 20 km ($P < 0.0001$). The most pronounced changes in ORs were observed between 2 km and 5 km from the CAFO.

Sensitivity analysis. After exclusion of urban areas, no significant changes were observed for mortality risks. Slightly lower ORs than in the main analysis were observed for hospital admissions, and slightly higher ORs were observed for ED visits. The results of GEE analysis also confirmed the main study results; one exclusion was some minor changes in hospital admissions.

Locations of matched zip codes are shown in Supplemental Figure S3 (Appendix): compared to "clustered" locations of zip codes with > 215hogs/km², non-CAFOs zip codes are sparsely located in different regions of North Carolina. The mortality rates of all studied diseases and hospital admission/ED visit rates of kidney disease, tuberculosis, and LBW were higher in Study group 2 than in matched zip codes

TABLE 2. Age-Adjusted Rates (per 100,000) of Mortality, Hospital Admissions, and ED Visits in NC Communities with Hog CAFOs (Study Group 1), NC Communities with > 215hogs/km² (Study Group 2), and NC Communities without Hog CAFOs (Control Group), 2007-2013. Underlying Cause/Primary Diagnosis and Underlying-Plus-Secondary Cause/Primary-Plus-Secondary Diagnosis. (95% Confidence Intervals Are Shown in the Parentheses)

Outcome	Disease	Underlying cause/Primary diagnosis			Underlying+secondary cause/ Primary+secondary diagnosis		
		Study group 1	Study group 2	Control group	Study group 1	Study group 2	Control group
Mortality	All-cause mortality	866 ^a (861.1-870.0)	934 ^b (922.7-944.8)	773 (770.4-775.2)	866 ^a (861.1-870.0)	934 ^b (922.7-944.8)	773 (770.4-775.2)
	Anemia	2.3 ^a (2.1-2.6)	2.6 ^a (2.1-3.2)	1.7 (1.6-1.8)	28.4 ^a (27.6-29.2)	35.5 ^{ab} (33.4-37.7)	17.0 (16.7-17.4)
	Kidney disease	21.1 ^a (20.4-21.8)	24.8 ^{ab} (23.0-26.6)	17.1 (16.7-17.5)	101 ^a (99.1-102.1)	119 ^{ab} (114.6-122.5)	75.4 (74.7-76.2)
	Tuberculosis	0.32 ^a (0.21-0.42)	0.24 ^a (0.04-0.43)	0.13 (0.12-0.14)	0.52 ^a (0.42-0.61)	0.63 ^a (0.32-0.81)	0.23 (0.22-0.34)
	Septicemia	15.5 ^a (14.9-16.1)	16.6 ^a (15.1-18.1)	12.7 (12.4-13.0)	67.9 ^a (66.7-69.1)	75.1 ^{ab} (71.9-78.2)	50.9 (50.3-51.5)
Hospital admissions	Anemia	112 ^a (110.7-114.0)	113 ^a (108.6-116.4)	87.4 (86.6-88.2)	1,989 ^a (1,982-1,996)	2,179 ^{ab} (2,162-2,196)	1,642 (1,638-1,645)
	Kidney disease	164 ^a (162.3-166.2)	187 ^{ab} (181.6-191.4)	128 (126.6-128.6)	1,809 ^a (1,802-1,815)	2,031 ^{ab} (2,015-2,048)	1,369 (1,366-1,372)
	Tuberculosis	1.8 ^a (1.6-2.0)	3.1 ^{ab} (2.4-3.7)	1.0 (0.9-1.1)	4.0 ^a (3.7-4.3)	6.2 ^{ab} (5.3-7.1)	2.4 (2.3-2.6)
	Septicemia	296 ^a (293.6-298.8)	313.1 ^{ab} (306.7-319.5)	239 (237.8-240.4)	437 ^a (433.9-440.2)	468 ^{ab} (460.3-475.9)	344 (342.1-345.2)
	Low birth weight	n/a	n/a	n/a	2.2 ^a (1.9-2.4)	2.5 ^a (1.9-3.1)	1.5 (1.4-1.6)
ED visits	Anemia	84.8 ^a (83.3-86.2)	85.4 ^a (81.9-88.9)	71.4 (70.6-72.1)	605 ^a (600.8-608.4)	682 ^{ab} (672.2-691.7)	480 (478.1-481.9)
	Kidney disease	26.4 ^a (25.6-27.2)	33.2 ^{ab} (31.1-35.3)	19.6 (19.2-20.0)	547 ^a (543.4-550.5)	643 ^{ab} (634.0-652.3)	376 (373.9-377.2)
	Tuberculosis	0.22 (0.13-0.32)	0.33 (0.12-0.53)	0.14 (0.11-0.14)	1.04 ^a (0.8-1.13)	1.42 ^a (1.03-1.93)	0.72 (0.62-0.74)
	Septicemia	15.4 ^a (14.8-16.0)	20.1 ^{ab} (18.4-21.7)	13.7 (13.4-14.0)	26.2 ^a (25.4-26.9)	35.4 ^{ab} (33.3-37.6)	21.1 (20.7-21.5)
	Low birth weight	n/a	n/a	n/a	3.0 ^a (2.7-3.3)	4.7 ^{ab} (3.9-5.5)	1.6 (1.5-1.7)

^aStatistically significant difference compared to the Control group.

^bStatistically significant difference compared to Study group 1.

n/a, non-applicable.

TABLE 3. Age-Adjusted Rates (per 100,000) of Mortality, Hospital Admissions, and ED Visits in NC Communities with Hog CAFOs (Study Group 1), NC Communities with > 215hogs/km² (Study Group 2), and NC Communities without Hog CAFOs (Control Group), 2007-2013. Underlying Cause/Primary Diagnosis and Underlying-Plus-Secondary Cause/Primary-Plus-Secondary Diagnosis. (95% Confidence Intervals Are Shown in the Parentheses)

Outcome	Disease	Underlying cause/Primary diagnosis		Underlying+secondary cause/ Primary+secondary diagnosis	
		Study group 1	Study group 2	Study group 1	Study group 2
Death	Anemia	1.24 (1.11-1.36), P = 0.0012	1.39 (1.15-1.64), P = 0.0077	1.34 (1.30-1.38), P < 0.0001#	1.50^a (1.43-1.57), P < 0.0001#
	Kidney disease	1.13 (1.09-1.17), P < 0.0001#	1.27^a (1.19-1.35), P < 0.0001#	1.18 (1.16-1.20), P < 0.0001#	1.31^a (1.27-1.35), P < 0.0001#
	Tuberculosis	2.77^a (2.33-3.21), P < 0.0001#	2.12 (1.19-3.04), P = 0.1125	2.23 (1.93-2.54), P < 0.0001#	2.22 (1.65-2.79), P = 0.0061
	Septicemia	1.07 (1.02-1.12), P = 0.0120	1.08 (0.97-1.17), P = 0.1633	1.18 (1.15-1.20), P < 0.0001#	2.30^a (2.11-2.48), P < 0.0001#
Hospital admissions	Anemia	1.07 (1.05-1.09), P < 0.0001#	1.07 (1.03-1.11), P = 0.0022	1.03 (1.03-1.04), P < 0.0001#	1.12^a (1.11-1.14), P < 0.0001#
	Kidney disease	1.09 (1.07-1.11), P < 0.0001#	1.21^a (1.18-1.24), P < 0.0001#	1.15 (1.15-1.16), P < 0.0001#	1.33^a (1.32-1.34), P < 0.0001#
	Tuberculosis	1.48 (1.31-1.64), P < 0.0001#	2.81^a (2.54-3.08), P < 0.0001#	1.39 (1.28-1.50), P < 0.0001#	2.30^a (2.11-2.48), P < 0.0001#
	Septicemia	1.03 (1.02-1.04), P < 0.0001#	1.03 (1.00-1.05), P = 0.0324	1.06 (1.05-1.07), P < 0.0001#	1.08 (1.06-1.10), P < 0.0001#
	LBW	n/a	n/a	1.44 (1.25-1.62), P < 0.0001#	1.40 (1.04-1.76), P = 0.0661
ED visits	Anemia	1.02 (1.00-1.05), P = 0.0721	1.08^a (1.03-1.13), P = 0.0028	1.08 (1.07-1.09), P < 0.0001#	1.21^a (1.19-1.23), P < 0.0001#
	Kidney disease	1.05 (1.00-1.09), P = 0.0431	1.26^a (1.18-1.34), P < 0.0001#	1.23 (1.22-1.24), P < 0.0001#	1.43^a (1.41-1.45), P < 0.0001#
	Tuberculosis	1.38 (0.84-1.93), P = 0.2451	2.26 (1.33-3.19), P = 0.0868	1.24 (1.01-1.47), P = 0.0721	2.22^a (1.84-2.61), P < 0.0001#
	Septicemia	0.89 (0.82-0.96), P = 0.0013	0.82 (0.69-0.96), P = 0.0057	0.98 (0.92-1.03), P = 0.3671	0.99 (0.89-1.09), P = 0.8742
	LBW	n/a	n/a	1.53 (1.34-1.73), P < 0.0001#	2.45^a (2.13-2.76), P < 0.0001#

^aStatistically significant difference between the Study groups 1 and 2.

#Remains significant under Bonferroni correction.

n/a, non-applicable.

without CAFOs (the results are presented in the Appendix, Table S5).

Discussion

We found that people living in southeastern North Carolina communities located near hog CAFOs had poorer outcomes for a variety of health conditions in different age groups than the residents of North Carolina communities located in zip codes without hog CAFOs; they had higher mortality due to infections, anemia, kidney disease, and perinatal conditions, and higher rates of hospital admissions and ED visits for LBW infants. The observed higher rate of all-cause mortality is consistent with the lower life expectancy in this area [1].

While the precise causes of higher anemia rates observed in our study are unclear, other studies have suggested that exposure to ammonia, hydrogen sulfide, methane, and particulate matters (PMs) near the CAFOs [23, 24],

contamination of water and soil with zinc [25], exposure to the antibiotic chloramphenicol previously widely used to treat infections in hogs [26], and inappropriate human use of veterinary medications (certain NSAIDs or antibiotics) [38] cause anemia. Moreover, anemia is an independent risk factor of death in patients with chronic diseases [39, 40], a complication of renal failure [41] and tuberculosis [42], and a risk factor for preterm birth and LBW infants [43].

Earlier studies reported that workers in the swine

FIGURE S3. Locations of Matched NC Zip Codes without Hog CAFOs (Matched Group A and Matched Group B) and Locations of Zip Codes with > 215hogs/km² (Study Group 2)

This figure is available in its entirety in the online edition of the NCMJ.

TABLE 4.

The Distance from the Source of Potential Contamination (“DISC”) Analysis: ORs of Mortality, Hospital Admissions, and ED Visits in NC Communities Located within Different Distances from Hog CAFOs: Underlying-Plus-Secondary Causes of Death/Primary-Plus-Secondary Diagnoses, Logistic Regression, Multivariable Analysis (Adjusted by Age, Income, Education, Health Insurance, Smoking, and Availability of Primary Care Providers), 2007-2013. (95% Confidence Intervals Are Shown in the Parentheses)

Outcome	Disease	The distance from hog CAFO			
		2 km	5 km	10 km	20 km
Death	Anemia	1.11 (1.05-1.18), <i>P</i> < 0.0001	1.05 ^a (1.03-1.07), <i>P</i> < 0.0001	1.04 (1.03-1.05), <i>P</i> < 0.0001	1.03 (1.03-1.04), <i>P</i> < 0.0001
	Kidney disease	1.14 (1.11-1.18), <i>P</i> < 0.0001	1.06 ^a (1.05-1.07), <i>P</i> < 0.0001	1.03 (1.03-1.04), <i>P</i> < 0.0001	1.02 (1.02-1.03), <i>P</i> < 0.0001
	Tuberculosis	1.37 (0.95-1.79), <i>P</i> = 0.1442	1.12 (0.96-1.27), <i>P</i> = 0.1621	1.09 (1.02-1.16), <i>P</i> = 0.0231	1.07 (1.03-1.11), <i>P</i> < 0.0001
	Septicemia	1.11 (1.06-1.15), <i>P</i> < 0.0001	1.04 ^a (1.03-1.06), <i>P</i> < 0.0001	1.03 (1.02-1.03), <i>P</i> < 0.0001	1.02 (1.02-1.09), <i>P</i> < 0.0001
Hospital admissions	Anemia	1.06 (0.91-1.07), <i>P</i> < 0.0001	1.02 ^a (1.02-1.03), <i>P</i> < 0.0001	1.01 (1.01-1.02), <i>P</i> < 0.0001	1.01 (1.01-1.01), <i>P</i> < 0.0001
	Kidney disease	1.22 (1.21-1.23), <i>P</i> < 0.0001	1.08 ^a (1.08-1.09), <i>P</i> < 0.0001	1.04 ^a (1.04-1.04), <i>P</i> < 0.0001	1.03 ^a (1.03-1.03), <i>P</i> < 0.0001
	Tuberculosis	1.59 (1.44-1.75), <i>P</i> < 0.0001	1.18 ^a (1.13-1.24), <i>P</i> < 0.0001	1.09 ^a (1.06-1.12), <i>P</i> < 0.0001	1.06 (1.04-1.07), <i>P</i> < 0.0001
	Septicemia	1.10 (1.08-1.11), <i>P</i> < 0.0001	1.04 ^a (1.03-1.04), <i>P</i> < 0.0001	1.02 ^a (1.02-1.02), <i>P</i> < 0.0001	1.02 (1.01-1.02), <i>P</i> < 0.0001
	LBW	1.21 (0.97-1.46), <i>P</i> = 0.1272	1.06 (0.97-1.15), <i>P</i> = 0.1913	1.04 (0.99-1.08), <i>P</i> = 0.1112	1.03 (1.01-1.06), <i>P</i> = 0.0082
ED visits	Anemia	1.15 (1.14-1.17), <i>P</i> < 0.0001	1.05 ^a (1.05-1.06), <i>P</i> < 0.0001	1.03 ^a (1.02-1.03), <i>P</i> < 0.0001	1.02 (1.02-1.02), <i>P</i> < 0.0001
	Kidney disease	1.23 (1.21-1.24), <i>P</i> < 0.0001	1.08 ^a (1.08-1.09), <i>P</i> < 0.0001	1.04 ^a (1.04-1.05), <i>P</i> < 0.0001	1.03 ^a (1.03-1.03), <i>P</i> < 0.0001
	Tuberculosis	1.99 (1.69-2.29), <i>P</i> < 0.0001	1.30 ^a (1.19-1.40), <i>P</i> < 0.0001	1.13 ^a (1.08-1.18), <i>P</i> < 0.0001	1.07 ^a (1.04-1.10), <i>P</i> < 0.0001
	Septicemia	1.14 (1.06-1.22), <i>P</i> < 0.0001	1.06 ^a (1.03-1.09), <i>P</i> < 0.0001	1.03 (1.02-1.04), <i>P</i> < 0.0001	1.02 (1.01-1.03), <i>P</i> < 0.0001
	LBW	2.28 (2.12-2.44), <i>P</i> < 0.0001	1.39 ^a (1.34-1.45), <i>P</i> < 0.0001	1.20 ^a (1.17-1.22), <i>P</i> < 0.0001	1.13 ^a (1.11-1.14), <i>P</i> < 0.0001

^aStatistically significant difference from the value of the result at shorter vs. longer distances (eg, 5 km vs. 2 km, or 10 km vs. 5 km) within the same row in the table.

industry have a higher risk for tuberculosis; however, this disease has been recently eradicated from US livestock [44]. Our findings on higher rates of tuberculosis likely result from the impact of a combination of factors in this North Carolina region where co-existing medical and social determinants may exacerbate each other [6, 10]. While no information is currently available on potential risk of occurrence of antibiotic-resistant strains of *Mycobacterium tuberculosis* in the communities adjacent to hog CAFOs, this aspect may require detailed analysis. The increased risk of undiagnosed latent tuberculosis that may be present in these communities, which may have a higher number of foreign-born residents [45], also requires attention. Co-existence of factors that may promote tuberculosis from its latent to active form (eg, diabetes, immunosuppression, and other conditions) needs to be accounted for when developing a strategy for improving identification of latent and active cases (ie, through screening) and treatment adherence in patients who require therapy.

Higher mortality rates for infants living in North Carolina zip codes with > 215hogs/km² represent an important health issue for this population that requires the immediate attention of public health and health care specialists. Maternal trauma and the length of gestation and fetal growth contribute the most to infant mortality in these North Carolina communities and can be targeted by special programs on maternal and child health. Higher rates of LBW infants in North Carolina communities adjacent to hog CAFOs are an important parameter of maternal and child health, not only because of the immediate medical care needed for such infants, but also because of their increased lifetime risk of chronic diseases (eg, higher risk of development of diabetes mellitus, arterial hypertension, ischemic heart disease, depression, respiratory diseases, and chronic kidney disease) [46]. Targeted programs in North Carolina communities adjacent to hog CAFOs could provide information about health issues related to women’s and children’s health to women of childbearing potential,

as well as supporting mothers and children from pregnancy through birth and beyond.

The DiSC analysis in our study highlighted a potential opportunity for associating residential and occupational exposures in communities located in close proximity to hog CAFOs; poorer health outcomes among the residents of communities located within 2-5 km from CAFOs could be due to additional exposures because of potential employment at CAFOs. That may provide some guidance as to the most efficient use of resources to screen and diagnose diseases/conditions found to be highly prevalent in these communities.

In this study we do not establish causality between exposures from hog CAFOs and higher risk of mortality, hospital admissions, or ED visits for studied diseases in communities adjacent to CAFOs. One interpretation of our findings could be that people who reside in such communities may simultaneously be affected by multiple risk factors including low income and education, higher smoking prevalence, and lower access to medical care. Nonetheless, after adjusting for such co-factors or comparing zip codes with similar co-factors, persistently poorer health outcomes were observed in the communities located in zip codes with hog CAFOs. Furthermore, the DiSC analysis demonstrated a higher risk of poorer health outcomes in closer proximity to the CAFO. Our sensitivity analysis showed that patterns of use of medical care among the residents of these North Carolina communities may also contribute to the differences in health outcomes. For example, residents of rural North Carolina areas (where most of the hog CAFOs are located) are more likely to use EDs when searching for medical assistance and less likely use hospitals (due to problems with access such as transportation issues, problems with medical insurance coverage, or behavioral patterns of preferring EDs to a staying in a hospital).

The limitations of this study include: i) a lack of individual measurements of exposure, co-factors, and potential biomarkers of exposure; ii) potential misclassification of

exposure from spray fields, accounting for weather, season and wind direction, exposure to poultry facilities, and coal power plants; iii) limited list of population characteristics in currently available dataset to match the compared population groups; and iv) potentially different residential and occupational locations for the same person. Further studies must address these limitations. The problems of identifying potential causative agents and evaluation of dose-response relationships in hog CAFOs studies are discussed in the literature; it is difficult to account for all required factors in occupational health studies, but the detection of specific exposures and diseases in residential communities is even more challenging due to additional complexities caused by dispersion of environmental agents, different exposure pathways, and variability of individual susceptibility to contaminants [6].

Community based research has been gaining prominence as a source of information for medical decision-making. It has been recognized that detailed individual-level data on co-factors are rarely available in the US; therefore, opportunities for individual-level analyses that account for multiple risk factors are very limited. To obtain information on health outcomes in certain populations, public health specialists and policymakers have begun to shift their attention from an exclusive focus on individual-level studies toward community level analyses. When contributions of specific risk factors to health outcomes in communities can be evaluated, this information can be used for optimization of resource allocation for medical interventions designed to improve health outcomes [47].

Conclusion

Southeastern North Carolina communities located in close proximity to hog CAFOs are characterized by poor indicators of health that are not solely due to the impact of converging demographic, socioeconomic, behavioral, and access-to-care factors, but are also due to the additional impact of multiple hog CAFOs located in this area. Although causality with specific exposures from hog CAFOs was not established, our findings suggest research is needed in environmental factors that may influence these outcomes. In addition, these findings suggest an immediate need for improved screening, diagnosis, and intervention for conditions including infant mortality and LBW infants that were found to be overrepresented in these communities. Poor health outcomes in North Carolina communities adjacent to hog CAFOs may also need to be addressed by improving access to medical resources, and future studies to determine the contribution of factors that influence these outcomes are needed. NCMJ

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TABLE S5.
Age-Adjusted Cause-Specific Rates (per 100,000) of Mortality, Hospital Admissions, and ED Visits in Communities Located in Zip Codes with > 215hogs/km² (Study Group 2) and in Communities Located in Zip Codes Matched by Percent of African Americans, Percent of Children and Adults Aged 65+ in Population, and Median Household Income (Matched Group A) and Additionally Matched by Percent of the Residents Aged 25+ with Bachelor or Higher Degree (Matched Group B), NC, 2007-2013. (95% Confidence Intervals Are Shown in the Parentheses)

This table is available in its entirety in the online edition of the NCMJ.

*Statistically significant difference when compared to Study group 2.
n/a, non-applicable.

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Acknowledgments

The authors thank Fred and Alice Stanback for supporting the Environmental Health Scholars Program at the Division of Surgical Sciences, Department of Surgery, Duke University School of Medicine. The authors thank Christine B. Lawson and Amy Keyworth from the North Carolina Department of Environment and Natural Resources, Division of Water Resources, the Animal Feeding Operations Program (Raleigh, North Carolina), and Evan Kane (currently from the Wake County Environmental Services, water Quality Division, Groundwater Protection and Wells Section in Raleigh, North Carolina) for valuable information on regulations and management of hog farms in North Carolina.

Potential conflicts of interest. The authors have no relevant conflicts of interest.

References

- Chetty R, Stepner M, Abraham S, et al. The association between income and life expectancy in the United States, 2001-2014. *JAMA*. 2016;315(16):1750-1766.
- Lackland DT, Bendall HE, Osmond C, Egan BM, Barker DJ. Low birth weights contribute to the high rates of early-onset chronic renal failure in the southeastern United States. *Arch Intern Med*. 2000;160(10):1472-1476.
- Wing S, Wolf S. Intensive livestock operations, health, and quality of life among eastern North Carolina residents. *Environ Health Perspect*. 2000;108(3):233-238.
- United States Department of Agriculture Census of Agriculture. 2012 Census Highlights: Hog and Pig Farming - A \$22.5 billion industry, up 25 percent since 2007. USDA Census of Agriculture website. https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Highlights/Hog_and_Pig_Farming/. Updated June 2014. Accessed July 19, 2018.
- Preller L, Heederik D, Boleij J, Vogelzang PF, Tielen MJ: Lung function and chronic respiratory symptoms of pig farmers: focus on exposure to endotoxins and ammonia and use of disinfectants. *Occup Environ Med*. 1995;52(10):654-660.
- Cole D, Todd L, Wing S. Concentrated swine feeding operations and public health: a review of occupational and community health effects. *Environ Health Perspect*. 2000;108(8):685-699.
- Wing S, Horton RA, Marshall SW, et al. Air pollution and odor in communities near industrial swine operations. *Environ Health Perspect*. 2008;116(10):1362-1368.
- Wing S, Freedman S, Band L. The potential impact of flooding on confined animal feeding operations in eastern North Carolina. *Environ Health Perspect*. 2002;110(4):387-391.
- Burkholder J, Libra B, Weyer P, et al. Impacts of waste from concentrated animal feeding operations on water quality. *Environ Health Perspect*. 2007;115(2):308-312.
- Wing S, Cole D, Grant G. Environmental injustice in North Carolina's hog industry. *Environ Health Perspect*. 2000;108(3):225-231.
- Mirabelli MC, Wing S, Marshall SW, Wilcosky TC. Race, poverty, and potential exposure of middle-school students to air emissions from confined swine feeding operations. *Environ Health Perspect*. 2006;114(4):591-596.
- Mirabelli MC, Wing S, Marshall SW, Wilcosky TC. Asthma symptoms among adolescents who attend public schools that are located near confined swine feeding operations. *Pediatrics*. 2006;118(1):e66-75.
- Wing S, Horton RA, Rose KM. Air pollution from industrial swine operations and blood pressure of neighboring residents. *Environ Health Perspect*. 2013;121(1):92-96.
- Schinasi L, Horton RA, Guidry VT, Wing S, Marshall SW, Morland K. Air pollution, lung function, and physical symptoms in communities near concentrated swine feeding operations. *Epidemiology*. 2011;22(2):208-215.
- Donham KJ, Wing S, Osterberg D, et al. Community health and socioeconomic issues surrounding concentrated animal feeding operations. *Environ Health Perspect*. 2007;115(2):317-320.
- Bullers S. Environmental stressors, perceived control, and health: the case of residents near large-scale hog farms in eastern North Carolina. *Human Ecology*. 2005;33(1):1-16.
- Kilburn KH. Exposure to reduced sulfur gases impairs neurobehavioral function. *South Med J*. 1997;90(10):997-1006.
- Thu KM. Public health concerns for neighbors of large-scale swine production operations. *J Agric Saf Health*. 2002;8(2):175-184.
- Schiffman SS, Walker JM, Dalton P, et al. Potential health effects of odor from animal operations, wastewater treatment, and recycling of byproducts. *J Agromedicine*. 2004;9(2):397-403.
- Merchant JA, Naleway AL, Svendsen ER, et al. Asthma and farm exposures in a cohort of rural Iowa children. *Environ Health Perspect*. 2005;113(3):350-356.
- Chrischilles E, Ahrens R, Kuehl A, et al. Asthma prevalence and morbidity among rural Iowa schoolchildren. *J Allergy Clin Immunol*. 2004;113(1):66-71.
- Kilburn KH. Human impairment from living near confined animal (hog) feeding operations. *J Environ Public Health*. doi: 10.1155/2012/565690.
- Hribar C, Schultz M. Understanding Concentrated Animal Feeding Operations and their Impact on Communities. Bowling Green, OH: National Association of Local Boards of Health; 2010.
- Nikolić M, Nikić D, Stanković A. Effects of air pollution on red blood cells in children. *Pol J Environ Stud*. 2008;17(28):267-271.
- Porea TJ, Belmont JW, Mahoney DH. Zinc-induced anemia and neutropenia in an adolescent. *J Pediatr*. 2000;136(5):688-690.
- Olsson M, Bensyrd I, Lundh T, Ottosson H, Skerfving S, Oskarsson A. Cadmium in blood and urine - impact of sex, age, dietary intake, iron status, and former smoking - association of renal effects. *Environ Health Perspect*. 2002;110(12):1185-1190.
- Kramer MH, Herwaldt BL, Craun GF, Calderon RL, Juranek DD. Surveillance for waterborne-disease outbreaks: United States, 1993-1994. Atlanta, GA: US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention (CDC); 1996.
- Rinsky JL, Nadimpalli M, Wing S, et al. Livestock-associated methicillin and multidrug resistant *Staphylococcus aureus* is present among industrial, not antibiotic-free livestock operation workers in North Carolina. *PLoS One*. 2013;8(7):e67641.
- Barton MD. Impact of antibiotic use in the swine industry. *Curr Opin Microbiol*. 2014;19:9-15.
- Neyra RC, Frisancho JA, Rinsky JL, et al. Multidrug-resistant and methicillin-resistant *Staphylococcus aureus* (MRSA) in hog slaughter and processing plant workers and their community in North Carolina (USA). *Environ Health Perspect*. 2014;122(5):471-477.
- Woolhouse M, Ward M, van Bunnik B, Farrar J. Antimicrobial resistance in humans, livestock and the wider environment. *Philos Trans R Soc Lond B Biol Sci*. 2015;370(1670):20140083.
- North Carolina Provisional Vital Statistics. Raleigh, NC: North Carolina State Center for Health Statistics, North Carolina Department of Health and Human Services; 2007, 2010, 2011, 2013, 2014, 2015; <https://schs.dph.ncdhhs.gov/data/vital.cfm>. Accessed July 19, 2018.
- Overview of the State Emergency Department Databases (SEDD). Rockville, MD: Healthcare Cost and Utilization Project (H-CUP); 2007-2013; <https://www.hcup-us.ahrq.gov/seddoverview.jsp>. Accessed July 19, 2018.
- Overview of the State Inpatient Databases (SID). Rockville, MD: Healthcare Cost and Utilization Project (H-CUP); 2007-2013; <https://www.hcup-us.ahrq.gov/sidoverview.jsp>. Accessed July 19, 2018.
- Keyfitz N. Sampling variance of the standardized mortality rates. *Hum Biol*. 1966;38:309-317.
- Bromberg S, Dill K. *Molecular Driving Forces*. New York, NY: Garland Science; 2002.
- Austin PC, Chiu M, Ko DT, Goeree R, Tu JV. Propensity score matching for estimating treatment effects. In: Faries DE, Leon AC, Haro JM, Obenchain RL, eds. *Analysis of Observational Health Care Data Using SAS*. Cary, NC: SAS Institute Inc.; 2010:51-84.
- Erramouspe J, Adamcik BA, Carlson RK. Veterinarian perception

- of the intentional misuse of veterinary medications in humans: a preliminary survey of Idaho-licensed practitioners. *J Rural Health*. 2002;18(2):311-318.
- 39 Sato Y, Fujimoto S, Konta T, et al. Anemia as a risk factor for all-cause mortality: obscure synergic effect of chronic kidney disease. *Clin Exp Nephrol*. 2018;22(2):388-394.
- 40 Del Fabbro P, Luthi JC, Carrera E, Michel P, Burnier M, Burnand B. Anemia and chronic kidney disease are potential risk factors for mortality in stroke patients: a historic cohort study. *BMC Nephrol*. 2010;11:27.
- 41 Stauffer ME, Fan T. Prevalence of anemia in chronic kidney disease in the United States. *PloS One*. 2014;9(1):e84943.
- 42 Minchella PA, Donkor S, Owolabi O, Sutherland JS, McDermid JM. Complex anemia in tuberculosis: the need to consider causes and timing when designing interventions. *Clin Infect Dis*. 2014;60(5):764-772.
- 43 Ren A, Wang J, Ye RW, Li S, Liu JM, Li Z. Low first-trimester hemoglobin and low birth weight, preterm birth and small for gestational age newborns. *Int J Gynaecol Obstet*. 2007;98(2):124-128.
- 44 LeJeune J, Kersting A. Zoonoses: an occupational hazard for livestock workers and a public health concern for rural communities. *J Agric Saf Health*. 2010;16(3):161-179.
- 45 Malekinejad M, Parriott A, Viitanen AP, Horvath H, Marks SM, Kahn JG. Yield of community-based tuberculosis targeted testing and treatment in foreign-born populations in the United States: A systematic review. *PloS One*. 2017;12(8):e0180707.
- 46 Hanson MA, Gluckman PD. Early developmental conditioning of later health and disease: physiology or pathophysiology? *Physiol Rev*. 2014;94(4):1027-1076.
- 47 Duke University. Together Duke Advancing Excellence through Community, Academic Strategic Plan. Durham, NC: Duke University; 2017.

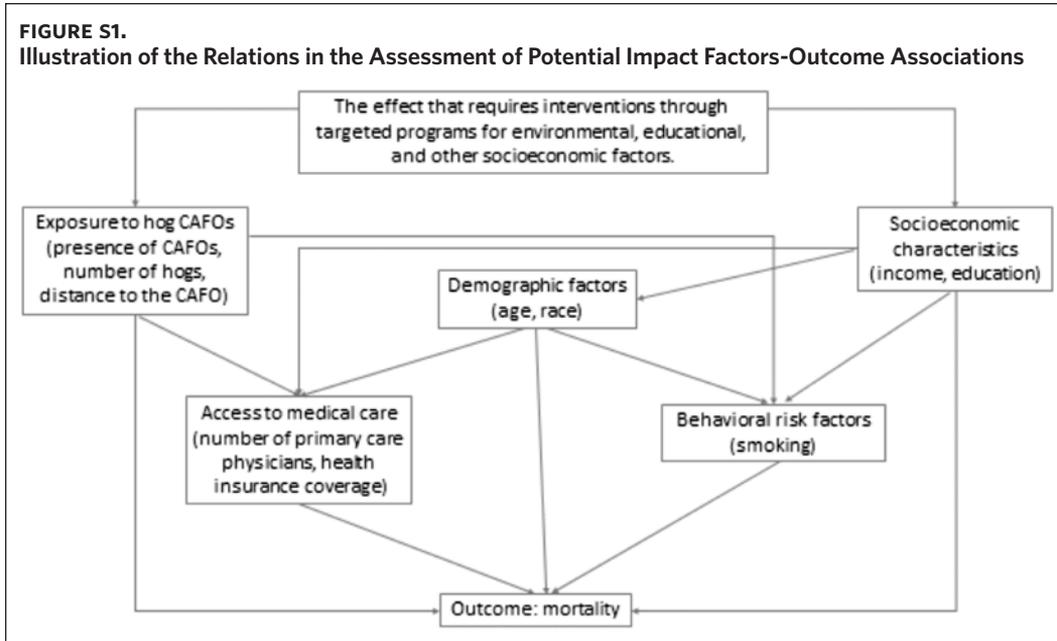
79502 APPENDIX 1.**APPENDIX 1.
The International Classification of Diseases (ICD) Codes Used in the Analysis****ICD-9 codes (used for analysis of HCUP data)**

280-285	Anemia (includes Iron deficiency anemias, Other deficiency anemias, Hereditary hemolytic anemias, Acquired hemolytic anemias, Aplastic anemia and other bone marrow failure syndromes, Other and unspecified anemias)
580-589	Kidney disease (Nephritis, Nephrotic Syndrome, and Nephrosis)
010-018	Tuberculosis
038	Septicemia, 995.91 - Sepsis
V21.3	Low birth weight

ICD-10 codes (used for analysis of Multiple Cause of Death data)

D50-D53, D55-D59, D60-D64	Anemia (includes Nutritional anemias, Hemolytic anemias, Aplastic and other anemias and other bone marrow failure syndromes)
N00-N19	Kidney disease (includes Glomerular diseases, Renal tubule-interstitial diseases, Acute kidney failure and chronic kidney disease)
A15-A19	Tuberculosis
A40, A41	Septicemia (includes Streptococcal sepsis, Other sepsis)
P07.1	Low birth weight newborn
P00-P96	Conditions originating in perinatal period
P00-P04	Newborns affected by maternal trauma
P10-P15	Disorders related to length of gestation and fetal growth

FIGURE S1.
Illustration of the Relations in the Assessment of Potential Impact Factors-Outcome Associations



79502 APPENDIX 3.

APPENDIX 3. Sensitivity Analysis

2a) Proc Genmod was used for GEE analysis

2b). The propensity score for matching zip codes without CAFO to zip codes with $> 215\text{hogs}/\text{km}^2$ (Study group 2) was evaluated using the percent of African Americans, percent of children and people aged 65+ among the residents, as well as median household income, and percent of people with a bachelor's or higher degree. The greedy matching algorithm [37] was used to match zip codes with close propensity scores.

The Matched group A included 56 zip codes that were matched by using the percent of African Americans, percent of children (aged 0-19) and people aged 65+ among the residents, and median household income. The Matched group B included 55 zip codes matched by above listed characteristics of Matched group A and additionally by the percent of people with a bachelor's or higher degree. Characteristics of matched zip codes (i.e., the results on balancing the variables in the matched groups) for the Matched group A and Matched group B are presented in Table S1.

79502 APPENDIX 4.

TABLE S1.
Characteristics of Matched Group A, Matched Group B, and Study Group 2, NC, 2007-2013

Variable	Matching design 1 Mean ¹ ±SE (95%CI)		Matching design 2 Mean ¹ ±SE (95%CI)	
	Matched group A	Study group 2	Matched group B	Study group 2
% of African-Americans	28.4±2.9% (22.8%-34.1%)	28.92±1.8% (25.5%-32.4%)	27.1%±3.0% (21.2%-33.0%)	28.9%±1.8% (25.4%-32.4%)
% of children (0-19 years old)	26.8±0.6% (25.7%-27.9%)	27.1±0.4% (26.2%-27.9%)	25.5%±0.6% (24.4%-26.6%)	27.3%±0.4% (26.3%-28.0%)
% of adults (65+ years)	14.0±0.6% (12.9%-15.2%)	14.3±0.4% (13.5%-15.2%)	15.0%±0.6% (13.8%-16.2%)	14.3%±0.4% (13.5%-15.2%)
Median household income (US dollars)	\$35,640±\$1,118 (\$33,450-\$37,831)	\$36,521±\$919 (\$34,719-\$38,322)	\$34,933±\$1,161 (\$32,658-\$37,208)	\$36,527±\$936 (\$34,693-\$38,362)
% of people with bachelor or higher degree education among those aged 25+ years	n/a	n/a	9.16%±0.8% (7.7%-10.7%)	11.1%±0.5% (10.2%-12.0%)

¹Means are evaluated without weights representing zip-code populations.
n/a, non-applicable.

Then, age-adjusted total mortality rate and cause-specific rates of mortality, hospital admissions, and ED visits were compared between Matched group A and B and Study group 2 for underlying cause of death or primary diagnosis and for underlying-plus-secondary cause of death or primary-plus-secondary diagnosis. As shown in Table S5, mortality rates for total mortality and anemia and kidney as underlying causes were higher in Study group 2 than in Matched group A and B. Also, mortality rates of anemia, kidney disease, tuberculosis, and septicemia were higher in Study group 2 than in both matched groups for these diseases as underlying-plus-secondary causes of death. Hospital admission and ED visit rates were higher in Study group 2 than in Matched group A and B for kidney disease and tuberculosis (for primary diagnoses and for primary-plus-secondary diagnoses). ED visits rate for children with LBW also was higher in Study group 2 than in both matched groups (for primary-plus-secondary diagnosis).

79502 APPENDIX 5.

TABLE S2.
Descriptive Table of the 3 Studied Groups of NC Communities with and without the Hog Concentrated Feeding Animal Operations (CAFOs): Race-Specific Population Groups, Socioeconomic Characteristics, Smoking Prevalence, and Access-To-Care Characteristics, NC, 2007-2013

Characteristics	NC communities with hog CAFOs (Study group 1)	NC communities with > 215hogs/km ² (Study group 2)	NC communities without hog CAFOs (Control group)
Race (%):			
White	63.9%**	58.3%**	73.7%
African-American (AA)	28.8%*	31.3%**	19.3%
American Indian	2.4%*	4.1%**	0.8%
Asian	0.8%**	0.3%**	2.5%
Other	4.1%	6.0%**	3.7%
Median household income	\$39,005**	\$36,520**	\$46,414
Bachelor or higher degree education	16.5%**	13.7%**	24.2%
Availability of primary care providers (per 100,000 population)	54**	51**	76
Percent of uninsured individuals	18.2%	18.5%	17.8%
Smokers prevalence among those aged 24+ years old	24.4%	25.9%**	24.0%

*P < 0.05.

**P < 0.001.

79502 APPENDIX 6.

TABLE S3.
Person-Years of Observations in Race-Specific Groups of the Residents of NC
Communities from the 3 Studied Groups, NC, 2007-2013

Race	NC communities with hog CAFOs (Study group 1)	NC communities with > 215hogs/km² (Study group 2)	NC communities without hog CAFOs (Control group)
White	10,054,073	1,588,477	36,675,276
African-American (AA)	4,528,375	851,839	9,593,021
American Indian	370,901	111,226	411,900
Asian	129,901	8,574	1,242,243
Other	642,425	162,896	1,870,849

FIGURE S2.
Mortality Rates among Patients with Co-Existing Anemia, Kidney Disease, and Septicemia:
The US Average, NC Average, and NC Communities with > 215hogs/km² (Study Group 2),
2007-2013. (95% Confidence Intervals Are Shown in the Parentheses)

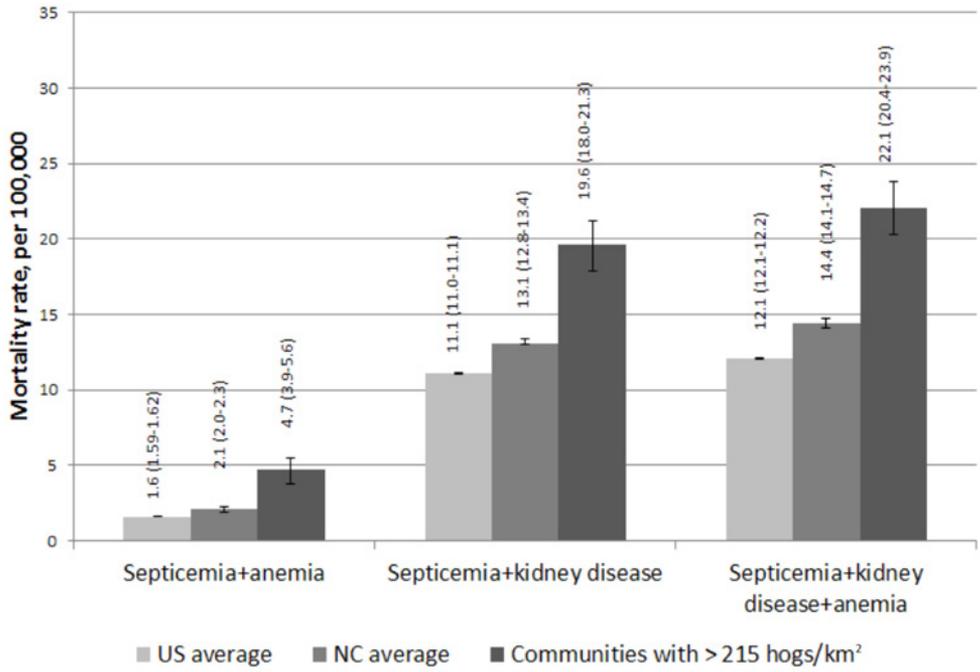
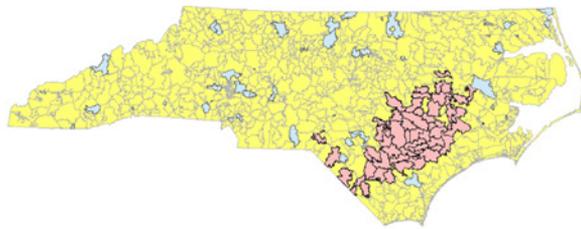


TABLE S4.
Age-Adjusted Mortality Rates (per 100,000) in NC Communities with > 215hogs/km² (Study Group 2): Ranks of This Area among the US States and District of Columbia with the Highest Mortality, 2007-2013. (95% Confidence Intervals Are Shown in the Parentheses)

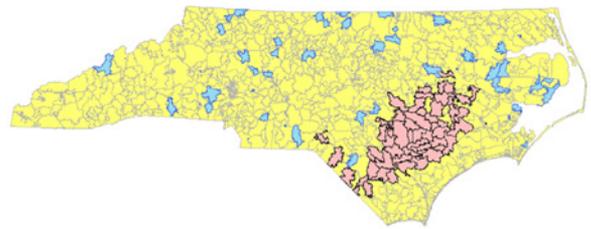
Disease, cause of mortality	NC communities with > 215hogs/km ²	Rank of the area with > 215hogs/km ² among the US states with the highest mortality	The US states (with their current respective ranks) ^a with mortality rates closest to the rates of the area with > 215hogs/km ²	
All-cause mortality	934 (922.7-944.8)	#4	#3 Alabama	940 (936.7-943.1)
Anemia:				
▪ as underlying cause,	2.6 (2.1-3.2)	#1	#1 Mississippi	2.3 (2.1-2.5)
▪ as underlying+secondary cause	35.5 (33.4-37.7)	#1	#1 West Virginia	24.4 (23.7-25.2)
Kidney disease:				
▪ as underlying cause,	24.8 (23.0-26.6)	#2	#1 Louisiana	26.2 (25.7-26.8)
▪ as underlying+secondary cause	119 (114.6-122.5)	#1	#1 West Virginia	96.2 (94.7-97.7)
Tuberculosis:				
▪ as underlying+secondary cause	0.63 (0.32-0.81)	#3	#2 District of Columbia	0.73 (0.49-1.04)
Septicemia:				
▪ as underlying cause,	16.6 (15.1-18.1)	#7	#6 Alabama	17.0 (16.6-17.4)
▪ as underlying+secondary cause	75.1 (71.9-78.2)	#2	#1 District of Columbia	83.6 (80.7-86.4)

^aMortality rates were calculated using the Multiple Cause of Death data from the Centers for Disease Control and Prevention (<https://wonder.cdc.gov/mcd.html>).

FIGURE S3.
Locations of Matched NC Zip Codes without Hog CAFOs (Matched Group A and Matched Group B) and Locations of Zip Codes with > 215hogs/km² (Study Group 2)



Legend
■ Matched group A
■ Study Group 2



Legend
■ Matched group B
■ Study Group 2

TABLE S5.

Age-Adjusted Cause-Specific Rates (per 100,000) of Mortality, Hospital Admissions, and ED Visits in Communities Located in Zip Codes with > 215hogs/km² (Study Group 2) and in Communities Located in Zip Codes Matched by Percent of African Americans, Percent of Children and Adults Aged 65+ in Population, and Median Household Income (Matched Group A) and Additionally Matched by Percent of the Residents Aged 25+ with Bachelor or Higher Degree (Matched Group B), NC, 2007-2013. (95% Confidence Intervals Are Shown in the Parentheses)

Outcome	Disease	Underlying cause/Primary diagnosis			Underlying+secondary cause/ Primary+secondary diagnosis		
		Study group 2	Matched group A	Matched group B	Study group 2	Matched group A	Matched group B
Mortality	Total mortality	934 (922.7-944.8)	867* (857.9-875.3)	920* (908.6-930.8)	934 (922.7-944.8)	867* (857.9-875.3)	920* (908.6-930.8)
	Anemia	2.65 (2.2-3.2)	2.1* (1.6-2.5)	1.8* (1.3-2.2)	35.5 (33.4-37.7)	20.6* (19.2-21.9)	24.1* (22.3-25.9)
	Kidney disease	24.8 (23.0-26.6)	20.9* (19.6-22.3)	22.5* (20.7-24.2)	119 (114.6-122.5)	90.1* (87.2-92.9)	107* (103.3-110.9)
	Tuberculosis	0.21 (0.04-0.38)	0.11 (0.01-0.20)	0.04* (0.04-0.13)	0.55 (0.28-0.82)	0.25* (0.10-0.40)	0.24* (0.06-0.42)
	Septicemia	16.6 (15.1-18.1)	15.9 (14.7-17.1)	16.7 (15.2-18.2)	75.1 (72.0-78.2)	62.7* (60.3-65.0)	67.6* (64.6-70.6)
Hospital	Anemia	113 (108.6-116.4)	116 (112.3-118.6)	141* (136.3-145.3)	2,179 (2,162-2,196)	1,867* (1,854-1,880)	2,165 (2,148-2,183)
	Kidney disease	187 (181.6-191.4)	152* (148.5-155.8)	175* (170.4-180.1)	2,031 (2,015-1,2048)	1,713* (1,701-1,725)	1,864* (1,848-1,880)
	Tuberculosis	3.1 (2.4-3.7)	1.7* (1.4-2.1)	0.86* (0.51-1.21)	6.2 (5.3-7.2)	3.7* (3.2-4.3)	2.4* (1.9-3.0)
	Sepsis	313.1 (306.7-319.5)	272* (267.4-277.2)	324* (317.2-330.4)	468 (460.3-475.9)	396* (390.4-402.2)	466 (458.4-474.3)
	Low birth weight	n/a	n/a	n/a	2.5 (1.9-3.1)	1.5* (1.2-1.9)	2.3 (1.7-2.9)
ED visits	Anemia	85.4 (81.9-88.9)	88.5 (85.8-91.3)	115* (111.0-119.3)	682 (672.2-691.7)	570* (563.0-577.0)	729* (718.6-739.0)
	Kidney disease	33.2 (31.1-35.3)	25.1* (23.6-26.6)	31.7 (29.6-33.8)	643 (634.0-652.3)	517* (510.7-524.2)	633 (623.7-642.3)
	Tuberculosis	0.32 (0.11-0.53)	0.15* (0.04-0.25)	0.08* (0.03-0.18)	1.4 (1.0-1.9)	0.89* (0.62-1.17)	0.61* (0.32-0.90)
	Sepsis	20.1 (18.5-21.7)	12.1* (11.1-13.2)	21.3 (19.6-23.0)	35.5 (33.3-37.6)	20.1* (18.7-21.4)	33.1 (31.0-35.2)
	Low birth weight	n/a	n/a	n/a	4.7 (3.9-5.5)	1.04* (0.74-1.34)	1.9* (1.4-2.5)

*Statistically significant difference when compared to Study group 2.
n/a, non-applicable.

Exhibit 9

**RECONCILING ENVIRONMENTAL JUSTICE WITH CLIMATE
CHANGE MITIGATION:
A CASE STUDY OF NC SWINE CAFOs**

D. Lee Miller¹ and Ryke Longest²

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INTRODUCTION: THE BIG PIG PROBLEM

For thirty years, the swine industry has externalized severe environmental and health harms onto poor communities of color in Eastern North Carolina.³ This “Big Pig” problem is caused by the confinement, consolidation, and concentration of industrial hog operations within the low, flat, and economically marginalized Coastal Plain.⁴

Big Pig’s rise was not inevitable. As recently as 1982, more than 11,000 small swine farms freckled nearly all of North Carolina’s 100 counties.⁵ Then came the “boom” of consolidation and industrialization that transformed hog

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3. Kate Jenkins, *Industrial Hog Farming and Environmental Racism* (Dec. 20, 2015), <http://www.stirjournal.com/2015/12/20/industrial-hog-farming-and-environmental-racism/>.
4. See Bob Edwards & Anthony E. Ladd, *Environmental Justice, Swine Production and Farm Loss in North Carolina*, 20 SOC. SPECTRUM 263, 264 (2000) (discussing concentration of swine production on coastal plain and growing environmental justice concerns).
5. *Id.* at 268 (“Of the nearly 11,400 farms in 1982 producing hogs and pigs . . . almost 60 percent had less than 25 hogs.”)

production into a highly consolidated and vertically integrated industry.⁶ Between 1989 and 1995, vertically integrated corporations and their contract growers built 700 Concentrated Animal Feeding Operations⁷ (CAFOs) in Eastern North Carolina while 7,000 smaller hog farmers went out of business.⁸ The emergent “megalopolis”⁹ of confinement houses quartered 8.2 million pigs¹⁰ that produced twice as much manure as the population of New York City without a sewage treatment plant in sight.¹¹

The new mega-facilities are concentrated in a handful of socially and environmentally vulnerable communities in the Coastal Plain where the most prominent geological features are sandy soils, high water tables, and proximity to the coast.¹² Ten North Carolina counties in the Coastal Plain now account for ten percent of the entire swine inventory of the United States.¹³ Nearly every hog is grown under contract to be slaughtered at the world’s largest swine slaughter facility located in the small town of Tar Heel, North Carolina.¹⁴

The 2,300 North Carolina swine CAFOs operating today rely on the so-called lagoon and spray field system.¹⁵ Hog waste is flushed from confinement barns into uncovered and unlined earthen pits, where it partially digests before industrial sprinklers spray the effluent onto nearby cropland.¹⁶

6. *See id.* at 264, 267 (discussing “explosion” of the North Carolina swine industry).

7. CAFOs are Animal Feeding Operations (AFOs) distinguished by their size or their designation as significant polluters of surface waters. 40 C.F.R. § 122.23(b)-(c) (2020). AFOs are livestock farms that raise animals in confinement. *Id.* § 122.23(b)(1).

8. Edwards, *supra* note 4, at 267.

9. Joby Warrick & Pat Stith, THE NEWS & OBSERVER, *New Studies Show that Lagoons are Leaking*, THE PULITZER PRIZES (Feb. 19, 1995), <https://www.pulitzer.org/winners/news-observer-raleigh-nc>.

10. NAT’L AGRIC. STATISTICS SERV., U.S. DEP’T AGRIC., HOGS AND PIGS: FINAL ESTIMATES 1993-1997 6 (1998) (noting 8.2 million swine in North Carolina in 1995).

11. Hannah Connor, *Comprehensive Regulatory Review: Concentrated Animal Feeding Operations Under the Clean Water Act From 1972 to the Present*, 12 VT. J. ENVTL. L. 276, 276 (2011).

12. *Our State Geography in a Snap: The Coastal Plain Region* (Jan. 1, 2012), <https://www.ncpedia.org/geography/region/coastal-plain>.

13. *See* NAT’L AGRIC. STATISTICS SERV., U.S. DEP’T OF AGRIC., 2019 NORTH CAROLINA AGRICULTURAL STATISTICS: ONE HUNDRED YEARS AND COUNTING 42 (2019) (displaying swine data by county).

14. *See* Paul Blest, *A Stench in the Nostrils of God* (Feb. 20, 2020), <https://theoutline.com/post/8633/smithfield-pork-tar-heel-north-carolina-industrial-farms-lawsuits?zd=1&zi=tmcimmnh> (describing Tar Heel slaughter facility). Local citizens later sued the state for failing to conduct an environmental impact assessment of the facility, raising specific concerns about cumulative and indirect impacts caused by new hog operations built to satisfy this increased processing capacity. *See generally* Citizens for Clean Indus., Inc. v. Lofton, 427 S.E.2d 120 (1993).

15. USGS *Studies Influence of Animal Feeding Operations on Stream Water Quality*, STORMWATER REPORT (Aug. 5, 2015), <https://stormwater.wef.org/2015/08/usgs-studies-influence-animal-feeding-operations-stream-water-quality/>.

16. *See* Michelle Nowlin, *Sustainable Production of Swine: Putting Lipstick on a Pig?*, 37 VT. L. REV. 1079, 1084–85 (2013) (describing the mechanics of the lagoon and spray field system).

The lagoon and spray field system lies at the root of Big Pig's environmental harms, including water pollution, air pollution, antibiotic resistance, and nuisance conditions.¹⁷

This pollution harms human health, especially the health of people who live nearby. A comprehensive literature review found respiratory illness, MRSA, Q fever, and stress/mood disorders are all “consistently and positively associated” with living near a CAFO.¹⁸ Local data confirm the trend. Duke University researchers found that North Carolinians living near a swine CAFO experienced a broad range of worse health outcomes compared with a control group.¹⁹ Neighbors suffered higher rates of all-cause mortality, infant mortality, mortality from anemia, kidney disease, tuberculosis, septicemia, and low birth weight.²⁰ These negative outcomes robustly and inversely correlated with proximity to the nearest hog CAFO.²¹

North Carolinians do not bear these health costs equitably. The environmental and public health harms of this system are a black-and-white issue of environmental justice (EJ) because CAFOs were disproportionately built in politically disenfranchised communities of color.²² Beginning in the mid-1990s, community-based participatory research by University of North Carolina epidemiologist Steve Wing investigated the locations and community health impacts of CAFOs in Eastern North Carolina.²³ He found “a case study of environmental racism.”²⁴ Compared to the non-Hispanic white population, Black people and Native Americans are respectively 1.4 and 2.39 times more likely to suffer the consequences of living within three miles of a swine CAFO.²⁵

17. See generally *id.* at 1085–96 (describing negative impacts of CAFOs); CARRIER HRIBAR, NAT'L ASS'N OF LOCAL BDS. OF HEALTH, UNDERSTANDING CONCENTRATED ANIMAL FEEDING OPERATIONS AND THEIR IMPACT ON COMMUNITIES 5–11 (2010) (describing negative impacts of CAFOs).

18. Joan A. Casey et al., *Industrial Food Animal Production and Community Health*, 2 CURRENT ENVTL. HEALTH REP. 259, 259 (2015).

19. Julia Kravchenko et al., *Mortality and Health Outcomes in North Carolina Communities Located in Close Proximity to Hog Concentrated Animal Feeding Operation*, 79 N.C. MED. J. 278, 278 (2018).

20. *Id.* at 278, 281–84.

21. *Id.* at 278, 285.

22. See, e.g., STEVE WING & JILL JOHNSTON, DEP'T OF EPIDEMIOLOGY, UNIV. OF N.C., INDUSTRIAL HOG OPERATIONS IN NORTH CAROLINA DISPROPORTIONATELY IMPACT AFRICAN-AMERICANS, HISPANICS AND AMERICAN INDIANS 1 (2015); Wendee Nicole, *CAFOs and Environmental Justice: The Case of North Carolina*, 121 ENVTL. HEALTH PERSP. A182, A183 (2013); Edwards, *supra* note 4, at 266.

23. See generally Steve Wing et al., *Community Based Collaboration for Environmental Justice: South-East Halifax Environmental Reawakening*, 8 ENV'T. & URBANIZATION 129 (1996) (describing environmental racism near hog production facilities).

24. *Id.* at 129. Wing uses “environmental racism” to describe how “[i]nstitutional racism connects with exposure to environmental hazards when inequalities of political and economic power result in a discriminatory pattern of location of polluting industries and wastes.” *Id.* at 131.

25. WING & JOHNSTON, *supra* note 22, at 6.

Lagoons break down solid and liquid waste into gasses, creating air pollution.²⁶ Liquid waste sprayed onto fields runs off or seeps into groundwater.²⁷ CAFOs emit volatile organic compounds (VOCs) like dimethyl sulfide, ammonia, hydrogen sulfide, and particulate matter.²⁸ Antibiotic-resistant pathogens travel through both air and water vectors.²⁹

Now, as global concern over climate change drives corporate demand to decarbonize supply chains, market forces exert pressure for converting existing lagoon and spray field CAFOs into biogas factories. Biogas mitigates GHG emissions by combusting methane into CO₂ while generating revenue from electricity sales and carbon offset credits.³⁰ Reconciling the interests of EJ, local natural resources, and the global climate requires agribusiness to reinvest some of this financial boon into the clean technologies they have promised—and shirked—for decades.

CHAPTER I: RISE OF THE RESISTANCE

North Carolina became the fastest-growing swine-producing state in the country during the early 1990s.³¹ From the very beginning of that boom, a clutch of grassroots community groups formed to oppose the lagoon and spray field system.³² They asked local government leaders to slow construction.³³ Residents rightly feared that large swine farms promising economic development would instead deliver air pollution, noxious odors, groundwater contamination, surface water pollution, the loss of independent family farms, farmland loss, and the loss of rural vitality and institutions.³⁴ One group, the Concerned Citizens of Tillery, successfully pushed county

26. Dan Charles, *Big Companies Bet On Cleaner Power From Pig Poop Ponds* (Nov. 22, 2019), <https://www.npr.org/sections/thesalt/2019/11/22/781565978/big-companies-bet-on-cleaner-power-from-pig-poop-ponds> (“On most farms, that gas just goes floating off into the air — and contributes to the overheating of the planet. Methane is a greenhouse gas with a warming impact at least 25 times greater, per pound, than carbon dioxide.”).

27. See generally Casey et al., *supra* note 18 (discussing the impacts of swine CAFOs, including to ground- and surface water).

28. HRIBAR, *supra* note 17, at 5.

29. See Casey et al., *supra* note 18, at 260 (summarizing the transmission of antibiotic-resistant pathogens).

30. U.S. DEP’T OF AGRIC. ET AL., *BIOGAS OPPORTUNITIES ROADMAP 12* (2014); NAT’L RENEWABLE ENERGY LAB., *ENERGY ANALYSIS: BIOGAS POTENTIAL IN THE UNITED STATES 1* (2013).

31. Edwards, *supra* note 4, at 263.

32. Elisabeth Stoddard, *Neoliberal Governance and Environmental Risk*, in *POLITICAL ECOLOGIES OF MEAT* 137, 146 (Jody Emel & Harvey Neo, eds., 2015). These groups included the Concerned Citizens of Tillery, the Alliance for a Responsible Swine Industry, the Rural Empowerment Association for Community Help, and the North Carolina Environmental Justice Network. *Id.*

33. See *id.* (describing pressures the community groups put on the state).

34. Steve Wing, *Social Responsibility and Research Ethics in Community-Driven Studies of Industrialized Hog Production*, 110 *ENV’T. HEALTH PERSP.* 437, 438 (2002).

officials to enact a local health ordinance requiring basic environmental protections missing from state laws.³⁵ Other groups ensured that anti-CAFO zoning ordinances proliferated at the county level.³⁶ But legal challenges and state preemption ultimately de-clawed local resistance.³⁷

Then a series of catastrophic lagoon breaches and hurricanes in the mid-1990s transmuted a local environmental problem into a political problem for state government. Operational deficiencies caused a lagoon breach in 1995 that spilled 25 million gallons of hog waste into the New River.³⁸ In 1996, *The (Raleigh) News and Observer* published a Pulitzer-Prize-winning series, “Boss Hog,” exposing how corporate swine interests had captured the legislature and wrought a toxic landscape in Eastern North Carolina.³⁹ During Hurricane Floyd in 1999, heavy rains caused at least five lagoons to burst; forty-seven other lagoons flooded, spilling their contents into the landscape.⁴⁰

Responding to community groups, the widespread spills, and the “Boss Hog” press, Governor Hunt convened the Blue Ribbon Commission on Agricultural Waste to study swine CAFO pollution.⁴¹ The Commission’s report found egregious violations and urged legislative action.⁴² In 1997, the legislature put a temporary moratorium on new lagoons that prohibited new lagoon and spray field waste management systems, absent strict environmental performance standards.⁴³ Since 1997, no new lagoons have been lawfully built, absent exceptions to the moratorium.⁴⁴ Thousands of existing lagoons were grandfathered in, and dozens of new lagoons were built under moratorium exceptions.⁴⁵

35. *Id.*

36. *Id.*

37. See, e.g., *Craig v. Cty. of Chatham*, 565 S.E.2d 172 (2002) (finding a town ordinance to be preempted by state law).

38. *Huge Spill of Hog Waste Fuels an Old Debate in North Carolina*, N.Y. TIMES, June 25, 1995, § 1, at 21.

39. See *The News & Observer (Raleigh, NC)*, THE PULITZER PRIZES, <https://www.pulitzer.org/winners/news-observer-raleigh-nc> (last visited May 1, 2020) (naming the “Boss Hog” article series as the 1996 Pulitzer Prize Winner in Public Service); Pat Stith et al., *THE NEWS & OBSERVER, Boss Hog: The Power of Pork, North Carolina’s Pork Revolution*, THE PULITZER PRIZES (Feb. 19, 1995), <https://www.pulitzer.org/winners/news-observer-raleigh-nc> (describing the relationship between the hog industry and North Carolina).

40. Nowlin, *supra* note 16, at 1088.

41. See DAVID KIRBY, *ANIMAL FACTORY* 144, 147 (2010) (describing the research of “the governor’s Blue Ribbon Commission on Agricultural Waste”).

42. *Id.*

43. See generally 1997 N.C. Sess. Laws 458 (codified as amended at N.C. GEN. STAT. § 143-215.10A (2013)) (enacting a moratorium on the construction or expansion of swine farms and lagoons).

44. *CAFO Wars Continue* (Mar. 12, 2019), <https://www.yadkinriverkeeper.org/news/2019/3/12/cafo-wars-continue>.

45. Talia Buford, *A Hog Waste Agreement Lacked Teeth, and Some North Carolinians Say They’re Left to Suffer* (Nov. 23, 2018), <https://www.propublica.org/article/a-hog-waste-agreement-lacked-teeth>.

The 1997 law also added state permitting and inspection requirements—a landmark victory at the time.⁴⁶ North Carolina’s Department of Environmental Quality (DEQ) requires facilities with more than 250 hogs to have either a state permit or a permit under the Clean Water Act’s National Pollution Discharge Elimination System (NPDES).⁴⁷ Virtually all hog farms use the State’s general permit rather than its more stringent federal counterpart.⁴⁸ Optimism over the inspection and permit system was short lived. Permitting fell far short of community hopes, in large part because DEQ has consistently issued permits without considering the additional burden placed on communities of color.⁴⁹ Inspections suffer from funding cuts and public records exemptions.⁵⁰

Indeed, if the permit system had lived up to its facial promises, the disproportionate burden borne by communities of color would at least have been much lighter. But DEQ’s swine permits are fundamentally flawed. They are predicated on the legal fiction that regulated facilities do not pollute public waters; they are classified as non-discharge facilities.⁵¹ The fiction that these facilities do not discharge rests on magical thinking backed by models.⁵² Permittees must spray waste at “agronomic rates,” meaning that nitrogen applied through manure balances with the theoretical nitrogen uptake by crops.⁵³ Yet the permit does not require ground- or surface-water monitoring except when regulators observe permit violations, a catch-22.⁵⁴ Worse, the permit exempts from the definition of a discharge any waste that

and-some-north-carolinians-say-left-to-suffer; *Despite Moratorium, More Hog Farms Built in North Carolina in Past 10 Years* (Mar. 23, 2007), <https://thepigsite.com/news/2007/03/despite-moratorium-more-hog-farms-built-in-north-carolina-in-past-10-years-1>.

46. See generally 1997 N.C. Sess. Law 458 (describing permitting requirements); N.C. GEN. STAT. § 143-215.10C (discussing applications and permits to construct or operate an animal waste management system); *id.* § 143-215.10F (discussing inspection program).

47. N.C. GEN. STAT. § 143-215.10C(a)(1); 15A N.C. ADMIN. CODE ch. 02T (2018).

48. See *List of Permitted Animal Facilities*, N.C. DEP’T ENVTL. QUALITY (Nov. 6, 2019), https://files.nc.gov/ncdeq/List_OF%20Permitted_Animal_Facilities2019-11-06.xls (listing data on permitted animal facilities in North Carolina).

49. *Infra*, Chapter III; Complaint at 34–41, *Waterkeeper Alliance, Inc. v. N.C. Dep’t of Env’tl. Quality* (Sept. 3, 2014), <https://earthjustice.org/sites/default/files/files/North-Carolina-EJ-Network-et-al-Complaint-under-Title-VI.pdf>.

50. Stoddard, *supra* note 32, at 148–49.

51. STEPHEN L. HARDEN, U.S. DEP’T. OF THE INTERIOR, SURFACE-WATER QUALITY IN AGRICULTURAL WATERSHEDS OF THE NORTH CAROLINA COASTAL PLAIN ASSOCIATED WITH CONCENTRATED ANIMAL FEEDING OPERATIONS 2 (2015).

52. See, e.g., *id.* at 47 (discussing analysis to identify differences in watersheds associated with either having or not having CAFO manure effects).

53. N.C. GEN. STAT. § 143-215.10C(e)(6)–(7); *id.* § 413-215.10C(f); see also DEP’T OF ENVTL. QUALITY, N.C. ENVTL. MGMT. COMM’N, SWINE WASTE MANAGEMENT SYSTEM GENERAL PERMIT 1, 3 (2014) [hereinafter GENERAL PERMIT] (listing permit requirements).

54. See generally DEP’T ENVTL. QUALITY, *supra* note 53 (showing no ground or surface water monitoring requirement).

spills during a 25-year, 24-hour storm event—defined as the strongest storm with a probable recurrence interval of 25 years.⁵⁵ Eastern North Carolina has experienced two 1,000-year storms in the past four years.⁵⁶

In 2000, North Carolina’s then Attorney General Mike Easley reached an agreement with Smithfield and its subsidiaries to identify replacement technology for grandfathered lagoons.⁵⁷ Smithfield committed to fund research on new environmentally superior waste treatment technologies (ESTs).⁵⁸ The company agreed to install ESTs on all company-owned farms within three years from the date that the “designee” determined that they met environmental performance standards and proved “technically, operationally, and economically feasible.”⁵⁹ Smithfield also agreed to provide assistance for their contract farmers to install ESTs.⁶⁰

The environmental performance standards specified ESTs must 1) eliminate all animal waste discharges to surface and ground water; and substantially eliminate 2) atmospheric ammonia emissions; 3) odor detectable beyond the farm boundary; 4) disease-transmitting vectors and airborne pathogens; and 5) nutrient and heavy metal contamination of soil and groundwater.⁶¹ Notably, the Smithfield Agreement left out methane as a pollutant subject to performance standards, as had the moratorium legislation before it.⁶²

An engineering committee under the Smithfield Agreement labored to set standards based on different interpretations of “substantially eliminate.” For example, the committee decided that, in the case of ammonia emissions, “substantially eliminate” meant a 60% reduction compared to a typical swine farm.⁶³ In the intervening years, multiple ESTs tested on North Carolina

55. *Id.* at 2.

56. See James Bruggers, *After Back-to-Back Hurricanes, North Carolina Reconsiders Climate Change* (Dec. 27, 2018), <https://insideclimatenews.org/news/27122018/hurricane-damage-north-carolina-climate-change-2018-year-review-florence-michael-matthew> (describing major rain events in North Carolina); Jason Samenow, *Florence was Another 1,000-year Rain Event. Is This the New Normal as the Planet Warms?* (Sept. 18, 2018), <https://www.washingtonpost.com/weather/2018/09/18/florence-was-another-year-rain-event-is-this-new-normal-planet-warms/> (explaining the increase in number of rare storms).

57. Agreement between the Attorney General of North Carolina et al., at 1–6 (July 25, 2000), https://projects.ncsu.edu/cals/waste_mgmt/smithfield_projects/agreement.pdf [hereinafter Smithfield Agreement].

58. *Id.* at 2–3.

59. *Id.* at 3–5.

60. *Id.* at 13.

61. *Id.* at 4.

62. See generally *id.* (showing no methane provisions).

63. SMITHFIELD AGREEMENT ADVISORY PANEL ENGINEERING SUBCOMMITTEE, ENVIRONMENTALLY SUPERIOR PERFORMANCE CRITERIA DEFINITIONS: RECOMMENDATIONS DOCUMENT 2,

swine farms proved capable of meeting—and far exceeding—the environmental performance standards.⁶⁴ The third generation of a treatment technology called Super Soils “was documented to remove approximately 99% of total suspended solids, 98% of [chemical oxygen demand], 99% of TKN (Total Kjeldahl nitrogen), 100% ammonia, 92% phosphorus, 95% copper, and 97% zinc from the flushed manure. Fecal coliform reductions were measured to be 99.98%.”⁶⁵

A separate economic subcommittee set out to define “economically feasible.”⁶⁶ A majority of the subcommittee agreed on a standard that would keep at least 88% of swine farms in business.⁶⁷ Four dissenting members, representing swine companies and an agricultural bank, wrote a dissenting report contending that the standard should be “no net increase in cost” compared to the lagoon and spray field system.⁶⁸ Industry’s dissent contradicted the terms of the Smithfield Agreement: “The parties understand and agree that alternative technologies that cost more than the lagoon and spray field system may be determined to be economically feasible.”⁶⁹ As early as 2006, designee Dr. C. Mike Williams concluded that Super Soils “comprise an unconditional Environmentally Superior Technology for new farms” meeting all EST requirements and economic feasibility.⁷⁰

Seven years into the Smithfield Agreement, the lagoons and spray fields operated unabated.⁷¹ In 2007, frustrated community groups championed a bill that would have banned all new lagoons and prohibited any swine facility from installing new waste treatment systems without adopting ESTs.⁷² It would have given grants to any producers who installed any of the five waste

[http://projects.ncsu.edu/cals/waste_mgmt/smithfield_projects/phase1report04/Appendix%20D\(Engineering\).pdf](http://projects.ncsu.edu/cals/waste_mgmt/smithfield_projects/phase1report04/Appendix%20D(Engineering).pdf).

64. See C.M. WILLIAMS, ANIMAL & POULTRY WASTE MGMT. CTR., N.C. STATE UNIV., EVALUATION OF GENERATION 3 TREATMENT TECHNOLOGY FOR SWINE WASTE 2 (2013) (noting second and third generation technologies achieved efficient environmental performance at reduced costs).

65. *Id.* at 3.

66. See CHANTAL LINE CARPENTIER ET AL., MAJORITY REPORT FROM THE ECONOMICS SUBCOMMITTEE OF THE ADVISORY PANEL TO THE DESIGNEE UNDER THE AGREEMENTS BETWEEN ATTORNEY GENERAL OF NORTH CAROLINA AND SMITHFIELD FOODS, PREMIUM STANDARD FARMS AND FRONTLINE FARMERS REGARDING RECOMMENDATIONS ON ECONOMIC FEASIBILITY DETERMINATIONS 30–31 (2005),

https://projects.ncsu.edu/cals/waste_mgmt/smithfield_projects/phase3report06/pdfs/Appendix%20D.pdf (presenting letter within majority report seeking to define “economically feasible”).

67. See *id.* at 6, 20 (agreeing with 12% reduction in swine operation to obtain better waste handling).

68. *Id.* at 3.

69. Smithfield Agreement, *supra* note 57, at 10.

70. MIKE WILLIAMS, DEVELOPMENT OF ENVIRONMENTALLY SUPERIOR TECHNOLOGIES: PHASE 3 REPORT 6 (2006).

71. See Stoddard, *supra* note 32, at 147 (noting that five ESTs had been developed, yet none were implemented); Buford, *supra* note 45 (noting that hog farmers continued to store hog waste in lagoons).

72. Stoddard, *supra* note 32, at 147.

management technologies approved as ESTs through the Smithfield Agreement.⁷³

After passing the NC Senate with unanimous support, then-Governor Mike Easley pulled the bill before it could pass the House.⁷⁴ It was replaced with a bill developed with industry support.⁷⁵ The new bill retained the ban on construction of any new lagoons without ESTs, but dispensed with the regulations on expanding facilities.⁷⁶ Perhaps most significantly, the new bill substituted comprehensive financial support for ESTs with a pilot program for producers to capture lagoon methane and sell it at subsidized prices for electricity generation.⁷⁷ As one commentator noted, “the legislation rolled back the more restrictive regulations in the original bill and turned the industry’s hog waste into a commodity that was to be subsidized by the state’s citizens.”⁷⁸

Methane capture could be a revenue source because it was not regulated at all. Methane itself is odorless and thus not covered by North Carolina odor standards.⁷⁹ While state water quality permits for swine are weak, air permits for swine are nonexistent.⁸⁰ Like the Clean Air Act regulations before, and the Smithfield Agreement that would follow, the state swine permit contains no standards for methane emissions.⁸¹ Omitting methane preserved Clean Air Act loopholes that allowed CAFOs to emit unlimited atmospheric methane, which in turn allows these emissions sources to meet “additionality” requirements of voluntary carbon markets.⁸² Thusly were the seeds sown for the nascent biogas industry, now on the rise twenty years later.

Community groups rose in opposition to the lagoon and spray field system. Throughout the 1990s and 2000s, they erected zoning restrictions, filed nuisance suits, and catalyzed the state’s legislature and executive

73. *Id.*

74. *Id.*

75. 2007 N.C. Sess. Laws 523 (codified at N.C. GEN. STAT. § 143-215.10I); *see also North Carolina Finalizes Swine Lagoon Ban* (Sept. 20, 2007), <https://www.nationalhogfarmer.com/news/newsflash/north-carolina-finalizes-lagoon-ban> (discussing new bill).

76. *North Carolina Finalizes Swine Lagoon Ban*, *supra* note 75.

77. Stoddard, *supra* note 32, at 147–48.

78. *Id.* at 148.

79. Lan Luo, *Properties of Methane Gas* (Feb. 23, 2020), <https://sciencing.com/properties-methane-gas-5090934.html>; *see generally* 15A N.C. ADMIN. CODE 02D § .1800 (2000) (lacking methane in odor standards).

80. *See generally* GENERAL PERMIT, *supra* note 53 (listing permitting requirements). The general permit applies to any swine animal feeding operation in North Carolina, but it does not regulate air pollution. *Id.*

81. *See generally id.* (containing no standards for methane emissions).

82. *See* Steven Ferrey, *When 1+1 No Longer Equals 2: The New Math of Legal “Additionality” Controlling World and U.S. Global Warming Regulation*, 10 MINN. J. L. SCI. & TECH. 591, 591–94 (2009) (describing “additionalities”).

powers to pass a lagoon moratorium, implement a permitting regime, and pressure industry into a landmark agreement.⁸³ Yet 25 years into the lagoon and spray field era, activism had failed to stop—let alone reverse—the environmental, social, or human health problems caused by concentrated swine.⁸⁴ By the early 2010's, the environmental and EJ communities began to look for new strategies.

CHAPTER II: NEW ACTORS CHANGE STRATEGIC LANDSCAPE

Around 2014, three new actors emerged to challenge the status quo: a mature and coordinated EJ community; well-resourced plaintiffs' attorneys; and corporate sustainability divisions of major firms.⁸⁵ Each opened a new legal assault against Big Pig's pollution. Each sought different remedies: compensatory and punitive monetary damages for past harms; change to the regulatory schema that account and correct for permitting inequities to prevent future harms; and emissions accounting and reductions in order to decarbonize the corporate supply chain.⁸⁶ Each remedy comes with a significant price tag, at least up front. But, while the infrastructure to capture methane for biogas will lower GHG emissions, it will not improve the daily lives of nearby residents.⁸⁷ The extent to which climate mitigation and EJ interests get reconciled will mold the legal and physical landscape for a generation to come.

Title VI Complaint

By 2014, the community organizations that first resisted the CAFO boom had blossomed into a coordinated network of environmental justice leaders. In 2014, Earthjustice, on behalf of the North Carolina Environmental Justice Network, the Rural Empowerment Association for Community Help, and the Waterkeepers Alliance, filed a complaint with the Environmental Protection

83. See generally Stoddard, *supra* note 32, at 137–49 (describing community groups' actions throughout the history of swine CAFOs).

84. See Lily Kuo, *The World Eats Cheap Bacon at the Expense of North Carolina's Rural Poor*, QUARTZ (Jul. 14, 2015), <https://qz.com/433750/the-world-eats-cheap-bacon-at-the-expense-of-north-carolinas-rural-poor/> (outlining the struggles of activists and those affected by swine CAFOs).

85. See CHRISTINE BALL-BLAKELY, ANIMAL LEGAL DEF. FUND, *CAFOs: PLAGUING NORTH CAROLINA COMMUNITIES OF COLOR* 30–37 (2018) (discussing coordinated community movement against CAFOs).

86. *Id.*

87. See Nicole, *supra* note 22, at A188 (noting methane digester will not, on its own, reduce odors, pathogens, and heavy metals).

Agency's (EPA) Office of Civil Rights.⁸⁸ The complaint alleged that the lagoon and spray field system disproportionately impacted communities of color with many types of pollution and that the state, through its permitting system, failed to address these racial disparities in violation of Title VI of the federal Civil Rights Act.⁸⁹

After preliminary investigation, the EPA issued a Letter of Concern to DEQ in 2017.⁹⁰ Its investigators found “adverse impacts from industrial swine operations on communities of color”⁹¹ and “retaliation, threats, intimidation, and harassment by swine facility operators and pork industry representatives” against residents who filed complaints.⁹² The letter seemingly rattled DEQ officials, who did not wait for the EPA to complete its full investigation before settling in 2018.⁹³ The settlement terms, negotiated with the same community organizations that DEQ had ignored for decades, put new arrows in the quivers of communities fighting for greater protections from CAFO pollution.⁹⁴ Among other terms, state officials agreed to propose specific updates to the state swine general permit;⁹⁵ develop and implement an Environmental Justice tool;⁹⁶ and take steps to broaden community participation in state permitting processes.⁹⁷

Nuisance Suits

In 2014, plaintiffs' attorneys filed nuisance suits on behalf of 500+ neighbors of swine CAFOs claiming that the lagoon and spray field system harmed the use and enjoyment of their property.⁹⁸ This was not the first

88. *See generally* Complaint Under Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, 40 C.F.R. Part 7, (2014) at 1, <https://earthjustice.org/sites/default/files/files/North-Carolina-EJ-Network-et-al-Complaint-under-Title-VI.pdf> (submitting administrative complaint to the EPA Office of Civil Rights).

89. *Id.* at 3, 12–13.

90. Letter from EPA External Civil Right Compliance Office, Office of General Counsel, to William G. Ross, Jr., Acting Secretary, North Carolina Department of Environmental Quality, (Jan. 12, 2017), <http://waterkeeper.org/wp-content/uploads/2017/01/Letter-to-Complainants-in-Case-11R-14-R4-Forwarding-Letter-of-Concern-to-NC-DEQ-1-12-2017.pdf>.

91. *Id.* at 3.

92. *Id.* at 4.

93. Settlement Agreement between N.C. Dep't. of Env'tl. Quality et. al. (May 3, 2018), https://files.nc.gov/ncdeq/documents/files/Final%20Settlement%20Agreement_attachments%20and%20sig.pdf.

94. *See id.* at 1 (naming parties to the agreement).

95. *Id.* at 4–5.

96. *Id.* at 6.

97. *Id.* at 7–8.

98. *See, e.g.*, Complaint of Linda Atkinson, et al., In re NC Swine Farm Nuisance Litig., No. 5:15-cv-00013-BR, 2017 WL 5178038 (E.D.N.C. Nov. 8, 2017); Complaint of Bertha Lee Carter Battle et al., In re NC Swine Farm Nuisance Litig., No. 5:15-cv-00013-BR, 2017 WL 5178038 (E.D.N.C. Nov. 8,

attempt to use nuisance law to rein in CAFO pollution, nor even the first to produce eye-catching verdicts.⁹⁹ Nuisance suits proliferated nationwide in the late 1990s.¹⁰⁰ In 2010, a Missouri court awarded neighbors \$11 million in damages caused by a swine mega-farm owned by Premium Standard Foods, a Smithfield subsidiary.¹⁰¹

Earlier nuisance actions floundered in North Carolina. Former U.S. Senator Robert Morgan sued a swine CAFO in the mid-1990s claiming that fumes from the lagoons were “often so noxious that at times it burns their eyes and noses, making it difficult for [plaintiffs] to see and breathe.”¹⁰² Senator Morgan lost the case. In contrast, the civil actions brought in 2014 to abate nuisances caused by the lagoon and spray field system have been groundbreaking.¹⁰³

Two strategic choices help explain the revival of common law remedies to hold Big Pig accountable. First, the cases name Smithfield, not the contract growers who grow most of Smithfield’s hogs, even though some of the targeted farms were owned by contract growers.¹⁰⁴ The court found that the contract growers were not a necessary party to the litigation,¹⁰⁵ successfully opening up the \$15 billion multi-national company¹⁰⁶ to damages without pinning them on the contract growers. In the process, plaintiffs reaped a

2017); Complaint of Alex Bordeaux et. al., In re NC Swine Farm Nuisance Litig., No. 5:15-cv-00013-BR, 2017 WL 5178038 (E.D.N.C. Nov. 8, 2017).

99. Leah Douglas, “Finally, Somebody Heard What the People Were Saying was Happening to Them” (May 1, 2018), <https://www.motherjones.com/food/2018/05/the-growing-grassroots-opposition-to-industrial-hog-farming-just-scored-a-major-victory/>.

100. Lisa Sorg, *Neutering Nuisance Laws in North Carolina* (Nov. 15, 2017), <http://www.nepolicywatch.com/2017/11/15/neutering-nuisance-laws-north-carolina/>.

101. See *Owens v. ContiGroup Cos.*, 344 S.W.3d 717 (Mo. Ct. App. 2011) (affirming the lower court’s decision to award plaintiffs over \$11 million in damages); Allan Ripp, *Missouri Jury Awards Residents \$11 Million in Damages From Living Under Cloud of Stench Caused by Industrial Hog Farms*, SPEER L. FIRM (Mar. 5, 2010), <https://www.prnewswire.com/news-releases/missouri-jury-awards-residents-11-million-in-damages-from-living-under-cloud-of-stench-caused-by-industrial-hog-farms-86643287.html>.

102. *Parker v. Barefoot*, 502 S.E.2d 42, 44 (1998), *overruled by Parker v. Barefoot*, 519 S.E.2d 315 (1999).

103. In re NC Swine Farm Nuisance Litig., No. 5:15-cv-00013-BR, 2017 WL 5178038 (E.D.N.C. Nov. 8, 2017); Barry Yeoman, *Here are the Rural Residents Who Sued the World’s Largest Hog Producer Over Waste and Odors—and Won*, FOOD & ENVTL. REPORTING NETWORK (Dec. 20, 2019), <https://thefern.org/2019/12/rural-north-carolinians-won-multimillion-dollar-judgments-against-the-worlds-largest-hog-producer-will-those-cases-now-be-overturned/>.

104. Complaint of Linda Atkinson et al., *supra* note 98; Complaint of Bertha Lee Carter Battle et al., *supra* note 98; Complaint of Alex Bordeaux et. al., *supra* note 98; Yeoman, *supra* note 103.

105. *In re NC Swine Farm Nuisance Litig.*, No. 15-cv-00013, 2017 BL 176858, at *6 (finding that the company was in full control of grower operations and awards, directed the type and amount of feed, directed waste disposal method and, in several cases, directed the siting of the contract grower’s operation).

106. Buford, *supra* note 45.

tactical advantage by focusing on decisions made by corporate officers rather than overstretched family farmers.

Second, plaintiffs' attorneys filed in federal court.¹⁰⁷ They relied on the diversity jurisdiction created by Smithfield, a Virginia corporation, owning all of the hogs through Murphy-Brown, a corporation registered in Delaware and controlled by Smithfield through a wholly owned subsidiary also registered in Delaware.¹⁰⁸

The cases presented temporary nuisance claims.¹⁰⁹ Complainants alleged that the hog facilities caused a range of problems—such as odors, ammonia emissions, pests, and truck noise—negatively affecting the use of plaintiffs' property.¹¹⁰ Plaintiffs suffered health effects that included burning eyes, respiratory problems, headaches, anxiety, and spikes in blood pressure.¹¹¹ Plaintiffs' claims alleged harms that ESTs were designed to remedy or prevent. The complaints allege additional wrongdoing that merit punitive damages.¹¹² Specifically, the plaintiffs alleged that the defendant and their executives knew about the nuisance, had the EST technology and financial resources to take corrective action, and failed to do so negligently and improperly.¹¹³

Five jury pools have produced verdicts in these cases that ranged from the hundreds of thousands to hundreds of millions of dollars.¹¹⁴ The largest reached \$473.5 million,¹¹⁵ later reduced to \$94 million by mandatory state caps on punitive damages.¹¹⁶ Smithfield appealed and key issues from the first five trials are now before the Fourth Circuit, which heard oral arguments on January 31, 2020.¹¹⁷

One of the big questions is whether the amended "Right to Farm" law, passed to deter nuisance suits, should apply retroactively. In the wake of the first large verdicts, the North Carolina legislature updated the State's Right

107. Third Amended Complaint, *McKiver v. Murphy-Brown, LLC*, No. 7:14-cv-00180-BR, 2018 WL 4189408 (E.D.N.C. Feb. 12, 2018).

108. *Id.* ¶¶ 25–28.

109. *Id.* ¶¶ 220–35.

110. *Id.* ¶ 3.

111. *Id.* ¶ 31, 219; Yeoman, *supra* note 103.

112. Third Amended Complaint, *supra* note 107, ¶ 236–39.

113. *Id.* ¶ 230.

114. *McKiver v. Murphy-Brown, LLC*, No. 7:14-CV-180-BR, 2018 WL 10322917, at *1 (E.D.N.C. May 7, 2018).

115. *See* Verdict, James Jacobs, et al., v. Murphy-Brown LLC, No. 7:14-CV-237-BR (E.D.N.C. Aug. 13, 2018) (outlining the amount of recovery and punitive damages each plaintiff was entitled to, which adds up to \$473.5 million).

116. N.C. GEN. STAT. §1D-25(b) (2019).

117. *See Oral Argument Calendar*, U.S. COURT OF APPEALS FOR THE FOURTH CIRCUIT, <https://www.ca4.uscourts.gov/oral-argument/cal/january-2020-session> (last visited May 2, 2020) (setting the oral argument date for *Joyce McKiver v. Murphy-Brown, LLC* for Friday, January 31, 2020).

to Farm law to make it virtually impossible for similarly situated neighbors to bring these kind of nuisance claims in the future.¹¹⁸ Based on this claim, an appellate court could overturn a key lower court ruling or remand for procedural reasons.¹¹⁹ On the other hand, if the Fourth Circuit upholds the damage awards, Smithfield may find that installing technology they have resisted for decades will no longer seem so “economically infeasible.”¹²⁰

Corporate Sustainability

Independent of the EJ communities’ concerns, a major shift in the industry’s handling of waste is on the horizon. Retailers have begun adopting GHG reduction targets throughout their supply chains to “green” their corporate image and demonstrate that private law can step in where governments have failed.¹²¹ In 2012, Walmart began conditioning purchase orders on suppliers’ use of a “Sustainability Index” that rates product sustainability across 100 metrics.¹²² Then, in 2017, Walmart set a goal of avoiding one billion metric tons of GHGs by 2030.¹²³ Walmart flexed its monopsony power as the nation’s largest grocery store over suppliers like Smithfield.¹²⁴ These “green” commitments are pushing suppliers like Smithfield to reduce emissions or risk the loss of critical retail outlets.

At the same time, energy companies and their corporate customers are demanding renewable and low-carbon feedstock for their power plants and

118. N.C. GEN. STAT §§ 106-701, 106-702 (2019). In nuisance actions against agricultural and forestry operations, plaintiffs must be the legal possessor of the property; the property must lie within ½ mile of the nuisance source; and the action must be filed within 1 year of the operations establishment or major change causing the nuisance. *Id.* Section 106-702 limits compensatory damages to the reduction in fair market value of the affected property and limits punitive damages to cases where there has been a criminal conviction or civil enforcement action by an environmental regulatory agency. *Id.*

119. *See* Parker v. Barefoot, 502 S.E.2d 42 (N.C. Ct. App. 1998) (overruled by Parker v. Barefoot, 519 S.E.2d 315 (1999) on the grounds that the jury was given improper instructions regarding the nuisance statute).

120. Anne Blythe, *Jury Awards More than \$25 Million to Duplin County Couple in Hog-Farm Case* (June 29, 2018), <https://www.newsobserver.com/news/local/article214096384.html>.

121. *See, e.g., More Than 300 Companies Commit to Set Science-Based Emissions Reduction Targets*, WORLD RES. INST., <https://www.wri.org/our-work/top-outcome/more-300-companies-commit-set-science-based-emissions-reduction-targets> (last visited May 2, 2020) (showing that companies make their own rules they must follow to reduce GHG).

122. *Walmart Announcements New Commitments to Drive Sustainability Deeper into the Company’s Global Supply Chain* (Oct. 25, 2012), <https://corporate.walmart.com/newsroom/2012/10/25/walmart-announces-new-commitments-to-drive-sustainability-deeper-into-the-companys-global-supply-chain>.

123. *Walmart on Track to Reduce 1 Billion Metric Tons of Emissions from Global Supply Chains by 2030* (May 8, 2019), <https://corporate.walmart.com/newsroom/2019/05/08/walmart-on-track-to-reduce-1-billion-metric-tons-of-emissions-from-global-supply-chains-by-2030>.

124. *Project Gigaton*, <https://www.walmartsustainabilityhub.com/project-gigaton> (last visited May 2, 2020).

pipelines. North Carolina's Renewable Energy Portfolio Standard provides a growing market for waste-to-energy projects.¹²⁵ North Carolina's Clean Energy Plan, a product of the governor's executive order¹²⁶ to meet Paris Accord targets, requires significant reductions in the State's energy-related GHG emissions.¹²⁷ Increasing demand further, there are growing opportunities to sell carbon credits from manure management practices into voluntary markets.¹²⁸

Broadly, there are two kinds of market pressure at play. On the one hand, major corporate retailers of low-cost meat, like Walmart, are demanding a lower carbon footprint from their supply chain.¹²⁹ On the other hand, natural gas pipeline project investors are hoping to offer renewable gas.¹³⁰ Together, market signals point in the direction of "greening" the corporate sustainability chain for major corporations on the food side, but also "greening" the gas side.

The loophole that ignores methane creates the business opportunity. If either the EPA or the states regulated methane emissions from CAFOs, methane captured for electricity production could neither be credited toward Walmart's reduction targets nor used to generate carbon offset credits, which require mitigation beyond baseline levels (the "additionality" requirement).¹³¹ In a counterfactual world with a methane mandate, there would be no new economic rents¹³² to divvy up through private law arrangements between corporate sustainability offices, hog producers, and electricity companies.

125. N.C. GEN. STAT. § 62-133.8 (2019) (promoting the development of renewable energy and energy efficiency in the state).

126. North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy, N.C. Exec. Order No. 80 (Oct. 29, 2018).

127. N.C. DEP'T ENVTL. QUALITY, NORTH CAROLINA CLEAN ENERGY PLAN: TRANSITIONING TO A 21ST CENTURY ELECTRICITY SYSTEM (2019).

128. CALIFORNIA AIR RES. BD., DRAFT SHORT-LIVED CLIMATE POLLUTANT REDUCTION STRATEGY 11 (2015).

129. Pippa Stevens, *Behind Walmart's Push to Eliminate 1 Gigaton of Greenhouse Gases by 2030* (Dec. 15, 2019), <https://www.cnn.com/2019/12/15/walmarts-project-gigaton-is-its-most-ambitious-climate-goal-yet.html>.

130. *Renewable Natural Gas Production*, U.S. DEP'T OF ENERGY, https://afdc.energy.gov/fuels/natural_gas_renewable.html (last visited May 2, 2020).

131. See generally Umair Irfan, *Can You Really Negate Your Carbon Emissions? Carbon Offsets, Explained* (Feb. 27, 2020), <https://www.vox.com/2020/2/27/20994118/carbon-offset-climate-change-net-zero-neutral-emissions> (explaining that "additionality" is a key principle to consider when making a reliable offset). The article draws the example of an additionality as "a counterfactual: Does buying this specific offset lead to a reduction of greenhouse gas emissions that would not have happened otherwise?" *Id.*

132. NANCY CARTWRIGHT, COUNTERFACTUALS IN ECONOMICS: A COMMENTARY 1 (2007) (counterfactuals are "causal surrogates" that defines causal relationships in economics).

Instead, climate change has created market signals that are pushing integrators to reduce the carbon embedded in their supply chain and pulling them into new biogas revenue streams.¹³³ Smithfield inventoried all of its lagoons in response to Walmart's demands.¹³⁴ In 2016, Smithfield promised to reduce its GHG emissions 25% below 2010 levels by the year 2025.¹³⁵ Two years later, Smithfield explained that it would meet this goal by retrofitting existing lagoons with "manure-to-energy" capabilities, including across 90% of Smithfield-owned hog-finishing facilities in North Carolina.¹³⁶ All told, the company expects to capture 85,000 tons of methane each year to generate renewable natural gas.¹³⁷

In fall 2018, Smithfield and the energy company Dominion committed to spend at least \$250 million to build biogas infrastructure in North Carolina, Virginia, and Utah.¹³⁸ A year later, the companies announced they were doubling that commitment to \$500 million dollars in an effort "to become the largest renewable natural gas supplier in the U.S."¹³⁹ The first North Carolina project, which will collect methane from 19 farms in the hog belt, will be constructed in 2020 and produce approximately 300,000 dekatherms.¹⁴⁰ Once refined, the gas will be injected into the ever-expanding Piedmont

133. 2018 *Integrated Report, Case Study: Expanding Our Efforts to Generate Renewable Energy* SMITHFIELD FOODS SUSTAINABILITY, <https://www.smithfieldfoods.com/integrated-report/2018/environment/case-study-expanding-our-efforts-to-generate-renewable-energy-2> (last visited May 2, 2020).

134. Maggie Monast, *What Food Companies Can Learn from Smithfield Foods Exceeding its Grain Sustainability Goal*, ENVTL. DEF. FUND (Feb. 25, 2019), <http://blogs.edf.org/growingreturns/2019/02/25/smithfield-exceeds-grain-sustainability-goal/>.

135. Press Release, Smithfield Foods, Smithfield Foods Leads Industry as First Major Protein Company to Adopt Greenhouse Gas Reduction Goal (Dec. 5, 2016), <https://www.smithfieldfoods.com/press-room/company-news/smithfield-foods-leads-industry-as-first-major-protein-company-to-adopt-greenhouse-gas-reduction-goal>.

136. Press Release, Smithfield Foods, Smithfield Foods Announces Landmark Investment to Reduce Greenhouse Gas Emissions (Oct. 25, 2018), <https://www.smithfieldfoods.com/press-room/company-news/smithfield-foods-announces-landmark-investment-to-reduce-greenhouse-gas-emissions>.

137. Steven Mufson, *Companies Launch Plan to Capture Methane from Hog Manure Lagoons* (Nov. 27, 2018), <https://www.washingtonpost.com/energy-environment/2018/11/27/companies-launch-plan-capture-methane-hog-manure-lagoons/>.

138. 2018 *Integrated Report*, *supra* note 133.

139. Press Release, Smithfield Foods, Dominion Energy and Smithfield Foods Invest Half Billion Dollars to Become Largest Renewable Natural Gas Supplier in U.S. (Oct. 23, 2019), <https://www.smithfieldfoods.com/press-room/company-news/dominion-energy-and-smithfield-foods-invest-half-billion-dollars-to-become-largest-renewable-natural-gas-supplier-in-us>.

140. John Downey, *How Dominion Energy, Smithfield Foods Plan to Make NC a Leader in Renewable Natural Gas*, CHARLOTTE BUS. J. (Dec. 2, 2019) <https://www.bizjournals.com/charlotte/news/2019/12/02/how-dominion-energy-smithfield-foods-plan-to-make.html>.

Natural Gas pipeline system.¹⁴¹ Once complete, the companies are planning an even larger project comprising at least 30 farms in Duplin County.¹⁴²

Of the three new actors to arrive in the 2010s, at this moment it is only clear that the last—the private law of corporate interests—will make a lasting impact on the CAFO landscape. The CAFO and biogas revolution is already under construction; the EJ organizations and long-suffering neighbors of these facilities are still waiting on their remedies.

CHAPTER III: RECONCILING CLIMATE CHANGE MITIGATION WITH ENVIRONMENTAL JUSTICE

Actors will be required to take swift and dramatic action to reduce GHG emissions in order to avoid the worst impacts of climate change. But reducing GHGs does not correct for historical inequity rooted in racism and other systems of oppression. As Smithfield and others reap the profits of climate mitigation, representatives of the people must compel them to finally fix the continuing, immediate, and localized environmental harms of their production system.

Reducing GHG emissions from CAFOs is essential given their contribution to methane emissions. On the mitigation side, agriculture contributes 9.3% to U.S. GHG emissions.¹⁴³ Livestock manure management alone produces methane and nitrous oxide that account for 13% of agricultural emissions (CO₂ equivalent).¹⁴⁴ Waste-to-energy (WTE) projects capture methane for biogas generation, which mitigates GHG emissions.¹⁴⁵

But WTE is not the same as ESTs, which correct the local environmental and public health harms associated with industrial hog farming.¹⁴⁶ The cheapest way to build an anaerobic digester that captures methane from a lagoon is to simply cover the lagoon with an impermeable layer of material.¹⁴⁷ An anaerobic digester requires no material improvement to the

141. *Id.*

142. *Id.*

143. See U.S. ENVTL. PROT. AGENCY, EPA 430-R-20-002, INVENTORY OF GREENHOUSE GAS EMISSIONS AND SINKS 5-1 (2020) (providing 2018 GHG percentages in the U.S.).

144. *Id.* at 5-2 (showing that manure management contributed 9.9% and 3.1% of total estimated agricultural release of methane and nitrous oxide, respectively).

145. Richard L. Skaggs et al., *Waste-to-Energy Biofuel Production Potential for Selected Feedstocks in the Conterminous United States*, 82 RENEWABLE & SUSTAINABLE ENERGY REV. 2640, 2640–41 (2017).

146. See generally *id.* at 2640 (concluding WTE is a way to divert wastes, such as those from hog farms, in a way that potentially eliminates or significantly reduces adverse effects of waste resources on public health, safety, welfare, and the environment).

147. PETER WRIGHT, OVERVIEW OF ANAEROBIC DIGESTION SYSTEMS FOR DAIRY FARMS 1-2 (2001).

existing lagoon and spray field system.¹⁴⁸ In contrast, Smithfield Foods' plans to install anaerobic digesters on existing lagoons do not mention any intent to implement the ESTs promised by—and developed through—the Smithfield Agreement.¹⁴⁹

Alarming, WTE technology on its own may actually worsen the impacts of the lagoon and spray field system.¹⁵⁰ Three areas of concern are already apparent. First, covering and pressurizing lagoons will increase downward pressure on the cesspools, most of which remain unlined.¹⁵¹ The few lagoons constructed after 1997 were required to have a clay or synthetic lining to limit hydraulic conductivity,¹⁵² which nonetheless have been shown to seep and leach into the environment even under normal operating conditions.¹⁵³ Second, trapping gasses under lagoon covers further concentrates available nutrients within the lagoon effluent that gets sprayed onto fields.¹⁵⁴ Finally, the distribution of biogas will impose additional, disproportionate burdens on communities of color. For example, getting the gas to market increases truck traffic and requires many miles of in-ground piping to transport unrefined gas to processing facilities.¹⁵⁵ The Grady Road project alone requires 30 miles of pipeline to move methane from farms to the plant.¹⁵⁶

Dr. C. Mike Williams understood that dismantling the lagoon and spray field system went hand-in-hand with generating new sources of revenue from a new waste management system.¹⁵⁷ His 2006 report under the Smithfield Agreement called for “expeditious” investment in further research to improve waste management technologies, as well as “institutional incentives, public policies, and markets related to the sale of byproducts (with priority on energy production) that will reward farmers for utilizing technologies

148. WILLIAM F. TOOLEY, NAT'L RES. CONSERVATION SERV., NRCS 69-3A75-0-123, AEROBIC TREATMENT OF MANURE LAGOONS SHOWING ENVIRONMENTAL AND ECONOMIC BENEFITS WITH ECOSYSTEM SERVICE PAYBACKS 1, 5 (2013).

149. Greg Barnes, *Smithfield's Plans to Cover Hog Lagoons Could Spur N.C. Biogas Industry* (Jan. 4, 2019), <https://www.northcarolinahealthnews.org/2019/01/04/smithfields-plans-to-cover-hog-lagoons-could-spur-n-c-biogas-industry/>.

150. Steve Davies, *Smithfield Converting Manure to Energy at Hog Farms in Three States* (Oct. 30, 2018), <https://www.agri-pulse.com/articles/11609-smithfield-converting-manure-to-energy-at-hog-farms-in-three-states>.

151. Nowlin, *supra* note 16, at 1084.

152. 15A N.C. ADMIN. CODE. 2T.0505 (2013).

153. Nowlin, *supra* note 16, at 1087 n.59 (citing J.M. Ham, *Seepage Losses from Animal Waste Lagoons: A Summary of a 4-year Investigation in Kansas*, 45.4 TRANSACTIONS OF THE ASAE 983, 983 (2002)).

154. ROSE M. STENGLEIN ET AL., IMPERMEABLE COVERS FOR ODOR AND AIR POLLUTION MITIGATION IN ANIMAL AGRICULTURE: A TECHNICAL GUIDE 7 (2011).

155. Downey, *supra* note 140.

156. *Id.*

157. WILLIAMS, *supra* note 70, at 5.

[that] yield improvements and environmental benefits over the current lagoon spray field system.”¹⁵⁸ Fourteen years later, industry has found an energy market for its byproducts, but shows no sign of implementing ESTs.

Market incentives for biogas production will only grow as urgency for climate action opens a firehose of private funding to de-carbonize agriculture. As one business-oriented environmental group notes, “When the world’s largest pork producer set out to reduce greenhouse gas emissions from its full supply chain, it sent a powerful signal to the industry at large: By cutting emissions it’s also creating new business opportunities.”¹⁵⁹

The public sector is ready to sweeten the pot. Cap-and-trade systems and renewable fuel standards commodify carbon offsets to provide additional revenue streams for companies that mitigate emissions.¹⁶⁰ Markets are already in place under both California and New England’s carbon budgets.¹⁶¹ Renewable fuel standards, both state and federal, create price premiums for sellers of biogas and biofuels.¹⁶² Leading presidential candidates,¹⁶³ think tanks,¹⁶⁴ and academics¹⁶⁵ have outlined bold proposals to help farmers generate additional revenues from climate-friendly practices including manure management.

For nearly two decades Smithfield Foods has argued that economic infeasibility precludes taking the necessary steps to install ESTs.¹⁶⁶ Like a

158. *Id.* at 47.

159. Maggie Monast, *How one Company’s Plan to turn Pollution into a Commodity Could Change an Entire Industry*, ENVTL DEF. FUND (Dec. 12, 2018), <https://www.edf.org/blog/2018/12/12/how-one-companys-plan-turn-pollution-commodity-could-change-entire-industry>.

160. *How Cap and Trade Works*, ENVTL. DEF. FUND, <https://www.edf.org/climate/how-cap-and-trade-works> (last visited Mar. 27, 2020).

161. Jackson Morris & Bruce Ho, *California Leads Off: Now RGGI Must Grab the Climate Baton*, NAT. RES. DEF. COUNCIL (July 19, 2017), <https://www.nrdc.org/experts/jackson-morris/california-leads-now-rggi-must-grab-climate-baton>.

162. *Overview for Renewable Fuel Standard*, EPA (Jan. 19, 2017), <https://www.epa.gov/renewable-fuel-standard-program/overview-renewable-fuel-standard>.

163. *See, e.g.*, Liz Crampton, *Sen. Bernie Sanders’ Plan to Expand Agriculture and Rural Policies* (May 5, 2019), <https://www.politico.com/story/2019/05/05/bernie-sanders-agriculture-rural-policies-1302634>.

164. *See, e.g.*, Bidisha Bhattacharyya, Ryan Richards, & Rita Clifton, *Building a 100 Percent Clean Future Can Drive an Additional \$8 Billion a Year to Rural Communities* (Jan. 8, 2020), <https://www.americanprogress.org/issues/green/reports/2020/01/08/479168/building-100-percent-clean-future-can-drive-additional-8-billion-year-rural-communities/>.

165. *See, e.g.*, Aashna Aggarwal et al., *Achieving the Mid-Century Strategy Goals for Deep Decarbonization in Agriculture and Forestry* (Duke Univ. Nicholas Inst. For Env’tl. Pol’y Solutions, Working Paper No. NI WP 18-02, 2018) (proposing the adoption of a national carbon bank, among other policy changes, to reduce U.S. GHG emissions).

166. *See, e.g.*, MAJORITY REPORT FROM THE ECONOMICS SUBCOMMITTEE OF THE ADVISORY PANEL TO THE DESIGNEE UNDER THE AGREEMENTS BETWEEN ATTORNEY GENERAL OF NORTH CAROLINA AND SMITHFIELD FOODS, PREMIUM STANDARD FARMS AND FRONTLINE FARMERS REGARDING RECOMMENDATIONS ON ECONOMIC FEASIBILITY DETERMINATIONS 3–4 (2005) (asserting that the economic feasibility of installing ESTs could be supported, but only up to a cost of \$400,000 for an “average” farm of 4320 head of cows).

leaking lagoon, that argument hardly holds water now that the poop—a headache to manage, even if poorly—is suddenly a revenue stream unto itself. It's an old adage that “you can't make a silk purse out of a sow's ear,” but with a nod from regulators the swine industry will fill a silk purse from a sow's rear. With that windfall comes the opportunity to harmonize the EJ and corporate sustainability interests by investing the new revenue from low-CO₂ pork and biogas production into ESTs.

Now is the time for farmers, industry executives, lawmakers, and NC regulators to seize the opportunity to end the public health and EJ crisis caused by the lagoon and spray field system. Turning the moral imperative—fixing the lagoon and spray field system—into reality requires robust policy along the following lines:

1. Parties to the Smithfield Agreement should agree that converting a lagoon into a biogas plant is a major change to an existing waste management system that triggers mandatory EST implementation;
2. Farmers and state regulators should add new permit conditions to reflect the consequences of lagoon covers on existing waste management systems, including requirements for increased surface- and groundwater testing upstream and downstream of installed digesters; and
3. Lawmakers should repeal Right to Farm and enact a lagoon-and-spray-field conversion program to help farmers transition either to ESTs or to return to pastured pork production.

CONCLUSION

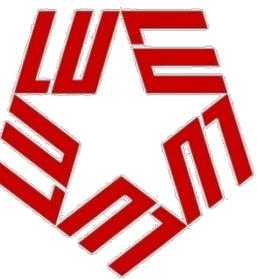
Any lessons from reconciling EJ with climate mitigation in North Carolina will be broadly applicable across the country. The Big Pig problem is a microcosm of the national movement toward decarbonizing agriculture. There is huge and growing investment in limiting GHGs and generating carbon credits in agricultural systems. With this focus comes a real threat of ignoring—or even worsening—other environmental, health, and justice problems.

Climate change threatens life on earth as we know it. Avoiding the worst effects of climate change requires emissions reductions from all sectors. As long as swine CAFOs exist, they must capture and destroy methane. Similarly, so long as corn and soy monocultures blanket the Midwest, they

must use conservation tillage, cover cropping, and other conservation practices to mitigate NOx.

However urgent and dire the climate crisis may be, paying for GHG mitigation should not prop up a system that is poisoning our water, air, and bodies. GHG sources do not exist in a policy vacuum; swine CAFOs in NC are embedded in a landscape of poor communities of color that have suffered their immediate consequences for a generation. In this context, the rise of biogas is both a risk and an opportunity. The risk in turning methane into a profit center is that industry will produce (and capture) more of it at the expense of non-commodified public goods like drinkable water or breathable air. The opportunity lies in how these revenues could be invested to finally implementing the ESTs that industry has resisted for decades. Seizing the opportunity will require a public mobilization on behalf of the communities that have combatted the lagoon and spray field system for the past 30 years.

Exhibit 10



CFD Flare Modeling Update

SETPMTC Meeting

by

Daniel Chen, Helen Lou, Kuyen Li

D. F. Smith Chemical Engineering Dept.

Xianchang Li, Mechanical Engineering Dept.

Christopher Martin, Chemistry & Biochemistry Dept.

Lamar University, Beaumont, TX

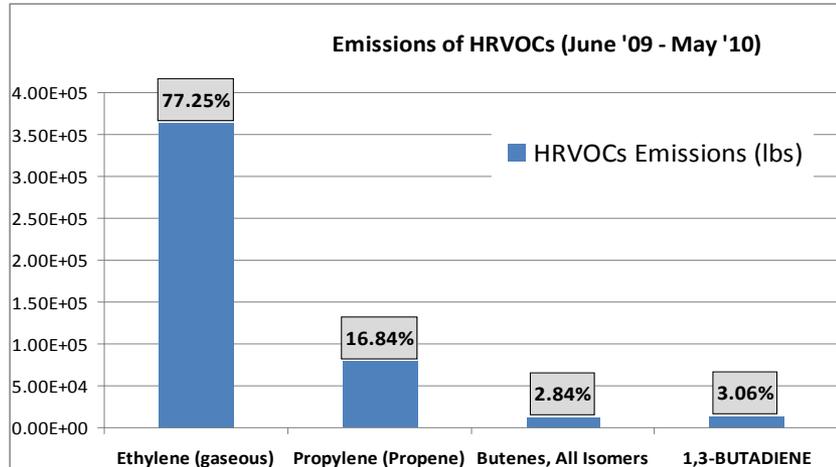
Houston, TX, August 23, 2012



Contents

- I. Introduction/Needs
- II. Methodology
- III. AQRP Project 11-022
- IV. SEP Project 2009-009

Reasons for TCEQ to focus on Industrial Flares



- One **potential under-reported or non-reported source** is the flare operations
- Flare emissions: **60% of the HRVOCs** (2007 HRVOC special inventory).
- Flare emissions depend heavily on **destruction & removal efficiency (DRE)**
 - Recent studies/gas imaging IR camera suggest that flares may not be as efficient as claimed (Environ, 2008;)
 - DRE may drop below 98% even when the flare operation is in compliance with 40 CFR § 60.18 (Allen, TCEQ 2010 Flare Study).
 - Complex issues such as **crosswind, high/low jet velocity, high air/steam assist, vent gas composition, etc.**
- Flare emissions also affected by **combustion efficiency (CE)** or the issue of **incomplete combustion products**
 - **Current air emission inventory from flaring is simply a mass throughput with 98% (TCEQ 2000)**
- As a result, TCEQ is conducting an evaluation on flare operations that may serve as a basis for a future SIP revision (<http://www11.tceq.state.tx.us/oce/ee/index.cfm>)

Complexity in Flare Emissions

- Process Type (Vent Gas Species/
Heating Value & Reaction Chemistry)
 - Refinery, Olefin, Polymer,
Landfill, and Exploration fields
(H₂-C₄)
- Operation Mode
 - Startup, Shutdown, Upset,
Maintenance, and Standby (
Turndown Ratio up to 15000:1)
- Flare Design/Control
 - Air assisted, Steam assisted, Non-
assisted, Pressure-assisted
 - Elevated, Enclosed
 - Steaming, Aeration, Tip Diameter
- Meteorological condition
 - Crosswind, Humidity, etc.



Needs for Computational Fluid Dynamics (CFD) Flare Modeling

- Alternative to expensive flare tests
 - Grab sampling or remote sensing are costly
 - Impossible to test during start up, upset, and maintenance periods
- Validated flare model for parametric studies
 - Establish the data base for effect (trend) of crosswind, jet velocity, VOC species, heating value, air-assist, steam-assist, tip diameter
 - Investigate the interaction between crosswind, jet velocity, vent gas heating value, and assisted air/steam
- Easy-to-use correlations and NN models for DRE/CE/ T_{\max}
- Validated flare model for inferential control
 - Determine optimal set points for air/steam/makeup fuel flow given vent gas composition, heating value, jet velocity, and crosswind velocity

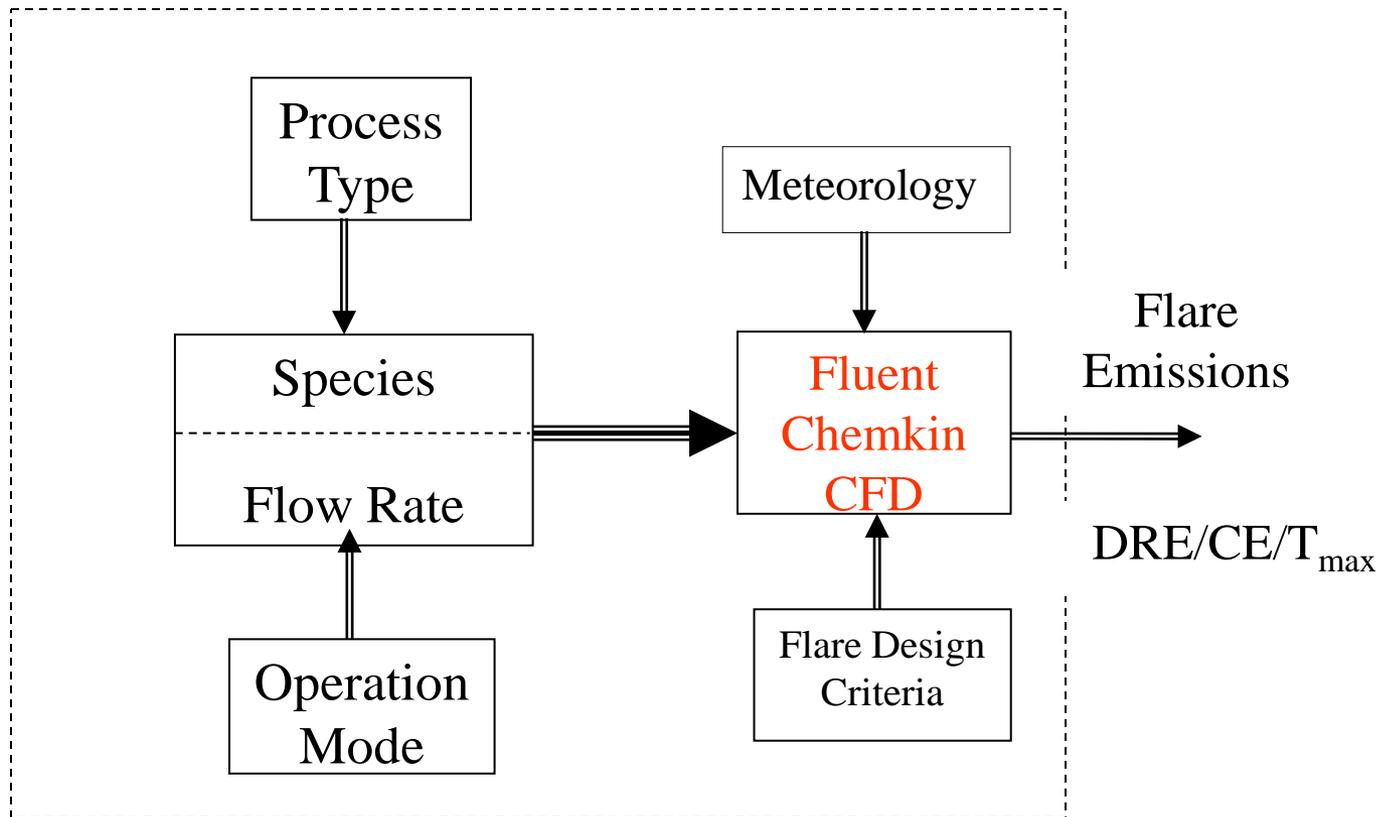
Objectives

- **Model laboratory flames** (McKenna Burner and Sandia National Lab Flame D)
 - to **validate the CFD with laboratory flames** for which detailed, speciated composition profiles are available for incomplete combustion products (e.g., formaldehyde).
- **Model controlled flares** (TCEQ/UT 2010 Flare Study)
 - to **validate the CFD with industrial flares** for which DRE/CE, and certain speciated emission data are available under controlled conditions.
- **Simulate** industrial flares under various operating modes and meteorological conditions to investigate
 - the **trend** of crosswind, heating value, vent gas type, steam assist, air assist, jet velocity, and flare-tip diameter.
 - the **interaction between crosswind, jet velocity, and heating value**
- **Develop easy-to-use correlations and neural network models**
 - to identify the **optimal operating regime** for high DRE/CE/ T_{\max} and to facilitate **inferential control**
 - to estimate **aldehydes/HO_x/NO_x emissions** given crosswind, jet velocity, vent gas heating value, and other operating/ design conditions

Methodology

CFD modeling for Industrial Flares

- Model industrial flaring systems using Fluent /Chemkin CFD with a reduced (50 species) mechanism for ethylene/propylene combustion
- Validated with experimental flame/controlled flare performance data



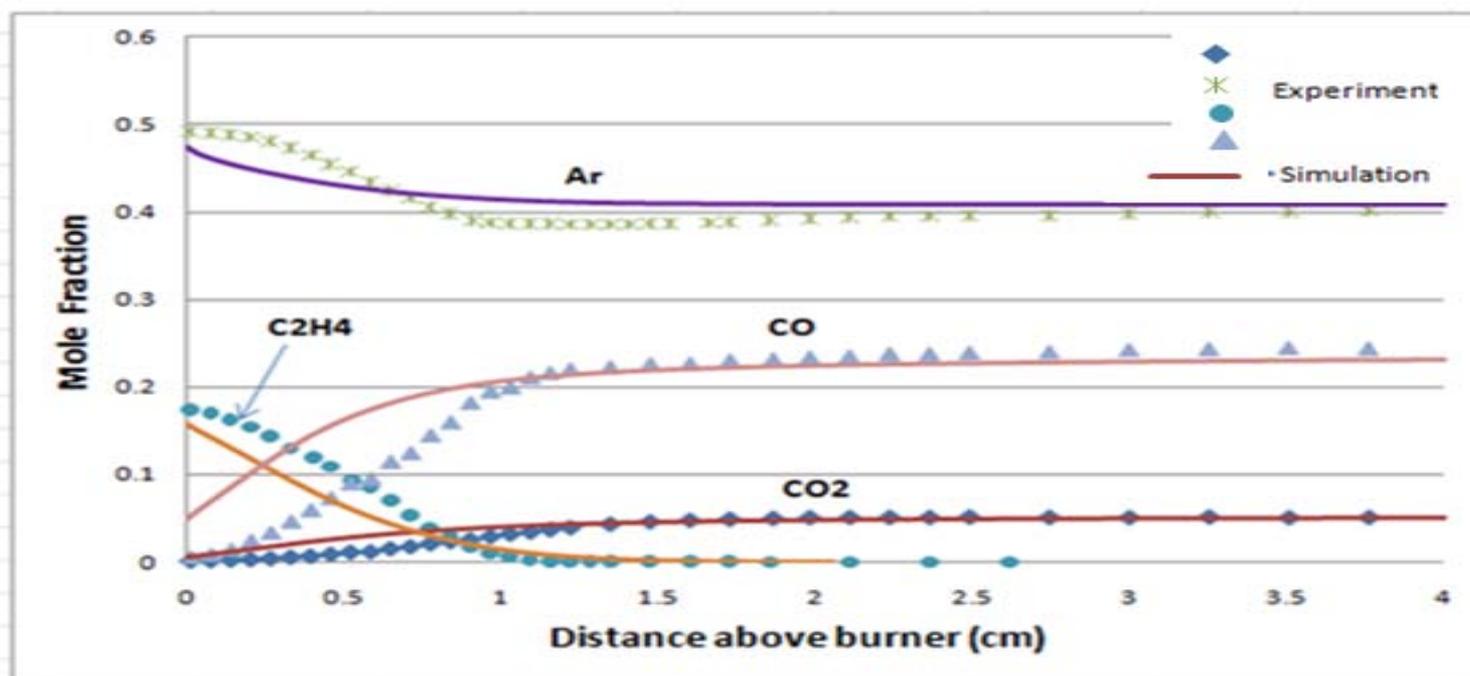
Journal Publications in Mechanism Development

"A reduced reaction mechanism for the simulation in ethylene flare combustion," *Clean Technologies and Environmental Policy*, June 16, 2011;

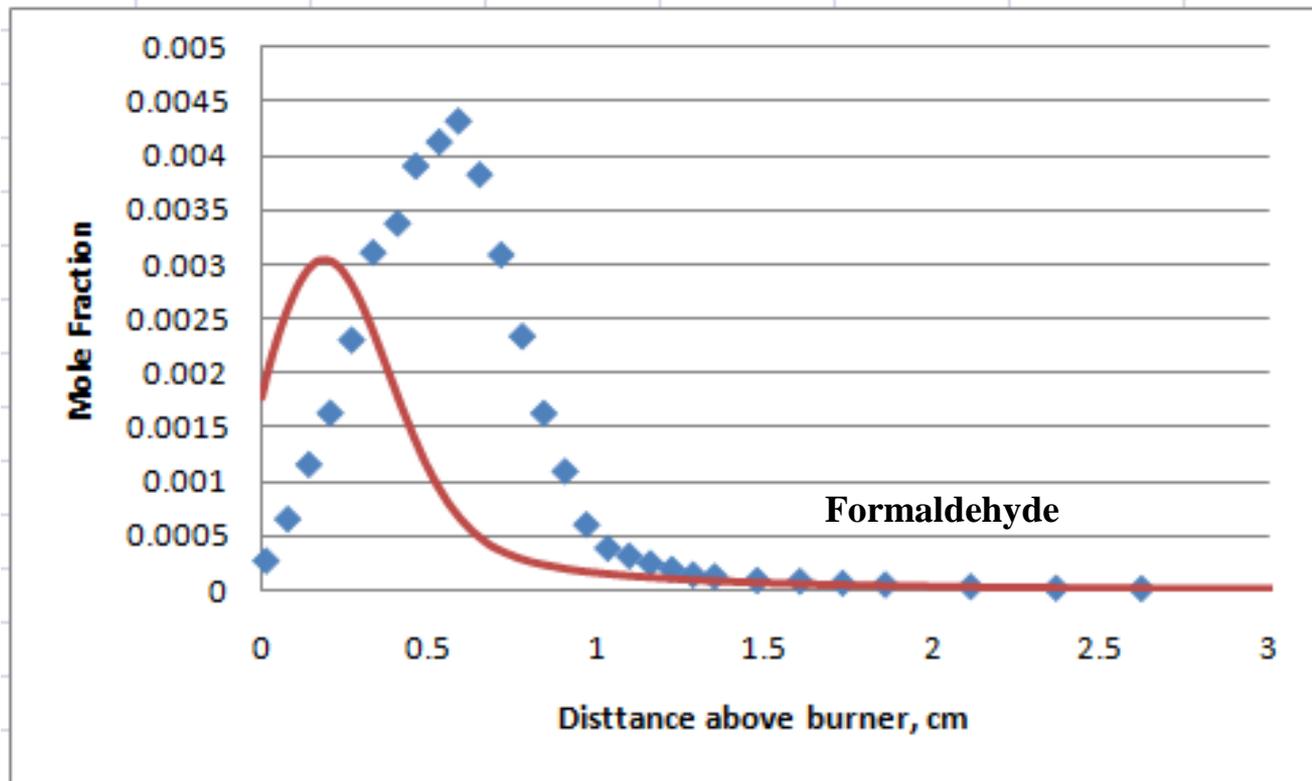
"Validation of a Reduced Combustion Mechanism for Light Hydrocarbons," *Clean Technologies and Environmental Policy*, "Clean Technologies and Environmental Policy, 14(1) 1-12, 2012.

"Optimal Reduction of the C1-C3 Combustion Mechanism for the Simulation of Flaring," *Industrial & Engineering Chemistry Research*, February 13, 2012.

Validation of LU 1.0 Mechanism



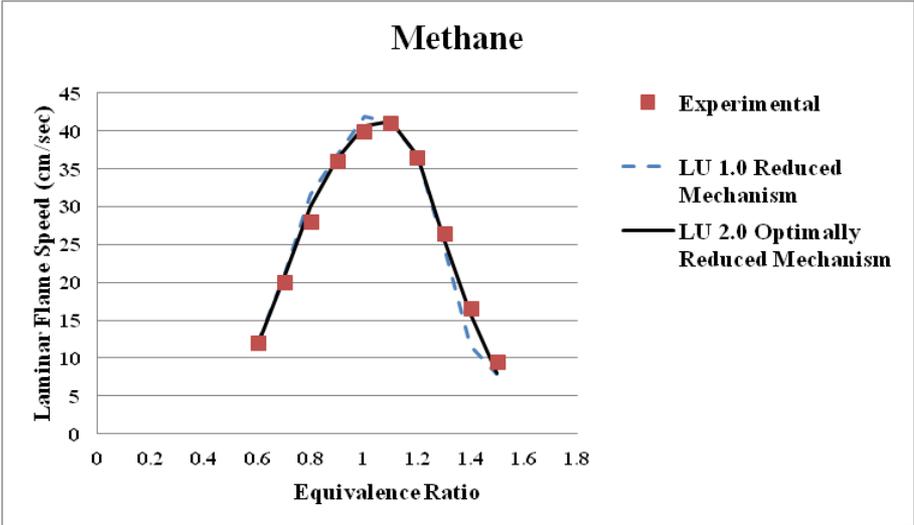
Comparison of the Molar Fraction of Major Species in **Burner Stabilized Flame** for C₂H₄/O₂/Ar ($\phi = 1.9$), **LU 1.0**



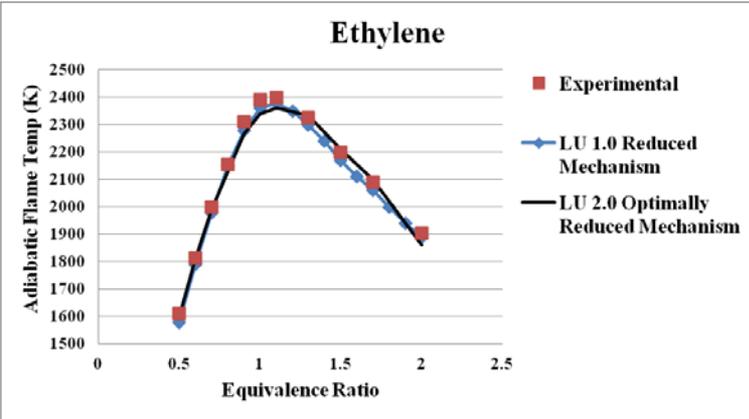
Comparison of Formaldehyde Mole Fraction Data for Burner Stabilized Flame, [LU 1.0](#)

Validation of LU 2.0 Combustion Mechanism for C₁-C₃ Hydrocarbons

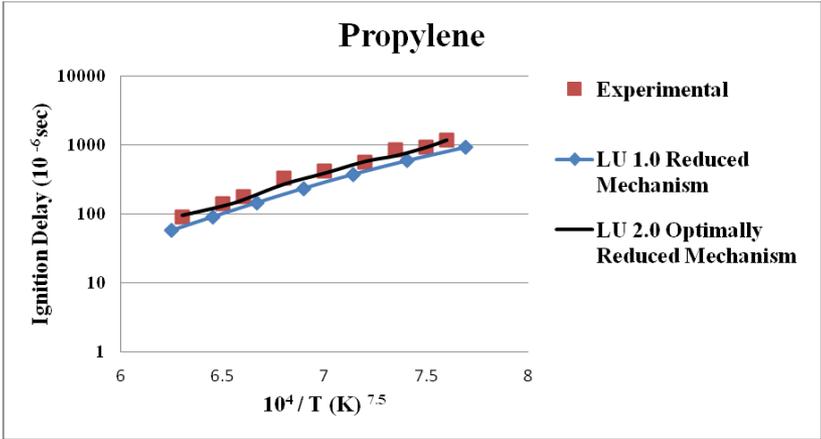
Laminar flame speed vs equivalence ratio for methane



Adiabatic flame temp vs. equivalence ratio for ethylene



Ignition delay vs. temperature for propylene



		% Error (Average)	
		LU1.0 vs. Experimental	LU2.0 vs. Experimental
Indicators			
Laminar Flame Speed	Methane	3.76	2.68
	Propylene	6.30	2.79
Adiabatic Flame Temperature	Methane	8.42	4.76
	Ethylene	2.07	1.08
Ignition Delay	Methane	2.09	1.41
	Ethylene	5.15	3.19
	Propylene	5.32	4.38
Overall		4.73	2.90

Data Base for Validation of CFD Modeling

- Laboratory Flames
 - Ethylene flames (MBMS, Bhargava 1998; Zhang 2006; Delfau, 2007)
 - Methane/Ethane/H₂/CO flames [TNF, 2012]

<http://www.sandia.gov/TNF/DataArch/delft3.html>

Image Source: 2010 TCEQ Flare Study Project, Final Report



- Controlled Flares
 - UT/John Zink (TCEQ 2010 Flare Study)
 - Propane flare with PFTIR (TCEQ/URS/UH, 2004)
 - Scaled-down flares in a large, closed-loop, wind tunnel facility (University of Alberta, 2004)
 - J.H. Pohl, *Evaluation of the Efficiency of Industrial Flares*, 1984/1985, EPA600-2-85-95 and 106
 - Propylene/Propane flare with Continuous Monitors/GC (EPA, 1983)

Validation of CFD with a CH₄ Sandia/ TU Darmstadt Flame



Fuel composition: CH₄ (25%), Air (75%) by volume.

Fuel exit velocity: 49.6 m/s

Nozzle diameter: 7.2 mm

Pilot composition: CO (0.4%), CO₂(11%), H₂O(9.4%), O₂(5.4%), N₂(73.8%)

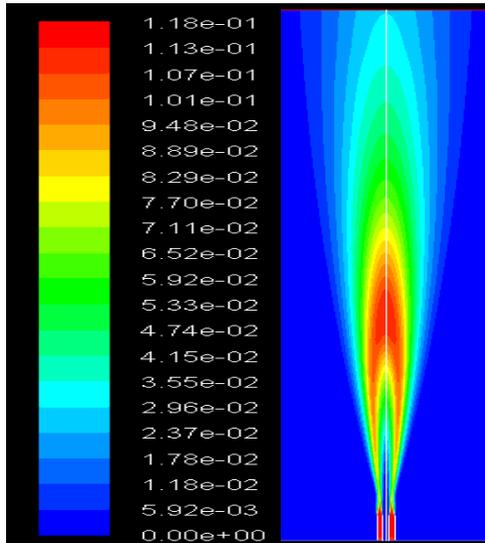
Pilot exit velocity: 11.4m/s

Pilot nozzle outer diameter: 18.2 mm

Mechanism : GRI 3.0 (reduced to 35 species)

2-D simulation

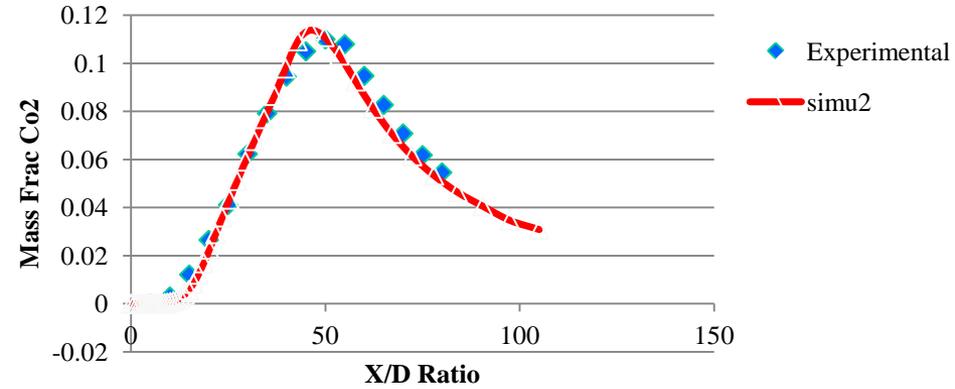




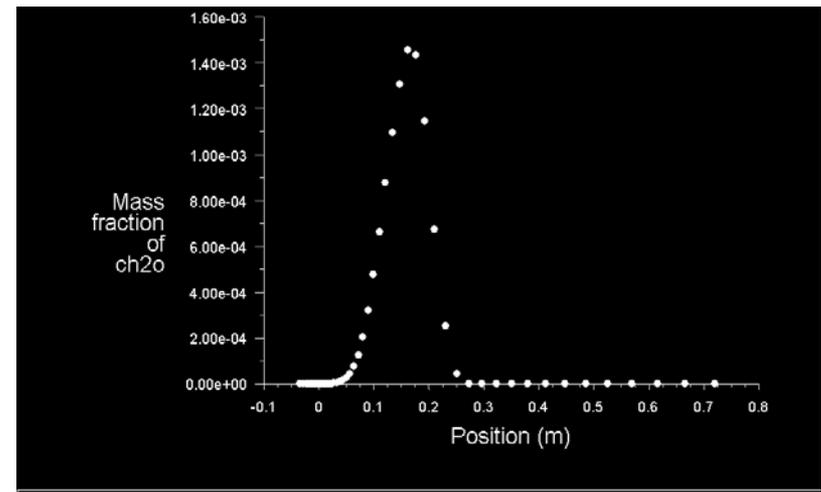
Sandia/TUD Piloted Flame

Temperature Profile

Mass Fraction of CO₂

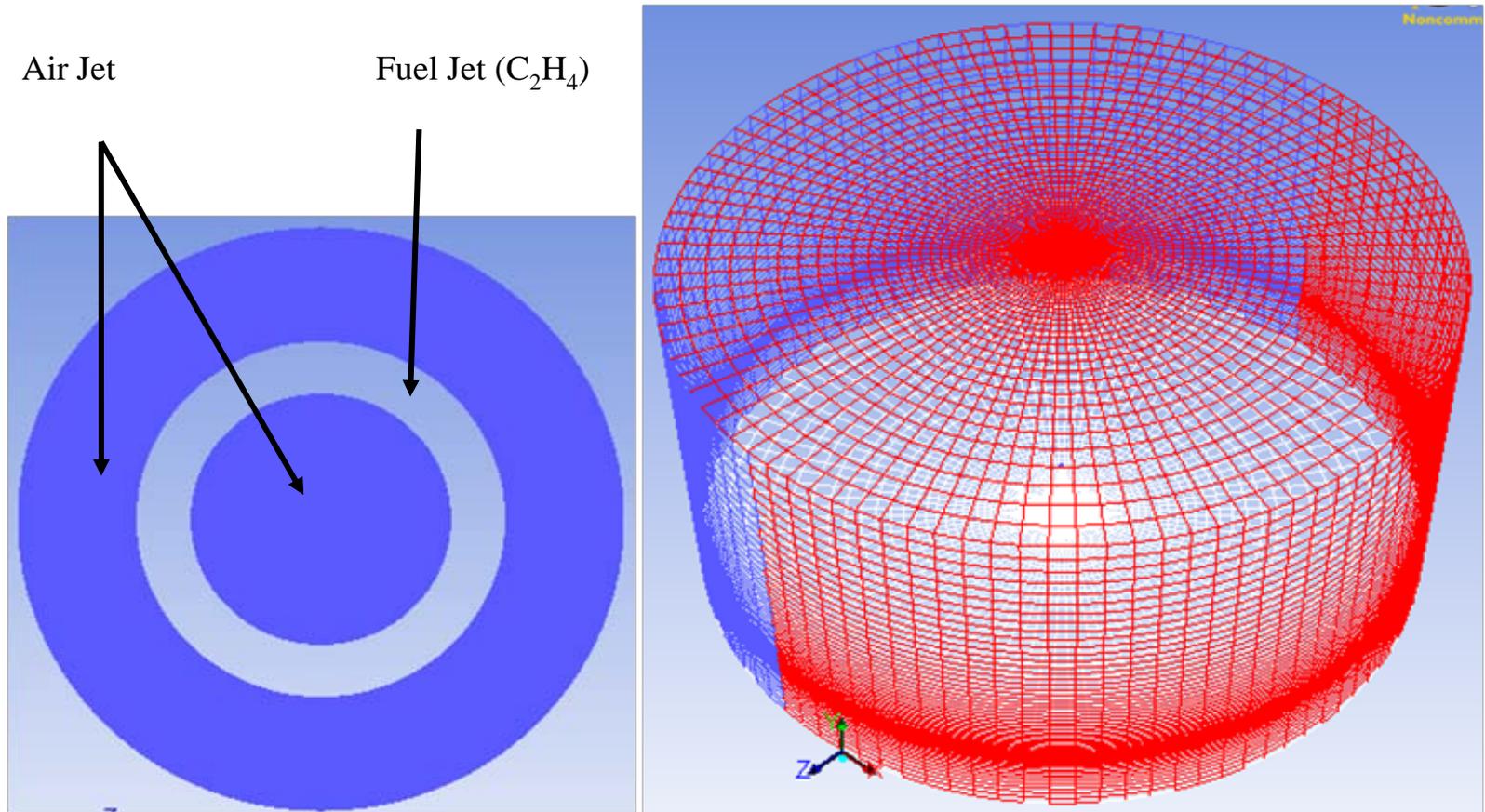


Formaldehyde Plot along Axis (Simulation)



Parametric Study of Industrial Flares

With Ring Shaped, Non-Premixed Geometry



Mass balance errors < 1%

Turbulence-Chemistry Interaction Models

Table 3: Comparison of EDC and PDF models

EDC (Eddy Dissipation Concept)	PDF (Probability Density Function)
Reactions taking place in the flame are governed by the Arrhenius rates	Reactions are governed by a conserved scalar quantity known as mixture fraction
Incorporates detailed chemical mechanisms	Fast reactions are assumed (Valid for >2100 K).
Molar concentrations are derived from Reaction rates, which are calculated using ISAT algorithm	Molar concentrations are derived from the predicted mixture fraction fields
Any number of inlet streams can be defined	Only two inlet streams are allowed i.e. Fuel and Oxidizer
Computationally very expensive; requires 5-6 days for convergence	Requires less time for convergence; only 2-3 days

Easy-to-Use Correlations

Polynomial Equations

$$Y = a_0 + a_1 * U + a_2 * V_j + a_3 * U * V_j + a_4 * U^2 + a_5 * V_j^2$$

where $a_i = i$ th weighting factor; $U =$ crosswind; $V =$ jet velocity

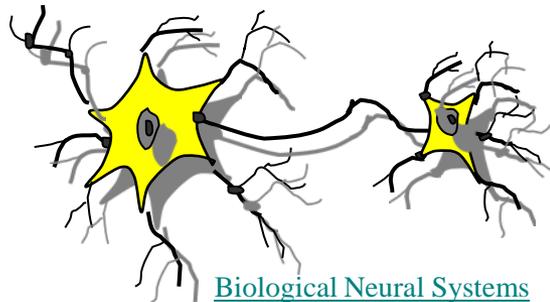
Exponential Equations

$$Y = a * U^b * V_j^c$$

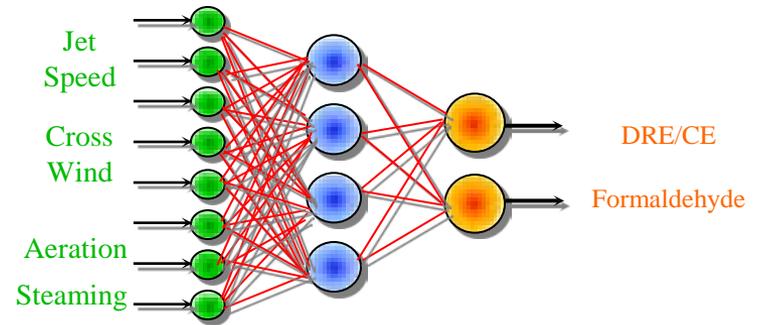
where Y is DRE or CE, and a , b , & c are constants.

Neural Network Models

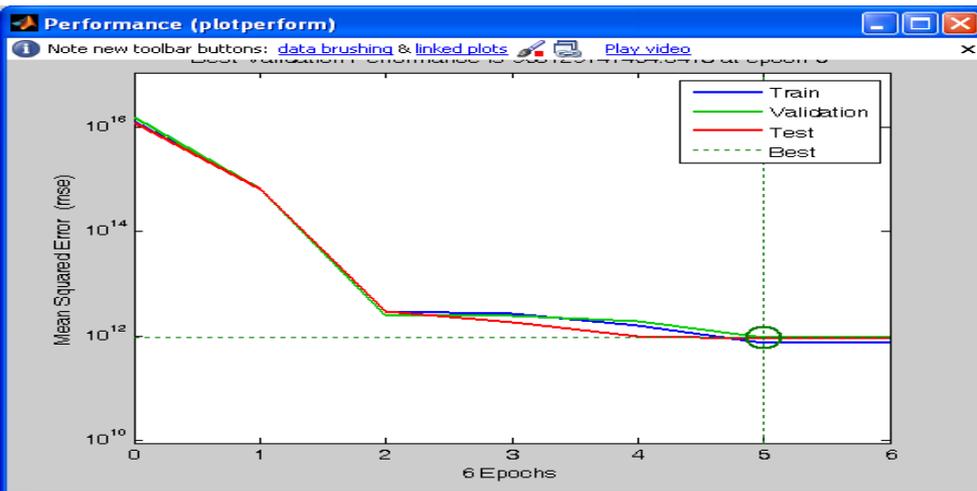
Biological vs. Artificial Neural Networks



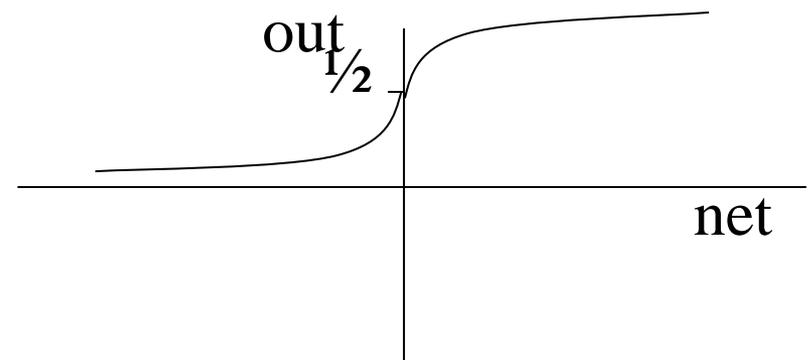
Artificial Neural Systems



The weights and biases (similar to slope & intercept in a single input case) can be identified with **MATLAB Neural Network Toolbox**.



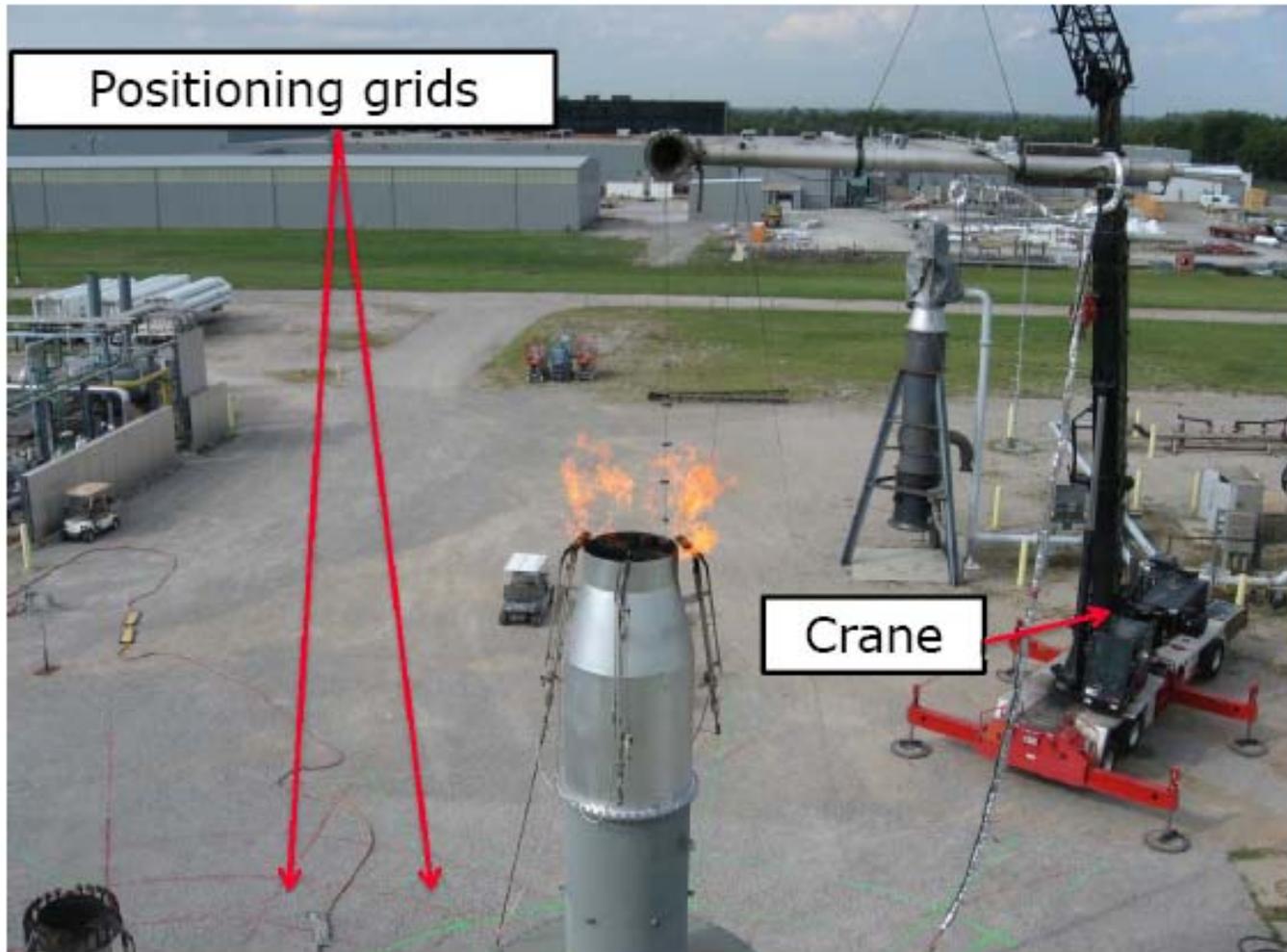
Neural network training to minimize the mean of square errors



Highly Nonlinear Sigmoid (Squashing) function:
 $out = 1/(1+e^{*(-\lambda net)})$

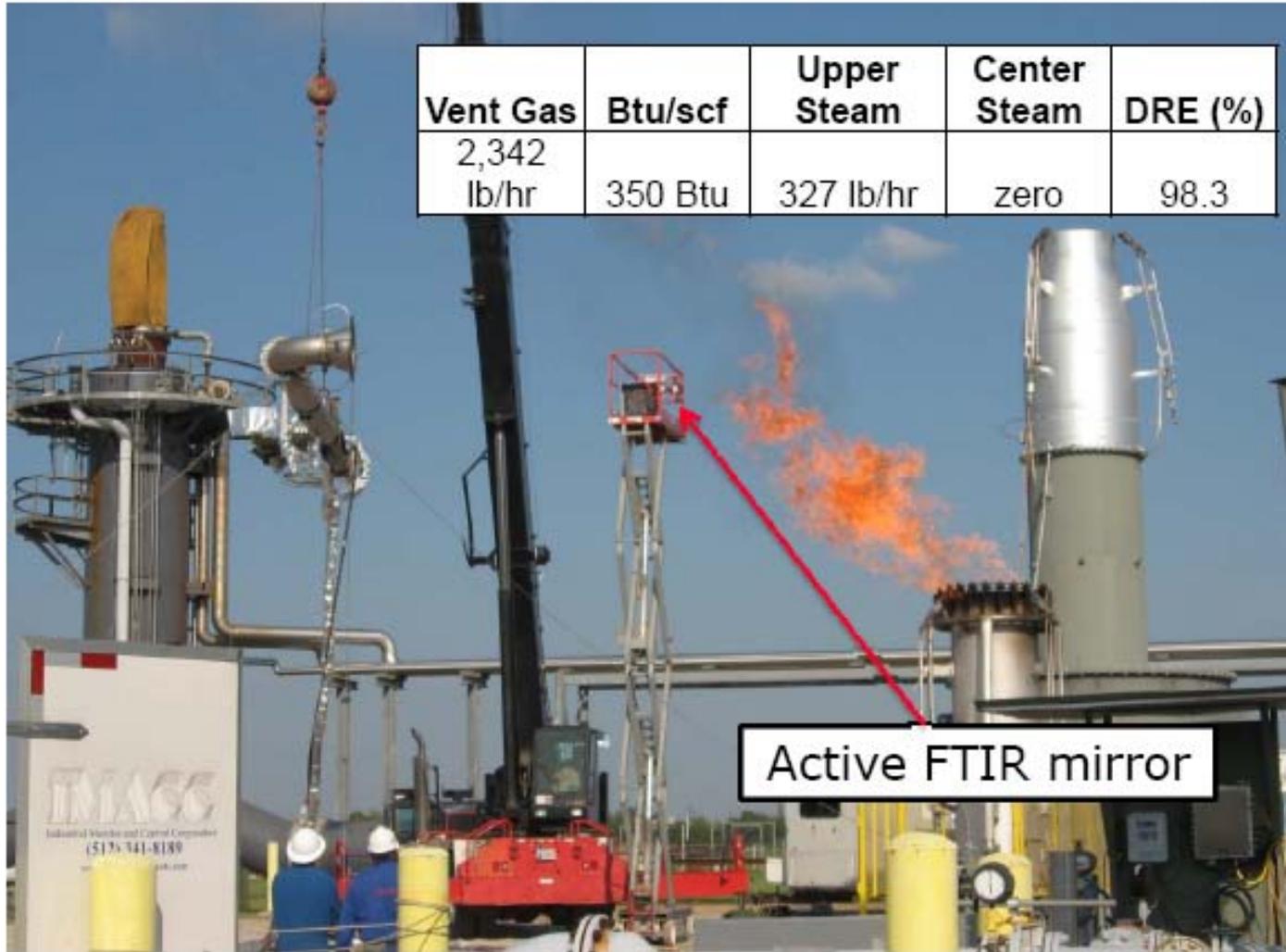
AQRP Project 11-022:
Modeling John Zink Flare Tests,
September 2010, Tulsa, Oklahoma

Elevated Position

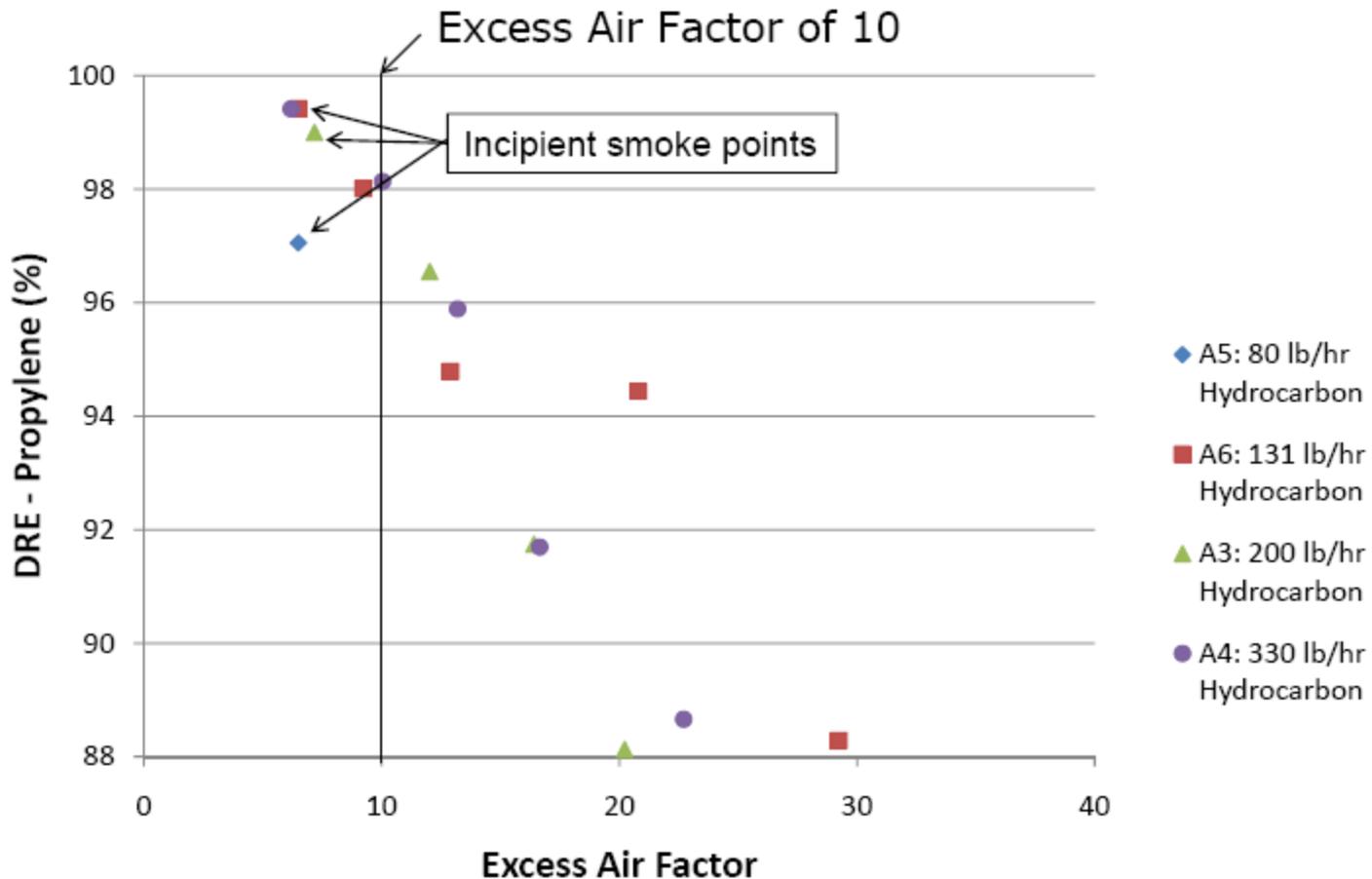


2010 TCEQ Flare Study Final Report, UT/CEER, TCEQ PGA No. 582-8-86245-FY09-04 and Task Order No. UTA10-000924-LOAT-RP9, Aug. 1, 2011.

Test Point S4.4

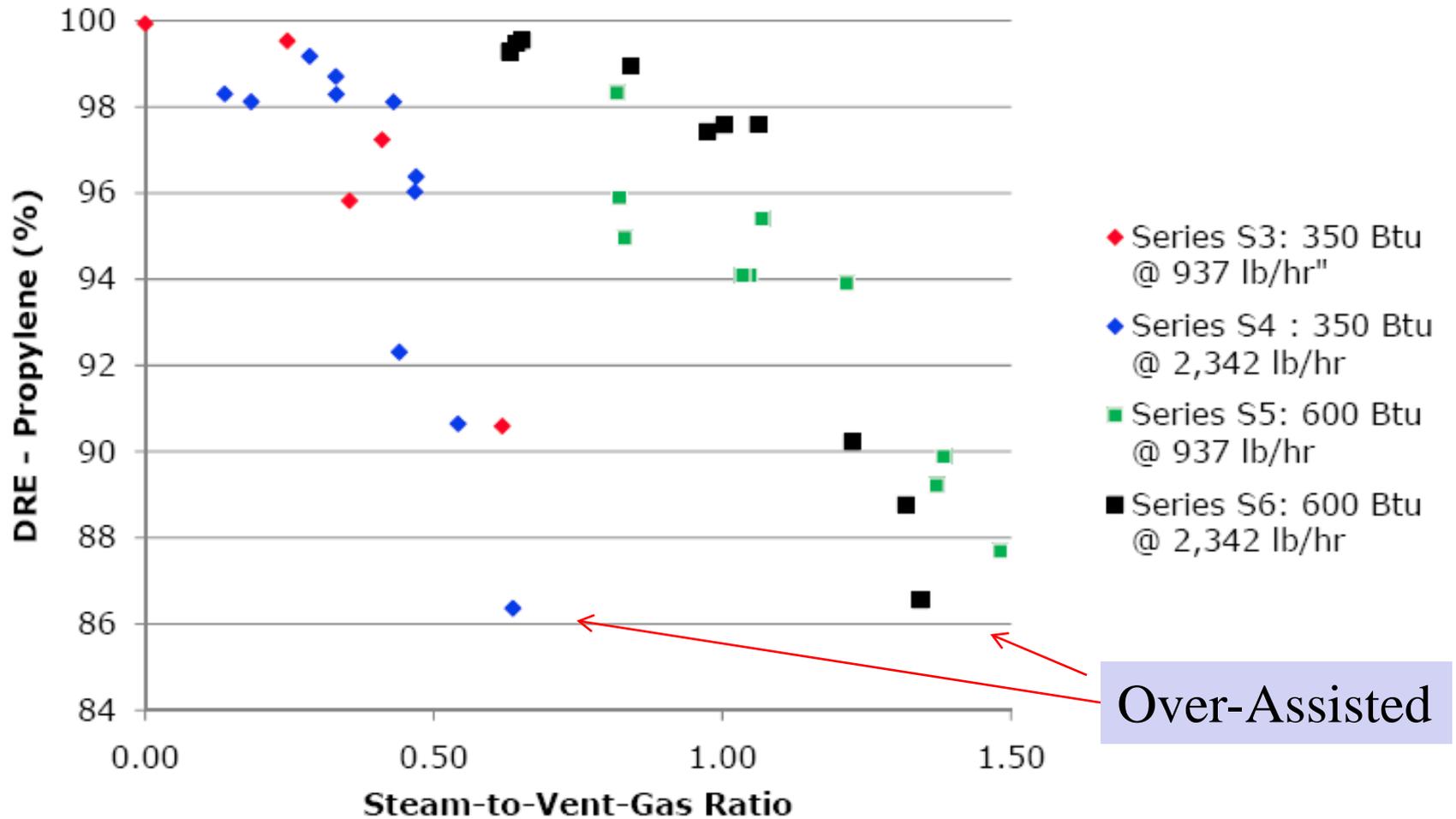


DRE vs. Excess Air



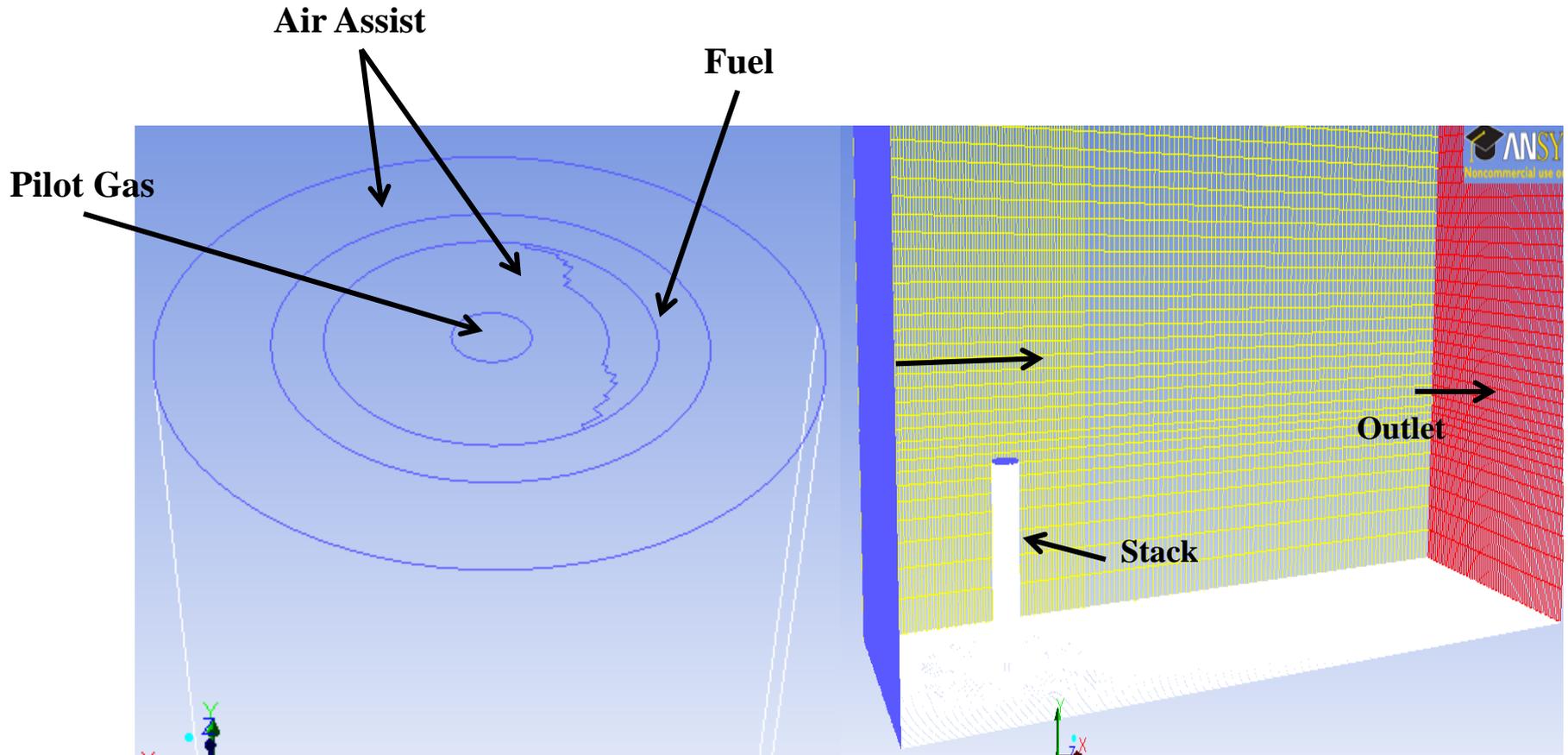
2010 TCEQ Flare Study Final Report, UT/CEER, TCEQ PGA No. 582-8-86245-FY09-04 and Task Order No. UTA10-000924-LOAT-RP9, Aug. 1, 2011.

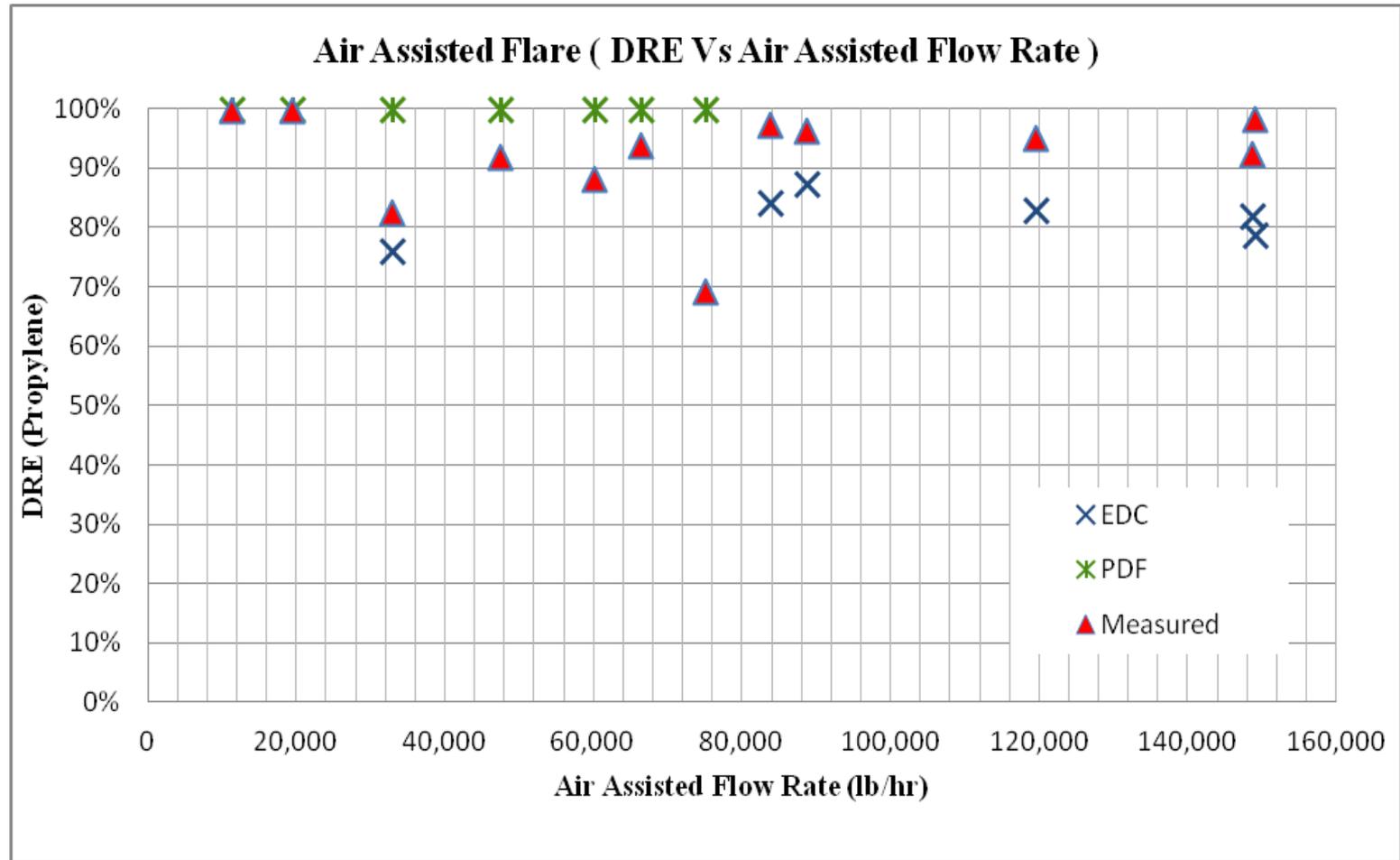
DRE Versus Steam-to-Vent-Gas Ratio at Varying Vent Gas Heating Values



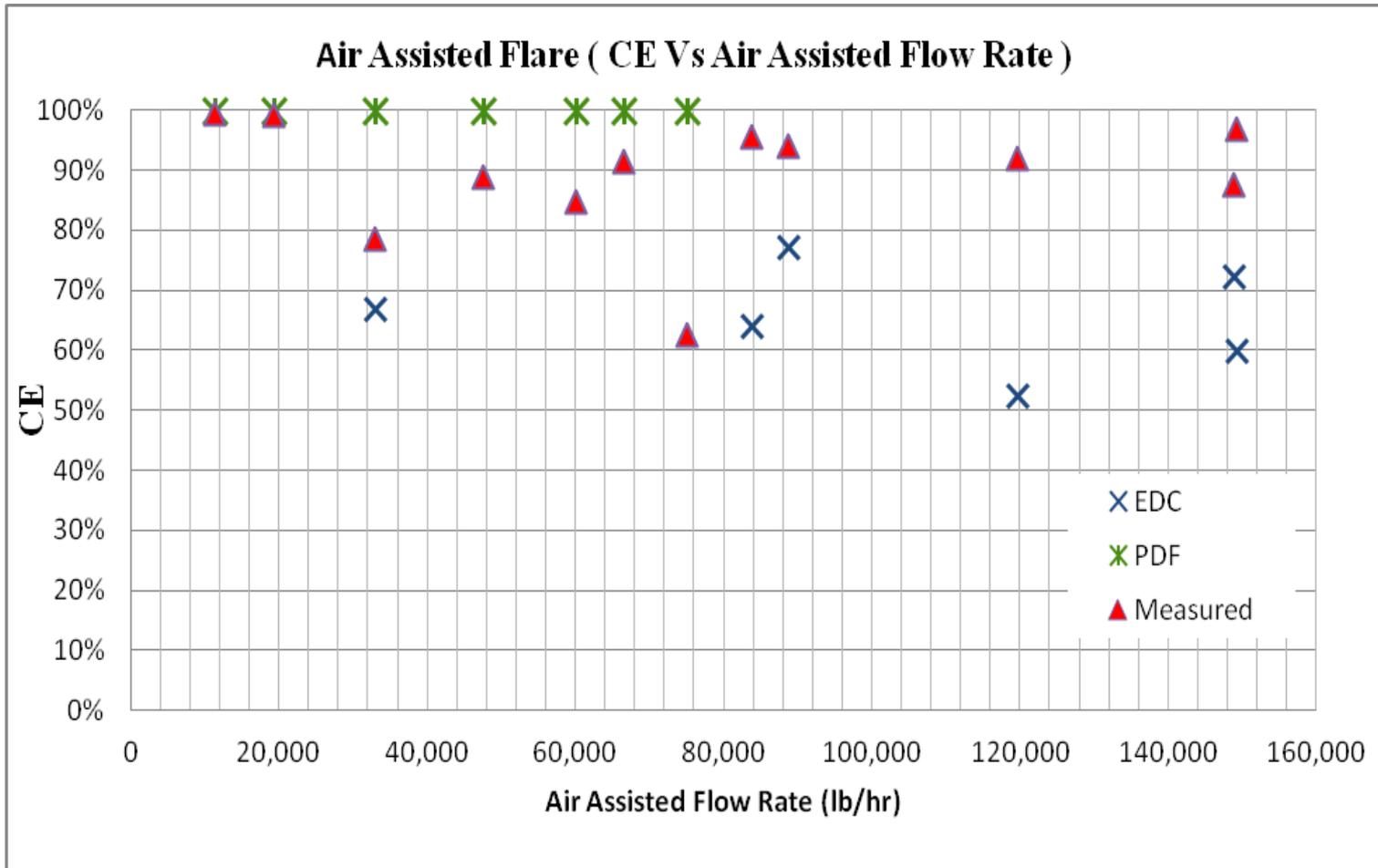
Over-Assisted

Modeling Air-assisted flares (using EDC approach)



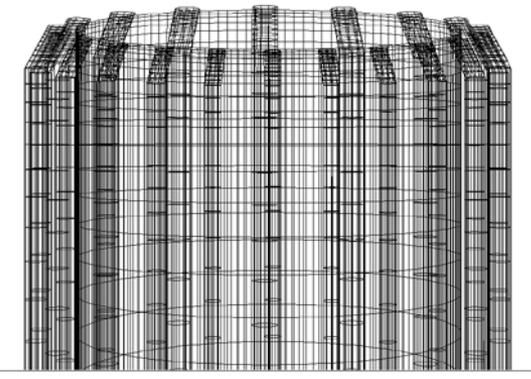
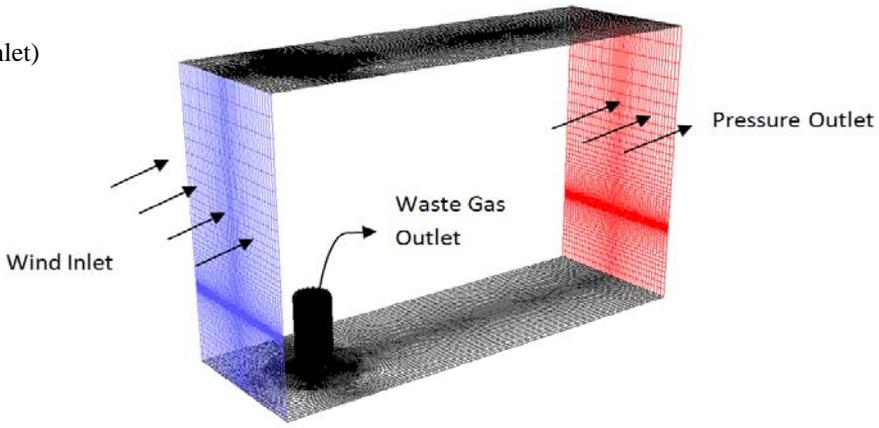
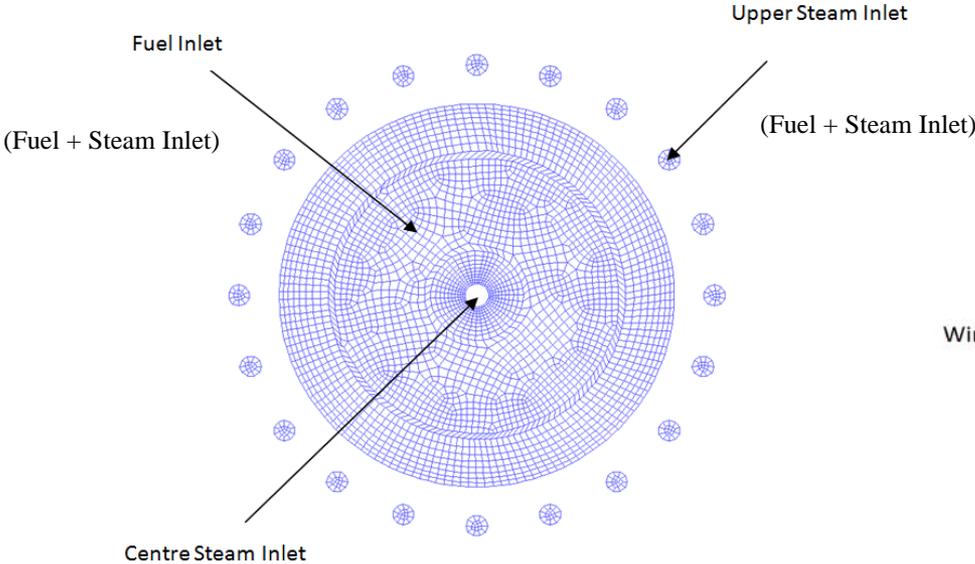


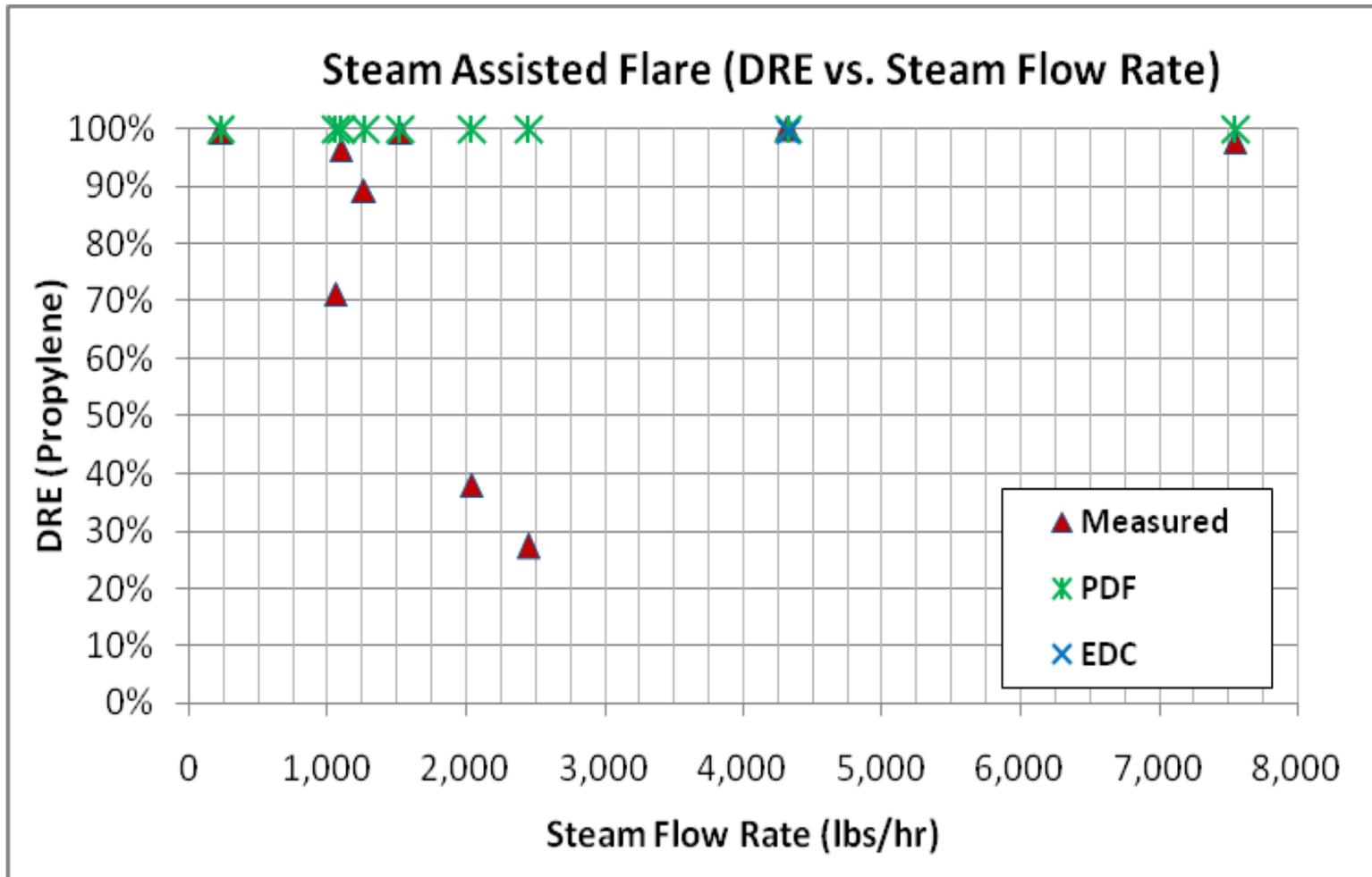
DRE as a function of assisted-air flow rate (measured vs. CFD, air-assisted cases)



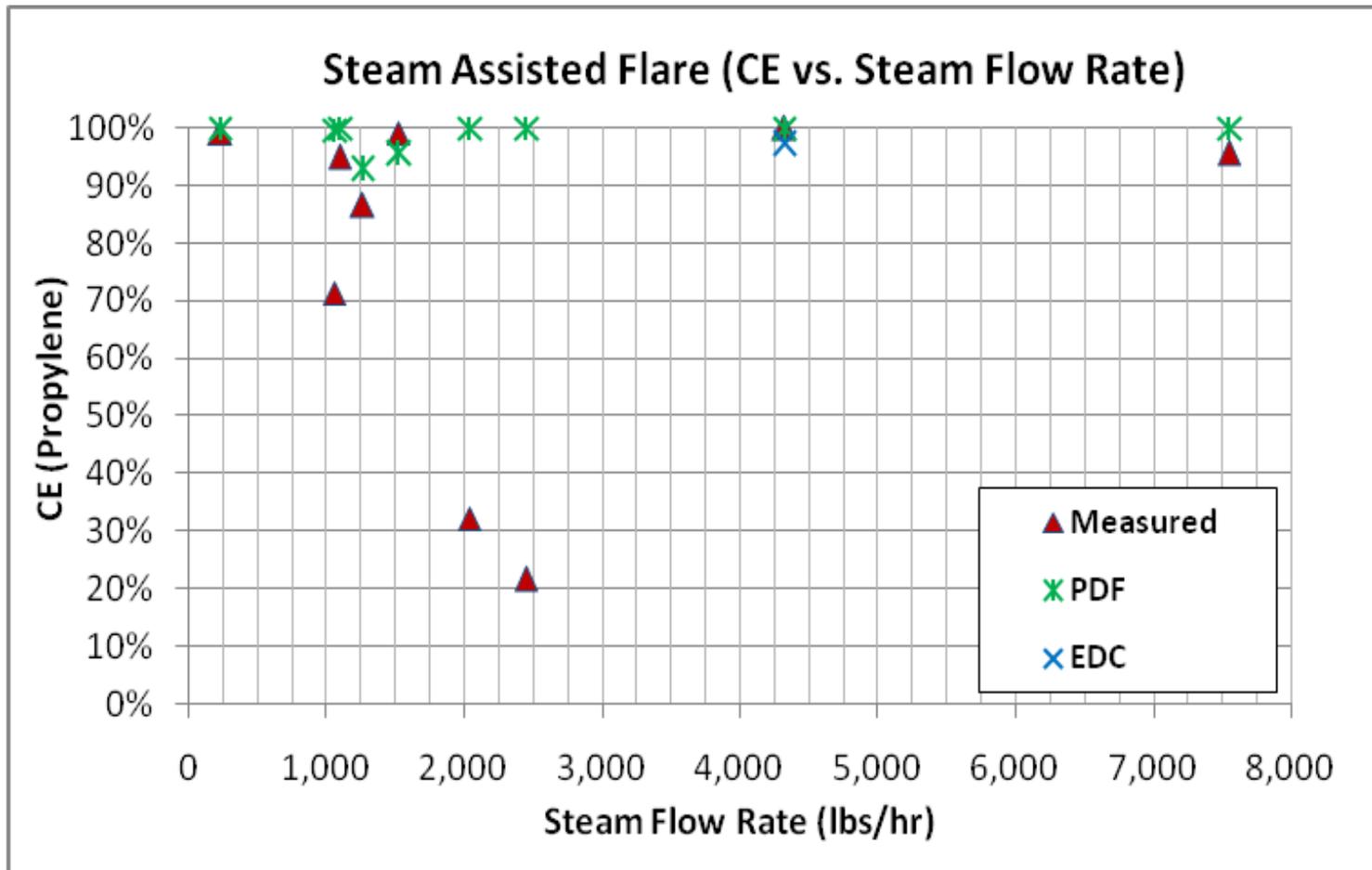
CE as a function of assisted-air flow rate (measured vs. CFD, air-assisted cases)

Steam-based test cases (PDF approach)





DRE as a function of assisted-steam flow rate (measured vs. CFD, steam-assisted cases)



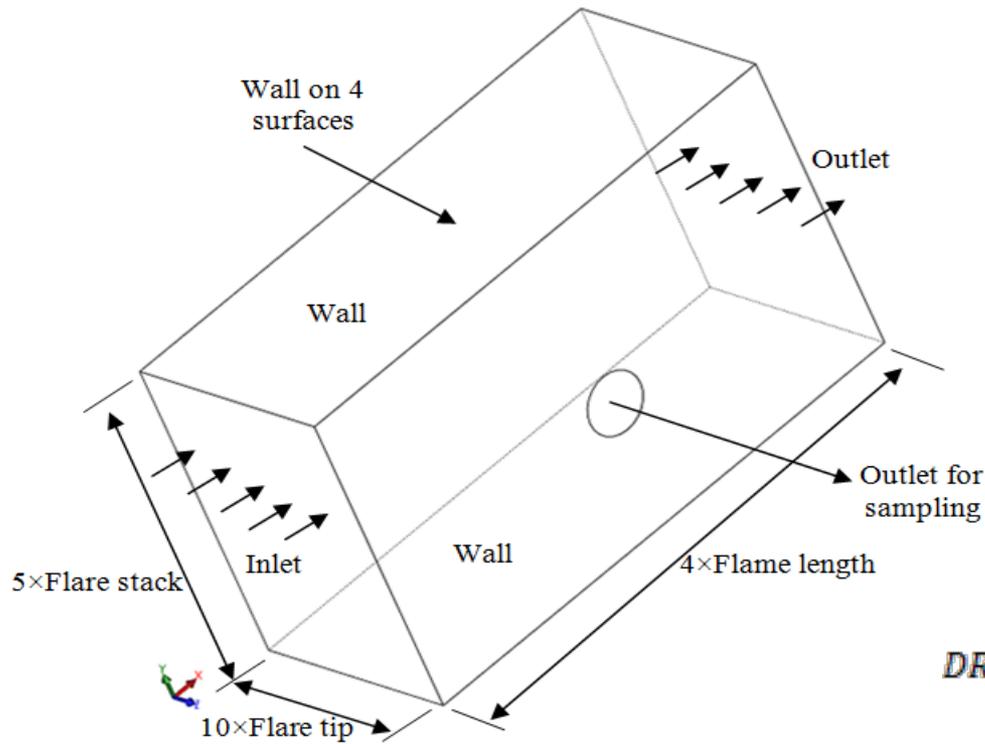
CE as a function of assisted-steam flow rate (measured vs. CFD, steam-assisted cases)

Conclusions for AQRP-11-022 (1)

- The EDC model under- predicts DRE of air-assisted cases by 6% to 19% with an average of 12%. It under- predicts CE by 12% to 39% with an average of 25%. The potential causes for the large discrepancies may be
 - the low flow rates, low heating values, high air/steam assists,
 - large number of simulation cells coupled with complex chemistry/transport phenomena
 - the difference between local sampling and the full surface integration (CFD post processing).
- Even though the more rigorous EDC model under-predicts the experimental results (in all cases except steam case S 1.5) in low LHV/low jet velocity flares, the same EDC model has been used in numerous times for flare modeling that routinely gives >98% combustion efficiencies for high LHV/high jet velocity flares.

Conclusions for AQRP-11-022 (2)

- The Probability Density Function model is not suitable for modeling low flow rate low heating value flares because the underlying assumption of infinitely fast combustion, while valid for high temperatures (>2100 K), is not appropriate at the modeled temperature range (1600-1950K)
 - Contrary to the EDC model, the PDF model over-predicts DRE by 0.1% to 72% with an average of 16%. It over-predicts CE by 0% to 78% with an average of 18%.
- Further studies are warranted
 - a cylindrical domain with more efficient, structured meshes need to be explored
 - the Large Eddy Simulation turbulence model, a transient formulation method, has the potential to give better results
 - combining the two models, PDF and EDC for simulating a low jet and low LHV flare is a viable option. An initial flame developed by the PDF model can be put into more rigorous chemistry-turbulence interaction by using the EDC model.



The plume measurements were carried out approximately in the center of the flare plume at a distance of **two flame lengths downwind from the flare tip** and with the inlet face perpendicular to the plume travel, Fig. 3.

$$DRE (\%) = \frac{(C_3H_6)_{in} - (C_3H_6)_{plume}}{(C_3H_6)_{in}} * 100 \quad (1)$$

$$CE (\%) = \frac{(CO_2)_{plume}}{(CO_2)_{plume} + (CO)_{plume} + \sum hydrocarbons_{plume}} * 100 \quad (2)$$

Fig. 3 Grab sampling described with a CFD simulation domain

CFD predicted DRE and CE values using Eqns. (3) and (4)

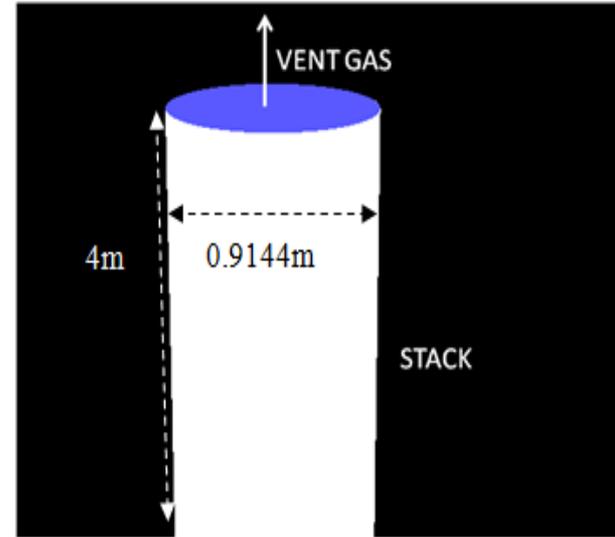
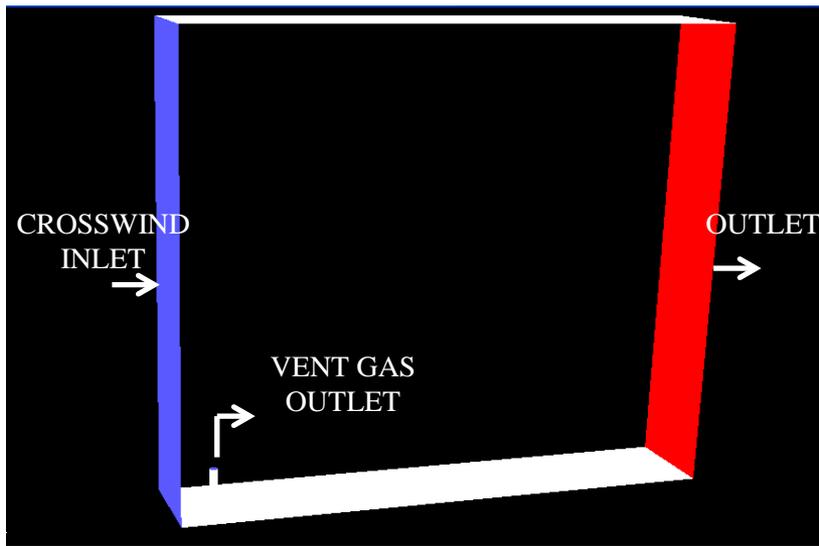
$$DRE(C_xH_y) = \frac{\text{Amount of } C_xH_y \text{ fed} - \text{Amount of } C_xH_y \text{ in flue gas}}{\text{Amount of } C_xH_y \text{ fed to the flare}} \quad (3)$$

$$CE = \frac{\text{Amount of fuel converted to } CO_2}{\text{Amount of fuel fed to the flare}} \quad (4)$$

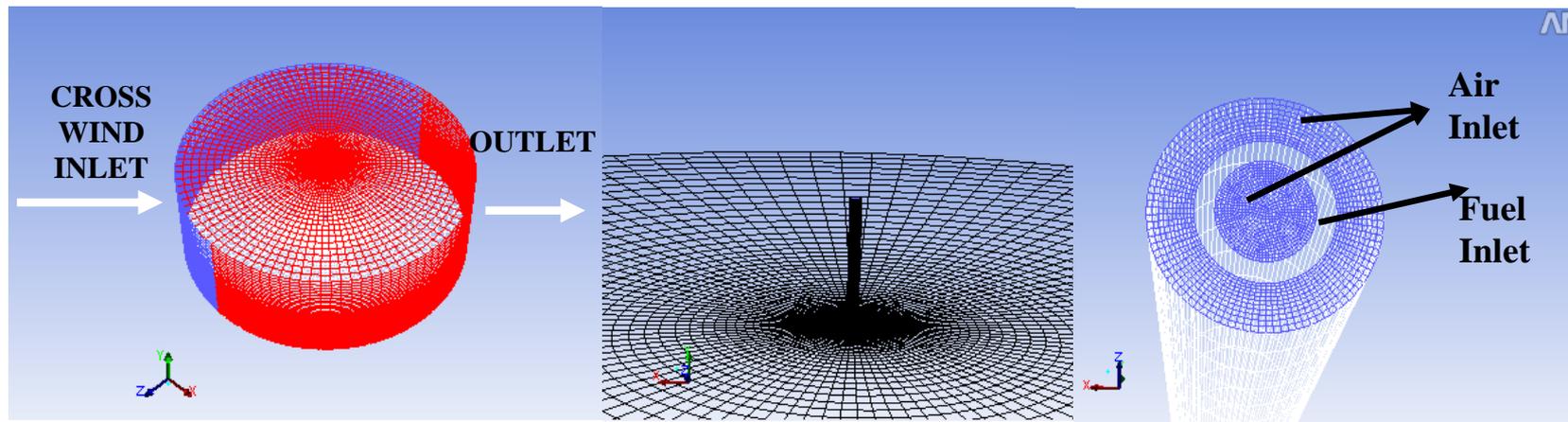
based on emission mass flow rates using rigorous integration over certain outlet surfaces. Future studies based on CFD simulation to explore the differences between local sampling at various selected locations and the full pressure outlet surfaces integration are thus warranted.



TCEQ SEP 2009-009 Project: Task 2-A Flare Speciation Study Using Advanced Computational Methods



Rectangular pre-mixed geometry: (a) Geometry showing inlet and outlets, and (b) Flare stack dimensions

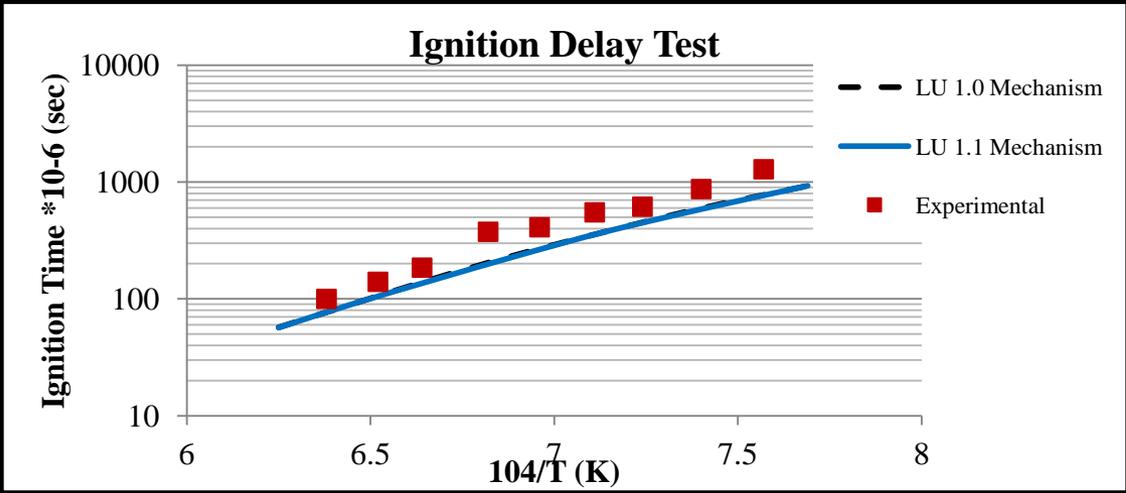
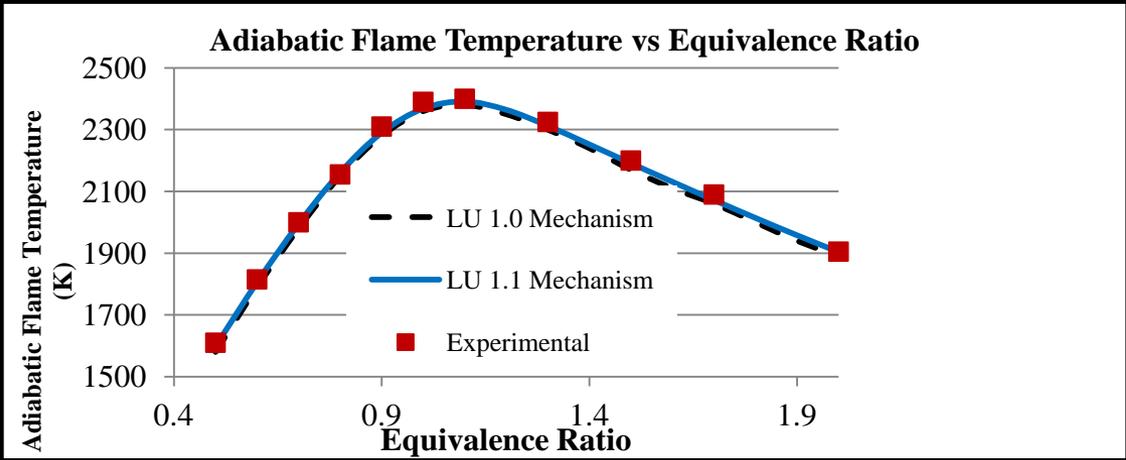
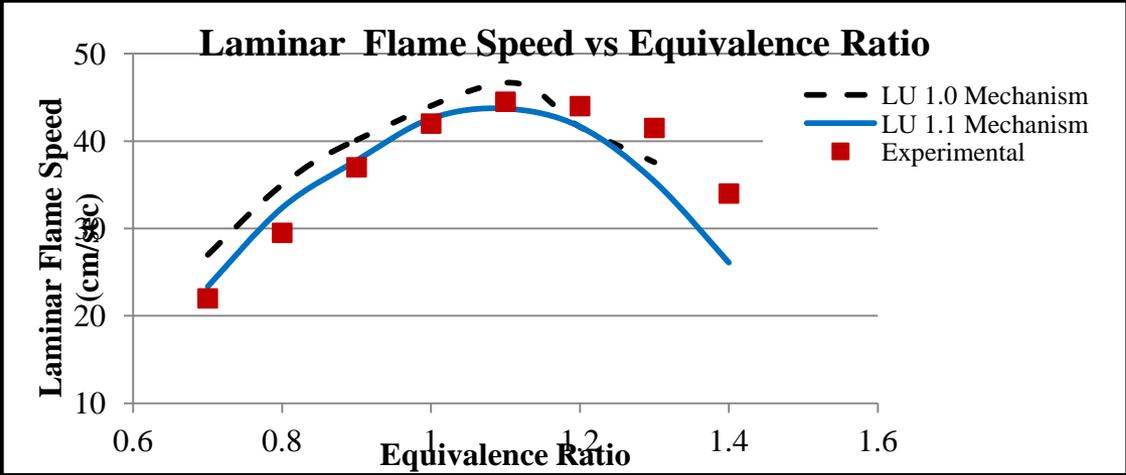


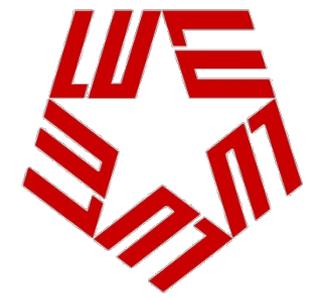
Cylindrical ring-shaped geometry: (a) Meshed geometry showing inlet and outlet, (b) Flare stack at the center of the cylinder, and (c) Details of flare tip (ring-shaped geometry)

New 50-Species Mechanism with NO₂ (LU 1.1)

- In 2010 John Zink flare tests, NO₂ is a monitored species.
- The full 93 species mechanism was reduced based on mole fractions, rate constants, & their effect on other major species for use in the EDC model.
- CN was replaced with NO₂ in LU 1.1.

LU 1.1

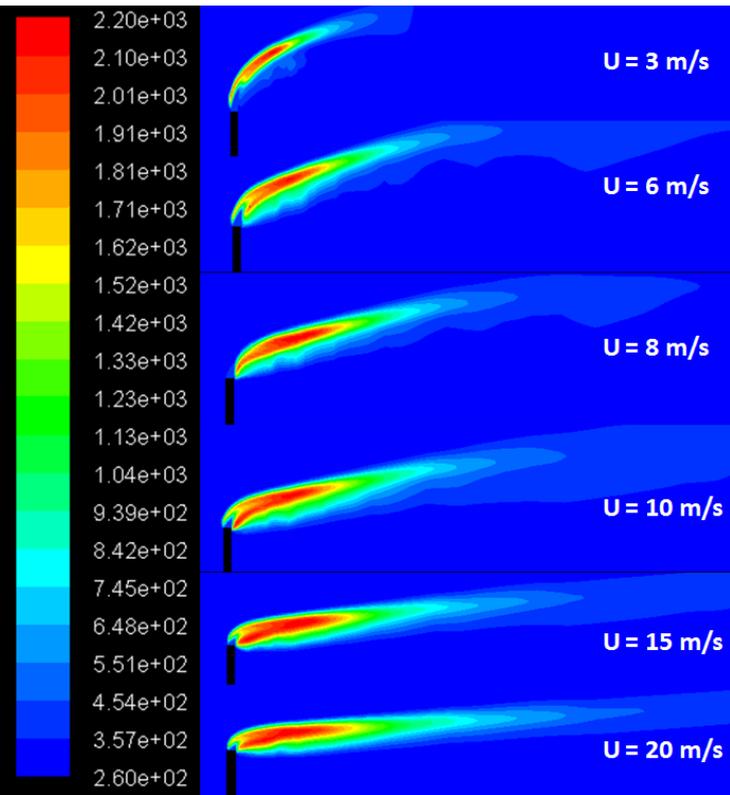




Parametric Studies

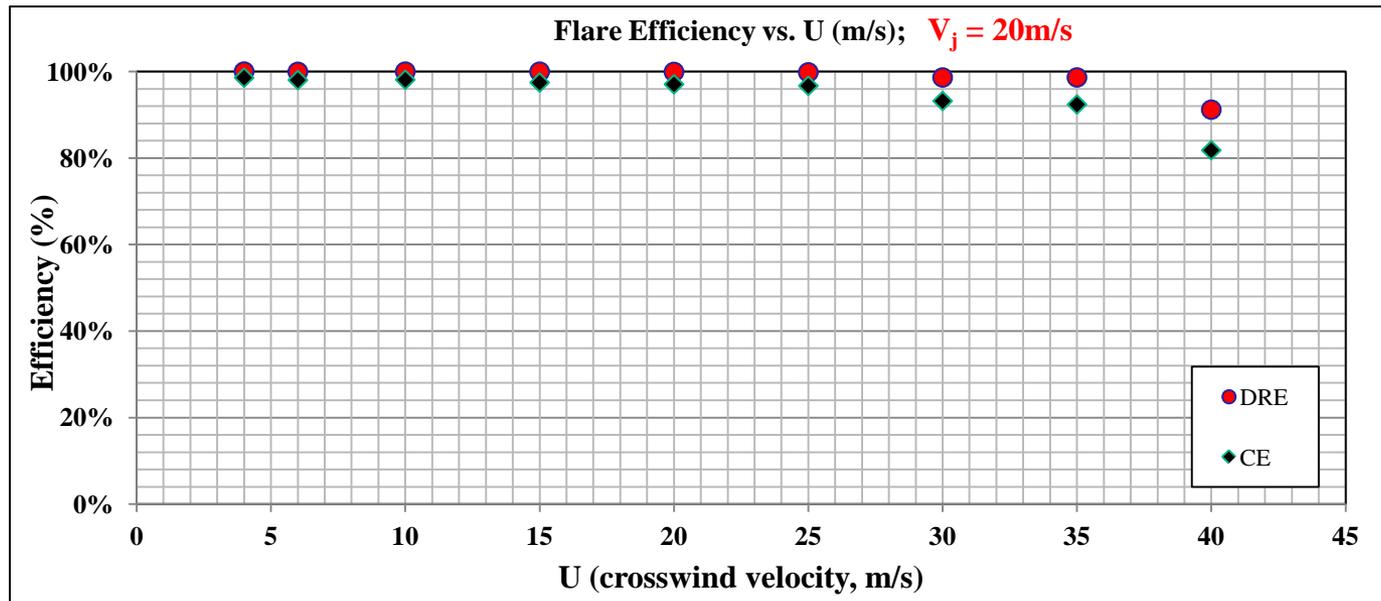
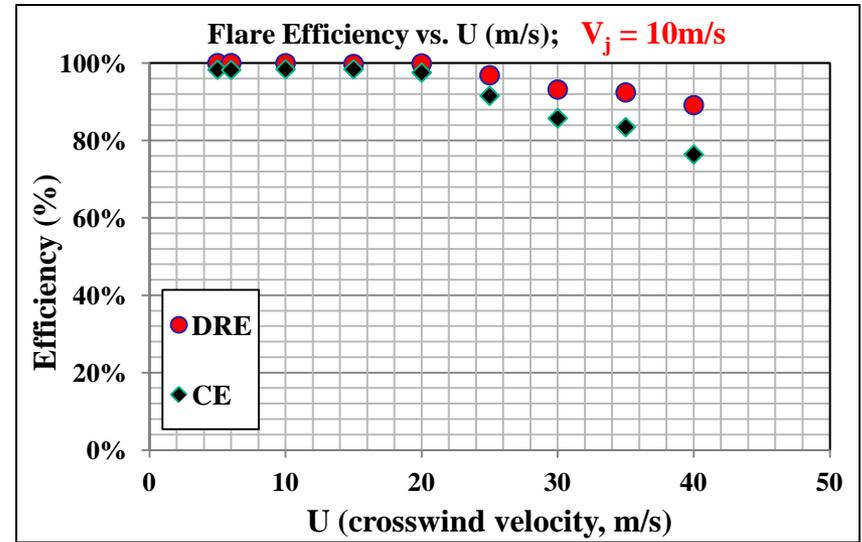
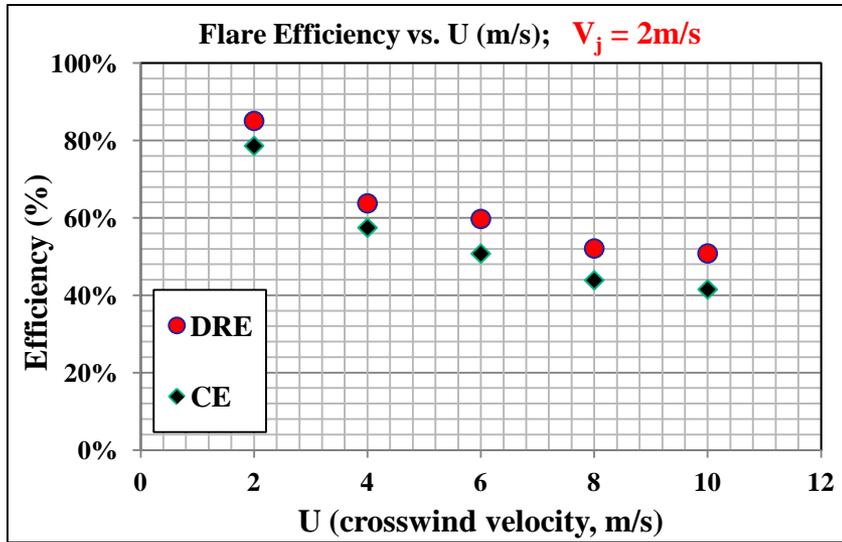
- I. Effect of Crosswind
- II. Effect of Jet velocity
- III. Effect of Assisted Air

Effect of Crosswind: Air-Assisted Flares

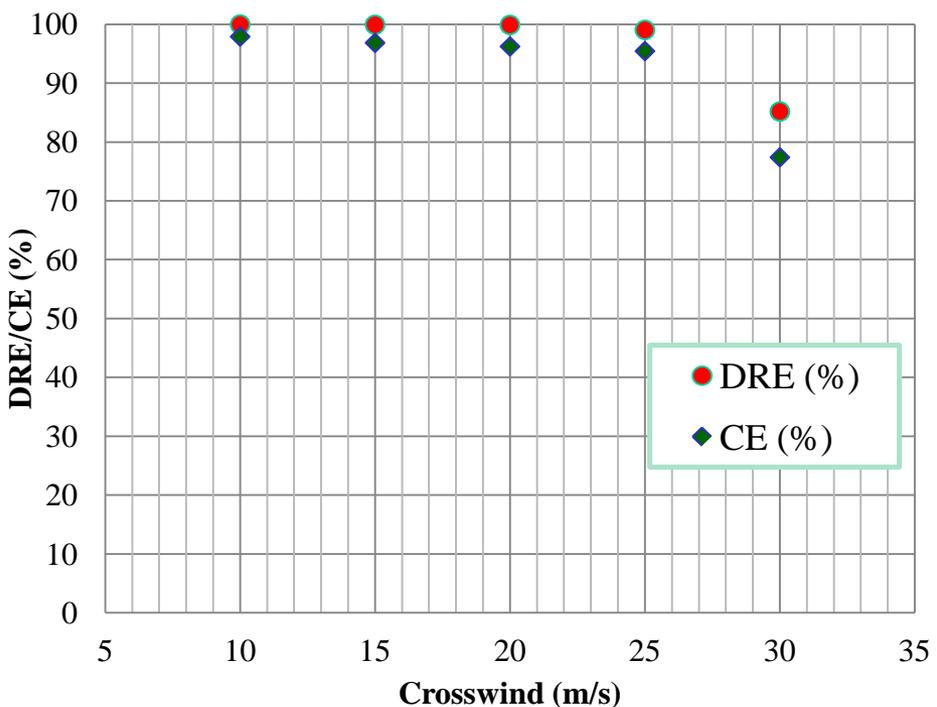


Base Case	
Fuel	C ₂ H ₄
Jet Velocity (m/s)	20.00
Fuel Inlet Temperature (K)	400.00
Premixed Air (% of stoichiometric Air)	30%
Tip Diameter (m)	0.6096
CFD Model	EDC

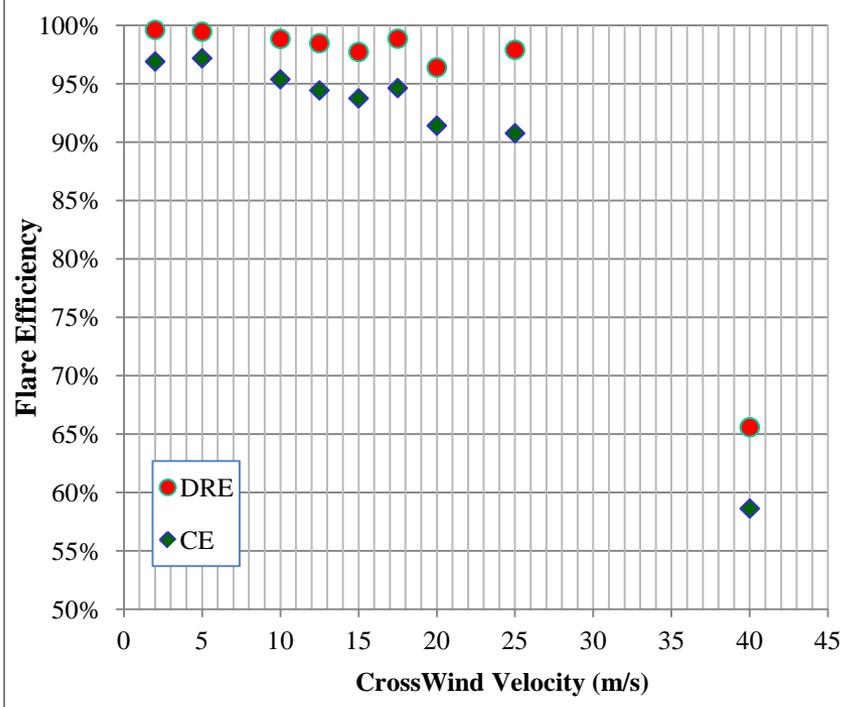
Effect of Crosswind on DRE/CE @ various Jet Velocities



Flare Efficiency vs. U, $V_j = 30 \text{ m/s}$



Flare Efficiency vs. U, $V_j = 40 \text{ m/s}$

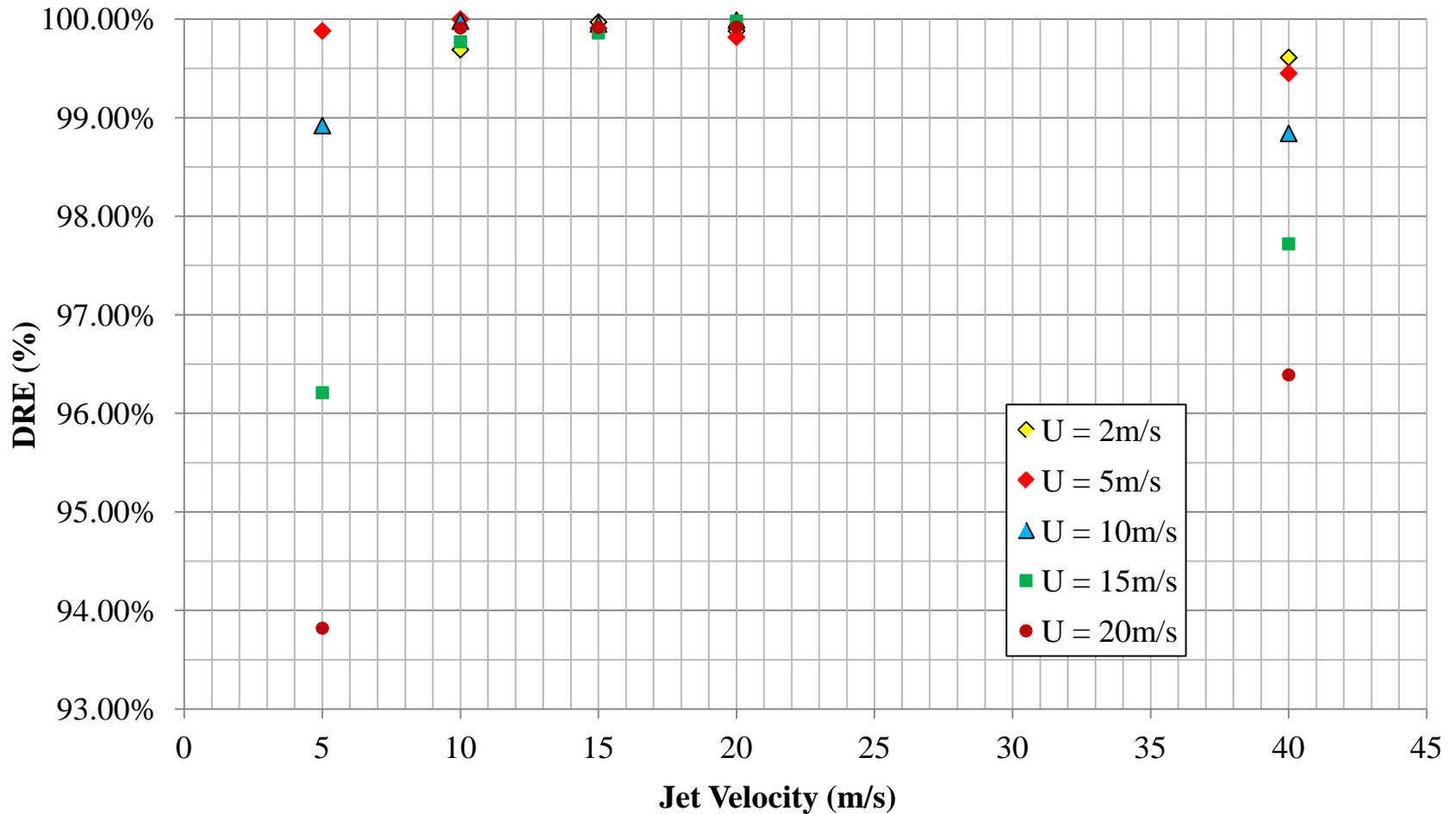


For $10 \leq V_j \leq 30 \text{ m/s}$ & $5 \leq U \leq 20 \text{ m/s} \Rightarrow \text{DRE} > 98\%$

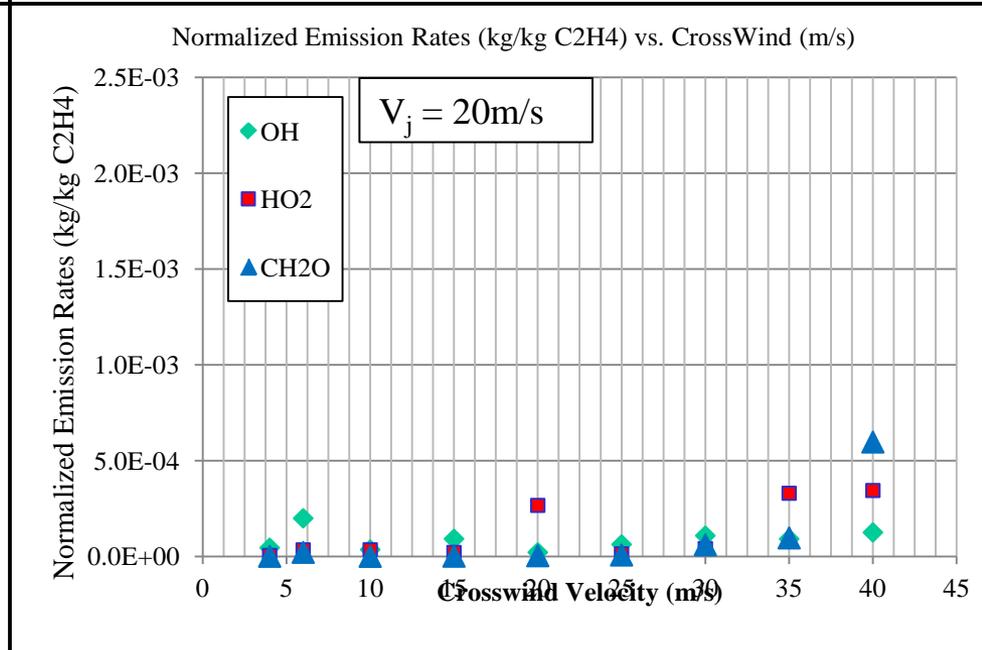
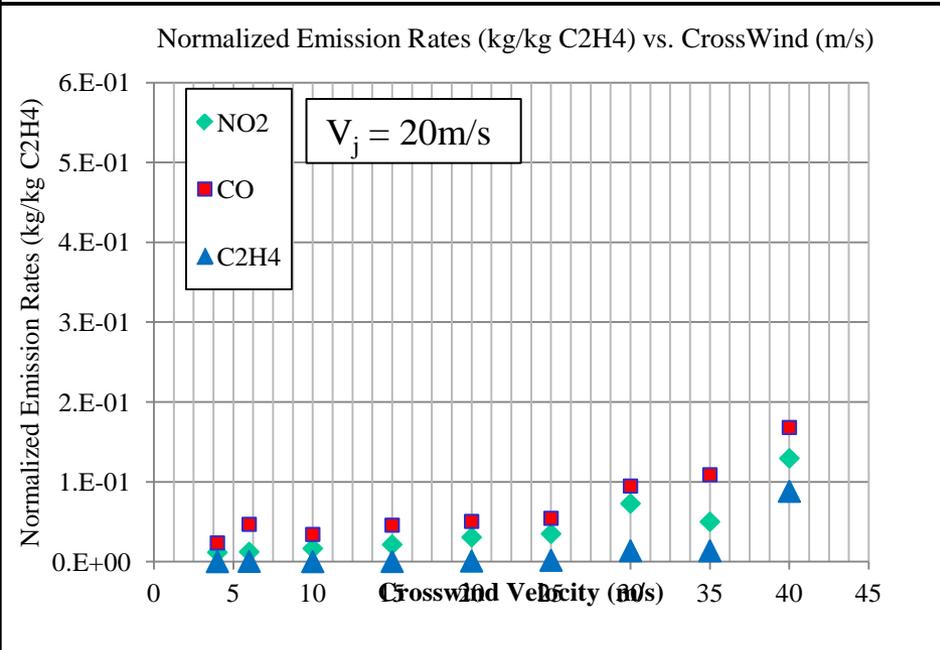
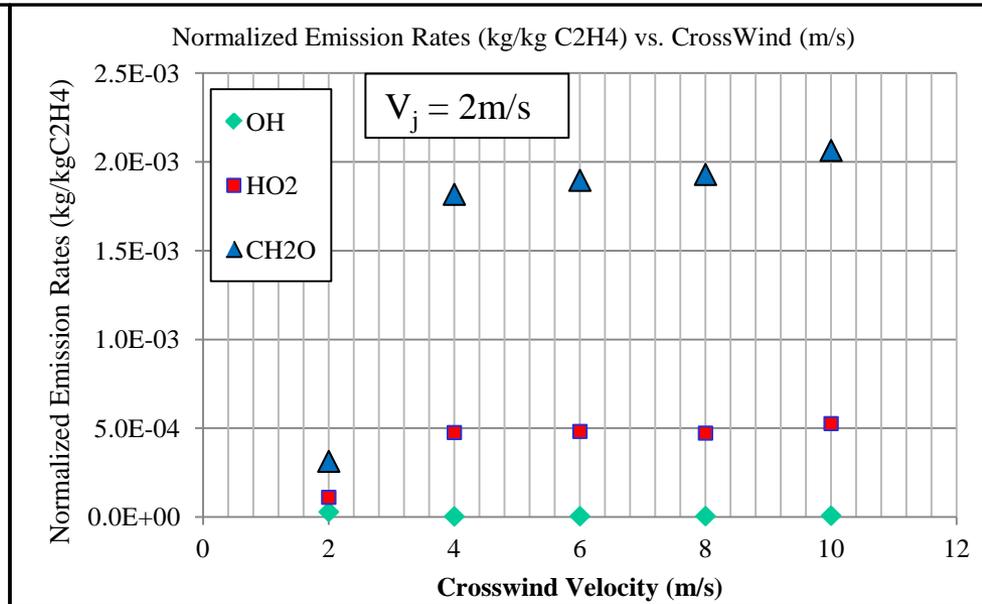
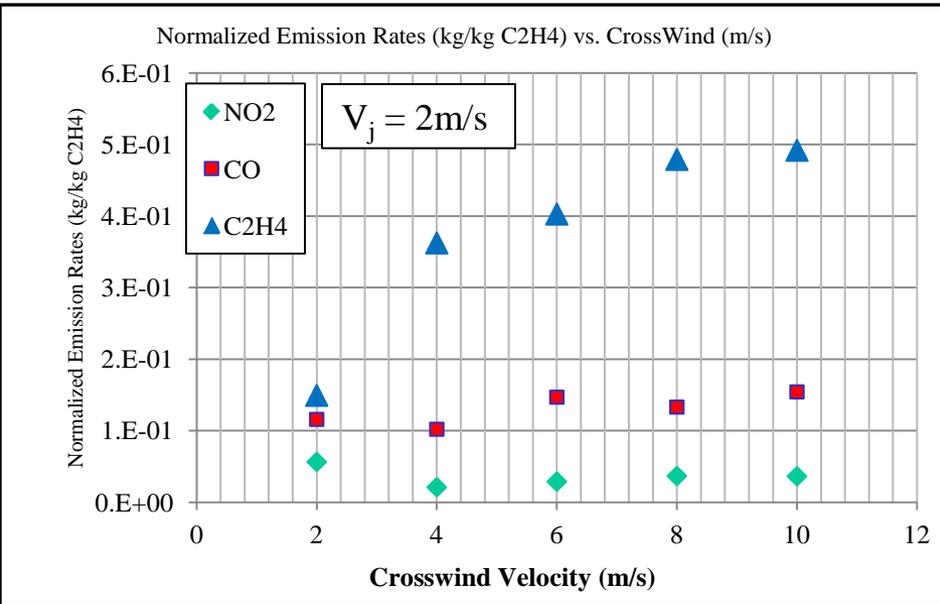
$V_{j, \max} = 48.80 \text{ m/s}$ for ethylene (LHV=1512 BTU/scf), Non-premixed, LU 1.1 mechanism

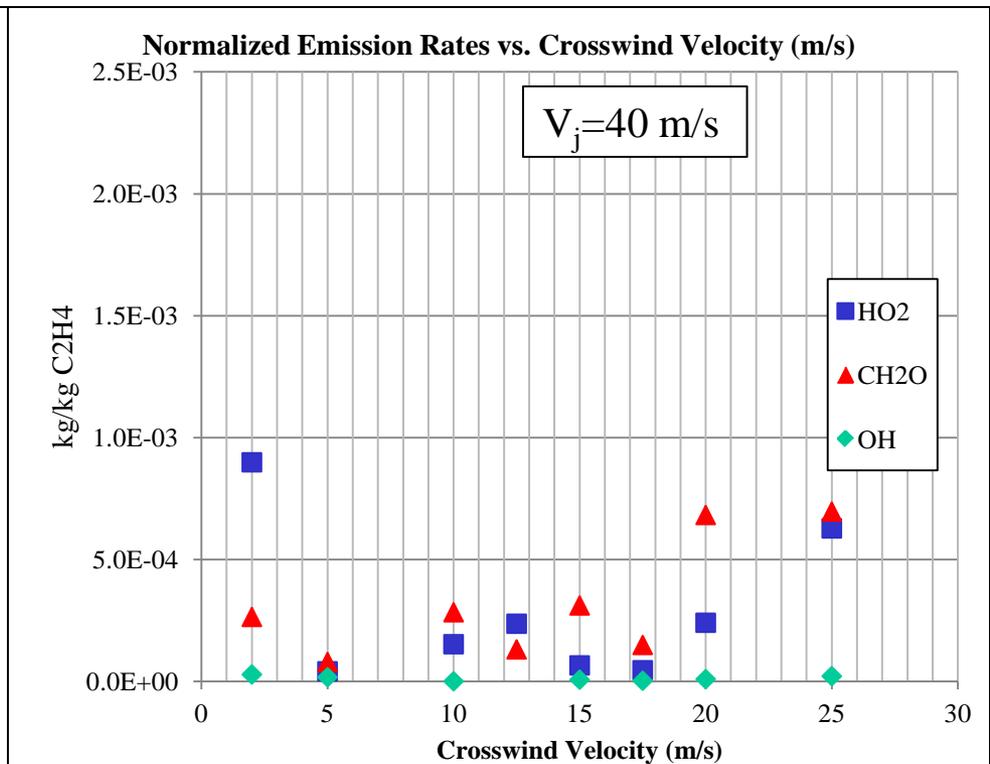
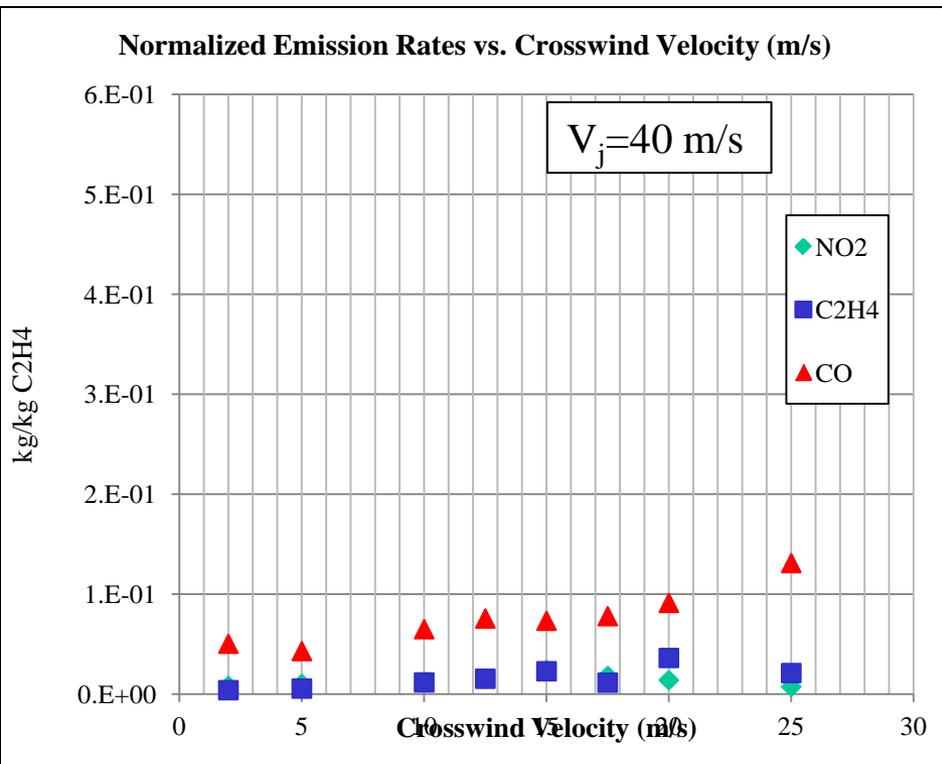
Effect of Jet Velocity on DRE

DRE (%) vs. Jet Velocity (m/s)

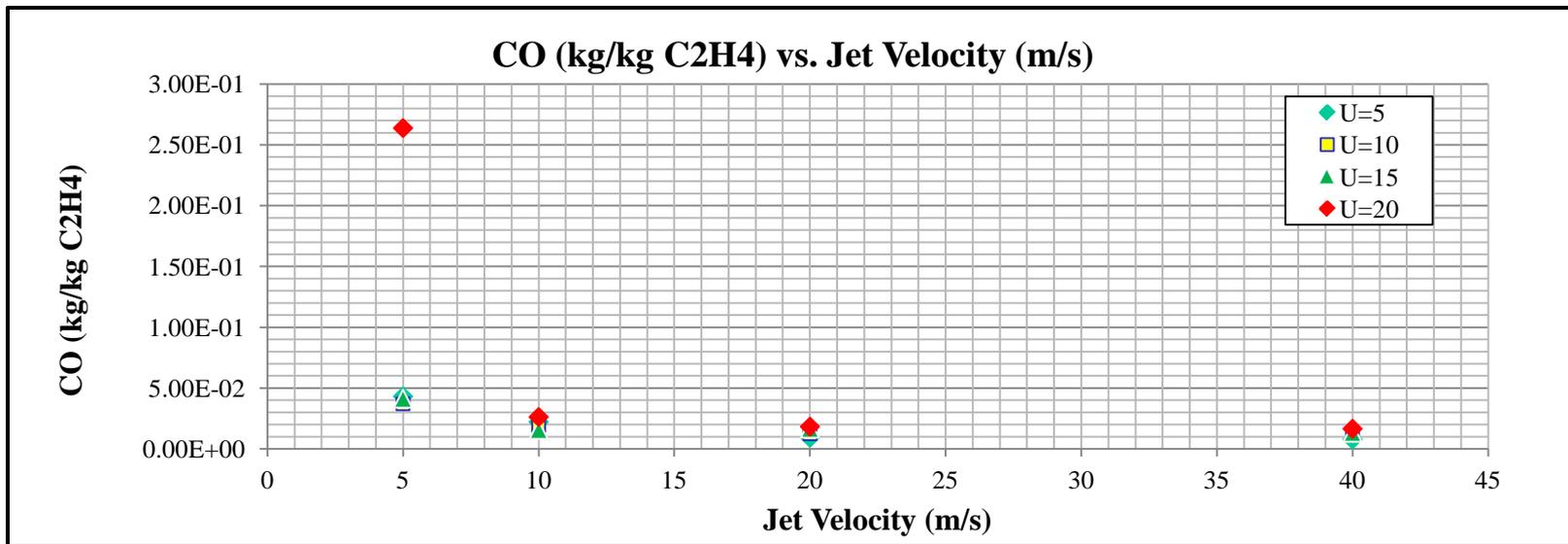
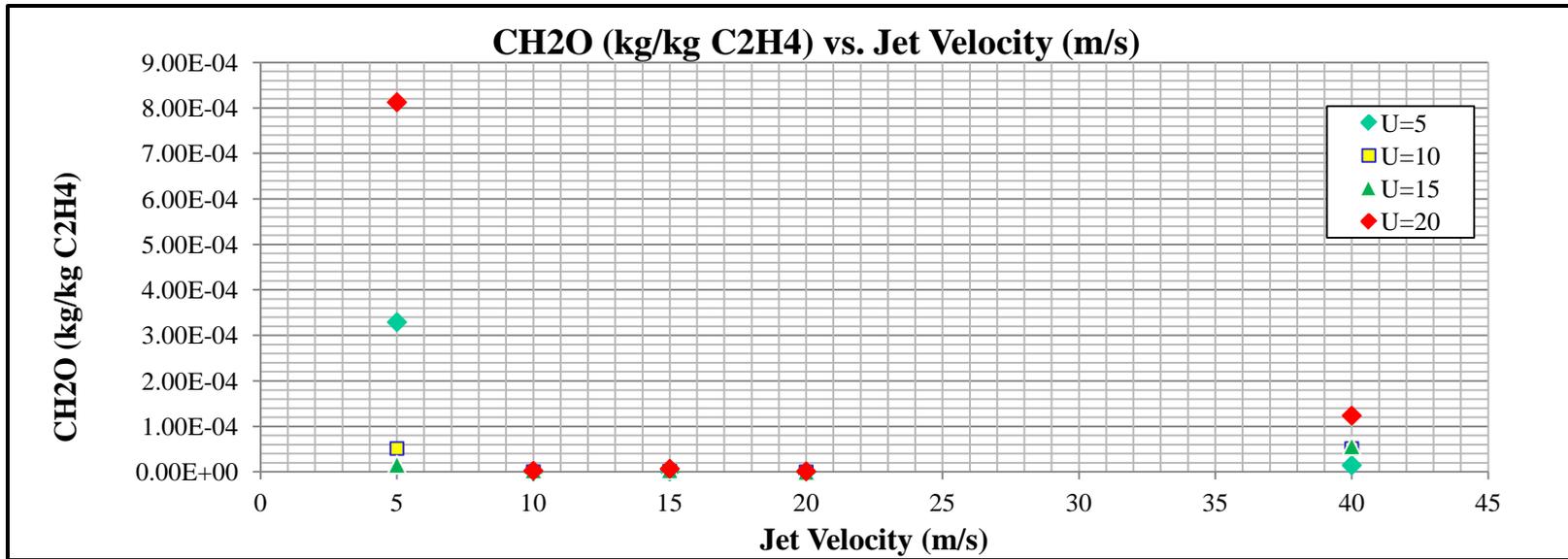


Effect of Crosswind on Emissions @ Various Jet Velocities

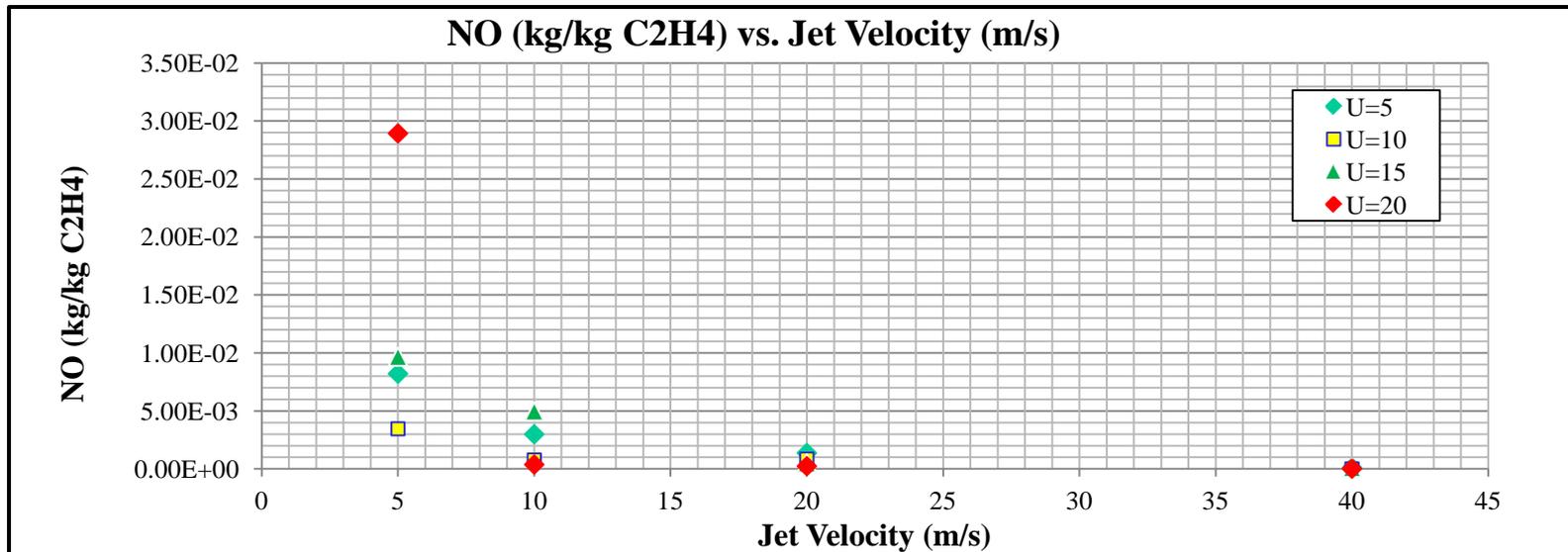
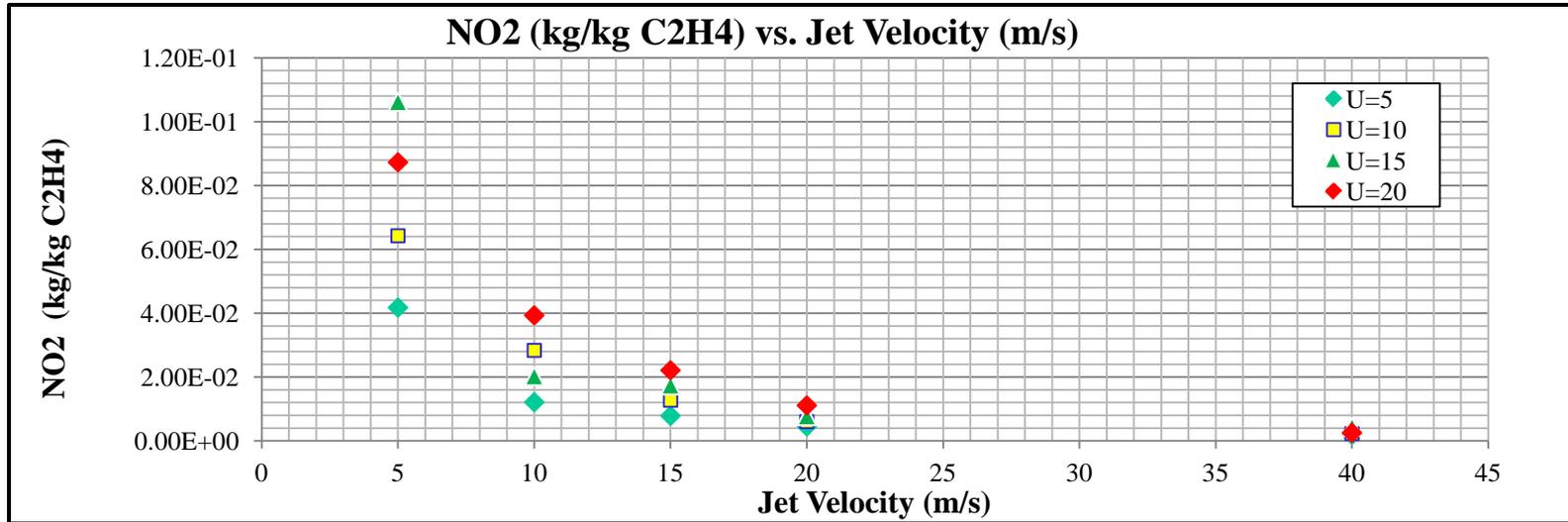




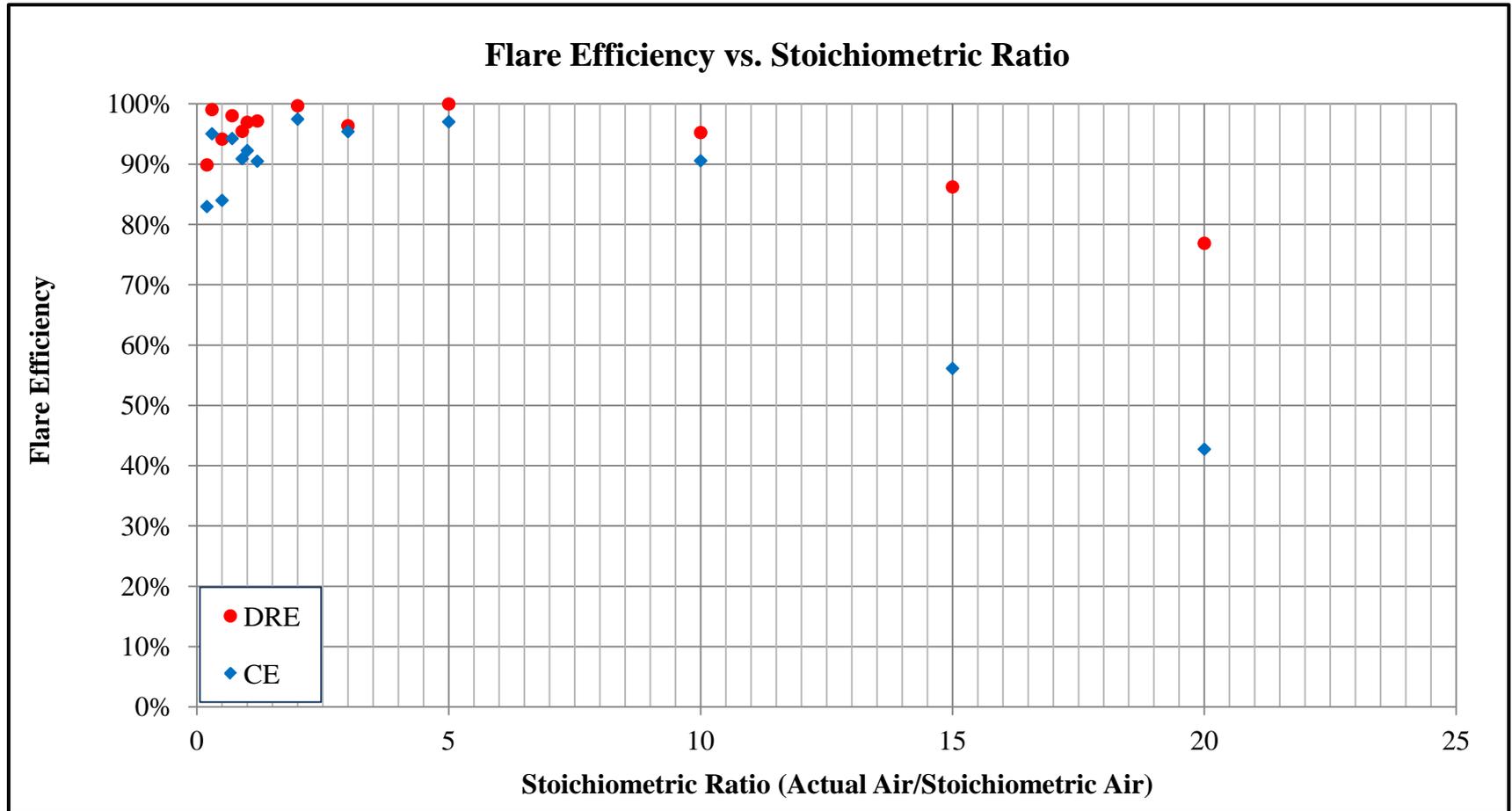
Effect of Jet Velocity on Emission Rates



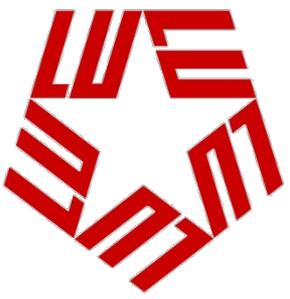
Effect of Jet Velocity on Emission Rates



Effect of *Assisted-Air* (in terms of Stoichiometric Ratio SR) on DRE/CE

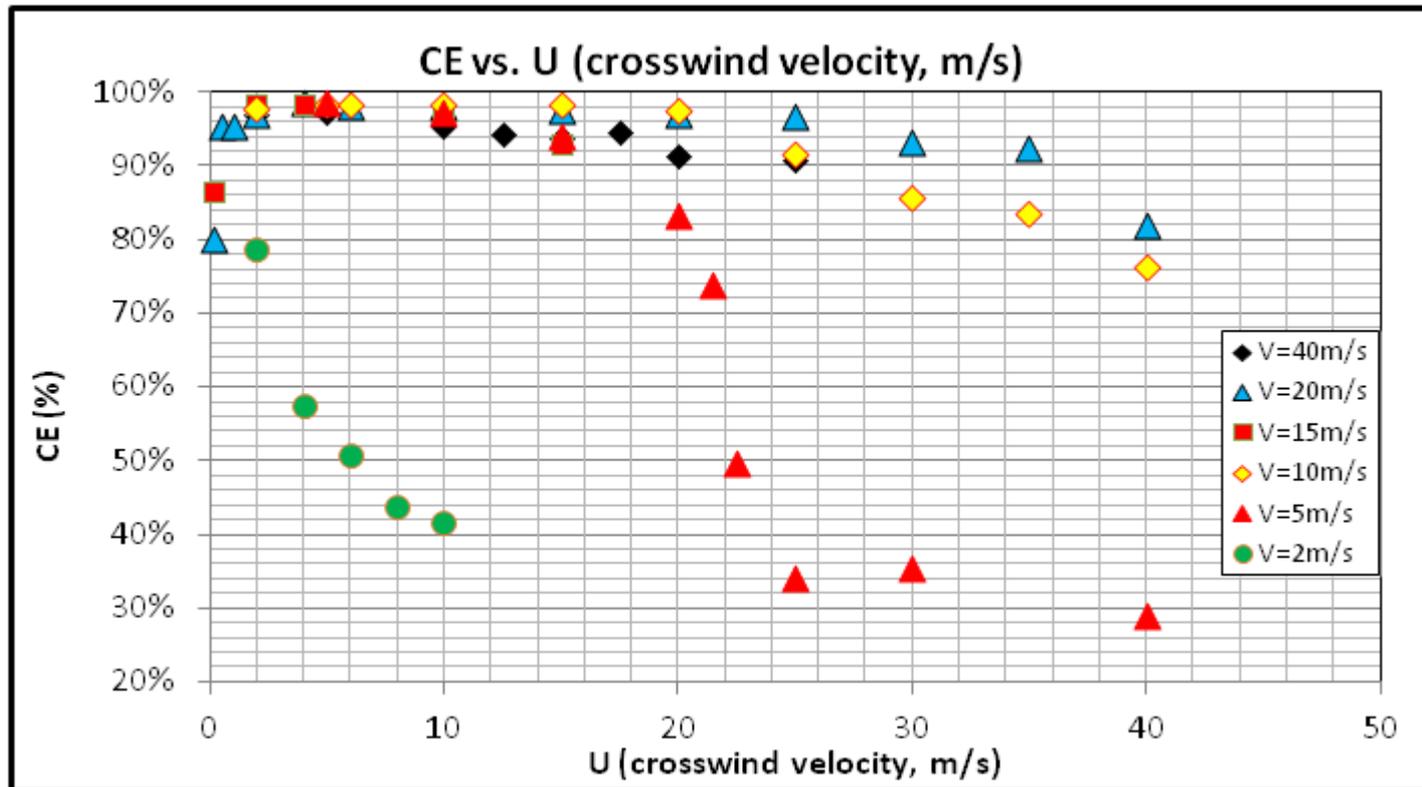


$$SR = \frac{\text{Actual air (lb/hr)}}{\text{Stoichiometric air (lb/hr)}}$$



Correlation Development

- I. DRE/CE vs. U & V
- II. Emissions vs. CE



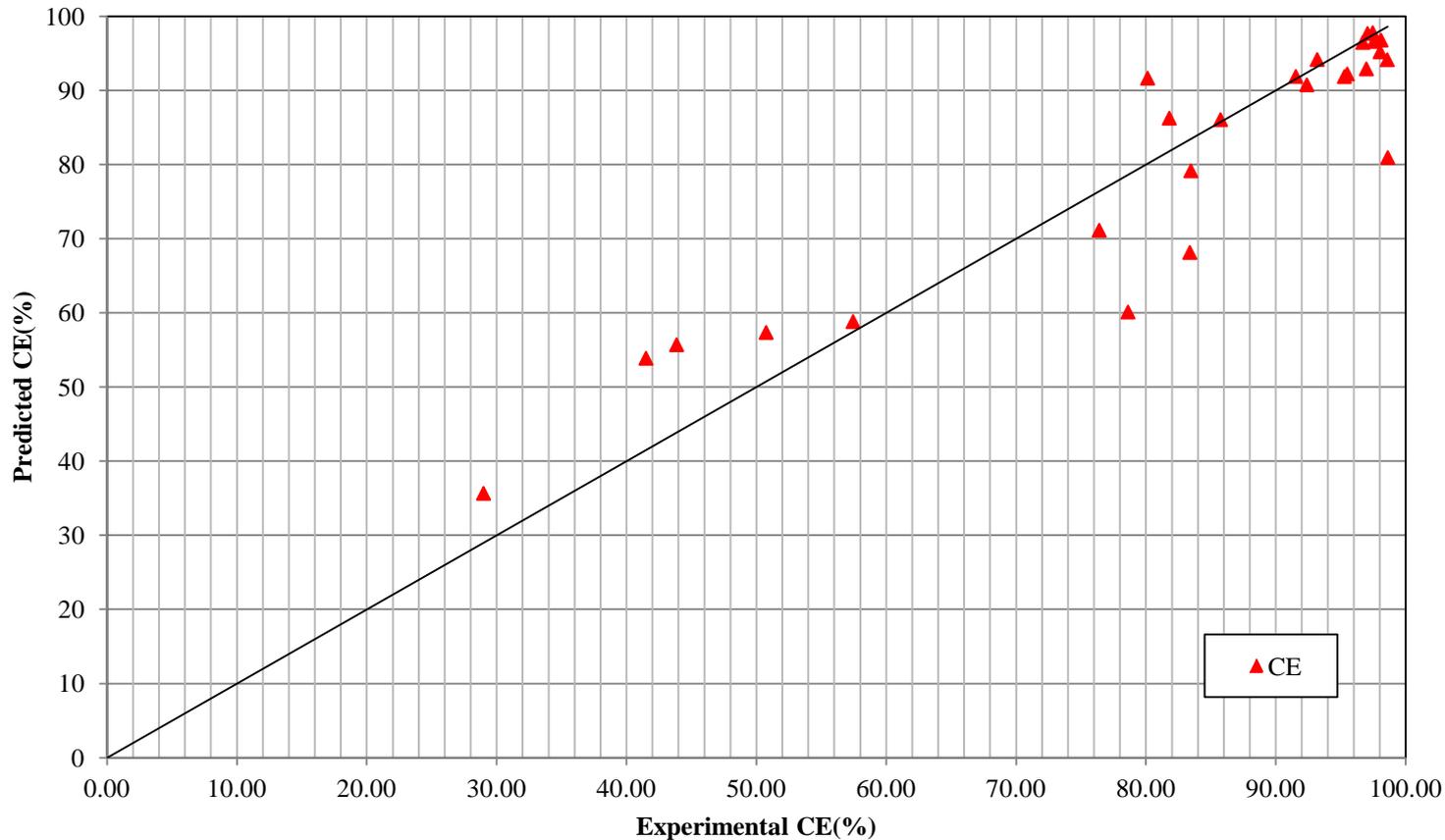
CE vs. Crosswind for all jet velocity cases

Quadratic Correlation for CE

- 31 data points
- $2\text{m/s} \leq V_j \leq 20\text{m/s}$
- $R^2 = 0.86$

Experimental vs. Predicted CE(%)

$$CE = -0.028U^2 - 0.372V^2 + 0.07U*V - 0.655U + 9.87V + 42.97$$



Vj (m/s)	U (m/s)	CE (%)
2	2	78.62
2	4	57.45
2	6	50.75
2	8	43.86
2	10	41.50
5	5	98.62
5	20	83.38
5	40	28.99
10	2	97.69
10	5	98.29
10	6	98.24
10	10	98.41
10	15	98.41
10	20	97.56
10	25	91.54
10	30	85.74
10	35	83.46
10	40	76.40
20	0.2	80.13
20	0.5	95.28
20	1	95.50
20	2	96.97
20	4	98.58
20	6	98.03
20	10	98.10
20	15	97.46
20	20	97.06
20	25	96.70
20	30	93.19
20	35	92.39
20	40	81.80

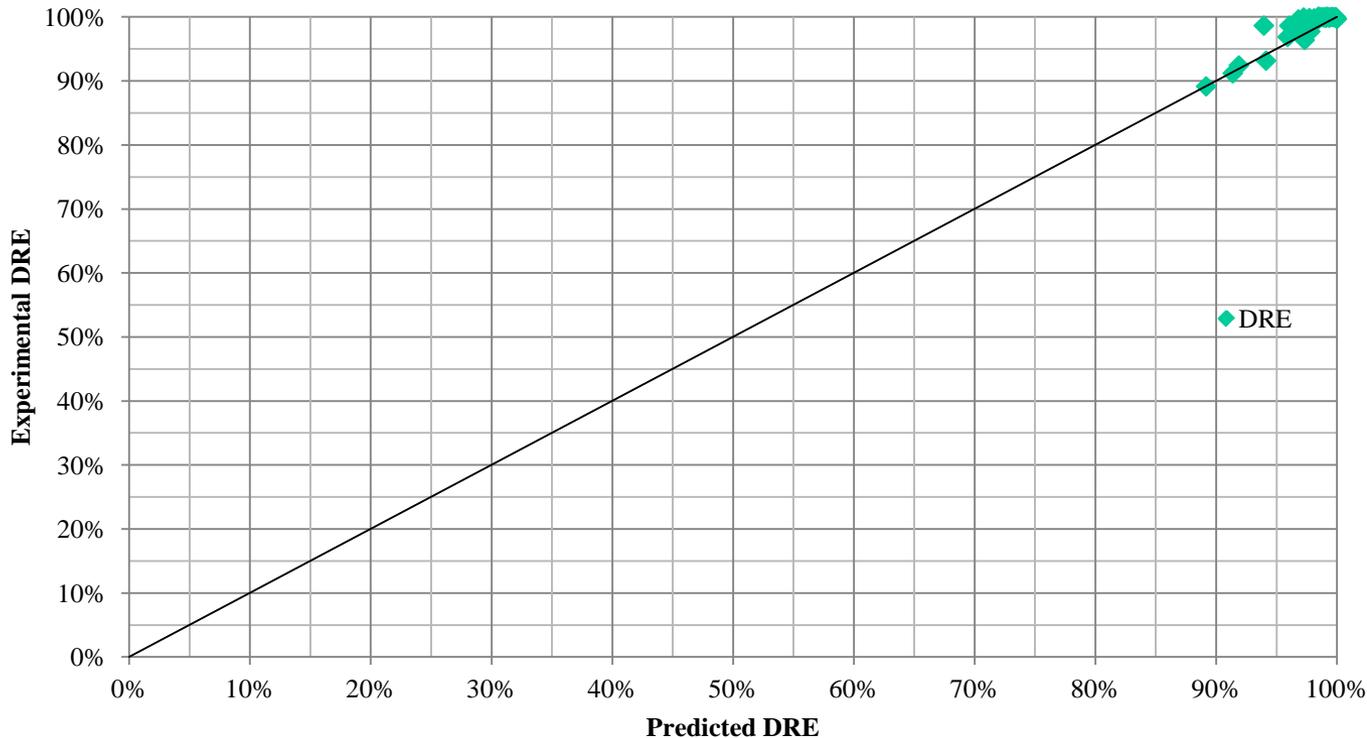
Quadratic Correlation for DRE

- 36 data points
- $10\text{m/s} \leq V_j \leq 40\text{m/s}$
- $R^2 = 0.84$, RMS Error = 0.0018

V(m/s)	U(m/s)	DRE %
23.5354	10.1356	0.9969
10.0000	5.0000	1.0000
10.0000	6.0000	1.0000
10.0000	10.0000	0.9998
10.0000	15.0000	0.9977
10.0000	20.0000	0.9991
10.0000	25.0000	0.9687
10.0000	30.0000	0.9317
10.0000	35.0000	0.9242
10.0000	40.0000	0.8915
15.0000	0.2000	0.9997
15.0000	2.0000	0.9997
15.0000	4.0000	0.9999
15.0000	10.0000	0.9995
15.0000	15.0000	0.9986
20.0000	0.2000	0.9997
20.0000	0.5000	0.9998
20.0000	1.0000	0.9999
20.0000	2.0000	0.9988
20.0000	4.0000	1.0000
20.0000	6.0000	0.9994
20.0000	10.0000	0.9999
20.0000	15.0000	0.9998
20.0000	20.0000	0.9992
20.0000	25.0000	0.9982
20.0000	30.0000	0.9863
20.0000	35.0000	0.9864
20.0000	40.0000	0.9119
40.0000	2.0000	0.9961
40.0000	5.0000	0.9945
40.0000	10.0000	0.9884
40.0000	12.5000	0.9847
40.0000	15.0000	0.9772
40.0000	17.5000	0.9886
40.0000	20.0000	0.9639
40.0000	25.0000	0.9790

Experimental vs. Predicted DRE (%)

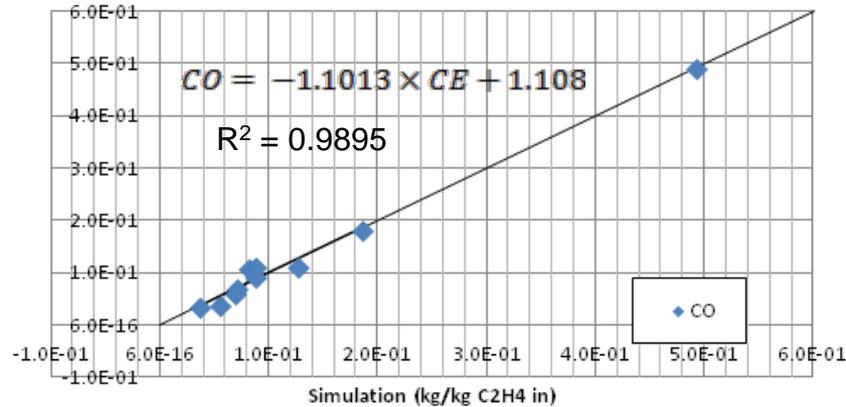
$$\text{DRE} = -8.17\text{E-}05V^2 - 9.24\text{E-}05U^2 + 2.71\text{E-}05VU + 3.57\text{E-}03V + 1.23\text{E-}03U + 0.95173$$



Speciated emission rates vs. combustion efficiency

Correlations between Emission Rates and Combustion Efficiency

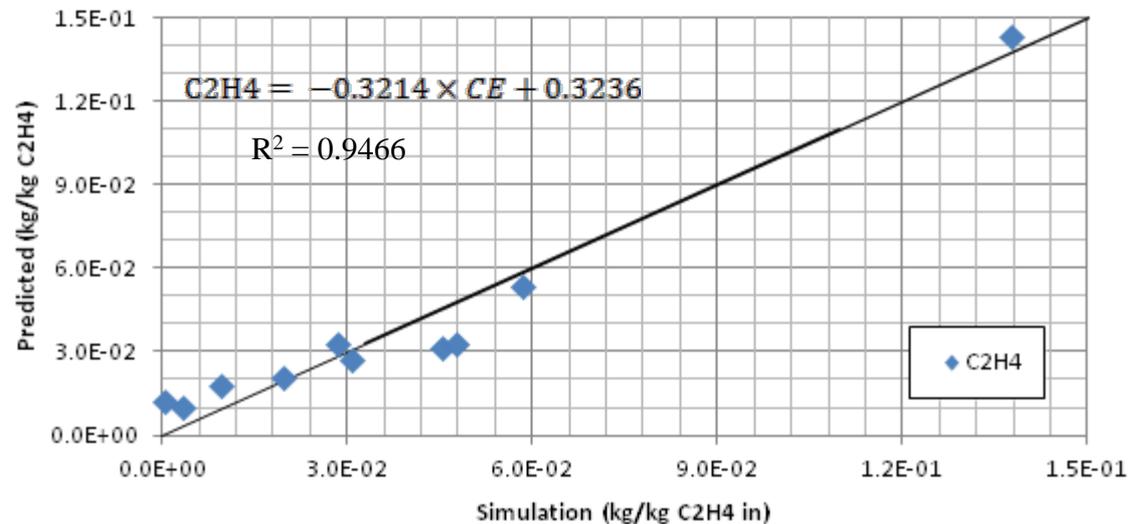
(a) Predicted vs. Simulation (CO)



$$CH_2O = -0.0414 \times CE + 0.0394$$

$$R^2 = 0.9461$$

(c) Predicted vs. Simulation (C₂H₄)





PATHLINES COLORED BY TEMPERATURE

Case: Jet = 10 m/s and Crosswind = 10 m/s





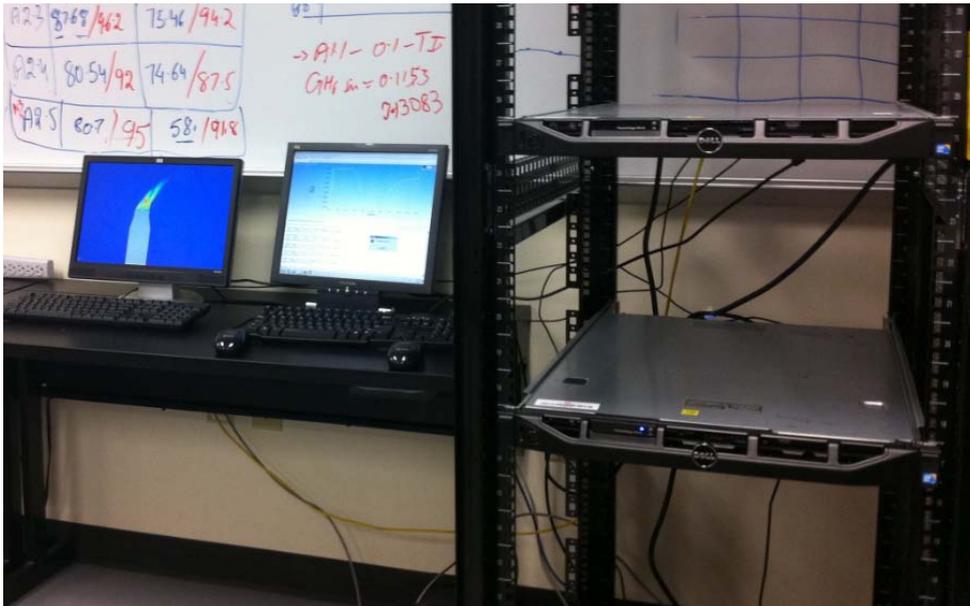
PATHLINES COLORED BY MASS FRACTION OF C_2H_4

Case: Jet = 10 m/s and Crosswind = 10 m/s



Lamar University CFD Lab

- Cutting Edge High Performance Computing (HPC) Cluster
 - 3 X 12 core servers; Intel Xeon X5670 @2.93GHz
 - More than 50 high speed processors
 - Up to 10GBs/second of data transfer speed for faster parallel computing





Model Selection

- Solver - Pressure based solver
- Solution Methods: Green-Gauss Cell based
- **k- ϵ realizable turbulence model**
 - Turbulence Intensity = 15%
 - Turbulence Viscosity Ratio = 10
- **Eddy Dissipation Concept Model** (turbulence-chemistry interaction).
- **Reduced 50-species mechanism** derived from a full 93-species GRI 3.0 + USC Mechanism.

Preliminary Results of Correlations

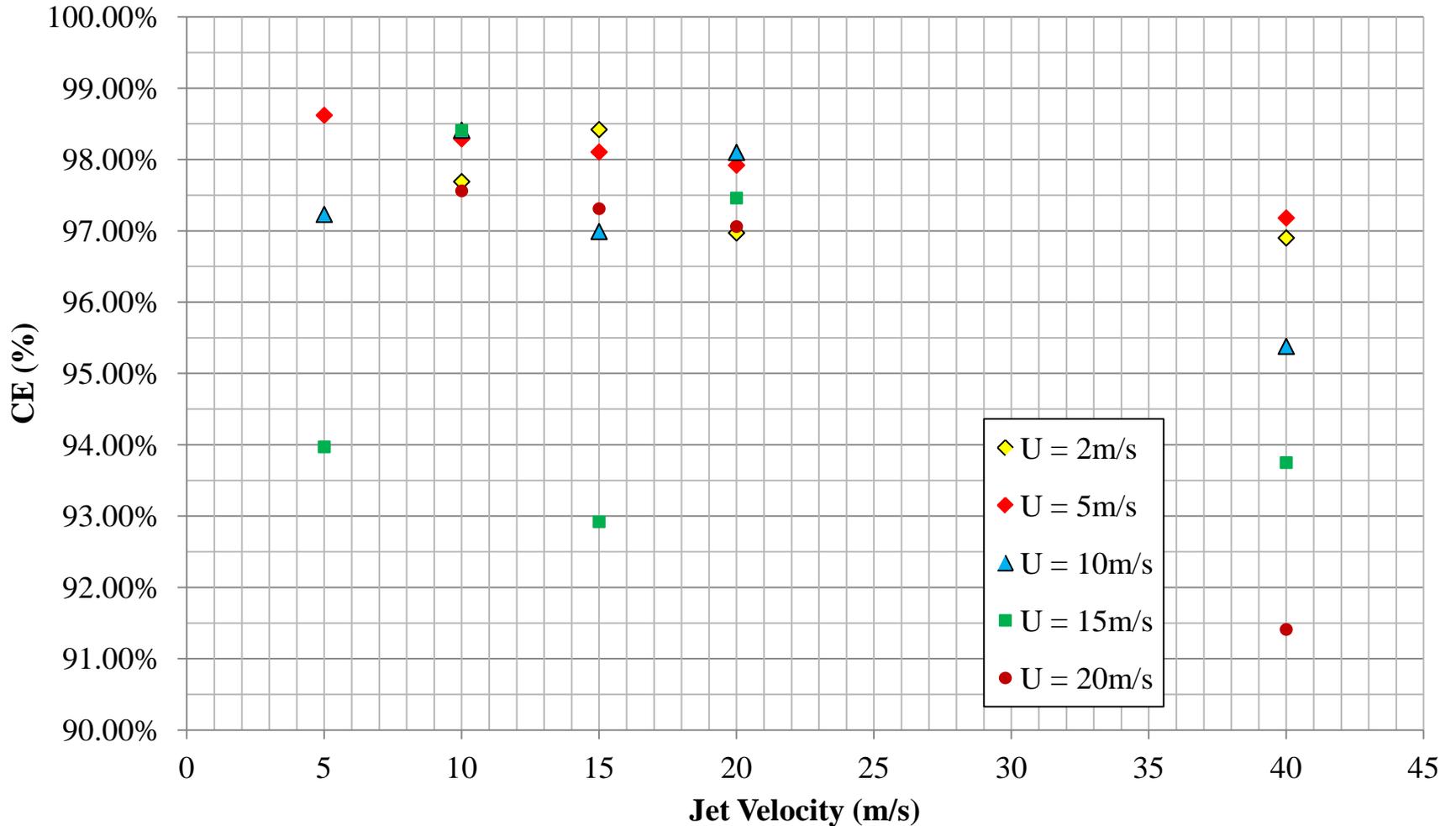
An exponential equation for CE (%):

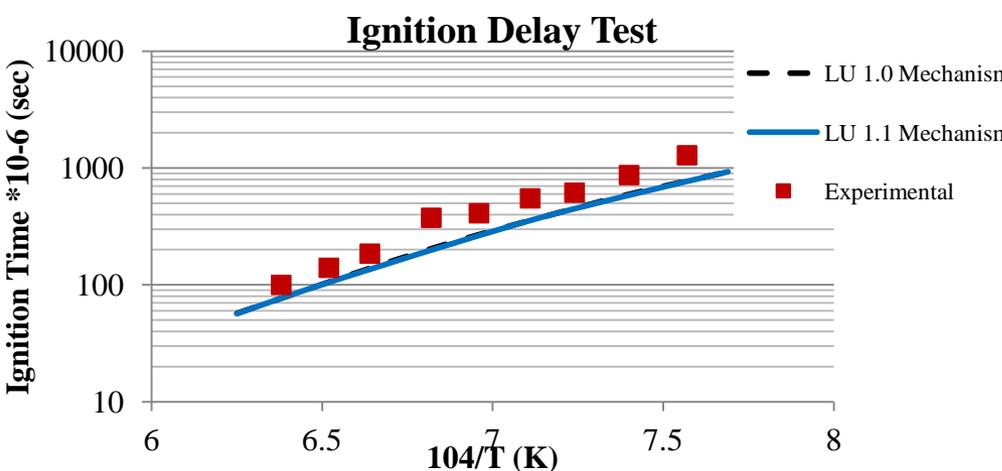
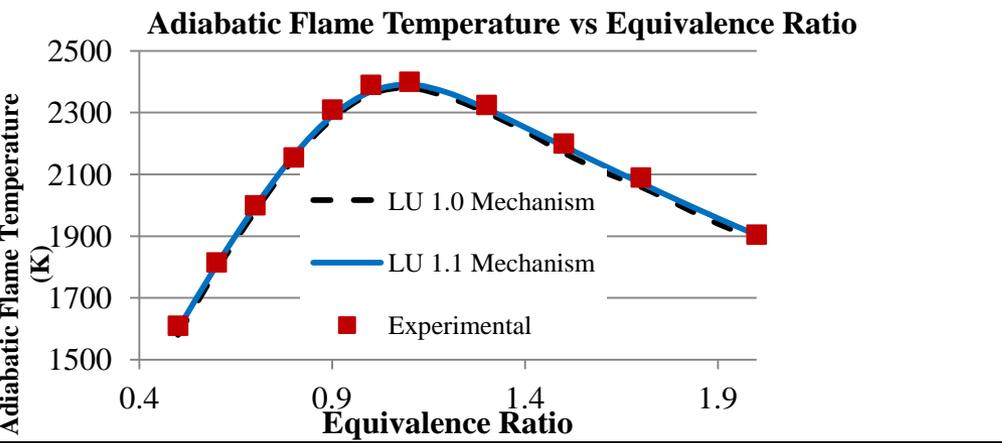
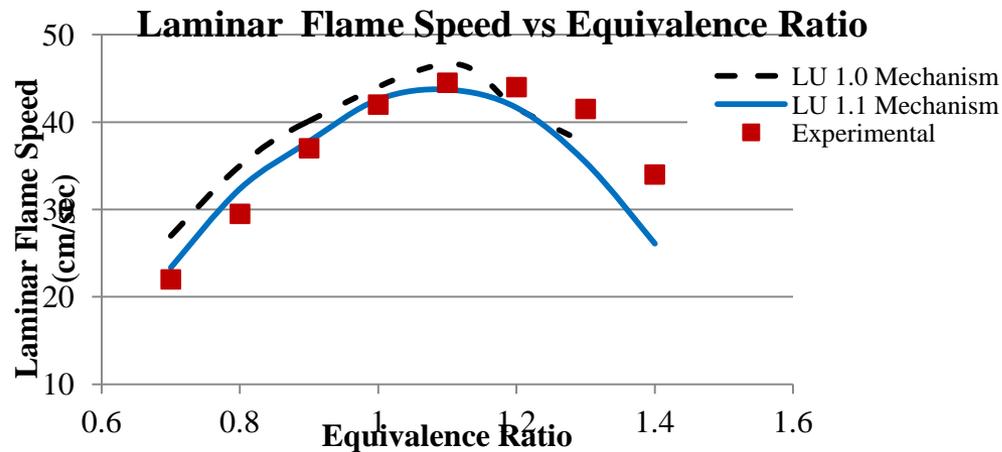
$$CE = 52.67 * U^{0.0022} * V_j^{0.2043} \quad R^2 = 0.65$$

- Ethylene flames
- Use crosswind U and jet velocity V_j as input variables

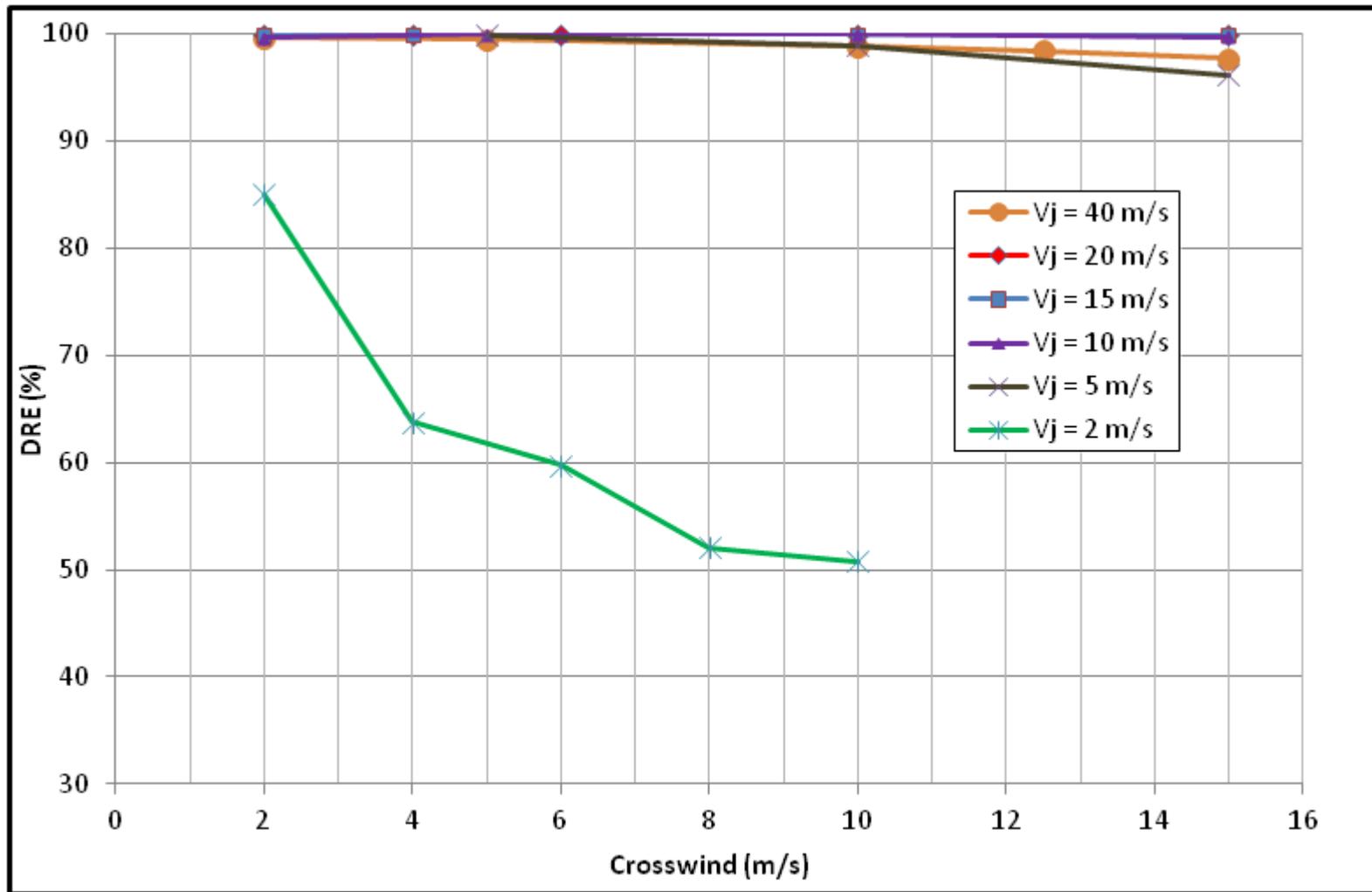
Effect of Jet Velocity on CE

CE (%) vs. Jet Velocity (m/s)

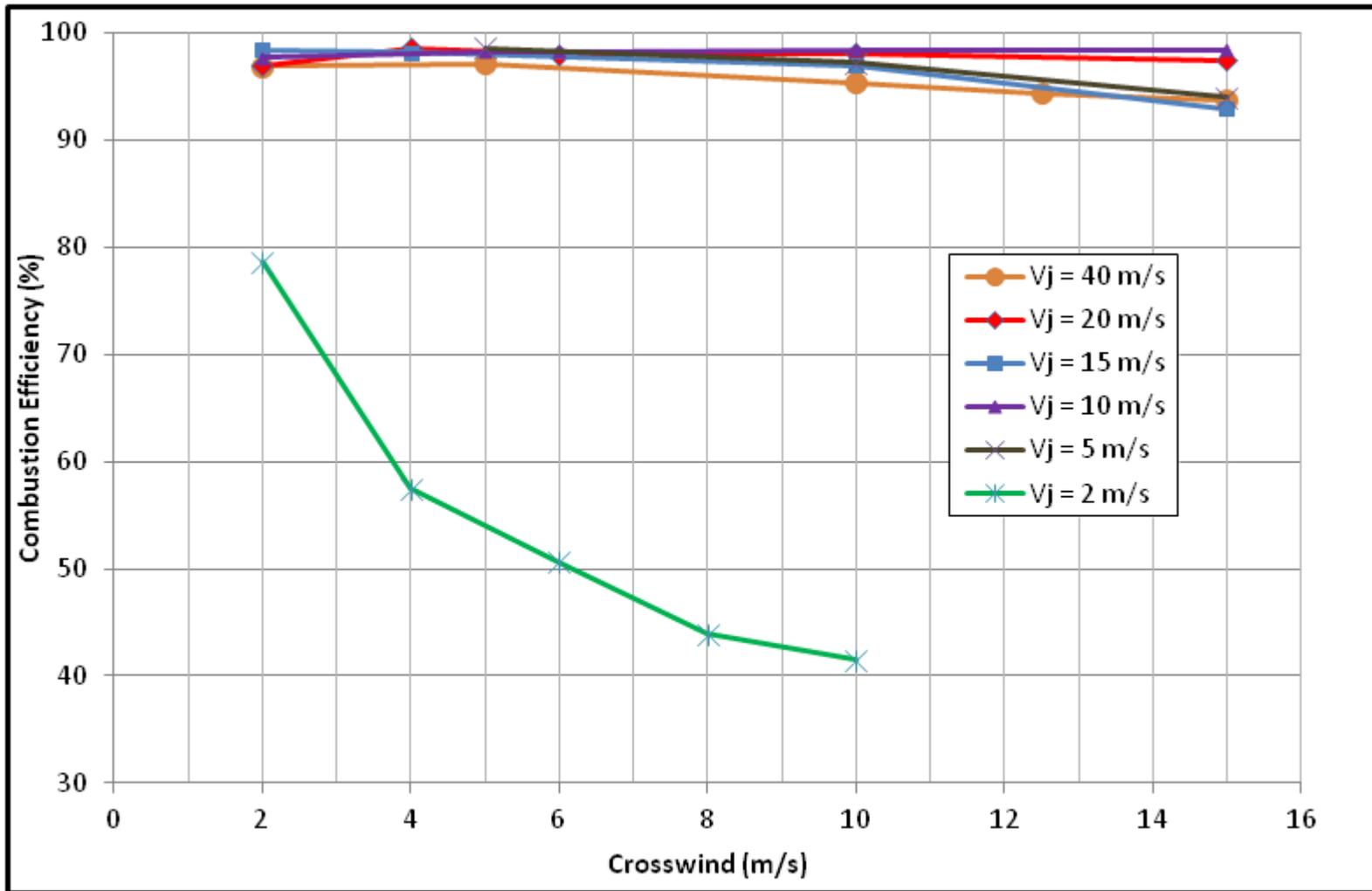




Indicators		Average Percentage Error	
		Without NO ₂ (LU 1.0)	With NO ₂ (LU 1.1)
Laminar Flame Speed	Propylene	11.605	8.058
Adiabatic Flame Temperature	Ethylene	1.138	0.527
Ignition Delay	Propylene	30.68	31.25

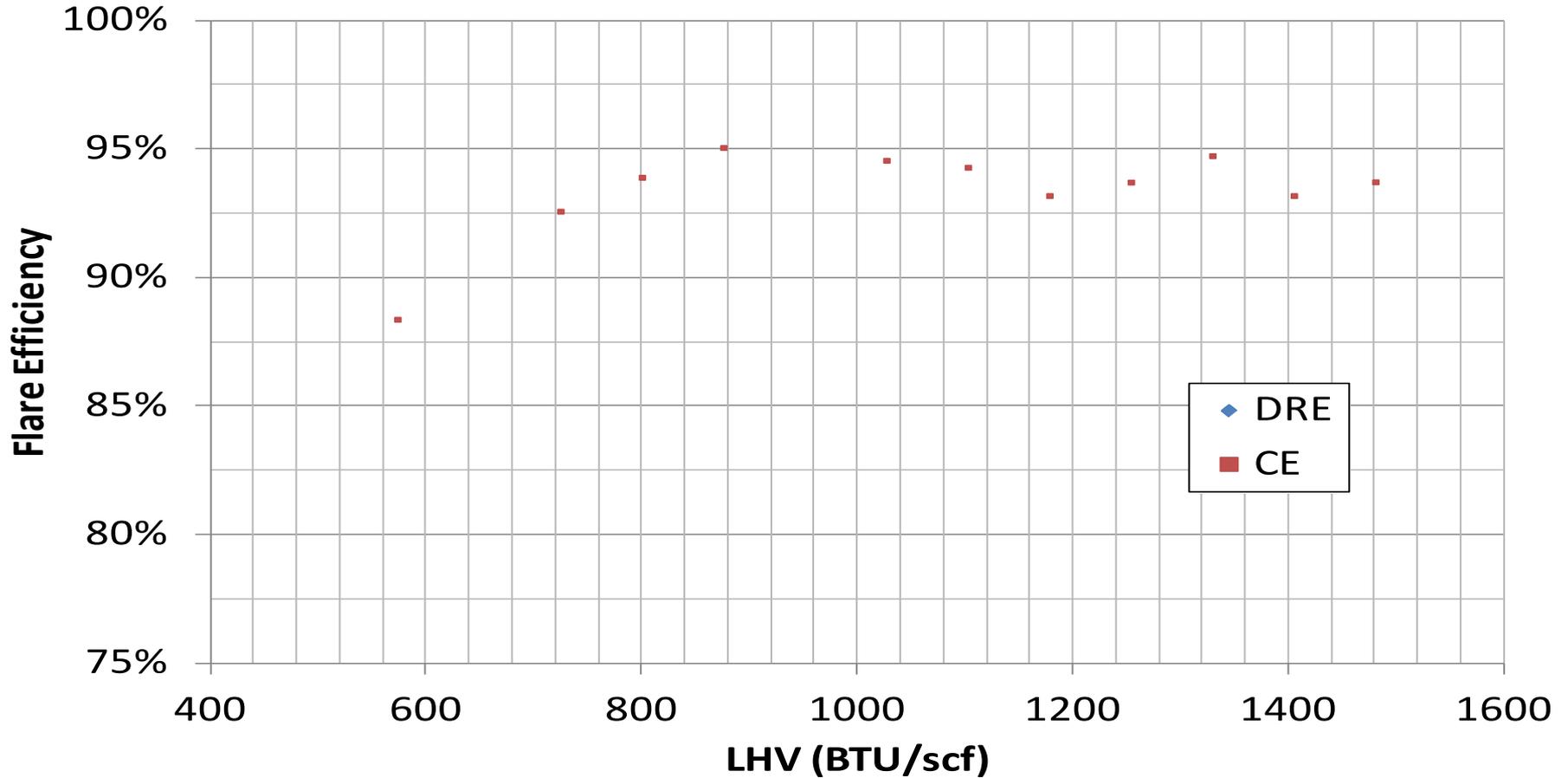


DRE at Different Jet Velocities



Comparison of CE at Different Jet Velocities

Flare Efficiency Vs. LHV (Btu/scf)

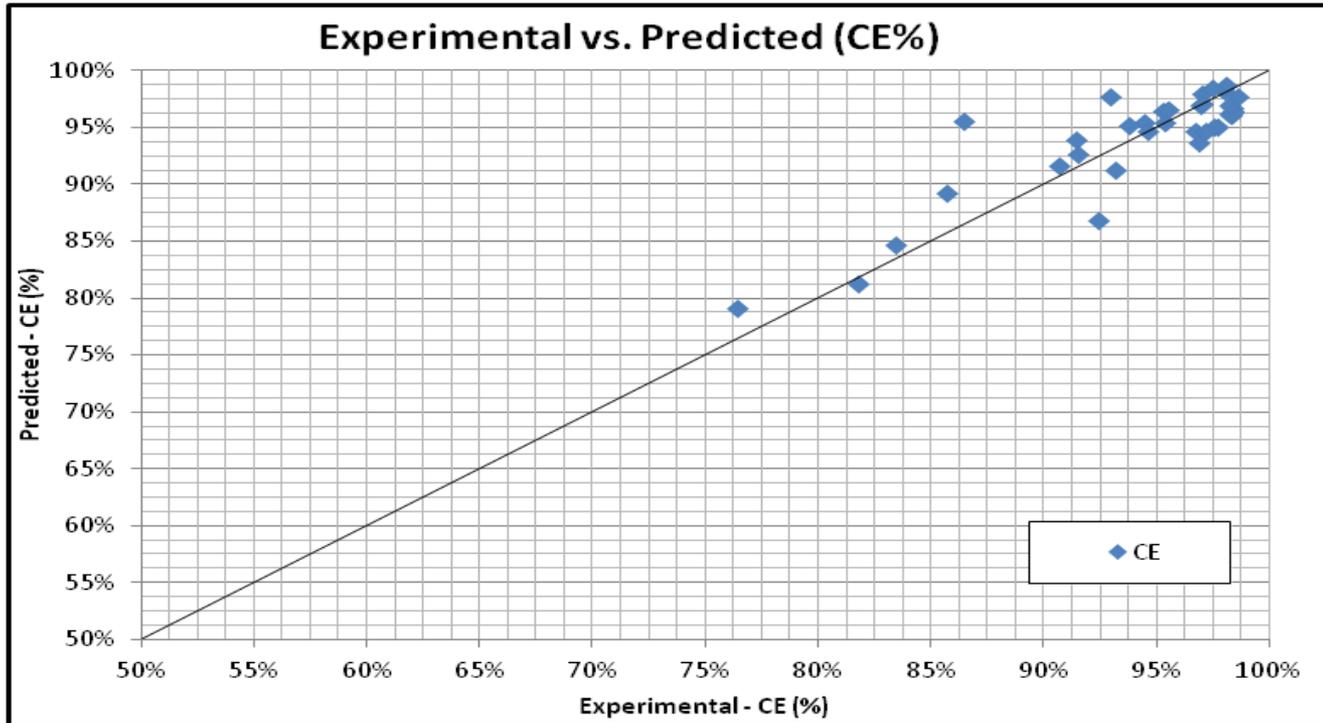


C_2H_4/N_2 Mixture, C_2H_4 from 100% (1512 Btu/scf) to 40% (605 Btu/scf)

$U = 10$ m/s, $V = 10$ m/s

Preliminary Results of Correlations

$$CE = aU^2 + bV^2 + cUV + dU + eV + f$$



where:

$$a = -2.09E-04$$

$$b = -1.19E-04$$

$$c = 5.57E-04$$

$$d = 4.53E-03$$

$$e = 5.49E-03$$

$$f = 9.00E-01$$

$$R^2 = 0.76$$

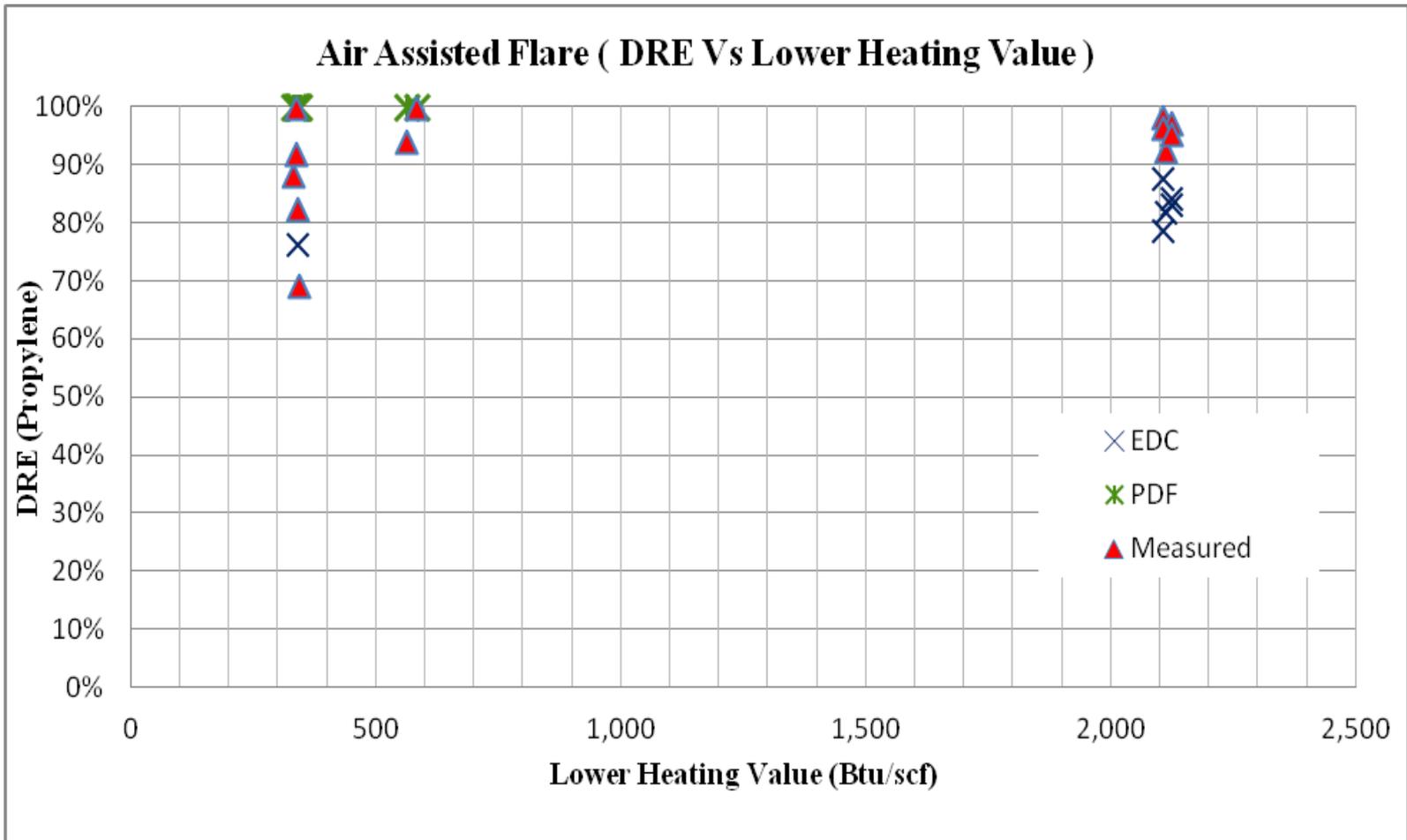
$$RMS = 2.63\%$$

- Ethylene flames
- Valid for:
 - Crosswind (U) : 0.2 m/s to 40 m/s
 - Jet Velocity (V_j) : 10m/s to 40 m/s

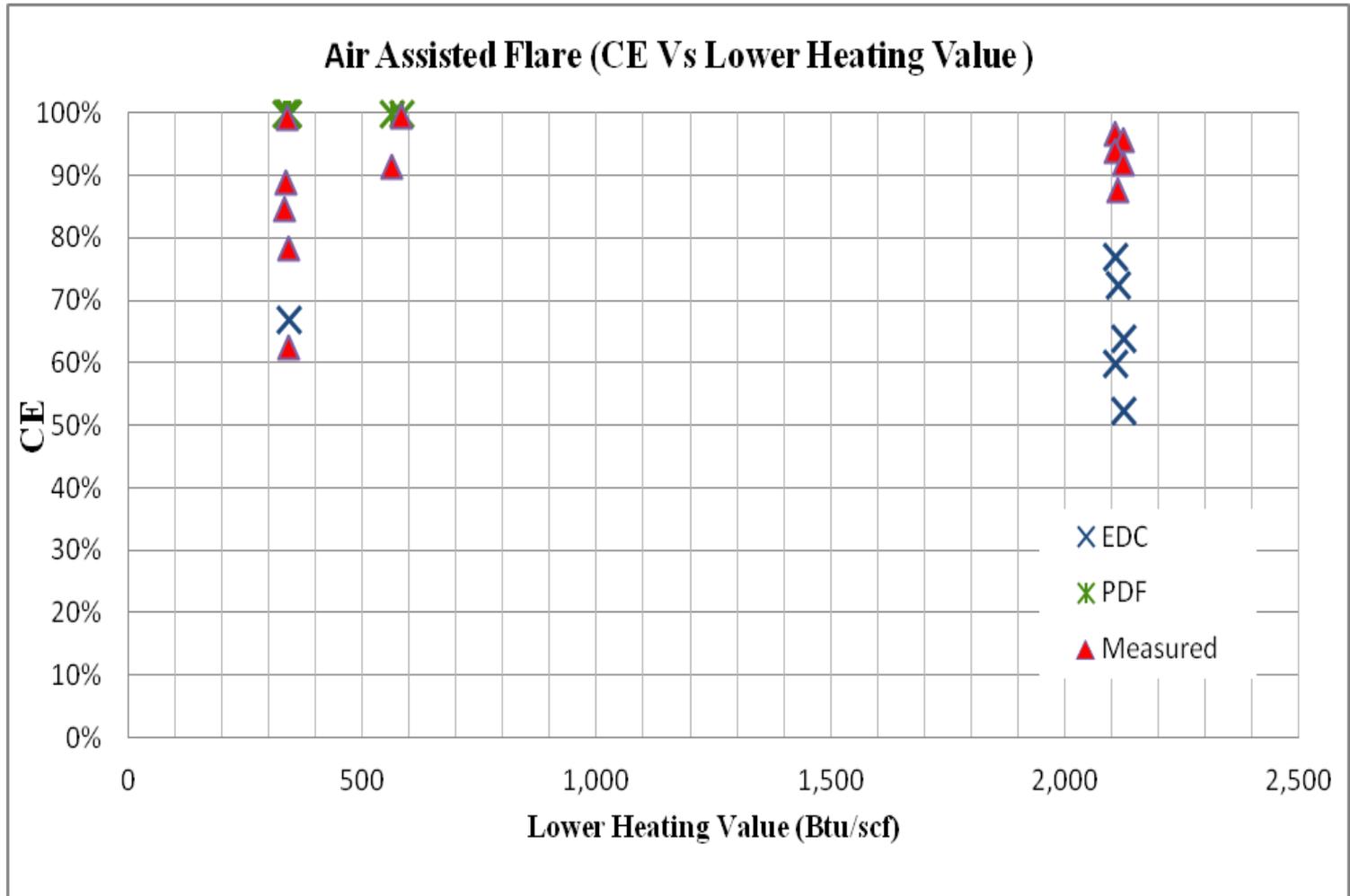
Air-assisted flare test cases

	Test Point	Actual Vent Gas (VG) Flow Rates				Vent Gas Vel m/s	Air Assist Vel m/s	Cross Wind Vel m/s	EDC	PDF
		Propylene	TNG	Nitrogen	LHV					
		lb/hr	lb/hr	lb/hr	Btu/scf					
High LHV	A1.1	918.88	0.00	0.00	2107.71	0.43	23.12	5.69	✓	✗
	A2.1	355.02	0.00	0.00	2125.45	0.17	12.99	5.74	✓	✗
	A2.3	352.14	0.00	0.00	2108.22	0.17	13.76	4.51	✓	✗
	A2.4	352.87	0.00	0.00	2112.57	0.17	23.06	4.49	✓	✗
	A2.5	354.71	0.00	0.00	2123.55	0.17	18.53	5.94	✓	✗
Low LHV	A3.1	181.23	18.77	702.55	338.67	0.59	3.00	4.61	✗	✓
	A3.3	181.23	18.37	700.60	333.86	0.59	9.32	4.96	✗	✓
	A3.6	181.23	18.76	704.18	337.55	0.59	7.36	5.31	✗	✓
	A5.2	72.29	7.69	274.41	342.86	0.23	11.65	0.96	✗	✓
	A5.3	71.26	7.55	271.37	341.87	0.23	5.10	1.12	✓	✓
Medium LHV	A4.3	298.74	30.30	591.10	562.91	0.58	10.30	4.79	✗	✓
	A6.1	117.80	11.86	221.21	583.73	0.22	1.77	7.12	✗	✓
	A6.4	118.06	12.08	221.25	584.89	0.22	6.29	6.31	✗	✗
	A6.5	117.85	12.08	221.11	584.44	0.22	8.77	6.92	✗	✗
	A6.6	118.55	12.44	220.68	588.07	0.22	22.67	6.69	✗	✗

- ✓ : Cases Simulated ✗ : Cases Not Simulated



DRE as a function of LHV (measured vs. CFD, air-assisted cases)

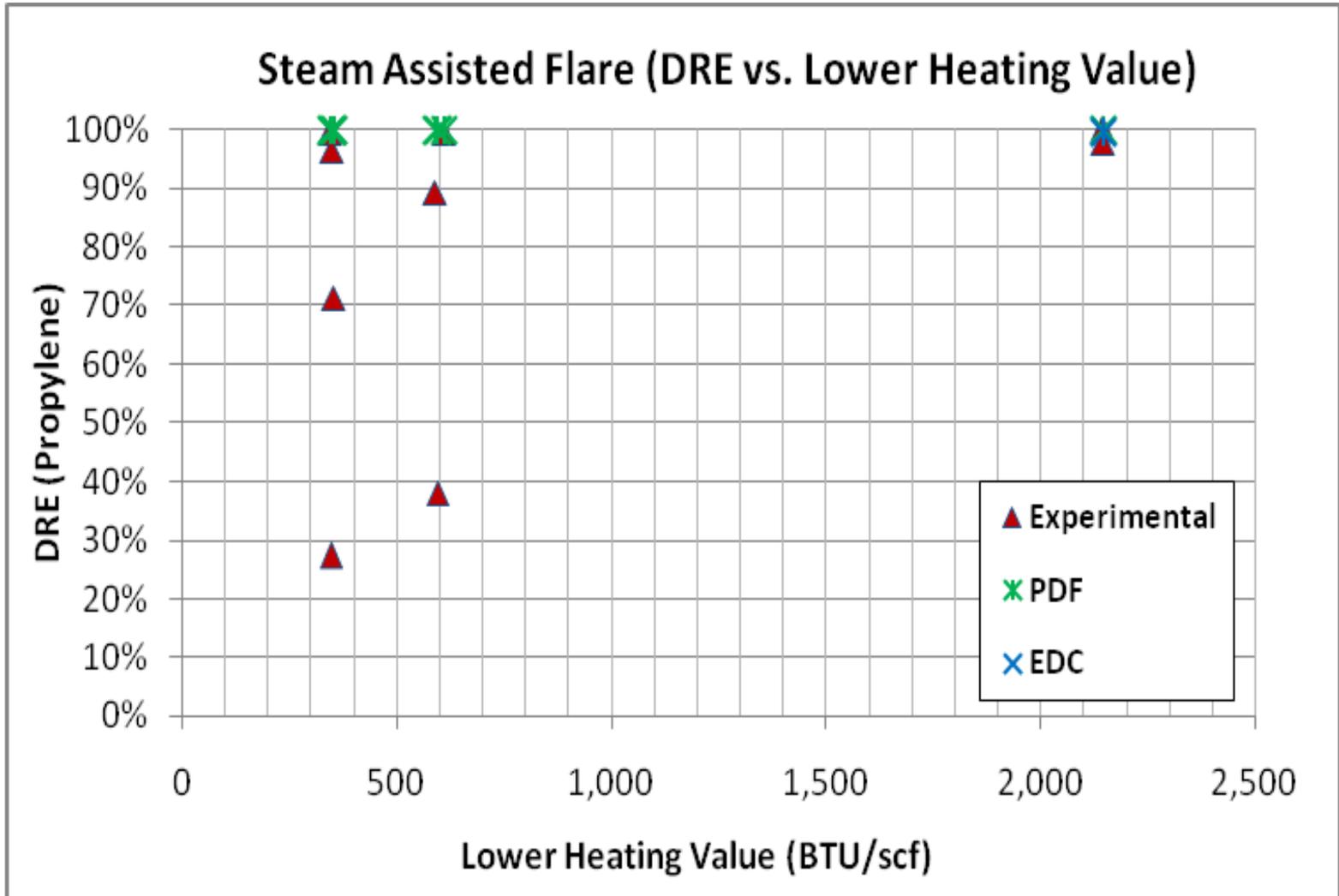


CE as a function of LHV (measured vs. CFD, air-assisted cases)

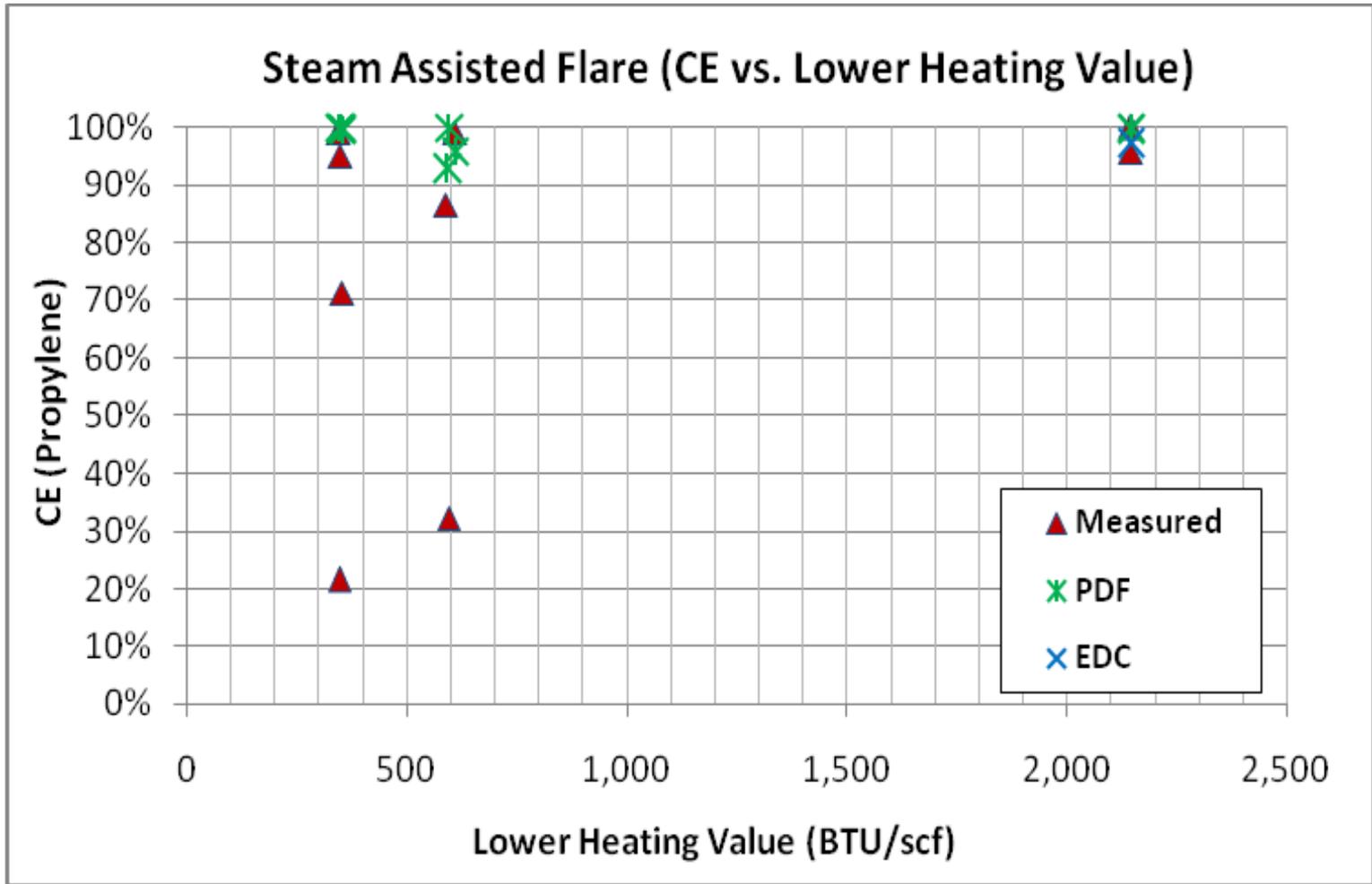
Steam-assisted flare test cases

	Test	Vent Gas Flow Rates		Actual Vent Gas		Steam Flow Rates		Steam to Gas Ratio	Wind	EDC	PDF	
		C ₃ H ₆	TNG	N ₂	LHV	Velocity	Center		Upper			Speed
												lb/hr
High	S1.5	2337.5	0.0	0.0	2145.1	0.5	525.9	3794.0	1.8	3.5	✗	✓
	S1.8	2338.4	0.0	0.0	2146.0	0.5	505.9	7044.1	3.2	3.8	✗	✓
	S1.9	2336.6	0.0	0.0	2144.3	0.5	504.9	7939.3	3.6	3.9	✗	✗
	S2.2	937.0	0.0	0.0	2103.1	0.3	541.6	7769.5	8.9	4.8	✗	✗
	S2.3	937.0	0.0	0.0	2122.5	0.3	539.3	4761.3	5.7	3.4	✗	✗
Medium	S3.7	191.3	18.9	715.5	345.5	0.2	0.0	227.8	0.2	3.2	✗	✓
	S4.1	490.5	45.0	1799.7	349.6	0.6	559.9	536.3	0.5	2.5	✗	✓
	S4.3	485.2	45.0	1801.6	346.4	0.6	567.3	1879.5	1.0	2.3	✗	✓
	S4.3	500.4	46.6	1802.1	355.2	0.6	627.8	2447.4	1.3	3.0	✗	✗
	S5.2	319.8	33.8	584.7	595.4	0.3	454.5	1580.4	2.2	4.5	✗	✓
	S5.3	312.3	31.7	578.0	589.6	0.3	481.5	782.5	1.4	4.1	✗	✓
	S5.4	317.6	32.2	579.4	595.4	0.3	483.7	1220.8	1.8	4.8	✗	✗
	S5.6	312.2	31.8	577.2	590.1	0.3	490.6	462.9	1.0	4.3	✗	✗
	S6.1	826.4	79.1	1455.6	608.9	0.6	517.8	1002.9	0.6	3.9	✗	✓
	S7.3	296.8	29.9	1083.6	352.8	0.4	515.6	537.9	0.7	3.5	✗	✓

- ✓ : Cases Simulated ✗ : Cases Not Simulated



DRE as a function of LHV (measured vs. CFD, steam-assisted cases)



CE as a function of LHV (measured vs. CFD, steam-assisted cases)