# EZRA WOOD

*Curriculum Vitae*
Department of Chemistry, Drexel University
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## Education

Ph.D. Chemistry, August 2004. Ron Cohen, Adviser.
University of California, Berkeley
Dissertation title: "A Novel Approach to Measurement of Atmospheric $N_2O_5$"

B.A. Chemistry *cum laude*, May 1997
Rutgers University, New Brunswick, NJ
Departmental honors in chemistry
Junior year abroad, 1995 – 1996, University of Bristol, UK

## Career History

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| 2016 – present | Associate Professor (tenure granted 2022)<br>Department of Chemistry<br>Drexel University |
| 2014 – 2016 | Research Assistant Professor and Lecturer<br>Department of Chemistry<br>University of Massachusetts – Amherst |
| 2010 – 2014 | Research Assistant Professor<br>Department of Public Health (Environmental Health Sciences)<br>University of Massachusetts – Amherst |
| 2006 – 2010 | Senior Scientist<br>Center for Atmospheric and Environmental Science<br>Aerodyne Research, Inc., Billerica, MA |
| 2005 – 2006 | Postdoctoral Researcher<br>Center for Atmospheric and Environmental Science<br>Aerodyne Research, Inc., Billerica, MA |

## External funding

<u>While at Drexel University / U. Massachusetts:</u>
Active Grants:
"Quantification of Ozone Formation Rates in Upper Manhattan", 5/2021 – 4/2023, NOAA Atmospheric Chemistry, Carbon Cycle, & Climate (AC4) program. $174,037 to Drexel. PI.

"Development of Methods for Quantifying Speciated Peroxy Radicals by Chemical Ionization Mass Spectrometry", 4/15/2020 – 3/31/2023, NSF, $429,097 to Drexel. PI.

"Quantification and Characterization of Ozone Formation in Central San Antonio", 5/1/2020 – 8/31/2021, TCEQ Texas Air Quality Research Program, $71,369 to Drexel. PI. *($15k spent before project was terminated due to the COVID-19 pandemic)*

"Analysis of Ozone Formation Data from the San Antonio Field Study", 10/1/2018 – 8/31/2019, TCEQ Texas Air Quality Research Program, $130,264 to Drexel. PI (joint with Prof. Shannon Capps, Drexel CAEE, Co-I).

"Spatial Mapping of Ozone Formation near San Antonio", 9/2016 – 8/2017, Texas Commission on Environmental Quality's Air Quality Research Program ($59,000 to Drexel). PI.

"Quantification of gas and aerosol characteristics from North American fires: emissions, evolution and exposure" (joint with Aerodyne Research, Inc.), 7/2016 – 6/2020, NOAA Atmospheric Chemistry, Carbon Cycle, & Climate (AC4) program ($128,000 total: $36,982 to UMass, $94,145 to Drexel). Sole Drexel PI.

"Development and Deployment of a Novel Peroxy Radical Detector", 10/2014 – 9/2017, NSF Atmospheric Chemistry program ($481,101 total: $275,241 to UMass, $205,759 to Drexel). Sole PI. Two consecutive no-cost extensions granted, expired 8/31/2019.

"Development of a $NO_X$ Chemistry Module for EDMS/AEDT to Predict $NO_2$ Concentrations" (joint with Wylie Laboratories, Aerodyne Research and KB Environmental), August 2013 – December 2015, Transportation Research Board / Airport Cooperative Research Program, $400,000 ($45,000 to U. Mass). Role: sole UMass PI and researcher.

"Methodology to Improve EDMS/AEDT Quantification of Aircraft Taxi/Idle Emissions" (joint with ATAC, KB Environmental and Sierra Research, Inc.), August 2013 – December 2015, Transportation Research Board / Airport Cooperative Research Program, $250,00 ($26,075 to U. Mass). Role: sole UMass PI and researcher.

<u>While at Aerodyne Research, Inc. (2005 – 2010)</u>

"Evaluation of U.S. Mobile Source Emissions" (joint with the Department of Civil and Environmental Engineering, University of California-Berkeley), 2010 - 2012, U.S. Environmental Protection Agency, $500,000 ($100,000 to Aerodyne Research). Role: Aerodyne project manager.

"Determination of HONO and $NO_2$ fluxes and concentrations over forest canopies using quantum cascade laser absorption spectroscopy" (joint with School of Engineering and Applied Sciences, Harvard University), December 2007 - 2010, National Science Foundation, $333,626 to Aerodyne Research, Inc. Role: contributor

"Measurement of Gaseous Hazardous Air Pollutant Emissions from Idling Aircraft as a Function of Engine and Ambient Conditions" (joint with Montana State University and US EPA), August 2008, Transportation Research Board /Airport Cooperative Research Program, $500,000 to Aerodyne Research. Role: contributor

"Houston Urban Air Composition Characterization Using a Mobile Laboratory and Measurements of HONO at Moody Tower", May 2008, Texas Environmental Research Center, $155,000 to Aerodyne Research. Role: contributor

"Aircraft and Airport-Related Hazardous Air Pollutants: Research Needs and Analysis" (joint with School of Public Health, Harvard University/Environmental Health and Engineering, Inc.), August 2006, Transportation Research Board / Airport Cooperative Research Program, $100,000 to Aerodyne Research. Role: Principle proposal writer and researcher.

**Internal Drexel Funding**

Drexel Scholarly Materials and Research Equipment Award for Tenure/Tenure Track Faculty, $6,050, 6/12/2022
Drexel Faculty Research Award, $7,000, 6/17/2019 – 6/30/2020
Drexel Career Development Award, $3,417, 7/2017 – 6/2018
Research co-op award from the Drexel Steinbright Career Development Center, 2017. This award provided 40% of the funds required to hire Jessica Pavelec (Drexel Chemistry BS 2018) as a co-op student during the Spring/Summer 2017 co-op cycle.

**Research**

Atmospheric Chemistry

Investigation of ozone and secondary organic aerosol particle formation using atmospheric measurements from stationary and mobile sites

*Major projects:*

• Forest fire photochemistry, Fall 2016 – Summer 2020 (McCall, Summer 2018; Boise, Summer 2019). Investigation of HOx radical chemistry and overall photochemistry in forest fires in the Western US.

• San Antonio Ozone Formation, Spring 2017. Investigation of $O_3$ formation chemistry in the greater San Antonio area.

• Radicals in Forests, Summer 2015 - 2017; funded by the NSF. Investigation of HOx radical chemistry and ozone production in three forests in the US. Three collaborating groups from the US and France for Summer 2015 (IRRONIC), 18 groups for Summer 2016 (PROPHET-AMOS), 5 groups for Summer 2017.

• SHARP (Study of Houston Atmospheric Radical Precursors), Houston, April-May 2009; funded by the Texas Environmental Research Center. Quantification of petrochemical emissions and the role of industrial formaldehyde emissions in accelerating ozone production, spatial mapping of hazardous air pollutant exposure, first ever in situ spectroscopic measurements of daytime nitrous acid.

• MILAGRO (Megacity Initiative: Local and Global Research Observations), Mexico City, March 2006; funded by NSF and DOE. Analysis of tropospheric ozone production, nitrogen oxide chemistry, hydrogen radical budgets, secondary organic aerosol formation.

• Nocturnal Nitrogen oxides, San Francisco Bay Area 2004 (Berkeley dissertation research).
Led field campaign to measure nocturnal nitrogen oxides in Lafayette, CA, December 2003 – January 2004 using newly built thermal dissociation – laser induced fluorescence instrument.

• TexAQS (Texas Air Quality Study), Houston, Summer 2000. Measurements of nitrogen dioxide and total nitrogen oxides (by thermal dissociation – laser induced fluorescence) and analysis of their role in ozone formation. Graduate student researcher.

Development of novel analytical methods for trace gas quantification
Laboratory developmentand field deployments of the following analytical techniques:

• *Chemical Ionization Mass Spectrometry (CIMS).* Research focuses on developing new methods of measuring and organic peroxy radicals.

• *Ethane Chemical Amplifier (ECHAMP)* (2010 – present). Research focuses on quantification of atmospheric peroxy radicals ($RO_2$ and $HO_2$), development of HOx calibration sources, and investigation of radical chemistry in forests.

• *Cavity Attenuated Phase Shift (CAPS) Spectroscopy, and Thermal Dissociation – CAPS.*

• *Tunable IR laser absorption spectrometry* (2005 – 2010). Development of new HONO/$NO_2$ spectrometer using cw quantum cascade lasers (joint with Harvard University, July 2008 – August 2010), lab validation and field deployment of pulsed quantum cascade tunable infrared laser differential absorption spectrometers for the detection of CO, $NO_2$, $C_2H_4$, $NH_3$, $HNO_3$, HONO, HCHO, HCOOH aboard Aerodyne mobile laboratory.

• *Thermal dissociation – Laser Induced Fluorescence* (1999 – 2004). Development of new sensors for the quantification of $NO_2$, organic nitrates, $NO_3$, and $N_2O_5$ (Berkeley dissertation research).

Airborne Pollutant Emissions
Quantification of pollutant emissions from on-road vehicles and the petrochemical industry.

*Major field projects:*
• Philadelphia 2018: quantification of NOx and $CH_4$ emissions in Philadelphia using the carbon balance method.
• Caldecott Tunnel 2010: characterization of individual exhaust plumes from heavy duty diesel trucks from a California tunnel, July 2010, Oakland CA. Joint with the Department of Civil and Environmental Engineering, University of California-Berkeley. Aerodyne project manager.
• FLAIR (Formaldehyde and Olefins from Large Industrial Releases), Houston, April-May 2009; funded by the Texas Environmental Research Center. Quantification of petrochemical emissions. Spatial mapping of hazardous air pollutant exposure.
• Somerville/Boston: near-roadway and tunnel measurements of vehicle emissions, January 2008 (partially funded by the Somerville Mystic View Task Force). Aerodyne project manager.
• MILAGRO, Mexico City: on-road and near-roadway characterization of vehicle emissions, March 2006 (funded by NSF and DOE). Senior Scientist.

• Mexicali, Mexico: on-road "chasing" measurements of vehicle emissions, April 2005 (funded by LASPAU). Research Scientist.
• Nogales truck crossing (US-Mexico border): near-road sampling of individual exhaust plumes from heavy duty diesel trucks, April 2005 (funded by Environmental Systems Products, Tucson AZ). Research Scientist.

Aviation and the Environment

Quantification of gas-phase and particulate matter emissions from commercial and military aircraft engines, studies of plume chemistry and the impact of airport operations on air quality

*Major projects:*

• ACRP project 02-43 – "Development of a $NO_X$ Chemistry Module for EDMS/AEDT to Predict $NO_2$ Concentrations", Sept 2013 – March 2015. Role: one of four contributing research groups.
• ACRP project 02-45 – "Methodology to Improve EDMS/AEDT Quantification of Aircraft Taxi/Idle Emissions", Sept 2013 – December 2014. Role: one of four contributing research groups.
• ACRP Project 02-03a, Quantification of VOC emissions as a function of temperature at Chicago Midway Regional Airport, Dallas Love Airport, and Chicago O'Hare International Airport. Role: Senior Scientist.
• APEX3, Cleveland International Airport, November 2005; funded by FAA/PARTNER, NASA. Research Scientist.
• Aircraft Particulate Emissions eXperiment 2 (JETS/APEX2), Oakland International Airport, August 2005; funded by FAA/PARTNER, California ARB, NASA. Research Scientist.
• Quantification of non-volatile particulate matter emissions from the F100 engine, Tinker Air Force Base, March 2007 and November 2008. Senior Scientist.
• Alternate Fuels emissions tests, GE facilities, Cincinnati; funded by FAA. Senior Scientist.
• Aircraft Alternate Fuels Emissions eXperiment (AAFEX), NASA-Dryden, January 2009, funded by NASA and FAA. Senior Scientist.
• Review of research priorities associated with airports and air toxics; 2005, funded by the Airport Cooperative Research Program (Transportation Research Board). Senior Scientist and lead investigator.

Exposure and Security Studies

• Quantification of VOC pollutants and health risks in Florence, MA (Fall 2011, funded by Northampton Dept. of Health). Primary Investigator.
• Spatial mapping of pollutant concentration gradients near highways, joint with Department of Civil and Environmental Engineering and Department of Public Health and Community Medicine, Tufts University, March 2007 and January 2008 (funded by the Somerville Mystic View Task Force). Aerodyne project manager.
• Quantification of interferences for explosives detection: measurements of nitrogen oxides at indoor sites within 4 major US airports, 2006 (funded by the U.S. Transportation Security Laboratory). Senior Scientist.
• Quantification of breathing zone pollutants during soldier training, Ft Sill, Oklahoma, 2007 (funded by the Department of Defense). Senior Scientist.

**Teaching**

*Course instructor, Drexel University:*

CHEC 353, "Physical Chemistry III and Applications", Fall 2019, Spring 2020, Fall 2020, Spring 2021, Fall 2022
Thirty to Sixty-two student course for chemical engineering and material science majors. Introduction to quantum mechanics, spectroscopy, and statistical mechanics.

Environmental Science 401/501, "Chemistry of the Environment", Spring 2018, 2019, 2020, and Fall 2020
Eleven to fifty-four student course for chemistry, environmental science, and engineering undergraduate and graduate students.

Chemistry 530, "Analytical Spectroscopy", Fall 2017, Fall 2018, Winter 2020, Fall 2021, Winter 2023
Three to thirteen-student course for chemistry grad students.

Environmental Science 405/605/T680, "Atmospheric Chemistry", Winter 2017, 2019
Seven to thirteen student course for chemistry, environmental science, and environmental engineering juniors, seniors, and graduate students.

*Course instructor, University of Massachusetts-Amherst:*

Chemistry 111, "General Chemistry", Fall 2014 - Spring 2016
280 student introductory chemistry course for non-chemistry science majors.

Public Health 562, "Air Quality Assessment", Spring 2012 and Fall 2012
A broad introductory course on air pollution for public health undergraduates and masters students. Topics include historical air pollution episodes, atmospheric chemistry and measurement principles, meteorology, health effects of air pollution, climate change, pollutant regulation, emission sources and control technology.

*Guest Lectures:*

*Drexel University:*
Fall 2016: Environmental Hazard Assessment (Environmental and Occupational Health 620)
Topic: Air Quality and Air Quality sampling

*University of Massachusetts-Amherst:*
Fall 2011: Indoor Environment and Health (Public Health 590N).
Topic: Volatile Organic Compounds

Spring 2012 and 2013: Building Energy and Environmental Systems (Environmental Conservation 697AC).
Topic: Indoor Air Quality.

Spring 2013: Indoor Environmental Systems (Environmental Conservation 311).
Topic: Buildings and Air Pollution.

Graduate Student Instructor, UC-Berkeley:

Atmospheric Chemistry and Physics Lab, Prof. Kristie Boering, Spring 2003
Honors general chemistry, Prof. Ron Cohen, Spring 2001
Quantitative Analysis, Prof. Evan Williams, Fall 1999
General chemistry, Prof. Angelica Stacy, Fall 1998

**Undergraduate researchers mentored:**
Neha Kunta, Drexel Chemistry Summer 2022 (Maryanoff Scholar)
Megan Rubino, Drexel Chemistry Fall 2021 – Spring 2022
Peter Peechatt, Drexel Chemistry Fall 2021 – Spring 2022
Asad Baig, Drexel Chemistry Summer 2021 (Maryanoff Scholar)
Lee Feinmann, Drexel Chemistry Spring 2021 (Maryanoff Scholar)
Caroline Adams, Drexel Chemistry Summer 2019 (STAR scholar),
Bryan Coppinger, Drexel Chemistry Summer 2018 (Maryanoff Scholar)
Roselyne Grieve, Drexel Chemistry, Fall 2017 – Spring 2018
Jessica Pavelec, Drexel Chemistry Spring-summer 2017 (Co-op student)
Mathew Rollings, UMass-Amherst Chemistry, Summer 2016
Benjamin Deming, UMass-Amherst Chemistry, Summer 2015 – Summer 2016
Ulrich Kakou, UMass-Amherst Chemistry, Fall 2014
John Charest, UMass-Amherst Chemistry, Summer 2013 – Spring 2014.
Cynthia Honorat, UMass-Amherst Chemistry, Fall 2012 – Spring 2013.
Baldwin Tran, UMass-Amherst Chemistry/biochemistry, Fall 2012 – Spring 2013.
Jinjin Lu, Smith College of Engineering (joint with Prof. D. Riley and Prof. S. Hsieh), Fall 2011.

**Post-doctoral researchers mentored:**
Daniel Anderson, February 2017 – July 2019
Shuvashish Kundu, June 2015 – June 2016

**Graduate Students mentored:**
Andrew Lindsay, Ph.D. 2022
Alexa Rhoads, M.S. 2022
Henry Colby, 2020 - present
Kyle Banecker, September 2018 – February 2021
Brigitte Weesner, M.S. 2020
Hannah Pepper, B.S./M.S. 2021

**Drexel Thesis Proposal Committees (2016 – 2022)**
Ketao Chen, Zhiyang Liu, Hannah Palmer, Elsa Gorre, Congmeng Lyu (CoE CAEE), Rayza Rosa Tavares Rodrigues, Henry Colby (as chair), Gregory Schwenk, Benjamin Rosen, Natalie Stuart, Megan Malvoisin, Anthony Howcroft (as chair), Nichole O'Neil, Lauren Kline

**Drexel Dissertation Committees (2016 – 2022)**
Allan Chao, Anita Avery (CoE CAEE), Elsa Gorre, Janna Domenico, David Guiseppe, Michelle Piotrowski, Cathy Muste, Donald Hall (as chair), Congmeng Lyu (CoE CAEE), Benjamin Werden (CoE CAEE), Ketao Chen.

**Drexel Master's Thesis Committees (2016 – 2022)**
Laura Ampollini (CoE CAEE), Karyn Camilo, Morgan Hesser.

**Peer-reviewed Publications**

(Bold = Wood lab members from Drexel or U. Mass)

(55) **Lindsay, A. and Wood, E.,** "Comparison of two photolytic calibration methods for nitrous acid", *Atmospheric Measurement Techniques May*, *15, 5455–5464, 2022*

(54) **Lindsay, A., Anderson, D**., Wernis, R., Liang, Y., Goldstein, A., Herndon, S., Roscioli, J., Dyroff, C., Fortner, E., Croteau, P., Majluf, F., Krechmer, J., Yacovitch, T., Knighton, W., **Wood, E**. "Ground-based Investigation of HOx and Ozone Chemistry in Biomass Burning Plumes in Rural Idaho", *Atmospheric Chemistry and Physics, 22, 4909–4928, 2022*

(53) Wei D., Alwe H., Millet D. B., Bottorff B., Lew M., Stevens P., Shutter J., Cox J., Keutsch F., Shi Q., Kavassalis S., Murphy J., Vasquez K., Allen H., Praske E., Crounse J., Wennberg P., Shepson P., Bui A., Wallace H., Griffin R., May N., Connor M., Slade J., Pratt K., **Wood E., Rollings M., Deming B., Anderson D.,** Steiner A., "FORest Canopy Atmosphere Transfer (FORCAsT) 2.0: model updates and evaluation with observations at a mixed forest site", *Geoscientific Model Development*, 14, 6309–6329, 2021

(52) **Anderson, D.; Lindsay, A.,** DeCarlo, P.; **Wood, E.,** "Urban Emissions of Nitrogen Oxides, Carbon Monoxide, and Methane Determined from Ground-Based Observations in Philadelphia", *Environ. Sci. Technol*, 55(8), 4532-4541, 2021

(51) Lew, M.; Rickly, P., Bottorff, B.; Reidy, E.; Sklaveniti, S.; Léonardis, T.; Locoge, N.; Dusanter, S.; **Kundu**, S.; **Wood**, W.; Stevens, P., "OH and $HO_2$ radical chemistry in a midlatitude forest: measurements and model comparisons", *Atmos. Chem. Phys*., 20, 9209–9230, 2020

(50) Lambe, A.; **Wood**, E.; Krechmer, J.; Majluf, F.; Williams, L.; Croteau, P.; Cirtog, M.; Féron, A.; Petit, J.; Albinet, A.; Jimenez, J.; Peng, Z., "Nitrate radical generation via continuous generation of dinitrogen pentoxide in a laminar flow reactor coupled to an oxidation flow reactor", *Atmos. Meas. Tech.*, 13, 2397–2411, 2020

(49) **Kundu**, S.; **Deming**, B. L.; Lew, M.; Bottorff, B.; Rickly, P.; Stevens, P. S.; Dusanter, S.; Sklaveniti, S.; Leonardis, T.; Locoge, N.; **Wood**, E. C., "Peroxy Radical Measurements by Ethane – Nitric Oxide Chemical Amplification and Laser-Induced Fluorescence during the IRRONIC field campaign in a Forest in Indiana" *Atmos. Chem. Phys*., 19, 9563–9579, 2019

(48) **Anderson**, D.; **Pavelec**, J.; Daube, C.; Herndon, S.; Knighton, W. B.; Lerner, B.; Roscioli, J. R.; Yacovitch, T.; **Wood**, E. C.;, "Characterization of Ozone Production in San Antonio, Texas Using Measurements of Total Peroxy Radicals", *Atmos. Chem. Phys,* 19 (5), 2845-2860, 2019

(47) Sklaveniti, S.; Locoge, N.; Stevens, P. S.; **Wood**, E.; **Kundu**, S.; Dusanter, S., "Development of an instrument for direct ozone production rate measurements: measurement reliability and current limitations", *Atmos. Meas. Tech.*, 11 (2), 741-761 10.5194/amt-11-741-2018, 2018

(46) **Wood**, E. C., **Deming**, B. L., and **Kundu**, S.: "Ethane-based chemical amplification measurement technique for atmospheric peroxy radicals", *Environ. Sci. Technol Letters*, 4, 15-19, 2017.

*Publications below were published prior to arriving at Drexel University (August 2016):*

(45) **Wood**, E. C., Knighton, W. B., Fortner, E. C., Herndon, S. C., Onasch, T. B., Franklin, J. P., Worsnop, D. R., Dallmann, T. R., Gentner, D. R., and Goldstein, A. H.: "Ethylene glycol emissions from on-road vehicles", *Environ. Sci. Technol*., 49, 3322-3329, 2015.

(44) Wormhoudt, J.; **Wood**, E. C.; Knighton, Kolb, C. E.; Herndon, S. C.; Olaguer, J., **"**Vehicle Emissions of Radical Precursors and Related Species Observed in the 2009 SHARP Campaign", *Journal of the Air & Waste Management Association*, doi: 10.1080/10962247.2015.1008654 (2015)

(43) **Wood**, E. C. and **Charest**, J., "Chemical Amplification – Cavity Attenuated Phase Shift Spectroscopy Measurements of Atmospheric Peroxy Radicals", 86 (20), 10266-10273 doi: 10.1021/ac502451m *Analytical Chemistry* (2014)

(42) Dallmann, T.; Onasch, T.; Kirchstetter, T.; Worton, D.; Fortner, E.; Herndon, S.; **Wood**, E.; Franklin, J.; Worsnop, D.; Goldstein, A.; Harley, R., "Characterization of Particulate Matter Emissions from On-Road Gasoline and Diesel Vehicles Using a Soot Particle Aerosol Mass Spectrometer", 14 (14), 7585-7599 *Atmospheric Chemistry and Physics* (2014)

(41) Pinto, J.; Dibb, J.; Lee, B. H.; Rappenglück, B.; **Wood**, E.; Levy, M.; Zhang, R.; Lefer, B.; Ren, X.; Stutz, J.; Tsai, C.; Ackermann, L.; Golovko, J.; Herndon, S.; Oakes, M.; Meng, Q.; Munger, J.; Zahniser, M.; Zheng, J., "Intercomparison of Field Measurements of Nitrous Acid (HONO) during the SHARP Campaign" doi: 10.1002/2013JD020287 *Journal of Geophysical Research-Atmospheres (*2014)

(40) Lee, B. H.; **Wood**, E. C.; Herndon, S. C.; Lefer, B. L.; Luke, W. T.; Brune, W. H.; Nelson, D. D.; Zahniser, M. S.; Munger, J. W., "Urban measurements of atmospheric nitrous acid: a caveat on the use of the photostationary state assumption" doi: 10.1002/2013JD020341, *Journal of Geophysical Research - Atmospheres* (2013)

(39) Gentner, D. R.; Worton, D.; Isaacman, G.; Davis, L.; Dallman, T.; **Wood**, E.; Herndon, S.; Goldstein, A.; Harley, R. A., "Chemical composition of gas-phase organic carbon emissions

from motor vehicles and implications for ozone production", doi 10.1021/es401470e *Environmental Science & Technology* (2013)

(38) **Wood**, E.; Herndon, S.; Fortner, E. C.; Onasch, T.; Wormhoudt, J.; Kolb, C. E.; Knighton, W. B.; Lee, B.; Zavala, M.; Molina, L.; Jones, M., "Combustion and Destruction/Removal Efficiencies of in-use Chemical Flares in the Greater Houston area." *Industrial and Engineering Chemistry Research*, doi:10.1021/ie202717m (2012)

(37) Dallman, T. R.; DeMartini, S. J.; Kirchstetter, T. W.; Herndon, S. C.; Onasch, T. B.; **Wood**, E. C.; Harley, R. A., "On-Road Measurement of Gas and Particle Phase Pollutant Emission Factors for Individual Heavy-Duty Diesel Trucks." *Environmental Science and Technology* 46, 8511-8518 (2012)

(36) Lee, B. H.; **Wood**, E. C.; Wormhoudt, J.; Shorter, J. H.; Herndon, S. C.; Zahniser, M. S.; Munger, J. W., "Effective line strengths of trans-nitrous acid near 1275 $cm^{-1}$ and cis-nitrous acid at 1660 $cm^{-1}$ using cw-QC TILDAS". *Journal of Quantitative Spectroscopy & Radiative Transfer* 113 (15), 1905-1912 (2012)

(35) Kinsey, J. S.; Timko, M. T.; Herndon, S. C.; **Wood**, E. C.; Yu, Z.; Miake-Lye, R. C.; Lobo, P.; Whitefield, P.; Hagen, D.; Wey, C.; Anderson, B. E.; Beyersdorf, A. J.; Hudgins, C. H.; Thornhill, K. L.; Winstead, E. L.; Howard, R.; Bulzan, D. I.; Tacina, K. B.; Knighton, W. B., "Determination of the Emissions from an Aircraft Auxiliary Power Unit (APU) during the Alternative Aviation Fuels EXperiment (AAFEX)". *J. Air & Waste Manage. Assoc*.**,** 62 (4), 420 – 430 (2012)

(34) Wormhoudt, J.; Herndon, S. C.; Franklin, J.; **Wood**, E. C.; Knighton, W. B.; Evans, S.; Laush, C.; Sloss, M.; Spellicy, R., "Comparison of remote sensing and extractive sampling measurements of flare combustion efficiency" *Industrial and Engineering Chemistry Research* doi:2012.10.1021/ie202783m (2012)

(33) Knighton, W. B.; Herndon, S. C.; Franklin, J. F.; **Wood**, E. C.; Wormhoudt, J.; Brooks, W.; Fortner, E. C., "Direct measurement of volatile organic compound emissions from industrial flares using real-time on-line techniques: Proton Transfer Reaction Mass Spectrometry and Tunable Infrared Laser Differential Absorption Spectroscopy" *Industrial and Engineering Chemistry Research*, doi:10.1021/ie202695v (2012)

(32) Knighton, W. B.; Herndon, S. C.; **Wood**, E. C.; Fortner, E.; Onasch, T. B.; Wormhoudt, J.; Kolb, C.; Lee, B.; Zavala, M.; Molina, L.; Jones, M., "Detecting fugitive emissions of 1,3-butadiene and styrene from a petrochemical facility: An application of a mobile laboratory and a modified proton transfer reaction mass spectrometer – $NO^+$ PTR-MS" *Industrial and Engineering Chemistry Research* doi:10.1021/ie202794j (2012)

(31) Herndon, S. C.; Nelson, D. D.; **Wood**, E. C.; Knighton, W. B.; Kolb, C. E.; Kodesh, Z.; Torres, V. M.; Allen, D. T., "Application of the carbon balance method to flare emissions characteristics". *Industrial and Engineering Chemistry Research* doi 10.1021/ie202676b2012, (2012).

(30) Torres, V. M.; Herndon, S. C.; **Wood**, E. C.; Al-Fadhli, F. M.; Allen, D. T., "Emissions of Nitrogen Oxides from Flares Operating at Low Flow Conditions." *Industrial and Engineering Chemistry Research*, doi 10.1021/ie300179x (2012)

(29) Timko, M. T.; Herndon, S. C.; de la Rosa Blanco, E.; **Wood**, E. C.; Yu, Z.; Miake-Lye, R. C.; Knighton, W. B.; Shafer, L.; DeWitt, M. J.; Corporan, E., "Combustion Products of Petroleum Jet Fuel, a Fischer–Tropsch Synthetic Fuel, and a Biomass Fatty Acid Methyl Ester Fuel for a Gas Turbine Engine". *Combustion Science and Technology*, 183 (10), 1039-1068 (2011)

(28) Santoni, G. W.; Lee, B. H.; **Wood**, E. C.; Herndon, S. C.; Miake-Lye, R. C.; Wofsy, S. C.; McManus, J. B.; Nelson, D. D.; Zahniser, M. S., "Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment". *Environmental Science & Technology*, doi:110720130733026 (2011)

(27) Lee, B. H.; Santoni, G. W.; **Wood**, E. C.; Herndon, S. C.; Miake-Lye, R. C.; Zahniser, M. S.; Wofsy, S. C.; Munger, J. W., "Measurements of Nitrous Acid in Commercial Aircraft Exhaust at the Alternative Aviation Fuel Experiment". *Environmental Science & Technology* 45 (18), 7648-7654 (2011)

(26) Lee, B. H.; Santoni, G.; **Wood**, E.; Miake-Lye, R.; Herndon, S.; Munger, J.; Wofsy, S., "Reactive Chemistry in Aircraft Exhaust". *Transportation Research Record: Journal of the Transportation Research Board***,** *2206* (1), 19-23 (2011)

(25) de la Rosa Blanco, E.; Peck, J.; Miake-Lye, R. C.; Hills, F. B.; **Wood**, E. C.; Herndon, S. C.; Annen, K. D.; Yelvington, P. E.; Leach, T., "Minimizing sampling loss in trace gas emission measurements for aircraft engines by using a chemical quick-quench probe". *Journal of Engineering for Gas Turbines and Power***,** *133* (7), 071602 (2011)

(24) **Wood**, E. C., Canagaratna, M. R., Herndon, S. C., Onasch, T. B.; Kolb, C. E.; Worsnop, D. R.; Kroll, J. H.; Knighton, W. B.; Seila, R.; Zavala, M.; Molina, L. T.; DeCarlo, P. F.; Jimenez, J. L.; Weinheimer, A. J.; Knapp, D. J.; Jobson, B. T.; Stutz, J.; Kuster, W. C.; Williams, E. J. "Investigation of the correlation between odd oxygen and secondary organic aerosol in Mexico City and Houston", *Atmospheric Chemistry and Physics*, 10(18), 8947-8968 (2010)

(23) Canagaratna M.R., Onasch T.B., **Wood** E.C., Herndon S.C., Jayne J.T., Cross E.C., Miake-Lye, R. C., Kolb, C. E., Worsnop, D. R. "Evolution of Vehicle Exhaust Particles in the Atmosphere" *Journal of the Air & Waste Management Association* 60:1192-1203 (2010)

(22) McManus, J. B., Zahniser, M., Nelson, D., Shorter, J., Herndon, S., **Wood**, E., and Wehr, R.: "Application of quantum cascade lasers to high-precision atmospheric trace gas measurements", *Optical Engineering* 49 (11), 111124 1-11 (2010)

(21) Lee, B., **Wood**, E., Zahniser, M., McManus, J. B., Nelson, D., Herndon, S., Santoni, G., Wofsy, S., and Munger, J.: "Simultaneous measurements of atmospheric HONO and $NO_2$ via

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**Book chapter, reports, conference proceedings**

(8) **Wood, E.** and Capps, S., "Analysis of Ozone Production Data from the San Antonio Field Study", Final Report for AQRP project 19-040, 2019

(7) **Wood, E.**, "Spatial Mapping of Ozone Production in San Antonio", Final Report for AQRP project 17-032, 2017

(6) Herndon, S. C., E. C. **Wood**, M. T. Timko, Z. Yu, and R. C. Miake-Lye. "Evolution of Aircraft Engine Emissions in the Atmosphere." Proceedings of the 3rd International Conference on Transport, Atmosphere and Climate (TAC-3), Prien am Chiemsee, 2012.

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(2) **Wood**, E. C.; Herndon, S.; Miake-Lye, R.; Nelson, D., Seeley, M. "Aircraft and Airport-Related Hazardous Air Pollutants: Research Needs and Analysis (ACRP Project 02-03)" Airport Cooperative Research Program, Transportation Research Board. Report # 7 (2008)

(1) **Wood**, E.C. and Cohen, R. C. "Fluorescence methods in Atmospheric Chemistry", Chapter 4 of Analytical Techniques for Atmospheric Measurement, Dwayne Heard, Editor., Blackwell Publications, Oxford (2006)

**Selected Presentations**

Wood, E. "Tackling the Other Greenhouse Gases: Methane Emissions in Philadelphia", Drexel Climate Year: Global Research Symposium, April 2021 (oral)

Lindsay, A., et al., "Measured and Modeled Ozone Production and Photochemistry in Biomass Burning Smoke in Rural Idaho" American Geophysical Union Fall Meeting (virtual), December 2020 (poster)

Lindsay, A., et al., “Ozone Production and Photochemistry of Biomass Burning Plumes in Rural Idaho” American Geophysical Union Fall Meeting, San Francisco, December 2019 (poster)

Anderson, D., et al. “Investigating the Impact of Power Plants, Oil & Gas Operations, and Biogenic Emissions on Ozone Production in San Antonio” American Geophysical Union Fall Meeting, San Francisco, December 2019 (poster)

Wood, E. “Photochemical Ozone Formation in San Antonio and Philadelphia”, NJIT Department of Chemistry and Environmental Science seminar, November 2019 (oral)

Wood, E. “Forest Fires: Are We All Doomed?”, Drexel College of Arts and Science Engaging the Environment symposium, June 2019

Wood, E., “Radical Photochemistry in Cities, Forests, and Forest Fires”, Department of Chemistry seminar, Drexel University, Nov 2018

Wood, E. “Impact of Chemistry, Meteorology, and $NO_2$ Emissions on $NO_2$ and $O_3$ Concentrations”, FAA roadmap meeting talk”, May 2018, Washington DC (oral)

Wood, E. “Photochemical Smog Formation in San Antonio and Elsewhere in the US”, Drexel Department of Environmental and Occupational Health Science seminar, March 2018 (oral)

Anderson, D., et al., “Using Total Peroxy Radicals to Evaluate Ozone Production in Northern Michigan and San Antonio”, American Geophysical Union Fall Meeting, New Orleans, December 2017 (poster)

Wood, E., et al., “Peroxy radicals ($HO_2$ + $RO_2$) during PROPHET-AMOS 2016” Prophet-AMOS Science team meeting, Ann Arbor, February 2017 (oral)

Wood, E. “Initial analysis of the 2017 San Antonio Field Study results: peroxy radical measurements and ozone formation”, AQRP August 2017 Science meeting (oral)

Wood, E., “Peroxy Radical Measurements during PROPHET-AMOS 2016” American Geophysical Union Fall Meeting, San Francisco, December 2016 (poster)

Wood, E., “Wall losses of peroxy radicals onto common sampling materials” American Chemical Society Fall meeting 2016, Philadelphia (oral)

Wood, E., “Peroxy Radicals, Chemical Flares and Ozone in Houston”, University of Massachusetts – Boston, Department of Chemistry seminar, March 2015 (oral)

Wood, E., “Alternative Chemical Amplification Methods for Peroxy Radical Detection”, American Geophysical Union conference, San Francisco, Dec 2014 (oral)

Wood, E., “Peroxy Radicals, Chemical Flares and Ozone in Houston”, Smith College Department of Chemistry seminar, Northampton MA, December 2 2013 (oral)

Wood, E. and Charest, J. "Atmospheric Peroxy Radical Measurements by Chemical Amplication - Cavity Attenuated Phase Shift Spectroscopy", American Geophysical Union conference, San Francisco, Dec 2013 (poster)

Wood, E. C., et al., "Ethylene Glycol emissions from on-road vehicles", American Geophysical Union conference, San Francisco, Dec 2012 (poster)

Wood, E. C. et al., "Using a mobile laboratory to characterize gas and particle emissions during the Study of Houston Atmospheric Radical Precursors (SHARP-2009)", Annual meeting of the American Meteorological Society, Atlanta, Jan 2010 (oral)

Wood, E. C. et al, "Aircraft Emissions, plume chemistry, and alternative fuels: results from the APEX and AAFEX campaigns", American Geophysical Union conference, San Francisco, Dec 2009 (poster)

Wood, E. C. et al, "Correlations between Ozone and Secondary Organic Aerosol observed in Urban Locations", American Geophysical Union conference, San Francisco, Dec 2007 (oral)

Wood, E. C., Nelson, D. D., Miake-Lye, R. C., Herndon, S. C., Seeley, M. "Aircraft and Airport-Related Hazardous Air Pollutants: Research Needs and Analysis", Transportation Research Board – Airport Cooperative Research Program, Washington D.C., June 2007 (oral)

Wood, E., Herndon, S., Timko, M., Onasch, T., Jayne, J., Northway, M., Miake-Lye, R., Knighton, W. B., "Speciation and chemical evolution of nitrogen oxide emissions from commercial aircraft", APEX3 conference, Cleveland, Nov 2006 (oral)

Wood, E. C., "Measurements of $N_2O_5$ East of the San Francisco Bay", Jet Propulsion Laboratory, Atmospheric Chemistry Dynamics & Radiation seminar, Pasadena, Oct 2004 (oral)

**Workshops**

"Formal Intercomparison of Observations of Nitrous Acid (FIONA), Technical Workshop", November 17-18, 2008, Fundacion CEAM, Valencia, Spain

"Nitrous acid: Tropospheric Chemistry, Measurement Methods and Future Directions", March 3-5, 2008, Invited Expert Workshop, Bergische Universität Wuppertal, Germany,

**Awards/honors**

2017 Drexel Career Development Award

2010 NASA Group Achievement Award, Alternative Aviation Fuel Experiment Team

2007 NASA Group Achievement Award, Aircraft Particle Emissions Experiment Team

2007 EPA Climate Protection Award, Joint Strike Fighter Emission Test Team

2005 AEDC Technical Achievement Award, JETS-APEX2 Test Team

1997 Phi Beta Kappa

**Media quotes:**

https://whyy.org/articles/cancer-causing-chemical-benzene-found-pes-refinery-site-south-philadelphia/

https://whyy.org/articles/port-richmond-junkyard-fire-air-quality-concerns/

**Professional Affiliations**
American Geophysical Union, member 2001 – present
American Chemical Society, member 2016 - 2018
American Meteorological Society, member 2009 – 2010
Union of Concerned Scientists, member 2001 – present
International Society of Indoor Air Quality and Climate, member 2011 – 2013, 2018 - 2019

*Reviewer for the following journals:*
Environmental Science and Technology
Environmental Science and Technology Letters
Analytical Chemistry
Atmospheric Chemistry and Physics (2 manuscripts)
Atmospheric Measurement Techniques
Atmospheric Environment
Journal of Atmospheric Research
Environmental Engineering Science
International Journal of Environmental Analytical Chemistry
International Journal of Energy and Environmental Engineering

*Proposal reviews:*
National Environment Research Council (UK)
National Science Foundation (Atmospheric Chemistry program and SBIR program)
National Oceanic and Atmospheric Administration (Atmospheric Chemistry, Carbon Cycle, and Climate program)

**Outreach**
2014 - 2019 Girls Inc. Eureka! workshop conducted for 12-13 yr old girls at U. Mass and Drexel: "Carbon Dioxide: Where is it?"