Dr. Derek J. Price
NOAA Affiliate, CPID, Research Scientist I
Office phone: (303)-497-4840
E-Mail: derek.price@noaa.gov

EDUCATION

Ph.D., Chemical and Environmental Engineering — August 2015
University of California - Riverside, Riverside, California, USA — GPA 3.41
Advisor: Dr. D. Cocker
Dissertation: "Environmental Chamber Studies of Reduced Nitrogen Compounds Observed in Anthropogenic Emissions"

M.S., Analytical Chemistry — May 2010
Utah State University, Logan, Utah, USA — GPA 4.00
Advisors: Dr. P. Silva, Dr. R. Brown
Thesis: "Field and Smog Chamber Studies of Agricultural Emissions and Reaction Products"

B.S., Chemistry, Emphasis: Environmental, Cum Laude — May 2008
Utah State University, Logan, Utah, USA — GPA 3.66
Advisor: Dr. P. Silva

RESEARCH EXPERIENCE

Research Scientist I - CIRES/NOAA — June 2020-Present

- Integrate new Total Carbon (TC) and Reactive Nitrogen (Nr) measurement systems into a novel calibration technique for the Aerodyne time of flight – aerosol mass spectrometer (ToF-AMS).

Postdoctoral Research - CU Boulder — 2017-2020

- Measured and analyzed indoor gas phase species with a chemical ionization mass spectrometer (CIMS) in two different ionization modes (iodide and nitrate) during a field campaign at an art museum (ARTISTIC study) in Boulder Colorado.
- Measured and analyzed indoor and ambient aerosol with a scanning mobility particle sizer (SMPS) during a field campaign at an athletic center (ATHLETIC study) in Boulder Colorado.
- Maintained an extractive electrospray ionization – time of flight – mass spectrometer (EESI-ToF-MS) for the measurement of indoor aerosols during the House Observations of Microbial and Environmental Chemistry (HOMEChem) study. Collaboration with University of Texas, Austin.
- Assisted in operating/troubleshooting a high resolution – time of flight – aerosol mass spectrometer (HR-ToF-AMS) onboard the NASA DC-8 aircraft during the Atmospheric Tomography (ATom-4) field campaign. Collaboration with NASA Armstrong Flight Research Center.

Postdoctoral Research - UCSD — 2015-2017

- Operated/troubleshot a range of instruments, including a high resolution – time of flight – aerosol mass spectrometer (HR-ToF-AMS) with light scattering (LS) and event trigger (ET) single particle operating modes, a single particle soot photometer (SP2), and a suite of particle sizing instruments (aerosol particle sizer (APS), optical particle sizer (OPS), and scanning electrical mobility spectrometer (SEMS)).

- Characterized the marine aerosol emissions from phytoplankton during the North Atlantic Aerosols and Marine Ecosystems Study (NAAMES). Collaboration with NASA Langley Research Center.
- Compared the fresh and aged emissions from a research vessel under various engine speeds and fuel types during a campaign in the Pacific Ocean.
- Measured and analyzed primary and secondary organic aerosols during a field campaign in Fontana California.

Graduate Student / Research Assistant (Ph.D.) 2010-2015

- Studied the reactions of agricultural emissions, such as amines and organic sulfur compounds, with OH and NO_3 radicals in dual 90 m^3, temperature controlled environmental smog chambers with a suite of instruments measuring the physical and chemical properties of the gas and aerosol phase constituents.
- Operated/troubleshot several instruments, including a high resolution – time of flight – aerosol mass spectrometer (HR-ToF-AMS), a selected ion flow tube – mass spectrometer (SIFT-MS), a particle into liquid sampler – liquid chromatography – time of flight – mass spectrometer (PILS-LC-ToF-MS), and a suite of homebuilt scanning mobility particle sizers (SMPS) and tandem differential mobility analyzers (TDMA).
- Determined novel chemical reaction mechanisms occurring in the radical oxidation of aliphatic amines through the analysis of mass spectrometer data.
- Lab supervisor for the Atmospheric Processes Laboratory (15-20 undergraduate and graduate students). Served from spring 2011 to spring 2015.
- Lab safety representative for the Atmospheric Processes Laboratory. Carried out responsibilities from spring 2011 to spring 2015.
- Participated in a field campaign characterizing the emissions of ships at sea under various engine speeds and fuel types. Collaboration with the University of California – San Diego.
- Given responsibility over the analytical process for detecting aldehydes and ketones from various sources, such as engine exhaust and ambient samples.
- Built an instrument to determine the concentration, size distribution, and volatility of secondary organic aerosol (mobile SMPS / V-TDMA).

Graduate Student / Research Assistant (MS) 2008-2010

- Monitored and analyzed the ambient air of Cache Valley, Utah. Measurements taken by a quadrupole aerosol mass spectrometer (Q-AMS) and air sampling filters.
- Studied the reactions of secondary amines with ozone and NOx in a smog chamber. Collaboration with the University of California – Riverside.
- Characterized the agricultural emissions from a dairy in San Joaquin valley, California. Operated/calibrated the Q-AMS. Collaboration with Space Dynamics Laboratory at Utah State University.

Undergraduate Research Assistant 2005-2008

- Measured and analyzed the agricultural emissions from a cotton farm in San Joaquin valley, California. Operated the Q-AMS. Collaboration with Space Dynamics Laboratory.
- Studied the reactions of tertiary amines with ozone and NOx in a smog chamber. Collaboration with the University of California – Riverside.
- Developed an experiment to monitor vehicle emissions from a local demolition derby.

- Compared the measurements of three different particle sizing instruments: an aerosol particle sizer (APS), a cascade impactor, and an optical particle counter (OPC).
- Studied the diesel emissions from trains idling near a local restaurant.
- Developed a method to extract and analyze particulate matter collected on filters. Collaboration with the Utah Water Research Laboratory.
- Calibrated the AMS for select amine compounds.

TEACHING EXPERIENCE

Graduate Student / Teaching Assistant (Ph.D.)

Taught one lecture for Fundamentals of Environmental Engineering (ENVE 133)	Winter '14
Chemical Process Design / Senior Design Project (CHE/ENVE 175B)	Spring '12
Environmental Engineering Laboratory (ENVE 160B)	Fall '10 & Fall '11

Graduate Student / Teaching Assistant (MS)

Quantitative Chemical Analysis Laboratory (Chem 3005)	Fall '08

SKILLS

Computer: Microsoft Office suite, Igor Pro, LabView, DAQFactory, and MatLab software.
Chamber: Designed, constructed, operated, and maintained environmental smog chambers.

PUBLICATIONS

First Author Publications

Price, D. J.; Day, D. A.; Pagonis, D.; Stark, H.; Handschy, A.; Algrim, L.; Miller, S. L.; de Gouw, J. A.; Ziemann, P. J.; Jimenez, J. L. Sources of gas-phase species in an Art Museum from comprehensive real-time measurements. (In prep for *Indoor Air*)

Price, D. J.; Day, D. A.; Pagonis, D.; Stark, H.; Algrim, L. B.; Handschy, A. V.; Liu, S.; Krechmer, J. E.; Miller, S. L.; Hunter, J. F.; de Gouw, J. A.; Ziemann, P. J.; Jimenez, J. L. Budgets of organic carbon composition and oxidation in indoor air. *Environ. Sci. Technol.* **2019**, 53, 13053-13063, DOI:10.1021/acs.est.9b04689

Price, D. J.; Chen, C.; Russell, L. M.; Lamjiri, M. A.; Betha, R.; Sanchez, K.; Liu, J.; Lee, A. K. Y.; Cocker III, D. R. More unsaturated, cooking-type hydrocarbon-like organic aerosol particle emissions from renewable diesel compared to ultra low sulfur diesel in at-sea operations of a research vessel. *Aerosol Sci. Technol.* **2017**, 51, 135-146. DOI:10.1080/02786826.2016.1238033

Price, D. J.; Kacarab, M. E.; Cocker III, D. R.; Purvis-Roberts, K. L.; Silva, P. J. Effects of temperature on the formation of secondary organic aerosol from amine precursors. *Aerosol Sci. Technol.* **2016**, 50, 1216-1226. DOI:10.1080/02786826.2016.1236182

Price, D. J. Environmental chamber studies of reduced nitrogen compounds observed in anthropogenic emissions. Ph.D. Dissertation, University of California - Riverside, Riverside, CA, August 2015.

Price, D. J.; Clark, C. H.; Tang, X.; Cocker III, D. R.; Purvis-Roberts, K. L.; Silva, P. J. Proposed chemical mechanisms leading to secondary organic aerosol in the reactions of aliphatic

amines with hydroxyl and nitrate radicals. *Atmos. Environ*. **2014**, 96, 135-144. DOI:10.1016/j.atmosenv.2014.07.035

Price, D. J. Field and smog chamber studies of agricultural emissions and reaction products. M.S. Thesis, Utah State University, Logan, UT, May 2010.

Coauthor Publications

Brown, W. L.; Day, D. A.; Stark, H.; Pagonis, D.; Krechmer, J. E.; Liu, X.; Price, D. J.; Katz, E. F.; DeCarlo, P. F.; Masoud, C. G.; Wang, D. S.; Hildebrandt Ruiz, L.; Arata, C.; Lunderberg, D. M.; Goldstein, A. H.; Farmer, D. F.; Vance, M. E.; Jimenez, J. L. Real-time organic aerosol chemical speciation in the indoor environment using extractive electrospray ionization mass spectrometry. *Indoor Air*. **2020**, 00, 1-15, DOI:10.1111/ina.12721

Veres, P. R.; Neuman, J. A.; Bertram, T. H.; Assaf, E.; Wolfe, G. M.; Williamson, C. J.; Weinzierl, B.; Tilmes, S.; Thompson, C.; Thames, A. B.; Schroder, J. C.; Saiz-Lopez, A.; Rollins, A. W.; Roberts, J. M.; Price, D.; Peischl, J.; Nault, B. A.; Møller, K. H.; Miller, D. O.; Meinardi, S.; Li, Q.; Lamarque, J.; Kupc, A.; Kjaergaard, H. G.; Kinnison, D.; Jimenez, J. L.; Jernigan, C. M.; Hornbrook, R. S.; Hills, A.; Dollner, M.; Day, D. A.; Cuevas, C. A.; Campuzano-Jost, P.; Burkholder, J.; Bui, T. P.; Brune, W. H.; Brown, S. S.; Brock, C. A.; Bourgeois, I.; Blake, D. R.; Apel, E. C.; Ryerson, T. B. Global airborne sampling reveals a new dimethyl sulfide oxidation mechanism in the marine atmosphere. *P. Natl. Acad. Sci. USA.* **2020**, 117, 4505-4510, DOI:10.1073/pnas.1919344117

Pagonis, D.; Algrim, L. B.; Price, D. J.; Day, D. A.; Handschy, A. V.; Stark, H.; Miller, S. L.; de Gouw, J.; Jimenez, J. L.; Ziemann, P. J. Autoxidation of limonene emitted in a university art museum. *Environ. Sci. Technol. Lett.* **2019**, 6, 520-524, DOI:10.1021/acs.estlett.9b00425

Lee, A. K. Y.; Rivellini, L.; Chen, C.; Liu, J.; Price, D. J.; Betha, R.; Russell, L. M.; Zhang, X.; Cappa, C. D. Influences of primary emission and secondary coating formation on the particle diversity and mixing state of black carbon particles. *Environ. Sci. Technol.* **2019**, 53, 9429-9438, DOI:10.1021/acs.est.9b03064

Pagonis, D.; Price, D. J.; Algrim, L. B.; Day, D. A.; Handschy, A. V.; Stark, H.; Miller, S. L.; de Gouw, J.; Jimenez, J. L.; Ziemann, P. J. Time-resolved measurements of indoor chemical emissions, deposition, and reactions in a university art museum. *Environ. Sci. Technol.* **2019**, 53, 4794-4802, DOI:10.1021/acs.est.9b00276

Cappa, C. D.; Zhang, X.; Russell, L. M.; Collier, S.; Lee, A. K. Y.; Chen, C.; Betha, R.; Chen, S.; Liu, J.; Price, D. J.; Sanchez, K. J.; McMeeking, G.; Williams, L.; Onasch, T.; Worsnop, D.; Abbatt, J.; Zhang, Q. Light absorption by ambient black and brown carbon and its dependence on black carbon coating state for two California, USA cities in winter and summer. *J. Geophys. Res. - Atmos.*, **2019**, 124. DOI:10.1029/2018JD029501

Chen, C.; Chen, S.; Russell, L. M.; Liu, J.; Price, D. J.; Betha, R.; Sanchez, K.; Lee, A. K. Y.; Williams, L.; Collier, S. C.; Zhang, Q.; Kumar, A.; Kleeman, M.; Zhang, X.; Cappa, C. D. Organic aerosol particle chemical properties associated with residential burning and fog in wintertime San Joaquin Valley (Fresno) and with vehicle and firework emissions in summertime South Coast Air Basin (Fontana). *J. Geophys. Res. - Atmos.*, **2018**, 123, DOI:10.1029/2018JD028374

Betha, R.; Russell, L. M.; Chen, C.; Liu, J.; Price, D. J.; Sanchez, K.; Chen, S.; Lee, A. K. Y.; Collier, S. C.; Zhang, Q.; Zhang, X.; Cappa, C. D. Larger submicron particles for emissions with residential burning in wintertime San Joaquin Valley (Fresno) than for vehicle combustion in

summertime South Coast Air Basin (Fontana). *J. Geophys. Res. - Atmos.*, **2018**, 123, DOI:10.1029/2017JD026730

Sanchez, K. J.; Chen, C.; Russell, L. M.; Betha, R.; Liu, J.; Price, D. J.; Massoli, P.; Ziemba, L. D.; Crosbie, E. C.; Moore, R.; Muller, M.; Schiller, S. A.; Wisthaler, A.; Lee, A. K. Y.; Quinn, P. K.; Bates, T. S.; Porter, J.; Bell, T. G.; Saltzman, E. S.; Vaillancourt, R. D.; Behrenfeld, M. J. Substantial seasonal contribution of observed biogenic sulfate particles to cloud condensation nuclei. *Nat. Sci. Rep.*, **2018**, 8:3235. DOI:10.1038/s41598-018-21590-9

Li, W.; Li, L.; Chen, C.; Kacarab, M.; Peng, W.; Price, D.; Cocker III, D. R. The potential of select intermediate-volatility organic compounds (IVOCs) and consumer products for secondary organic aerosol (SOA) and ozone formation under relevant urban conditions. *Atmos. Environ.*, **2018**, 178, 109-117. DOI:10.1016/j.atmosenv.2017.12.019

Lee, A. K. Y.; Chen, C.; Liu, J.; Price, D. J.; Betha, R.; Russell, L. M.; Zhang, X.; Cappa, C. D. Formation of secondary organic aerosol coating on black carbon particles near vehicular emissions. *Atmos. Chem. Phys.*, **2017**, 17, 15055-15067. DOI:10.5194/acp-17-15055-2017

Kuang, X. M.; Scott, J. A.; da Rocha, G. O.; Betha, R.; Price, D. J.; Russell, L. M.; Cocker, D. R.; Paulson, S. E. Hydroxyl radical formation and soluble trace metal content in particulate matter from renewable diesel and ultra low sulfur diesel in at-sea operations of a research vessel. *Aerosol Sci. Technol.* **2017**, 51, 147-158. DOI:10.1080/02786826.2016.1271938

Betha, R.; Russell, L. M.; Sanchez, K.; Liu, J.; Price, D. J.; Lamjiri, M. A.; Chen, C.; Kuang, X. M.; da Rocha, G. O.; Paulson, S. E.; Miller, J. W.; Cocker, D. R. Lower NO_x but higher particle and black carbon emissions from renewable diesel compared to ultra low sulfur diesel in at-sea operations of a research vessel. *Aerosol Sci. Technol.* **2017**, 51, 123-134. DOI:10.1080/02786826.2016.1238034

Tang, X.; Price, D. J.; Praske, E. J.; Vu, D. N.; Purvis-Roberts, K. L.; Silva, P. J.; Cocker III, D. R.; Asa-Awuku, A. Cloud condensation nuclei (CCN) activity of aliphatic amine secondary aerosol. *Atmos. Chem. Phys.* **2014**, 14, 5959-5967. DOI:10.5194/acp-14-5959-2014

Tang, X.; Price, D. J.; Praske, E. J.; Lee, S.; Shattuck, M. A.; Purvis-Roberts, K. L.; Silva, P. J.; Asa-Awuku, A.; Cocker III, D. R. NO_3 radical, OH radical and O_3- initiated secondary aerosol formation from aliphatic amines. *Atmos. Environ.* **2013**, 72, 105-112. DOI:10.1016/j.atmosenv.2013.02.024

Silva, P. J.; Erupe, M. E.; Price, D.; Elias, J.; Malloy, Q. G. J.; Li, Q.; Warren, B.; Cocker III, D. R. Trimethylamine as precursor to secondary organic aerosol formation via nitrate radical reaction in the atmosphere. *Environ. Sci. Technol.* **2008**, 42, 4689-4696. DOI:10.1021/es703016v

PRESENTATIONS

Platform Presentations

Price, D. J.; Day, D. A.; Pagonis, D.; Stark, H.; Handschy, A.; Algrim, L.; Liu, S.; Krechmer, J.: Hunter, J.; Miller, S.; de Gouw, J.; Ziemann, P. J.; Jimenez, J. L. The Budgets of Organic Carbon Composition and Oxidation Plus Sources of Gas-Phase Species in Indoor Air. University of Utah – Department of Atmospheric Sciences Graduate Seminar, Salt Lake City, 2019.

Price, D. J.; Day, D. A.; Pagonis, D.; Stark, H.; Handschy, A.; Algrim, L.; Miller, S.; de Gouw, J.; Ziemann, P. J.; Jimenez, J. L. Indoor air measurements of organic carbon and source

identification in an art museum using chemical ionization mass spectrometry and positive matrix factorization. CIMS Users Meeting, Boulder, 2019.

Price, D. J.; Pagonis, D.; Algrim, L.; Handschy, A.; Miller, S.; Stark, H.; Day, D. A.; de Gouw, J.; Ziemann, P. J.; Jimenez, J. L. Identification of Sources of Trace Gases in an Art Museum using Mass Spectrometry and Positive Matrix Factorization. ISIAQ Indoor Air Conference, Philadelphia, 2018.

Price, D. J.; Day, D. A.; Jimenez, J. L. Positive matrix factorization of CIMS data sets. Front Range Chemical Ionization Mass Spectrometer Users' Meeting, Boulder, 2018.

Price, D. J. Atmospheric chemistry of aliphatic amines: Reaction mechanisms and temperature effects. Atmospheric Chemistry Program Seminar, University of Colorado, Boulder, 2017.

Price, D. J.; Cocker III, D. R. Characterization of the oxidation chemistry of secondary aliphatic amines under dry and humid conditions. American Association for Aerosol Research (AAAR) 34th Annual Conference, Minneapolis, 2015.

Price, D. J. Environmental chamber studies of reduced nitrogen compounds observed in anthropogenic emissions. Dissertation Defense, Riverside, 2015.

Price, D. J.; Kacarab, M. E.; Cocker III, D. R. The effects of temperature and relative humidity on the formation of secondary organic aerosol from amine precursors. American Chemical Society (ACS) National Meeting, San Francisco, 2014.

Price, D. J. University of California Riverside – Department of Chemical and Environmental Engineering (UCR-CEE) Graduate Student Symposium, Riverside, 2011-2014.

Price, D. J. Application of selected ion flow tube mass spectrometry (SIFT-MS) to atmospheric processes studies. Syft User Meeting, Columbus, 2014.

Price, D. J.; Tang, X.; Purvis-Roberts, K. L.; Silva, P. J.; Cocker III, D. R. Oligomer-like aerosol formation from the reactions of secondary and tertiary amines with hydroxyl and nitrate radicals. AAAR 31st Annual Conference, Minneapolis, 2012.

Price, D. J. Field and smog chamber studies of agricultural emissions and reaction products. Thesis Defense, Logan, 2010.

Price, D. J. Reactions of amines with O_3 and NO_x in a smog chamber to understand the ambient chemistry of amines measured in Cache Valley, Utah. Graduate Student Seminar, Utah State University, 2008.

Price, D. J.; Erupe, M. E.; Silva, P. J. Measurement of amines and other particulate composition over a six year period in Cache Valley, Utah. ACS NORM/RMRM Regional Meeting, Park City, 2008.

Poster Presentations

Price, D. J.; Pagonis, D.; Algrim, L.; Handschy, A.; Miller, S.; Stark, H.; Day, D. A.; de Gouw, J.; Ziemann, P. J.; Jimenez, J. L. The sources and budget of organic carbon in an art museum. Chemistry of Indoor Environments Conference, Boulder, 2018.

Price, D. J.; Chen, C.; Lamjiri, M. A.; Betha, R.; Russell, L. M.; Coffman, D.; Johnson, J.; Quinn, P.; Bates, T. Chemical composition of ambient and sea-sweep generated marine aerosol

measured over the North Atlantic during the NAAMES campaign. NAAMES science meeting, Corvallis, 2016.

Price, D. J.; Chen, C.; Lamjiri, M. A.; Betha, R.; Sanchez, K.; Liu, J.; Russell, L. M. Comparison of organic aerosol emissions from a marine vessel powered by ultra low sulfur diesel and hydrotreated vegetable oil. 33rd Informal Symposium on Kinetics and Photochemical Processes in the Atmosphere, Irvine, 2016.

Price, D. J.; Sanchez, K.; Liu, J.; Lamjiri, M. A.; Chen, C.; Betha, R.; Russell, L. M.; Cocker III, D. R.; Miller, J. W. Characterization of fresh and aged emissions from a marine vessel fueled with diesel and biodiesel. AAAR 34th Annual Conference, Minneapolis, 2015.

Price, D. J.; Betha, R.; Zhang, Y.; Lamjiri, M. A.; Russell, L. M. Instrumentation employed to measure chemical properties of atmospheric aerosols during NAAMES. NASA Langley Research Center, NAAMES planning meeting, Hampton, 2015.

Price, D. J.; Kacarab, M. E.; Cocker III, D. R.; Purvis-Roberts, K. L.; Silva, P. J. Effects of meteorological conditions on the formation of secondary organic aerosol from amine precursors. AAAR 33rd Annual Conference, Orlando, 2014.

Price, D. J.; Tang, X.; Cocker III, D. R.; Purvis-Roberts, K. L.; Silva, P. J. Reaction pathways of primary, secondary and tertiary amines with ozone, hydroxyl radical and nitrate radical. AAAR 32nd Annual Conference, Portland, 2013.

Price, D. J.; Cocker III, D. R. Environmental chamber studies of vehicle emissions: aging of vehicle exhaust and possible impacts from selective catalytic reduction (SCR) control technologies. UCTC conference, Los Angeles, 2013.

Price, D. J.; Tang, X.; Cocker III, D.R.; Purvis-Roberts, K. L.; Silva, P.J. Reaction mechanisms of secondary and tertiary amines with OH and NO_3 radicals. ACS National Meeting, San Diego, 2012.

Price, D. J.; Brown, R. S.; Moore, K. D.; Silva, P. J. Measurement of particulate matter during dairy operations in California. AAAR 28th Annual Conference, Minneapolis, 2009.

Price, D. J.; Silva, P. J. Analysis of the reactions of amines with O_3 and NO_x in a smog chamber to understand the ambient chemistry of amines measured in Cache Valley, Utah. 237th ACS National Meeting, Salt Lake City, 2009

Price, D. J. Analysis of the reactions of secondary tertiary amines with O_3 and NO_x using a proton transfer reaction – mass spectrometer and an aerosol mass spectrometer. Undergraduate Student Showcase, Utah State University, 2008.

Price, D. J.; Silva, P. J. Measurement of particulate composition over a five year period in Cache Valley, Utah. AAAR 26th Annual Conference, Reno, 2007.

AWARDS AND HONORS

- NASA Group Achievement Award, Atmospheric Tomography Mission, 2019
- American Association for Aerosol Research Student Poster Competition Winner, 2014
- University of California Transportation Center Graduate Fellowship Award, 2012
- Stephen E. Bialkowski Environmental Award, 2010

- B.S. Diploma cum laude, Utah State University, 2008
- Maeser-Bauer Outstanding Senior in Chemistry, 2008
- USU Department of Chemistry and Biochemistry Undergraduate Research Award, 2008
- USU College of Science Undergraduate Research MiniGrant Stipend, 2007
- Federal SMART Grant, 2006-2008

PROFESSIONAL AFFILIATIONS

- American Geophysical Union (2020 – present)
- American Association for the Advancement of Science (2012 – present)
- American Association for Aerosol Research (2010 – present)
- American Chemical Society, Analytical and Environmental Chemistry Divisions (2008 – present)
- The Honor Society of Phi Kappa Phi
- Golden Key International Honour Society