



August 28, 2024

Lynda Eisenberg, Director  
Department of Planning and Zoning  
George Howard Building  
3430 Court House Drive  
Ellicott City, MD 21043

Dear Ms. Eisenberg,

RE: Non-conformance of the W.R. Grace Pilot Reactor for Chemical Recycling proposal with the Howard County Zoning Ordinance – Planned Employment Center (PEC) District

We are writing to request that the Department re-evaluate the conformance of W.R. Grace's proposed Research-Scale Pilot Plant for chemical recycling of plastic with the Howard County Zoning Regulations (HCZR) for the Planned Employment Center zoning district, based on information from expert technical and regulatory reviews of their application to MDE for an air permit (docket #16-23), that points to uses that are not allowed by right in the PEC zone.

### **Background**

On September 21, 2023, Mr. Steve Rolls submitted a letter to Daniel Resca, Project Manager at W.R. Grace, and Susan Nash, Regulatory and Compliance Engineer at MDE's Air Quality Permits Program, maintaining that because the installation will be "used for Research and Development purposes only" and will be "part of an existing previously approved research lab facility," it will "not require any additional zoning review or approval," nor will it "necessitate the submission and approval of a new Conditional Use application." (Exhibit A)

### **Non-conformance of the pilot project with permitted uses in the PEC district**

Based on reviews we commissioned by technical experts on pyrolysis/combustion and related federal Clean Air Act regulations, it is clear that the proposed pilot project involves both incineration and the processing of solid waste, neither of which is a permitted use in the PEC district.

**Incineration of plastic waste.** According to the attached technical review by Dr. Ranajit Sahu, who holds a Ph.D. in Mechanical Engineering with a focus on pyrolysis and combustion, the reactor, which is claimed to be "oxygen-free" appears to be a pyrolysis unit (Exhibit B). He notes that "The absence of oxygen...is an aspirational goal, because it is not possible to eliminate the presence of all oxygen in real world pyrolysis units. Thus, the Application's description that the reactor will be

“oxygen-free” is not practically possible.” “Pyrolysis/gasification is therefore the first stage or first step in combustion.”

The declaration provided by regulatory expert Jane Williams (Exhibit C) states that the facility proposed by W.R. Grace meets the criteria of an incinerator on three counts:

- (a) It is combusting solid waste;
- (b) The EPA considers plastic a solid waste; and
- (c) Off-gases will be treated by a thermal oxidizer

She notes that the federal Clean Air Act defines the term “solid waste incineration unit” as “any facility which combusts any solid waste” and that the incinerator that W.R. Grace is planning to construct is covered by the U.S. Environmental Protection Agency’s Other Solid Waste Incineration (OSWI) Rule because “it plans to burn plastic in a facility that has less than 35 tons per year of throughput and meets the definition in the OSWI Rule of a very small municipal waste incinerator.” Further, W.R. Grace’s pyrolysis unit will have to comply with the federal Clean Air Act Section 129 regulations, which address emissions from solid waste combustion. We don’t believe that the MDE evaluator included Section 129 in its review of compliance of the application with federal air regulations.

**Solid waste processing facility.** This small reactor will be taking feedstock of plastic solid waste and processing it. This was abundantly clear in the presentation made by W.R. Grace at MDE’s April 29, 2024 public hearing, which described it as “converting plastic waste back to plastic precursors” (Exhibit D, slide 7). According to HCZR Section 103, a Solid Waste Processing Facility is defined as: “a combination of structures, machinery or devices used to reduce or alter the volume, chemical characteristics, or physical characteristics of solid waste.” These facilities include “incinerators, solid waste transfer stations, material recovery facilities, and yard waste composting facilities, ...enclosed sludge storage facilities, and any other use which meets this definition but is not specifically defined in these Zoning Regulations.”

In conclusion, based on a technical review of the air permit application and the Clean Air Act regulations that apply, the proposed pilot project is not a permitted use under Section 116 (PEC district) of the HCZR. According to Section 101, Rules of Constitution, “All uses are prohibited unless specifically enumerated as a use permitted as a matter of right or as an accessory use in the various districts as provided by these Regulations.”

In light of these facts, we respectfully request that you retract the September 21, 2023 Zoning Compliance Certificate transmitted to the Maryland Department of the Environment.

Sincerely,

Carolyn Parsa, Chair  
Howard County Sierra Club  
[carolyn.parsa@mdsierra.org](mailto:carolyn.parsa@mdsierra.org)

Crystal Konny, Zero Waste Lead  
Howard County Sierra Club  
[cgkonny@gmail.com](mailto:cgkonny@gmail.com)

Exhibits:

- A. Letter from Steve Rolls, Division of Public Service and Zoning Administration, to Danial Resca, Project Manager, W.R. Grace and Susan Nash, Air and Radiation Administration, Maryland Department of the Environment, September 21, 2023, RE: MDE Air Permit to Construct, and Zoning Compliance Certificate for, Research-Scale Pilot Plant in an existing building and lab, Building 30, Lab 120, at 7500 Grace Drive, Columbia, Maryland, Tax Map 35, Grid 22, Parcel 145, Lot PAR A.
- B. Technical Review of the W.R. Grace Plastics Conversion Pilot Plant Application by Dr. Ranajit Sahu, August 19, 2024.
- C. Declaration of Jane Williams, Chair, Sierra Club National Clean Air Team, on Clean Air Act regulatory requirements for the W.R. Grace incinerator application, August 26, 2024.
- D. Grace Pilot Plant, Presentation by Bob Riley, Director of Sustainability, and Rob Harding, Senior Technical Advisor, W. R. Grace, April 29, 2024.

cc:

Steve Rolls, Division of Public Service and Zoning Administration, Howard County

Hon. Calvin Ball, Howard County Executive

Hon. Deb Jung, Chair, Howard County Council

Hon. Liz Walsh, Vice Chair, Howard County Council

Hon. Opel Jones, Howard County Council

Hon. Christiana Rigby, Howard County Council

Hon. David Yungmann, Howard County Council

Sen. Katie Fry Hester (District 9)

Del. Chao Wu (District 9)

Del. Natalie Ziegler (District 9)

Del. Courtney Watson (District 9)

Sen. Clarence Lam (District 12)

Del. Jessica Feldmark (District 12)

Del. Terri Hill (District 12)

Sen. Guy Guzzone (District 13)

Del. Vanessa Atterbeary (District 13)

Del. Pamela Lanman Guzzone (District 13)

Del. Jen Terrasa (District 13)



# HOWARD COUNTY DEPARTMENT OF PLANNING AND ZONING

3430 Court House Drive ■ Ellicott City, Maryland 21043 ■ 410-313-2350

Lynda D. Eisenberg, AICP, Director

FAX 410-313-3467

September 21, 2023

Daniel Resca  
Project Manager  
W.R. Grace  
7500 Grace Drive  
Columbia, MD 21044

Susan Nash  
Regulatory and Compliance Engineer Sr.  
Air and Radiation Administration  
Air Quality Permits Program  
Maryland Department of the Environment  
Suite 720  
1800 Washington Boulevard  
Baltimore, MD 21230

RE: MDE Air Permit to Construct, and Zoning Compliance Certificate for, Research-scale Pilot Plant in an existing building and lab, Building 30 Lab 120 at 7500 Grace Drive in Columbia, Maryland, Tax Map 35, Grid 22, Parcel 145, Lot PAR A (the "Property")

To Whom It May Concern:

The Property referenced above is located in a PEC (Planned Employment Center) zoning district, per the Howard County Zoning Regulations ("HCZR").

This office understands that the Property's owner will be installing a new research-scale pilot plant in an existing lab within an existing building (Building 30, Lab 120) at the Property. The purpose of this facility is to develop the process and catalysts associated with Grace's new technology for the chemical recycling of plastics. This new pilot plant will be used for Research and Development purposes only and will not be used as a commercial production plant. The proposed Installation will be part of an existing previously approved research lab facility and will not require any additional zoning review or approval. We have determined that the proposed installation will not necessitate the submission and approval of a new Conditional Use application. Further, a review of our records confirms that there are no zoning violations at the Property.

The Howard County Zoning Regulations are viewable at [https://library.municode.com/md/howard\\_county/codes/zoning](https://library.municode.com/md/howard_county/codes/zoning).

If you have any questions, please contact me at 410-313-4415 or [srolls@howardcountymd.gov](mailto:srolls@howardcountymd.gov).

Sincerely,

*Steve Rolls*

Steve Rolls, Planning Support Technician II  
Division of Public Service  
and Zoning Administration

(PUL-23-064)

**WR Grace Plastics Conversion Pilot Plant Application  
Columbia, MD**

**Comments by Dr. Ranajit (Ron) Sahu**

1. My name is Dr. Ranajit (Ron) Sahu. A copy of my resume is provided in Attachment A to these comments. I have a Bachelor's of Technology degree in Mechanical Engineering from the Indian Institute of Technology (IIT) followed by M.S and Ph.D degrees in Mechanical Engineering from the California Institute of Technology (Caltech). My Ph.D work focused on pyrolysis and combustion, which are directly relevant to these comments.
2. I have reviewed the Maryland Department of the Environment (MDE) Application for a Permit to Construct a research-scale pilot plant by WR Grace & Company at the facility in Columbia Maryland. Per the August 3 2024 cover letter accompanying the Application, the stated purpose of this facility would be to "test catalytic chemical conversion of plastics process." This catalytic conversion reaction will occur "at high temperature, in an oxygen-free environment" and will require the addition of heat. The conversion reaction will produce "a product vapor comprised of non-condensable gas and condensable liquid." This product vapor, after removal of residual catalyst, will go through a product recovery system involving vapor condensation and gas/liquid separation. Finally, the separated non-condensable gas will go through an electric flameless thermal oxidizer prior to venting to the atmosphere. The condensed liquids will be collected and shipped to a third party for waste treatment.
3. The Application does not contain much additional details. For example, the types of plastics that will be converted are not described. The amount of heat to be added to the reactor and the temperature of the reactor across the range of plastics to be converted are not described. The composition of the product vapor is not described across the range of plastics to be converted. Rather, in Table 1 (Application, pdf 42) a product gas composition is provided based on "engineering estimates." The basis of this engineering estimate is not clear at all and it is not clear therefore, if the composition provided in Table 1 is relevant for all types of plastics that will be converted/studied in this pilot plant. The notes accompanying Table 1 also contain numerous additional assumptions regarding: the VOC control efficiency of the flameless electrical thermal oxidizer ("greater than 99.99%...", but curiously missing any minimum temperature that will achieve and maintain this high destruction efficiency across the range of product vapor compositions); as well as the 99% particulate control efficiency. It is not clear how these assumptions will be verified on a continuous basis.
4. Significantly, while the Application does not state so, the reactor – given its oxygen "free" condition and heat addition, appears to be a pyrolysis unit.
5. Theoretically, pyrolysis is the chemical decomposition of typically organic (i.e., carbon-based) materials, like the plastics that will presumably be converted in this proposed pilot plant, via the application of heat but in the absence of oxygen. The absence of oxygen, however, is an aspirational goal, because it is not possible to eliminate the presence of all oxygen in real-world pyrolysis units. Thus, the Application's description that the reactor will be "oxygen-free" is not practically possible.

6. In general terms, all materials that can be pyrolyzed/gasified contain some oxygen or oxygen compounds. I presume that some oxygen may be present in the plastics in this instance. Also, if the pyrolysis chamber or container may not be perfectly sealed and maintained at greater than atmospheric pressure, in which case external oxygen can be introduced into the pyrolysis process. For both reasons, it is impossible to operate a pyrolysis unit in the absence of all oxygen. That would be true of this proposed pilot plant as well.

7. As the temperature of plastic materials that are to be pyrolyzed/gasified is increased in order to effect the pyrolysis/gasification, the presence of some of the inherent oxygen in the plastic materials and/or any externally introduced oxygen will initiate combustion reactions while pyrolysis/gasification is going on. Thus, some combustion is impossible to avoid in the proposed reactor.

8. Pyrolysis/gasification is therefore the first stage or first step in combustion. Heat causes the waste materials to release volatile organic materials which then react with available oxygen (always present to some degree), releasing more heat and causing the formation of carbon dioxide and carbon monoxide along with other products of complete and incomplete combustion. The product vapors from the reactor will contain all of these pollutants.

9. I would urge the MDE to therefore properly characterize this reactor and to also ask WR Grace for additional details I have noted in paragraph 3 above before processing this Application.

10. I would also note that WR Grace has characterized this pilot plant as a R&D operation. Presumably, at some point data collected in this pilot plant stage may be used for scaling up the facility to commercial-scale. Therefore obtaining accurate emissions data from the pilot plant is very important. While physical scale-up of chemical reactors does not always similar scale the emissions from the facility, in this instance, the use of the electrically-heated thermal oxidizer adds a new complexity. The MDE should ask, if the pilot project is likely to be deemed a success and would therefore be scaled-up, whether Grace would similarly scale up the electrically-heated thermal oxidizer or instead choose to use a more typical thermal or catalytical oxidizer heated using natural gas. In which case, the emissions profile from the pilot plant would, of course, not be the same as from an actual, commercial-scale, facility.

# ATTACHMENT A

## **RANAJIT (RON) SAHU, PH.D, CEM (NEVADA)**

### **CONSULTANT, ENVIRONMENTAL AND ENERGY ISSUES**

**311 North Story Place**

**Alhambra, CA 91801**

**Phone: 702.683.5466**

**e-mail (preferred): [ronsahu@gmail.com](mailto:ronsahu@gmail.com); [sahuron@earthlink.net](mailto:sahuron@earthlink.net)**

### **EXPERIENCE SUMMARY**

Dr. Sahu has over thirty two years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment for a wide range of emissions sources including stationary and mobile sources; soils and groundwater remediation including landfills as remedy; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

He has over thirty years of project management experience and has successfully managed and executed hundreds of projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past three decades include various trade associations as well as individual companies such as steel mills, petroleum refineries, chemical plants, cement manufacturers, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, land development companies, and various entities in the public sector including EPA, the US Dept. of Justice, several states (including New York, New Jersey, Connecticut, Kansas, Oregon, New Mexico, Pennsylvania, and others), various agencies such as the California DTSC, and various cities and municipalities. Dr. Sahu has executed projects in all 50 US states, numerous local jurisdictions and internationally.

In addition to consulting, for approximately two decades, Dr. Sahu taught numerous courses in several Southern California universities as adjunct faculty, including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management). He also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental and engineering areas discussed above in both state and Federal courts as well as before administrative bodies (please see Annex A).

### **EXPERIENCE RECORD**

2000-present **Independent Consultant.** Providing a variety of private sector (industrial companies, land development companies, law firms, etc.), public sector (such as the US Department of Justice), and public interest group clients with project management, environmental consulting, project management, as well as regulatory and engineering support consulting services.

1995-2000 Parsons ES, **Associate, Senior Project Manager and Department Manager for Air Quality/Geosciences/Hazardous Waste Groups, Pasadena, CA.**



- Parsons ES, **Manager for Air Source Testing Services**. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.
- 1992-1995 Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department.
- 1990-1992 Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department.
- 1989-1990 Kinetics Technology International, Corp. **Development Engineer**. Involved in thermal engineering R&D and project work related to low-NO<sub>x</sub> ceramic radiant burners, fired heater NO<sub>x</sub> reduction, SCR design, and fired heater retrofitting.
- 1988-1989 Heat Transfer Research, Inc. **Research Engineer**. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

### EDUCATION

- 1984-1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.
- 1984 M. S., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.
- 1978-1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

### TEACHING EXPERIENCE

#### Caltech

- "Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.
- "Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.
- "Caltech Secondary and High School Saturday Program," - taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.
- "Heat Transfer," - taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.
- "Thermodynamics and Heat Transfer," Fall and Winter Terms of 1996-1997.

#### U.C. Riverside, Extension

- "Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.
- "Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.
- "Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.
- "Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.
- "Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.
- "Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.
- "Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

“Advanced Hazardous Waste Management” University of California Extension Program, Riverside, California. 2005.

#### Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

“Environmental Risk Assessment,” Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 1998.

“Hazardous Waste Remediation” Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 2006.

#### University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

#### University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

#### International Programs

“Environmental Planning and Management,” 5 week program for visiting Chinese delegation, 1994.

“Environmental Planning and Management,” 1 day program for visiting Russian delegation, 1995.

“Air Pollution Planning and Management,” IEP, UCR, Spring 1996.

“Environmental Issues and Air Pollution,” IEP, UCR, October 1996.

### **PROFESSIONAL AFFILIATIONS AND HONORS**

#### **President of India Gold Medal, IIT Kharagpur, India, 1983.**

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-mid-1990s.

Air and Waste Management Association, West Coast Section, 1989-mid-2000s.

### **PROFESSIONAL CERTIFICATIONS**

EIT, California (#XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, 2000 - 2021.

CEM, State of Nevada (#EM-1699).

### **PUBLICATIONS (PARTIAL LIST)**

- "Physical Properties and Oxidation Rates of Chars from Bituminous Coals," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **67**, 275-283 (1988).
- "Char Combustion: Measurement and Analysis of Particle Temperature Histories," with R.C. Flagan, G.R. Gavalas and P.S. Northrop, *Comb. Sci. Tech.* **60**, 215-230 (1988).
- "On the Combustion of Bituminous Coal Chars," PhD Thesis, California Institute of Technology (1988).
- "Optical Pyrometry: A Powerful Tool for Coal Combustion Diagnostics," *J. Coal Quality*, **8**, 17-22 (1989).
- "Post-Ignition Transients in the Combustion of Single Char Particles," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **68**, 849-855 (1989).
- "A Model for Single Particle Combustion of Bituminous Coal Char." Proc. ASME National Heat Transfer Conference, Philadelphia, **HTD-Vol. 106**, 505-513 (1989).
- "Discrete Simulation of Cenospheric Coal-Char Combustion," with R.C. Flagan and G.R. Gavalas, *Combust. Flame*, **77**, 337-346 (1989).
- "Particle Measurements in Coal Combustion," with R.C. Flagan, in "**Combustion Measurements**" (ed. N. Chigier), Hemisphere Publishing Corp. (1991).
- "Cross Linking in Pore Structures and Its Effect on Reactivity," with G.R. Gavalas in preparation.
- "Natural Frequencies and Mode Shapes of Straight Tubes," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).
- "Optimal Tube Layouts for Kamui SL-Series Exchangers," with K. Ishihara, Proprietary Report for Kamui Company Limited, Tokyo, Japan (1990).
- "HTRI Process Heater Conceptual Design," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).
- "Asymptotic Theory of Transonic Wind Tunnel Wall Interference," with N.D. Malmuth and others, Arnold Engineering Development Center, Air Force Systems Command, USAF (1990).
- "Gas Radiation in a Fired Heater Convection Section," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1990).
- "Heat Transfer and Pressure Drop in NTIW Heat Exchangers," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1991).
- "NO<sub>x</sub> Control and Thermal Design," Thermal Engineering Tech Briefs, (1994).
- "From Purchase of Landmark Environmental Insurance to Remediation: Case Study in Henderson, Nevada," with Robin E. Bain and Jill Quillin, presented at the AQMA Annual Meeting, Florida, 2001.
- "The Jones Act Contribution to Global Warming, Acid Rain and Toxic Air Contaminants," with Charles W. Botsford, presented at the AQMA Annual Meeting, Florida, 2001.

### **PRESENTATIONS (PARTIAL LIST)**

- "Pore Structure and Combustion Kinetics - Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).
- "Measurement of Temperature-Time Histories of Burning Single Coal Char Particles," with R.C. Flagan, presented at the American Flame Research Committee Fall International Symposium, Pittsburgh, (1988).
- "Physical Characterization of a Cenospheric Coal Char Burned at High Temperatures," with R.C. Flagan and G.R. Gavalas, presented at the Fall Meeting of the Western States Section of the Combustion Institute, Laguna Beach, California (1988).

"Control of Nitrogen Oxide Emissions in Gas Fired Heaters - The Retrofit Experience," with G. P. Croce and R. Patel, presented at the International Conference on Environmental Control of Combustion Processes (Jointly sponsored by the American Flame Research Committee and the Japan Flame Research Committee), Honolulu, Hawaii (1991).

"Air Toxics - Past, Present and the Future," presented at the Joint AIChE/AAEE Breakfast Meeting at the AIChE 1991 Annual Meeting, Los Angeles, California, November 17-22 (1991).

"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9-10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers - Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19-24, 1994.

## Annex A

### Expert Litigation Support

#### A. Occasions where Dr. Sahu has provided Written or Oral testimony before Congress:

1. In July 2012, provided expert written and oral testimony to the House Subcommittee on Energy and the Environment, Committee on Science, Space, and Technology at a Hearing entitled “Hitting the Ethanol Blend Wall – Examining the Science on E15.”

#### B. Matters for which Dr. Sahu has provided affidavits and expert reports include:

2. Affidavit for Rocky Mountain Steel Mills, Inc. located in Pueblo Colorado – dealing with the technical uncertainties associated with night-time opacity measurements in general and at this steel mini-mill.
3. Expert reports and depositions (2/28/2002 and 3/1/2002; 12/2/2003 and 12/3/2003; 5/24/2004) on behalf of the United States in connection with the Ohio Edison NSR Cases. *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).
4. Expert reports and depositions (5/23/2002 and 5/24/2002) on behalf of the United States in connection with the Illinois Power NSR Case. *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).
5. Expert reports and depositions (11/25/2002 and 11/26/2002) on behalf of the United States in connection with the Duke Power NSR Case. *United States, et al. v. Duke Energy Corp.*, 1:00-CV-1262 (Middle District of North Carolina).
6. Expert reports and depositions (10/6/2004 and 10/7/2004; 7/10/2006) on behalf of the United States in connection with the American Electric Power NSR Cases. *United States, et al. v. American Electric Power Service Corp., et al.*, C2-99-1182, C2-99-1250 (Southern District of Ohio).
7. Affidavit (March 2005) on behalf of the Minnesota Center for Environmental Advocacy and others in the matter of the Application of Heron Lake BioEnergy LLC to construct and operate an ethanol production facility – submitted to the Minnesota Pollution Control Agency.
8. Expert Report and Deposition (10/31/2005 and 11/1/2005) on behalf of the United States in connection with the East Kentucky Power Cooperative NSR Case. *United States v. East Kentucky Power Cooperative, Inc.*, 5:04-cv-00034-KSF (Eastern District of Kentucky).
9. Affidavits and deposition on behalf of Basic Management Inc. (BMI) Companies in connection with the BMI vs. USA remediation cost recovery Case.
10. Expert Report on behalf of Penn Future and others in the Cambria Coke plant permit challenge in Pennsylvania.
11. Expert Report on behalf of the Appalachian Center for the Economy and the Environment and others in the Western Greenbrier permit challenge in West Virginia.
12. Expert Report, deposition (via telephone on January 26, 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women’s Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) in the Thompson River Cogeneration LLC Permit No. 3175-04 challenge.
13. Expert Report and deposition (2/2/07) on behalf of the Texas Clean Air Cities Coalition at the Texas State Office of Administrative Hearings (SOAH) in the matter of the permit challenges to TXU Project Apollo’s eight new proposed PRB-fired PC boilers located at seven TX sites.
14. Expert Testimony (July 2007) on behalf of the Izaak Walton League of America and others in connection with the acquisition of power by Xcel Energy from the proposed Gascoyne Power Plant – at the State of

- Minnesota, Office of Administrative Hearings for the Minnesota PUC (MPUC No. E002/CN-06-1518; OAH No. 12-2500-17857-2).
15. Affidavit (July 2007) Comments on the Big Cajun I Draft Permit on behalf of the Sierra Club – submitted to the Louisiana DEQ.
  16. Expert Report and Deposition (12/13/2007) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case. *Plaintiffs v. Allegheny Energy Inc., et al.*, 2:05cv0885 (Western District of Pennsylvania).
  17. Expert Reports and Pre-filed Testimony before the Utah Air Quality Board on behalf of Sierra Club in the Sevier Power Plant permit challenge.
  18. Expert Report and Deposition (October 2007) on behalf of MTD Products Inc., in connection with *General Power Products, LLC v MTD Products Inc.*, 1:06 CVA 0143 (Southern District of Ohio, Western Division) .
  19. Expert Report and Deposition (June 2008) on behalf of Sierra Club and others in the matter of permit challenges (Title V: 28.0801-29 and PSD: 28.0803-PSD) for the Big Stone II unit, proposed to be located near Milbank, South Dakota.
  20. Expert Reports, Affidavit, and Deposition (August 15, 2008) on behalf of Earthjustice in the matter of air permit challenge (CT-4631) for the Basin Electric Dry Fork station, under construction near Gillette, Wyoming before the Environmental Quality Council of the State of Wyoming.
  21. Affidavits (May 2010/June 2010 in the Office of Administrative Hearings)/Declaration and Expert Report (November 2009 in the Office of Administrative Hearings) on behalf of NRDC and the Southern Environmental Law Center in the matter of the air permit challenge for Duke Cliffside Unit 6. Office of Administrative Hearing Matters 08 EHR 0771, 0835 and 0836 and 09 HER 3102, 3174, and 3176 (consolidated).
  22. Declaration (August 2008), Expert Report (January 2009), and Declaration (May 2009) on behalf of Southern Alliance for Clean Energy in the matter of the air permit challenge for Duke Cliffside Unit 6. *Southern Alliance for Clean Energy et al., v. Duke Energy Carolinas, LLC*, Case No. 1:08-cv-00318-LHT-DLH (Western District of North Carolina, Asheville Division).
  23. Declaration (August 2008) on behalf of the Sierra Club in the matter of Dominion Wise County plant MACT.us
  24. Expert Report (June 2008) on behalf of Sierra Club for the Green Energy Resource Recovery Project, MACT Analysis.
  25. Expert Report (February 2009) on behalf of Sierra Club and the Environmental Integrity Project in the matter of the air permit challenge for NRG Limestone’s proposed Unit 3 in Texas.
  26. Expert Report (June 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*
  27. Expert Report (August 2009) on behalf of Sierra Club and the Southern Environmental Law Center in the matter of the air permit challenge for Santee Cooper’s proposed Pee Dee plant in South Carolina).
  28. Statements (May 2008 and September 2009) on behalf of the Minnesota Center for Environmental Advocacy to the Minnesota Pollution Control Agency in the matter of the Minnesota Haze State Implementation Plans.
  29. Expert Report (August 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
  30. Expert Report and Rebuttal Report (September 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

31. Expert Report (December 2009) and Rebuttal reports (May 2010 and June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).
32. Pre-filed Testimony (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
33. Pre-filed Testimony (July 2010) and Written Rebuttal Testimony (August 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions*, No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.
34. Expert Report (August 2010) and Rebuttal Expert Report (October 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Liability Phase.
35. Declaration (August 2010), Reply Declaration (November 2010), Expert Report (April 2011), Supplemental and Rebuttal Expert Report (July 2011) on behalf of the United States in the matter of DTE Energy Company and Detroit Edison Company (Monroe Unit 2). *United States of America v. DTE Energy Company and Detroit Edison Company*, Civil Action No. 2:10-cv-13101-BAF-RSW (Eastern District of Michigan).
36. Expert Report and Deposition (August 2010) as well as Affidavit (September 2010) on behalf of Kentucky Waterways Alliance, Sierra Club, and Valley Watch in the matter of challenges to the NPDES permit issued for the Trimble County power plant by the Kentucky Energy and Environment Cabinet to Louisville Gas and Electric, File No. DOW-41106-047.
37. Expert Report (August 2010), Rebuttal Expert Report (September 2010), Supplemental Expert Report (September 2011), and Declaration (November 2011) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (District of Colorado).
38. Written Direct Expert Testimony (August 2010) and Affidavit (February 2012) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).
39. Deposition (August 2010) on behalf of Environmental Defense, in the matter of the remanded permit challenge to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
40. Expert Report, Supplemental/Rebuttal Expert Report, and Declarations (October 2010, November 2010, September 2012) on behalf of New Mexico Environment Department (Plaintiff-Intervenor), Grand Canyon Trust and Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. Public Service Company of New Mexico* (PNM), Civil No. 1:02-CV-0552 BB/ATC (ACE) (District of New Mexico).
41. Expert Report (October 2010) and Rebuttal Expert Report (November 2010) (BART Determinations for PSCo Hayden and CSU Martin Drake units) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.
42. Expert Report (November 2010) (BART Determinations for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.
43. Declaration (November 2010) on behalf of the Sierra Club in connection with the Martin Lake Station Units 1, 2, and 3. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Case No. 5:10-cv-00156-DF-CMC (Eastern District of Texas, Texarkana Division).
44. Pre-Filed Testimony (January 2011) and Declaration (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf

- Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).
45. Declaration (February 2011) in the matter of the Draft Title V Permit for RRI Energy MidAtlantic Power Holdings LLC Shawville Generating Station (Pennsylvania), ID No. 17-00001 on behalf of the Sierra Club.
  46. Expert Report (March 2011), Rebuttal Expert Report (June 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).
  47. Declaration (April 2011) and Expert Report (July 16, 2012) in the matter of the Lower Colorado River Authority (LCRA)'s Fayette (Sam Seymour) Power Plant on behalf of the Texas Campaign for the Environment. *Texas Campaign for the Environment v. Lower Colorado River Authority*, Civil Action No. 4:11-cv-00791 (Southern District of Texas, Houston Division).
  48. Declaration (June 2011) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.
  49. Expert Report (June 2011) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).
  50. Declaration (August 2011) in the matter of the Sandy Creek Energy Associates L.P. Sandy Creek Power Plant on behalf of Sierra Club and Public Citizen. *Sierra Club, Inc. and Public Citizen, Inc. v. Sandy Creek Energy Associates, L.P.*, Civil Action No. A-08-CA-648-LY (Western District of Texas, Austin Division).
  51. Expert Report (October 2011) on behalf of the Defendants in the matter of *John Quiles and Jeanette Quiles et al. v. Bradford-White Corporation, MTD Products, Inc., Kohler Co., et al.*, Case No. 3:10-cv-747 (TJM/DEP) (Northern District of New York).
  52. Declaration (October 2011) on behalf of the Plaintiffs in the matter of *American Nurses Association et. al. (Plaintiffs), v. US EPA (Defendant)*, Case No. 1:08-cv-02198-RMC (US District Court for the District of Columbia).
  53. Declaration (February 2012) and Second Declaration (February 2012) in the matter of *Washington Environmental Council and Sierra Club Washington State Chapter v. Washington State Department of Ecology and Western States Petroleum Association*, Case No. 11-417-MJP (Western District of Washington).
  54. Expert Report (March 2012) and Supplemental Expert Report (November 2013) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.*, Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).
  55. Declaration (March 2012) in the matter of *Center for Biological Diversity, et al. v. United States Environmental Protection Agency*, Case No. 11-1101 (consolidated with 11-1285, 11-1328 and 11-1336) (US Court of Appeals for the District of Columbia Circuit).
  56. Declaration (March 2012) in the matter of *Sierra Club v. The Kansas Department of Health and Environment*, Case No. 11-105,493-AS (Holcomb power plant) (Supreme Court of the State of Kansas).
  57. Declaration (March 2012) in the matter of the Las Brisas Energy Center *Environmental Defense Fund et al., v. Texas Commission on Environmental Quality*, Cause No. D-1-GN-11-001364 (District Court of Travis County, Texas, 261<sup>st</sup> Judicial District).
  58. Expert Report (April 2012), Supplemental and Rebuttal Expert Report (July 2012), and Supplemental Rebuttal Expert Report (August 2012) on behalf of the states of New Jersey and Connecticut in the matter of the Portland Power plant *State of New Jersey and State of Connecticut (Intervenor-Plaintiff) v. RRI Energy Mid-Atlantic Power Holdings et al.*, Civil Action No. 07-CV-5298 (JKG) (Eastern District of Pennsylvania).



59. Declaration (April 2012) in the matter of the EPA's EGU MATS Rule, on behalf of the Environmental Integrity Project.
60. Expert Report (August 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Harm Phase.
61. Declaration (September 2012) in the Matter of the Application of *Energy Answers Incinerator, Inc.* for a Certificate of Public Convenience and Necessity to Construct a 120 MW Generating Facility in Baltimore City, Maryland, before the Public Service Commission of Maryland, Case No. 9199.
62. Expert Report (October 2012) on behalf of the Appellants (Robert Concilus and Leah Humes) in the matter of Robert Concilus and Leah Humes v. Commonwealth of Pennsylvania Department of Environmental Protection and Crawford Renewable Energy, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2011-167-R.
63. Expert Report (October 2012), Supplemental Expert Report (January 2013), and Affidavit (June 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.
64. Pre-filed Testimony (October 2012) on behalf of No-Sag in the matter of the North Springfield Sustainable Energy Project before the State of Vermont, Public Service Board.
65. Pre-filed Testimony (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.
66. Expert Report (February 2013) on behalf of Petitioners in the matter of Credence Crematory, Cause No. 12-A-J-4538 before the Indiana Office of Environmental Adjudication.
67. Expert Report (April 2013), Rebuttal report (July 2013), and Declarations (October 2013, November 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).
68. Declaration (April 2013) on behalf of Petitioners in the matter of *Sierra Club, et al., (Petitioners) v Environmental Protection Agency et al. (Respondents)*, Case No., 13-1112, (Court of Appeals, District of Columbia Circuit).
69. Expert Report (May 2013) and Rebuttal Expert Report (July 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).
70. Declaration (August 2013) on behalf of A. J. Acosta Company, Inc., in the matter of *A. J. Acosta Company, Inc., v. County of San Bernardino*, Case No. CIVSS803651.
71. Comments (October 2013) on behalf of the Washington Environmental Council and the Sierra Club in the matter of the Washington State Oil Refinery RACT (for Greenhouse Gases), submitted to the Washington State Department of Ecology, the Northwest Clean Air Agency, and the Puget Sound Clean Air Agency.
72. Statement (November 2013) on behalf of various Environmental Organizations in the matter of the Boswell Energy Center (BEC) Unit 4 Environmental Retrofit Project, to the Minnesota Public Utilities Commission, Docket No. E-015/M-12-920.
73. Expert Report (December 2013) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).
74. Expert Testimony (December 2013) on behalf of the Sierra Club in the matter of Public Service Company of New Hampshire Merrimack Station Scrubber Project and Cost Recovery, Docket No. DE 11-250, to the State of New Hampshire Public Utilities Commission.

75. Expert Report (January 2014) on behalf of Baja, Inc., in *Baja, Inc., v. Automotive Testing and Development Services, Inc. et. al.*, Civil Action No. 8:13-CV-02057-GRA (District of South Carolina, Anderson/Greenwood Division).
76. Declaration (March 2014) on behalf of the Center for International Environmental Law, Chesapeake Climate Action Network, Friends of the Earth, Pacific Environment, and the Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. the Export-Import Bank (Ex-Im Bank) of the United States*, Civil Action No. 13-1820 RC (District Court for the District of Columbia).
77. Declaration (April 2014) on behalf of Respondent-Intervenors in the matter of *Mexichem Specialty Resins Inc., et al., (Petitioners) v Environmental Protection Agency et al.*, Case No., 12-1260 (and Consolidated Case Nos. 12-1263, 12-1265, 12-1266, and 12-1267), (Court of Appeals, District of Columbia Circuit).
78. Direct Prefiled Testimony (June 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17319 (Michigan Public Service Commission).
79. Expert Report (June 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).
80. Direct Prefiled Testimony (August 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of Consumers Energy Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17317 (Michigan Public Service Commission).
81. Declaration (July 2014) on behalf of Public Health Intervenors in the matter of *EME Homer City Generation v. US EPA* (Case No. 11-1302 and consolidated cases) relating to the lifting of the stay entered by the Court on December 30, 2011 (US Court of Appeals for the District of Columbia).
82. Expert Report (September 2014), Rebuttal Expert Report (December 2014) and Supplemental Expert Report (March 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).
83. Expert Report (November 2014) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).
84. *Declaration (January 2015) relating to Startup/Shutdown in the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.*
85. Pre-filed Direct Testimony (March 2015), Supplemental Testimony (May 2015), and Surrebuttal Testimony (December 2015) on behalf of Friends of the Columbia Gorge in the matter of the Application for a Site Certificate for the Troutdale Energy Center before the Oregon Energy Facility Siting Council.
86. Brief of Amici Curiae Experts in Air Pollution Control and Air Quality Regulation in Support of the Respondents, On Writs of Certiorari to the US Court of Appeals for the District of Columbia, No. 14-46, 47, 48. *Michigan et. al., (Petitioners) v. EPA et. al., Utility Air Regulatory Group (Petitioners) v. EPA et. al., National Mining Association et. al., (Petitioner) v. EPA et. al.*, (Supreme Court of the United States).
87. Expert Report (March 2015) and Rebuttal Expert Report (January 2016) on behalf of Plaintiffs in the matter of *Conservation Law Foundation v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).
88. Declaration (April 2015) relating to various Technical Corrections for the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.
89. Direct Prefiled Testimony (May 2015) on behalf of the Michigan Environmental Council, the Natural Resources Defense Council, and the Sierra Club in the matter of the Application of DTE Electric Company

- for Authority to Increase its Rates, Amend its Rate Schedules and Rules Governing the Distribution and Supply of Electric Energy and for Miscellaneous Accounting Authority, Case No. U-17767 (Michigan Public Service Commission).
90. Expert Report (July 2015) and Rebuttal Expert Report (July 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).
  91. Declaration (August 2015, Docket No. 1570376) in support of “Opposition of Respondent-Intervenors American Lung Association, et. al., to Tri-State Generation’s Emergency Motion;” Declaration (September 2015, Docket No. 1574820) in support of “Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors for Remand Without Vacatur;” Declaration (October 2015) in support of “Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors to State and Certain Industry Petitioners’ Motion to Govern, *White Stallion Energy Center, LLC v. US EPA*, Case No. 12-1100 (US Court of Appeals for the District of Columbia).
  92. Declaration (September 2015) in support of the Draft Title V Permit for Dickerson Generating Station (Proposed Permit No 24-031-0019) on behalf of the Environmental Integrity Project.
  93. Expert Report (Liability Phase) (December 2015) and Rebuttal Expert Report (February 2016) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., Environmental Law and Policy Center, and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).
  94. Declaration (December 2015) in support of the Petition to Object to the Title V Permit for Morgantown Generating Station (Proposed Permit No 24-017-0014) on behalf of the Environmental Integrity Project.
  95. Expert Report (November 2015) on behalf of Appellants in the matter of *Sierra Club, et al. v. Craig W. Butler, Director of Ohio Environmental Protection Agency et al.*, ERAC Case No. 14-256814.
  96. Affidavit (January 2016) on behalf of Bridgewatch Detroit in the matter of *Bridgewatch Detroit v. Waterfront Petroleum Terminal Co., and Waterfront Terminal Holdings, LLC.*, in the Circuit Court for the County of Wayne, State of Michigan.
  97. Expert Report (February 2016) and Rebuttal Expert Report (July 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.
  98. Direct Testimony (May 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.
  99. Declaration (June 2016) relating to deficiencies in air quality analysis for the proposed Millenium Bulk Terminal, Port of Longview, Washington.
  100. Declaration (December 2016) relating to EPA’s refusal to set limits on PM emissions from coal-fired power plants that reflect pollution reductions achievable with fabric filters on behalf of Environmental Integrity Project, Clean Air Council, Chesapeake Climate Action Network, Downwinders at Risk represented by Earthjustice in the matter of *ARIPPA v EPA, Case No. 15-1180*. (D.C. Circuit Court of Appeals).
  101. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.
  102. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Backus Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

103. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Drakulic Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.
104. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Deutsch Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.
105. Affidavit (February 2017) pertaining to deficiencies water discharge compliance issues at the Wood River Refinery in the matter of *People of the State of Illinois (Plaintiff) v. Phillips 66 Company, ConocoPhillips Company, WRB Refining LP (Defendants)*, Case No. 16-CH-656, (Circuit Court for the Third Judicial Circuit, Madison County, Illinois).
106. Expert Report (March 2017) on behalf of the Plaintiff pertaining to non-degradation analysis for waste water discharges from a power plant in the matter of *Sierra Club (Plaintiff) v. Pennsylvania Department of Environmental Protection (PADEP) and Lackawanna Energy Center*, Docket No. 2016-047-L (consolidated), (Pennsylvania Environmental Hearing Board).
107. Expert Report (March 2017) on behalf of the Plaintiff pertaining to air emissions from the Heritage incinerator in East Liverpool, Ohio in the matter of *Save our County (Plaintiff) v. Heritage Thermal Services, Inc. (Defendant)*, Case No. 4:16-CV-1544-BYP, (US District Court for the Northern District of Ohio, Eastern Division).
108. Rebuttal Expert Report (June 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight (Plaintiffs) v Coyote Creek Mining Company LLC (Defendant)*, Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).
109. Expert Affidavit (August 2017) and Penalty/Remedy Expert Affidavit (October 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant,)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).
110. Expert Report (August 2017) on behalf of Appellant in the matter of *Patricia Ann Troiano (Appellant) v. Upper Burrell Township Zoning Hearing Board (Appellee)*, Court of Common Pleas of Westmoreland County, Pennsylvania, Civil Division.
111. Expert Report (October 2017), Supplemental Expert Report (October 2017), and Rebuttal Expert Report (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).
112. Declaration (December 2017) on behalf of the Environmental Integrity Project in the matter of permit issuance for ATI Flat Rolled Products Holdings, Breckenridge, PA to the Allegheny County Health Department.
113. Expert Report (Harm Phase) (January 2018), Rebuttal Expert Report (Harm Phase) (May 2018) and Supplemental Expert Report (Harm Phase) (April 2019) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).
114. Declaration (February 2018) on behalf of the Chesapeake Bay Foundation, et. al., in the matter of the Section 126 Petition filed by the state of Maryland in *State of Maryland v. Pruitt (Defendant)*, Civil Action No. JKB-17-2939 (Consolidated with No. JKB-17-2873) (US District Court for the District of Maryland).
115. Direct Pre-filed Testimony (March 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of *NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC*, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington).
116. Expert Affidavit (April 2018) and Second Expert Affidavit (May 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power*

*Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

117. Direct Pre-filed Testimony and Affidavit (December 2018) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).
118. Expert Report (February 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.
119. Declaration (March 2019) on behalf of Earthjustice in the matter of comments on the renewal of the Title V Federal Operating Permit for Valero Houston refinery.
120. Expert Report (March 2019) on behalf of Plaintiffs for Class Certification in the matter of *Resendez et al v Precision Castparts Corporation* in the Circuit Court for the State of Oregon, County of Multnomah, Case No. 16cv16164.
121. Expert Report (June 2019), Affidavit (July 2019) and Rebuttal Expert Report (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellants) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.
122. Affidavit/Expert Report (August 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.
123. Expert Report (October 2019) relating to the appeal of air permit (Plan Approval) on behalf of Appellants in the matter of *Clean Air Council and Environmental Integrity Project (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection and Sunoco Partners Marketing and Terminals L.P.*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-057-L.
124. Expert Report (December 2019), Affidavit (March 2020), Supplemental Expert Report (July 2020), and Declaration (February 2021) on behalf of Earthjustice in the matter of *Objection to the Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation*, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.
125. Affidavit (December 2019) on behalf of Plaintiff-Intervenor (Surfrider Foundation) in the matter of *United States and the State of Indiana (Plaintiffs), Surfrider Foundation (Plaintiff-Intervenor), and City of Chicago (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2:18-cv-00127 (US District Court for the Northern District of Indiana, Hammond Division).
126. Declarations (January 2020, February 2020, May 2020, July 2020, and August 2020) and Pre-filed Testimony (April 2021) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE)*, before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.
127. Expert Report (April 2020) on behalf of the plaintiff in the matter of Orion Engineered Carbons, GmbH (Plaintiff) vs. Evonik Operations, GmbH (formerly Evonik Degussa GmbH) (Respondent), before the German Arbitration Institute, Case No. DIS-SV-2019-00216.
128. Expert Independent Evaluation Report (June 2020) for *PacifiCorp's Decommissioning Costs Study Reports dated January 15, 2020 and March 13, 2020 relating to the closures of the Hunter, Huntington, Dave Johnston, Jim Bridger, Naughton, Wyodak, Hayden, and Colstrip (Units 3&4) plants*, prepared for the Oregon Public Utility Commission (Oregon PUC).

129. Direct Pre-filed Testimony (July 2020) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.
130. Expert Report (August 2020) and Rebuttal Expert Report (September 2020) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware Operating – NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A))*, before the State of New Mexico, Environmental Improvement Board.
131. Expert Report (July 2020) on the *Initial Economic Impact Analysis (EIA) for A Proposal To Regulate NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.
132. Expert Report (August 2020) and Supplemental Expert Report (February 2021) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the Conservation Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)
133. Expert Report (August 2020) and Supplemental Expert Report (December 2020) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)
134. Pre-filed Direct Testimony (October 2020) and Sur-rebuttal Testimony (November 2020) on behalf of petitioners (Ten Persons Group, including citizens, the Town of Braintree, the Town of Hingham, and the City of Quincy) in the matter of Algonquin Gas Transmission LLC, Weymouth MA, No. X266786 Air Quality Plan Approval, before the Commonwealth of Massachusetts, Department of Environmental Protection, the Office of Appeals and Dispute Resolution, OADR Docket Nos. 2019-008, 2019-009, 2019010, 2019-011, 2019-012 and 2019-013.
135. Expert Report (November 2020) on behalf of Protect PT in the matter of *Protect PT v. Commonwealth of Pennsylvania Department of Environmental Protection and Apex Energy (PA) LLC*, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2018-080-R (consolidated with 2019-101-R)(the “Drakulic Appeal”).
136. Expert Report (December 2020) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (Defendants)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)
137. Pre-filed Testimony (January 2021) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.
138. Expert Reports (March 2021 and May 2021) regarding the Aries Newark LLC Sludge Processing Facility, Application No. CPB 20-74, Central Planning Board, City of Newark, New Jersey.
139. Expert Report (April 2021) for *Charles Johnson Jr. (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:20-CV-01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Eastern District of Louisiana, New Orleans Division).
140. Affidavit (April 2021) for *Clayton Faerber et.al., (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 20-CV-00328 01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Southern District of Mississippi).

141. Expert Report (April 2021, June 2023) for *Floyd Ruffin (Plaintiff), v. BP Exploration and Production Inc., et al. (Defendant)*, Civil Action No. 2:20-cv-00334-CJB-JCW (US District Court for the Eastern District of Louisiana, New Orleans Division).
142. Expert Report (April 2021) and Sur-Rebuttal Report (June 2021) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Corning Inc., et al. (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).
143. Expert Report (May 2021) for *Clifford Osmer (Plaintiff) v. BP Exploration and Production Inc., et al., (Defendants)* related to No. 18-CV-12557 (US District Court for the Eastern District of Louisiana).
144. Expert Report (May 2021) and Rebuttal Expert Report (January 2022) for *James Noel (Plaintiff) v. BP Exploration and Production Inc., et al. (Defendant)*, Civil Action No. 1:19-CV-00694-JB-MU-C (US District Court for the Southern District of Alabama, Southern Division).
145. Expert Report (June 2021) and Declarations (May 2021 and June 2021) on behalf of Plaintiffs in the matter of *Sierra Club (Plaintiff) v. Woodville Pellets, LLC (Defendant)*, Civil Action No. 9:20-cv-00178-MJT (US District Court for the Eastern District of Texas, Lufkin Division.)
146. Expert Witness Disclosure (June 2021) on behalf of the Plaintiffs in the matter of *Jay Burdick, et al., (Plaintiffs) v. Tanoga Inc. (d/b/a Taconic) (Defendant)*, Index No. 253835, (State of New York Supreme Court, County of Rensselaer).
147. Expert Report (June 2021) on behalf of Appellants in the matter of *PennEnvironment and Earthworks (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection (Appellee) and MarkWest Liberty Midstream and resource, LLC (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2020-002-R.
148. Expert Report (June 2021) for *Antonia Saavedra-Vargas (Plaintiff) v. BP Exploration and Production Inc., et al. (Defendant)*, Civil Action No. 2:18-CV-11461 (US District Court for the Eastern District of Louisiana, New Orleans Division).
149. Affidavit (June 2021) for Lourdes Rubi in the matter of *Lourdes Rubi (Plaintiff) v. BP Exploration and Production Inc., et al., (Defendants)*, related to 12-968 BELO in MDL No. 2179 (US District Court for the Eastern District of Louisiana, New Orleans Division).
150. Expert Report (June 2021) for *Wallace Smith (Plaintiff) v. BP Exploration and Production Inc., et al. (Defendant)*, Civil Action No. 2:19-CV-12880 (US District Court for the Eastern District of Louisiana, New Orleans Division).
151. Declaration (July 2021) on behalf of Plaintiffs in the matter of *Stephanie Mackey and Nick Migliore, on behalf of themselves and all others similarly situated (Plaintiffs) v. Chemtool Inc. and Lubrizol Corporation (Defendants)*, Case No. 2021-L-0000165, State of Illinois, Circuit Court of the 17<sup>th</sup> Judicial Circuit, Winnebago County.
152. Declaration (July 2021, August 2021) on behalf of Petitioners in the matter of the Petition for a Hearing on the Merits Regarding Air Quality Permit No. 3340-RMD issued to New Mexico Terminal Services, LLC by *Mountain View Neighborhood Association et al., (Petitioners) v. City of Albuquerque Environmental Health Department*, AQCB Petition No. 2020-1 before the Albuquerque-Bernalillo County Air Quality Control Board.
153. Expert Disclosure (September 2021) and Affidavit (May 2023) on behalf of the Plaintiffs in the matter of *State of New York, Town of Hempstead, Town of Brookhaven, Incorporated Village of Garden City and Long Island Power Authority et al., (Plaintiffs) v. Covanta Hempstead Company et al., (Defendants)*, Index No. 7549/2013 before the Supreme Court of the State of New York, County of Nassau.
154. Expert Report (October 2021) for *John A. Battiste (Plaintiff) v. BP Exploration and Production Inc., et al. (Defendant)*, Civil Action No. 1:21-CV-00118 (US District Court for the Southern District of Alabama, Mobile Division)
155. Declaration/Expert Report (October 2021) for *Charles K. Grasley et al., (Plaintiffs) v. Chemtool Incorporated (Defendant)*, Case No. 2021-L-0000162 (State of Illinois, In the Circuit Court of the 17<sup>th</sup> Judicial Circuit, Winnebago County).

156. Declaration (October 2021) and Expert Report (November 2021) on behalf of the Plaintiffs in the matter of Toll Brothers, Inc., and Porter Ranch Development Company (Plaintiffs) v. Sempra Energy, Southern California Gas Company et. al., (Defendants), Southern California [Aliso Canyon] Gas Leak Cases, JCCP No.: 4861, Lead Case No.: BC674622, Superior Court of the State of California for the County of Los Angeles.
157. Expert Report (November 2021) and Declaration (September 2022) on behalf of Plaintiffs in Re: Deepwater Horizon BELO Cases, Case No. 3:19cv963-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).
158. Declaration (November 2021) for the *United States of America and the State of Kansas, Department of Health and Environment (Plaintiffs) v. Coffeyville Resources Refining & Marketing, LLC (Defendant)*, Civ. No. 6:04-cv-01064-JAR-KGG (US District Court for the District of Kansas).
159. Expert Report/Affidavit (December 2021) on behalf of the City of Detroit in the matter of Marathon Petroleum Company (Claimant) v. City of Detroit Building Safety Engineering and Environmental Department, BSEED Case No. MCR 2018-2525, DAH Appeal No. 21-SWA-01, before the State of Michigan, City of Detroit Department of Appeals and Hearings.
160. Expert Report (December 2021) for *John Pabst (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 21-CV-00290 (US District Court for the Eastern District of Louisiana).
161. Expert Report (December 2021) for *Audrey Annette Tillery-Perdue individually and as person representative of the estate of Eddie Lewis Perdue (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendant)*, Civil Action No. 5:19-cv-00052-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).
162. Expert Report (February 2022) for *Richard Dufour (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 19-cv-00591 (US District Court for the Southern District of Mississippi).
163. Expert Report (February 2022) and Rebuttal Expert Report (June 2022, in preparation) for *Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).
164. Expert Report (February 2022) in the matter of the *Appeal Petition for Hearing on Air Quality Permit No. 8585 on behalf of Earth Care New Mexico et. al., (Petitioners) v. New Mexico Environment Department and Associated Asphalt and Materials, LLC (Applicant)*, No. EIB 21-48 before the State of New Mexico Environmental Improvement Board.
165. Expert Report (March 2022), Affidavit (June 2022), Supplemental Expert Report (April 2023) in the matter of *Clean Air Council et. al., (Appellants) v. Commonwealth of Pennsylvania, Department of Environmental Protection (Appellee) and Renovo Energy Center (Permittee)* EHB Docket No. 2021-055-R before the Commonwealth of Pennsylvania Environmental Hearing Board.
166. Declaration (March 2022) in the matter of Max Midstream Texas LLC Air Quality Permit No. 162941 for the Seahawk Crude Condensate Terminal in Calhoun County Texas, TCEQ Docket No. 2022-0157-AIR, before the Texas Commission on Environmental Quality.
167. Expert Pre-filed Testimony (April 2022) in the matter of Application of TPC Group LLC for New State and PSD Air Quality Permits (various), TCEQ Docket No. 2021-1422-AIR, SOAH Docket No. 582-22-0799, Before the Texas State Office of Administrative Hearings.
168. Expert Report (April 2022) and Rebuttal Report (August 2022) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)
169. Rule 26 Disclosure (May 2022) in the matter of the *Water Works and Sewer Board of the City of Gadsden (Plaintiff) v. 3M Company, et. al., (Defendants)*, Civil Action No.: 31 CV-2016-900676.00 (Circuit County of Etowah County, Alabama)
170. Expert Report (June 2022) for *Heather Schumacher (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-011939 (Circuit Court of Cook County, Illinois.)



171. Expert Report (June 2022), Rebuttal Reports (August 2022, September 2022) for Plaintiffs in *Phylliss Grayson et. al. (Plaintiffs), v Lockheed Martin Corporation (Defendant)*, Case No. 6:20-cv-01770. (US District Court for the Middle District of Florida – Orlando Division.)
172. Expert Affidavit (July 2022) for Center for Environmental Rights in connection with the 2019 South Africa Integrated Resource Plan in *African Climate Alliance et. al. v. The Minister of Mineral Resources and Energy et. al.*, in the High Court of South Africa, Gauteng Division, Pretoria.
173. Expert Affidavit (July 2022) for Center for Environmental Rights in connection with the Limpopo Mine (Lephalale Coal Mines Ltd.) in *Earthlife Africa v. The Minister of Forestry, Fisheries and Environment et. al.*, in the High Court of South Africa, Gauteng Division, Pretoria, Case No. 9149/2022.
174. Pre-filed Testimony (July 2022) and Rebuttal Testimony (September 2020) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)* before the Washington Utilities and Transportation Commission, Docket UE-220066 and UG-220067 (Consolidated).
175. Expert Report (September 2022) *Clean Air Council, Citizens for Pennsylvania’s Future, Mountain Watershed Association (Appellants) v. Allegheny County Health Department (Appellee) and Allegheny Energy Center (Intervenor, Permittee)*, Case No. 21-043 before the Hearing Officer of the Allegheny County Health Department.
176. Expert Affidavit (October 2022) for *Concerned Citizens of Cook County GA (Petitioner) v. Georgia Department of Natural Resources (Respondent) and Spectrum Energy Georgia, LLC (Respondent Intervenor)* before the Office of State Administrative Hearings, State of Georgia, Docket No: 2303405-OAH-BNR-AQ-37-Barnes.
177. Expert Rebuttal Report (January 2023), Supplemental Rebuttal Expert Report (March 2023, May 2023, November 2023) for *Ann Jordan et. al., and Blake Darnell (Plaintiffs) v. Terumo BCT et. al., (Defendants)* before District Court, Jefferson County, Colorado Case Numbers: 2020CV031457, 2021CV030474 (consolidated with 2020CV031457) and 2020CV03148.
178. Expert Report (January 2023) and Rebuttal Expert Report (April 2023) for *Potomac Riverkeeper and Sierra Club (Plaintiffs) v. Virginia Electric and Power Company (Defendant)*, Civil Action No. 2:21-CV-23 (Kleeh) (US District Court for the Northern District of West Virginia, Elkins Division).
179. Affidavit (January 2023) for *Richard Dufour (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:19-cv-00591-HSO-BWR (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Southern District of Mississippi).
180. Expert Report (January 2023) and Supplemental Expert Report (July 2023) on behalf of Plaintiffs in the matter of *Stephanie Mackey et. al., (Plaintiffs) v. Chemtool Inc. et. al., (Defendants) and Holian Insulation Company Inc. (Third-party Defendant)*, Case No.: 3:21-cv-50283, U.S. District Court, Northern District of Illinois, Western Division.
181. Expert Report (February 2023) for *Vervicia Henderson, et al. (Plaintiff) v. Lockheed Martin Corporation (Defendant)*, Case No. 6:21-cv-01363, U.S. District Court, Middle District of Florida, Orlando Division.
182. Expert Report (February 2023) for *Carol Davis (Plaintiff) v. Lockheed Martin Corporation (Defendant)*, Case No. 6:22-cv-81-RBD-EJK, U.S. District Court, Middle District of Florida, Orlando Division.
183. Expert Report (February 2023) for Mark Letart (Plaintiff), et al. v. Union Carbide Corporation, et al. (Defendants), Case No. 2:19-cv-877, U.S. District Court, Southern District of West Virginia, Charleston Division.
184. Affidavit (March 2023) on behalf of plaintiffs in the matter of the *State of New Mexico, ex rel. Raul Torrez, Attorney General (Plaintiffs) v. Sterigenics US LLC, Sotera Health Holdings, LLC, Sotera Health LLC and Sotera Health Company (Defendants)*, Case No.: D-307-CV-2020-02629, State of New Mexico, Third Judicial District Court, County of Dona Ana
185. Pre-filed Direct Testimony (March 2023) in the matter of *Algonquin Gas Transmission LLC., on behalf of Community Residents (Petitioners)*, Commonwealth of Massachusetts Department of Environmental

- Protection, Office of Appeals and Dispute Resolution, OADR Docket Nos. 2017-011 and 012, Waterways Application License No. W16-4600, Weymouth Mass.
186. Declaration (April 2023) in the matter of Sierra Club (Plaintiff) v. Tennessee Valley Authority in the matter of the Johnsonville Aeroderivative Combustion Turbines Project, Case No.: 3:22-cv-1054, U.S., District Court, Middle District of Tennessee, Nashville Division.
  187. Expert Report (May 2023/June 2023), Affidavit (April 2023) and Declaration (July 2023) for *Ezequiel Caraballo-Pache (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 8:20-cv-00263-SCB-JSS (US District Court for the Middle District of Florida, Tampa Division).
  188. Affidavit (May 2023) for *Lawrence Tucei (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:22-cv-00078-HSO-BWR (US District Court for the Southern District of Mississippi).
  189. Expert Report (May 2023/June 2023) for *Vincent Culliver (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 3:21-cv-4942-MCR/HTC (US District Court for the Northern District of Florida).
  190. Expert Report (June 2023) for *Matthew Williams (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:22-cv-00278-LG-BWR (US District Court for the Southern District of Mississippi).
  191. Declaration (June 2023) in support of public commenters relating to the Michigan Department of Environment Great Lakes and Energy (EGLE)'s Annual Network Monitoring Plan 2024.
  192. Expert Report (July 2023) and Rebuttal Expert Report (September 2023) relating to Greenhouse Gas and Energy Management (GEMM2) for Manufacturing in Colorado (September 2023) on behalf of Environmental Defense Fund.
  193. Pre-filed Direct Testimony (July 2023) on behalf of Citizens for Environmental Justice in the matter of the permit Application of Valero Refining-Texas, LP for Modification to State and Prevention of Significant Deterioration Air Quality Permits No. 38754 and PSDTX324M15 before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-23-14975, TCEQ Docket No. 2023-0203-AIR.
  194. Declaration (August 2023) in support of comments by Environmental Defense Fund in connection with the "Good Neighbor Plan" for the 2015 Ozone National Ambient Air Quality Standards, published at 88 Fed. Reg. 36,654 (June 5, 2023) ("Final Rule"), Docket ID No. EPA-HQ-OAR-2021-0668.
  195. Expert Report (August 2023) on behalf of Appellants in the matter of *PennEnvironment and Sierra Club (Appellants) v. Commonwealth of Pennsylvania, Department of Environmental Protection, (Appellee), and PPG Industries, Inc. (Permittee)*, EHB Docket No. 2022-032-B. Environmental Hearing Board, Department of Environmental Protection, State of Pennsylvania.
  196. Pre-filed Testimony (September 2023) and Cross Answering Testimony (October 2023) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)*, Docket: UG-230393. Before the Washington Utilities and Transportation Commission.
  197. Expert Report (December 2023) on behalf of plaintiffs in the matter of *PennEnvironment and Sierra Club (Plaintiffs) v. PPG Industries, Inc. (Defendant)*. Case No.: Civil Action Nos. 2:12-cv-00342, 2:12-cv-00527, 2:13-cv-01395, 1:13-cv-01396, 2:14cv-00229 (consolidated). U.S. District Court Western District of Pennsylvania.

**C. Occasions where Dr. Sahu has provided oral testimony in depositions, at trial or in similar proceedings include the following:**

198. Deposition on behalf of Rocky Mountain Steel Mills, Inc. located in Pueblo, Colorado – dealing with the manufacture of steel in mini-mills including methods of air pollution control and BACT in steel mini-mills and opacity issues at this steel mini-mill.

199. Trial Testimony (February 2002) on behalf of Rocky Mountain Steel Mills, Inc. in Denver District Court.
200. Trial Testimony (February 2003) on behalf of the United States in the Ohio Edison NSR Cases, *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).
201. Trial Testimony (June 2003) on behalf of the United States in the Illinois Power NSR Case, *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).
202. Deposition (10/20/2005) on behalf of the United States in connection with the Cinergy NSR Case. *United States, et al. v. Cinergy Corp., et al.*, IP 99-1693-C-M/S (Southern District of Indiana).
203. Oral Testimony (August 2006) on behalf of the Appalachian Center for the Economy and the Environment re. the Western Greenbrier plant, WV before the West Virginia DEP.
204. Oral Testimony (May 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) re. the Thompson River Cogeneration plant before the Montana Board of Environmental Review.
205. Oral Testimony (October 2007) on behalf of the Sierra Club re. the Sevier Power Plant before the Utah Air Quality Board.
206. Oral Testimony (August 2008) on behalf of the Sierra Club and Clean Water re. Big Stone Unit II before the South Dakota Board of Minerals and the Environment.
207. Oral Testimony (February 2009) on behalf of the Sierra Club and the Southern Environmental Law Center re. Santee Cooper Pee Dee units before the South Carolina Board of Health and Environmental Control.
208. Oral Testimony (February 2009) on behalf of the Sierra Club and the Environmental Integrity Project re. NRG Limestone Unit 3 before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.
209. Deposition (July 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*
210. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Coletto Creek coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
211. Deposition (October 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
212. Deposition (October 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.
213. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Tenaska coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH). (April 2010).
214. Oral Testimony (November 2009) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.
215. Deposition (December 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
216. Oral Testimony (February 2010) on behalf of the Environmental Defense Fund re. the White Stallion Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.
217. Deposition (June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

218. Trial Testimony (September 2010) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, State of Maryland, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case in US District Court in the Western District of Pennsylvania. *Plaintiffs v. Allegheny Energy Inc., et al.*, 2:05cv0885 (Western District of Pennsylvania).
219. Oral Direct and Rebuttal Testimony (September 2010) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).
220. Oral Testimony (September 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions*, No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.
221. Oral Testimony (October 2010) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.
222. Oral Testimony (November 2010) regarding BART for PSCo Hayden, CSU Martin Drake units before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.
223. Oral Testimony (December 2010) regarding BART for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.
224. Deposition (December 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).
225. Deposition (February 2011 and January 2012) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).
226. Oral Testimony (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).
227. Deposition (August 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).
228. Deposition (July 2011) and Oral Testimony at Hearing (February 2012) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.
229. Oral Testimony at Hearing (March 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).
230. Oral Testimony at Hearing (April 2012) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).
231. Oral Testimony at Hearing (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.
232. Deposition (March 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.
233. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

234. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).
235. Deposition (February 2014) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).
236. Trial Testimony (February 2014) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.*, Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).
237. Trial Testimony (February 2014) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).
238. Deposition (June 2014) and Trial (August 2014) on behalf of ECM Biofilms in the matter of the *US Federal Trade Commission (FTC) v. ECM Biofilms* (FTC Docket #9358).
239. Deposition (February 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).
240. Oral Testimony at Hearing (April 2015) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).
241. Deposition (August 2015) on behalf of Plaintiff in the matter of *Conservation Law Foundation (Plaintiff) v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).
242. Testimony at Hearing (August 2015) on behalf of the Sierra Club in the matter of *Amendments to 35 Illinois Administrative Code Parts 214, 217, and 225* before the Illinois Pollution Control Board, R15-21.
243. Deposition (May 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).
244. Trial Testimony (October 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).
245. Deposition (April 2016) on behalf of the Plaintiffs in *UNatural Resources Defense Council, Respiratory Health Association, and Sierra Club (Plaintiffs) v. Illinois Power Resources LLC and Illinois Power Resources Generation LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (Central District of Illinois, Peoria Division).
246. Trial Testimony at Hearing (July 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.
247. Trial Testimony (December 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.
248. Trial Testimony (July-August 2016) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

249. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.
250. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Backus Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.
251. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Drakulic Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.
252. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Deutsch Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.
253. Deposition Testimony (July 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight v Coyote Creek Mining Company LLC (Defendant)* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).
254. Deposition Testimony (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).
255. Deposition Testimony (December 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).
256. Deposition Testimony (January 2018) in the matter of National Parks Conservation Association (NPCA) v. State of Washington Department of Ecology and British Petroleum (BP) before the Washington Pollution Control Hearing Board, Case No. 17-055.
257. Trial Testimony (January 2018) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).
258. Trial Testimony (April 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington).
259. Deposition (June 2018) (harm Phase) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).
260. Trial Testimony (July 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.
261. Deposition (January 2019) and Trial Testimony (January 2019) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).
262. Deposition (February 2019) and Trial Testimony (March 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.
263. Deposition (June 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the

- State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.
264. Deposition (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellants) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.
  265. Deposition (December 2019) on behalf of the Plaintiffs in the matter of David Kovac, individually and on behalf of wrongful death class of Irene Kovac v. BP Corporation North America Inc., Circuit Court of Jackson County, Missouri (Independence), Case No. 1816-CV12417.
  266. Deposition (February 2020, virtual) and testimony at Hearing (August 2020, virtual) on behalf of Earthjustice in the matter of *Objection to the Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation*, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.
  267. Hearing (July 14-15, 2020, virtual) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.
  268. Hearing (September 2020, virtual) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware Operating – NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A))*, before the State of New Mexico, Environmental Improvement Board.
  269. Deposition (December 2020, March 4-5, 2021, all virtual) and Hearing (April 2021, virtual) in support of Petitioner’s Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE)*, before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.
  270. Hearing (September 2020, virtual) on the *Initial Economic Impact Analysis (EIA) for A Proposal To Regulate NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.
  271. Deposition (December 2020, virtual and Hearing February 2021, virtual) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.
  272. Deposition (January 2021, virtual) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)
  273. Deposition (February 2021, virtual) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (Defendants)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)
  274. Deposition (April 2021, virtual) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the Conservation Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)
  275. Deposition (June 2021, virtual) on behalf of Plaintiffs in the matter of *Sierra Club (Plaintiff) v. Woodville Pellets, LLC (Defendant)*, Civil Action No. 9:20-cv-00178-MJT (US District Court for the Eastern District of Texas, Lufkin Division).

276. Deposition (June 2021, virtual) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Corning Inc., et al. (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).
277. Testimony (June 2021, virtual) regarding the Aries Newark LLC Sludge Processing Facility, Application No. CPB 20-74, (Central Planning Board, City of Newark, New Jersey).
278. Testimony at Hearing (October 2021) on behalf of Evraz Rocky Mountain Steel in the matter of Colorado's Proposed Revisions to Regulation 22, the Greenhouse Gas Emissions and Energy Management for the Manufacturing Sector in Colorado (GEMM Rule), before the Colorado Air Quality Control Commission.
279. Deposition (November 2021) for *Charles Johnson Jr. (Plaintiff) v. BP Exploration and Production Inc., et al. (Defendant)*, Civil Action No. 2:20-CV-01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Eastern District of Louisiana).
280. Testimony at Hearing (November 2021) on behalf of *National Parks Conservation Association, et al.*, in the matter of the Proposed Revisions to Colorado's Regional Haze State Implementation Plan (SIP) and Colorado Regulation 23, before the Colorado Air Quality Control Commission.
281. Deposition (December 2021) on behalf of Plaintiffs in Re: Deepwater Horizon BELO Cases, Case No. 3:19cv963-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).
282. Deposition (December 2021) for *James Noel (Plaintiff) v. BP Exploration and Production Inc., et al. (Defendant)*, Civil Action No. 1:19-CV-00694-JB-MU-C (US District Court for the Southern District of Alabama, Southern Division).
283. Testimony at Hearing (February 2022, virtual) in the matter of the *Appeal Petition for Hearing on Air Quality Permit No. 8585 on behalf of Earth Care New Mexico et al., (Petitioners) v. New Mexico Environment Department and Associated Asphalt and Materials, LLC (Applicant)*, No. EIB 21-48 before the State of New Mexico Environmental Improvement Board.
284. Deposition (March 2022) and Rebuttal Deposition (July 2022) for *Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois.)
285. Deposition (April 2022, virtual) in the matter of Application of TPC Group LLC for New State and PSD Air Quality Permits (various), TCEQ Docket No. 2021-1422-AIR, SOAH Docket No. 582-22-0799, Before the Texas State Office of Administrative Hearings.
286. Deposition (May 2022, virtual) in the matter of the *Water Works and Sewer Board of the City of Gadsden (Plaintiff) v. 3M Company, et al., (Defendants)*, Civil Action No.: 31 CV-2016-900676.00 (Circuit County of Etowah County, Alabama)
287. Deposition (June 2022 and September 2022, both virtual) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)
288. Deposition (June 2022, virtual) on behalf of the Plaintiffs in the matter of Toll Brothers, Inc., and Porter Ranch Development Company (Plaintiffs) v. Sempra Energy, Southern California Gas Company et al., (Defendants), Southern California [Aliso Canyon] Gas Leak Cases, JCCP No.: 4861, Lead Case No.: BC674622, Superior Court of the State of California for the County of Los Angeles.
289. Deposition (July 2022) for *Richard Dufour (Plaintiff) v. BP Exploration and Production Inc., et al. (Defendant)*, Civil Action No. 19-cv-00591 (US District Court for the Southern District of Mississippi).
290. Trial (August 2022) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Phillips (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).
291. Trial (August 2022, in person) for *Susan Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).
292. Deposition (September 2022, virtual) for *Heather Schumacher (Plaintiff) v. Sterigenics U.S., LLC, et al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)



293. Deposition (September 2022) on behalf of Plaintiffs in *Phylliss Grayson et. al. (Plaintiffs), v Lockheed Martin Corporation (Defendant)*, Case No. 6:20-cv-01770. (US District Court for the Middle District of Florida – Orlando Division.)
294. Deposition (September 2022) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).
295. Hearing (October 2022) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)* before the Washington Utilities and Transportation Commission, Docket UE-220066 and UG-220067 (Consolidated).
296. Trial (October 2022, in person) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).
297. Depositions (March 2023, June 2023) for *Ann Jordan et. al., and Blake Darnell (Plaintiffs) v. Terumo BCT et. al., (Defendants)* before District Court, Jefferson County, Colorado Case Numbers: 2020CV031457, 2021CV030474 (consolidated with 2020CV031457) and 2020CV03148.
298. Depositions (March 2023, April 2023, May 2023) for Quinn Buczek (Plaintiff) v. Sterigenics US, LLC, Sotera Health, LLC, Prologis First US Properties, LP, et. al., (Defendants) before State Court of Gwinnett County, State of Georgia, Case No. Civil Action File No. 20-C-05918-S1.
299. Deposition (May 2023) for *Potomac Riverkeeper and Sierra Club (Plaintiffs) v. Virginia Electric and Power Company (Defendant)*, Civil Action No. 2:21-CV-23 (Kleeh) (US District Court for the Northern District of West Virginia, Elkins Division).
300. Deposition (May 2023) for Mark Letart (Plaintiff), et al. v. Union Carbide Corporation, et al. (Defendants), Case No. 2:19-cv-877, U.S. District Court, Southern District of West Virginia, Charleston Division.
301. Testimony at Hearing on behalf of Evraz North America In the Matter of Colorado Air Quality Regulation Proposed Revisions to Regulation Number 3 to establish enhanced Modeling, monitoring and permitting requirements for Stationary sources in disproportionately impacted communities 5 CCR 1001-5, before the Air Quality Control Commission, State of Colorado.
302. Deposition (2023) for *Vervicia Henderson, et al. (Plaintiff) v. Lockheed Martin Corporation (Defendant)*, Case No. 6:21-cv-01363, U.S. District Court, Middle District of Florida, Orlando Division.
303. Testimony at Hearing (July 2023) *Clean Air Council, Citizens for Pennsylvania’s Future, Mountain Watershed Association (Appellants) v. Allegheny County Health Department (Appellee) and Allegheny Energy Center (Intervenor, Permittee)*, Case No. 21-043 before the Hearing Officer of the Allegheny County Health Department.
304. Deposition (July 2023) for *Ezequiel Caraballo-Pache (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 8:20-cv-00263-SCB-JSS (US District Court for the Middle District of Florida, Tampa Division).
305. Deposition (August 2023) for *Floyd Ruffin (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:20-cv-00334-CJB-JCW (US District Court for the Eastern District of Louisiana, New Orleans Division).
306. Deposition (August 2023) on behalf of petitioners in *Doreen Carey et; al., (Petitioners) v. Fulcrum Centerpoint LLC. (Permittee/Respondent) and Indiana Department of Environmental Management (Respondent)*, Permit Number 089-44042-00660, before the Indiana Office of Environmental Adjudication.
307. Deposition (August 2023) on behalf of the Plaintiff in the *Water Works and Sewer Board of the Town of Centre, Alabama v. 3M Company, et. al.*, Civil Action No.: CV-2017-900049. Circuit Court of Cherokee County, State of Georgia.
308. Deposition (August 2023) for *Matthew Williams (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:22-cv-00278-LG-BWR (US District Court for the Southern District of Mississippi).

309. Deposition (September 2023) for *Vincent Culliver (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 3:21-cv-4942-MCR/HTC (US District Court for the Northern District of Florida).
310. Testimony at Hearing for Greenhouse Gas and Energy Management (GEMM2) for Manufacturing in Colorado (September 2023) on behalf of Environmental Defense Fund.
311. Testimony at Hearing (October 2023) in the matter of *Algonquin Gas Transmission LLC., on behalf of Community Residents (Petitioners)*, Commonwealth of Massachusetts Department of Environmental Protection, Office of Appeals and Dispute Resolution, OADR Docket Nos. 2017-011 and 012, Waterways Application License No. W16-4600, Weymouth Mass.
312. Testimony at Hearing (August 2023) on behalf of Citizens for Environmental Justice in the matter of the permit Application of Valero Refining-Texas, LP for Modification to State and Prevention of Significant Deterioration Air Quality Permits No. 38754 and PSDTX324M15 before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-23-14975, TCEQ Docket No. 2023-0203-AIR.
313. Testimony at Hearing (September 2023) on behalf of Appellants in the matter of *PennEnvironment and Sierra Club (Appellants) v. Commonwealth of Pennsylvania, Department of Environmental Protection, (Appellee), and PPG Industries, Inc. (Permittee)*, EHB Docket No. 2022-032-B. Environmental Hearing Board, Department of Environmental Protection, State of Pennsylvania.
314. Testimony at Hearing (November 2023) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)*, Docket: UG-230393. Before the Washington Utilities and Transportation Commission.

To Whom It May Concern:

I am Jane Williams, Chair of the Sierra Club National Clean Air Team. I have been a Sierra Club member for over 25 years and have served on the Clean Air Team for much of that time. As part of my duties, I routinely litigate on federal Clean Air Act rules and my team has been very active shaping policy and enforcing the federal Clean Air Act, Section 129 rules and the Definition of Non-Hazardous Solid Waste rule which govern the combustion of solid waste and incinerator emissions. One of these incinerator rules is the Other Solid Waste Incineration Rule (OSWI Rule).

My Clean Air Team initiated litigation challenging the final EPA OSWI rule because it left the toxic emissions from different types of waste incinerators unregulated or under-regulated. 70 Fed. Reg. 74870 (December 16, 2005). <https://www.epa.gov/stationary-sources-air-pollution/other-solid-waste-incinerators-oswi-new-source-performance#rule-history>.

The incinerator the W.R. Grace facility is planning to construct is covered by this OSWI rule since it plans to burn plastic in a facility that has less than 35 tons per year of throughput and meets the definitions in the OSWI rule of a very small municipal waste incinerator.

Previously, EPA has argued that it has broad discretion to decide which types of incinerators to regulate under the Clean Air Act's incinerator provision, 42 U.S.C. 7429. 70 Fed. Reg. at [74874-74875](#). However, the Clean Air Act requires EPA to set emission standards for "each category of solid waste incineration units." 42 U.S.C.7429(a)(1)(A). It further provides that the term "solid waste incineration unit" means "any facility which combusts any solid waste" with a narrow exception for certain types of materials recovery facility and power production facility. 42 U.S.C. 7429(g)(1).

Because the Clean Air Act requires EPA to issue standards for all facilities that combust any solid waste (and plastic is considered solid waste), except for those units expressly exempted by Congress, neither the EPA nor the states can exempt any other categories of incinerator without exceeding their authorities under the federal Clean Air Act. The state of Maryland has been granted authority by the the EPA to implement the federal Clean Air Act. [<https://www.federalregister.gov/documents/2012/06/20/2012-15018/delegation-of-authority-to-the-state-of-maryland-to-implement-and-enforce-additional-or-revised>.]

On June 5, 2023, EPA withdrew its proposal to exempt pyrolysis units burning plastic from Section 129 of the Clean Air Act after a nationwide campaign by the Sierra Club and other allies. Final action to exempt these pyrolysis units from the Clean Air Act was never taken by the agency, so any pyrolysis unit built or proposed to be built has a duty to comply with the federal Clean Air Act Section 129 regulations and that duty has been continuous. [<https://www.federalregister.gov/documents/2023/06/05/2023->

11476/standards-of-performance-for-new-stationary-sources-and-emission-guidelines-for-existing-sources.]

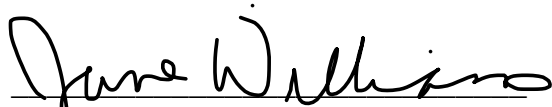
EPA has argued in the past that because some types of incinerators (e.g. agricultural waste incinerators) recover energy from the combustion process, they are not incinerators subject to regulation under 42 U.S.C. 7429. 70 Fed. Reg. at [74875-74877](#). That argument also is without merit. The Clean Air Act states precisely which types of energy recovery units are exempt from regulation as incinerators, and the unit proposed at W.R. Grace is not one of those units.

The facility proposed by the W.R. Grace company is clearly an incinerator since it meets a number of the criteria of an incinerator:

1. By combusting solid waste: since despite the assertion by W.R. Grace that the process is not oxidation, the waste itself entering the facility contains oxygen,
2. Plastic is considered a solid waste by the EPA under the Resource Conservation and Recovery Act,
3. Offgases from the process are being treated by a thermal oxidizer.

Both the text and legislative history of the Clean Air Act indicate that Congress intended section 7429 to cover all facilities that combust solid waste, except those expressly exempted by Congress. Since Congress did not expressly exempt these small units combusting plastic and other wastes from the Clean Air Act, they are still covered by the Act and need a Section 129 Clean Air Act permit. Indeed, subsequent court decisions have affirmed that Congress did intend to regulate these small facilities burning waste. [See *Sierra Club v. EPA*, 167 F.3d 658, 662 (D.C. Cir. 1999) (standards must reflect actual performance of best performing units).]

In summary, the Sierra Club has been very active since the 1990 Clean Air Act amendments were enacted ensuring that the intent of Congress to have EPA regulate the emissions of all different types of incinerators is realized. We have taken these actions specifically to ensure that if incinerators are built that health protective emission limits apply and that these facilities remain regulated by the federal Clean Air Act.



Jane Williams, chair  
Sierra Club  
National Clean Air Team  
August 26, 2024

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2

**GRACE**

**Grace Pilot Plant  
MDE Public Hearing  
April 29, 2024**

Bob Riley – Director, Sustainability  
Rob Harding – Senior Technology Advisor

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3

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<b>Specialty Catalysts</b>		<b>Polluting Technologies</b>		<b>SRKs and Fine Chemicals</b>	

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4

**Committed to making our operations—and our industry—more sustainable**

Investing in research and practices to help protect the environment and support our customers' sustainability goals

	<b>22%</b> GHG emission reduction
	<b>10%</b> Water usage reduction
	<b>5%</b> Waste (landfill) reduction

**On track to reduce our footprint by 2029.**

**GOLD**  
Top 5%  
Sustainability  
Rating  
**ecovadis**

W.R. Grace & Co. **GRACE**

**We are investing in research on plastic waste reduction**

Our scientists are looking for a better way to address plastic waste

	Fewer emissions
	Fewer pollutants
	Less energy
	Less cost
	Less sorting

W.R. Grace & Co. **GRACE**

**Our R&D effort: converting plastic waste back to plastic precursors**



W.R. Grace & Co. **GRACE**

**How we'll do it: small pilot plant within existing building**

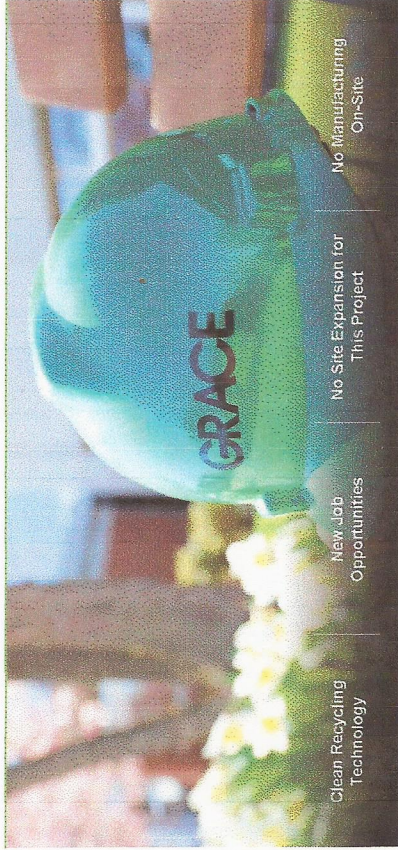
A floor plan of a building with a green area labeled 'Pilot Plant' and a 'WATER TREATMENT' area. To the right is a photograph of the pilot plant structure, a metal frame with yellow safety railings. Below the photo is the text '24'H x 32'L x 12'W'.

W.R. Grace & Co. **GRACE**

## How we'll do it: cleanly process small amounts of plastic



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Clean Recycling Technology

New Job Opportunities

No Site Expansion for This Project

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- Safety information
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- Safety and health topics

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**Mean Ways to Reach Us:**

- Contact us online
- 800-833-6666
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- Address