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## References

- AGA. 2015. "Gas Piping and Technology Committee (GPTC) Guide for Gas Transmission, Distribution, and Gathering Piping Systems." *Appendix 11 ANSI Z380.1-2015:IV-8*.
- API. 2016. "Underground Natural Gas Storage Integrity and Safe Operations."
- AQCC. 2017. Colorado Department of Public Health and Environment, Regulation 7, Control of Ozone via Ozone Precursors and Control of Hydrocarbons via Oil and Gas Emissions (Emissions of Volatile Organic Compounds and Nitrogen Oxides). edited by Colorado Air Quality Control Commission (AQCC).
- Brandt, A. , R. Garvin, A. Heath, and D. Cooley. 2016. "Methane Leaks from Natural Gas Systems Follow Extreme Distributions." *Environ. Sci. Technol.* 50 (20):12512-12520. doi: 10.1021/acs.est.6b04303.
- Brandt, A.R., G. A. Heath, E. A. Kort, F. O'Sullivan, G. Pétron, S. M. Jordaan, P. Tans, and J. Wilcox. 2014. "Methane Leaks from North American Natural Gas Systems." *Science* 343 (6172):733-735. doi: 10.1126/science.1247045.
- Brantley, H.L., E.D. Thoma, W.C. Squier, B.B. Guven, and D. Lyon. 2014. "Assessment of Methane Emissions from Oil and Gas Production Pads Using Mobile Measurements." *Environmental Science & Technology* 48 (24):14508-14515.
- CAPP. 2007. Best Management Practice: Management of Fugitive Emissions at Upstream Oil and Gas Facilities. Canadian Association of Petroleum Producers (CAPP).
- CARB. 2016. Aliso Canyon Natural Gas Leak, ARB's Final Estimate of the Aliso Canyon Natural Gas Leak. California Air Resources Board (CARB).
- Chattopadhyay, S. . 2008. "Application of Nanomaterials for Environmental Monitoring, Remediation and Challenges." International Environmental Nanotechnology Conference: Applications and Implications, Chicago, Illinois, October 7-9.
- Conley, S., G. Franco, I. Faloon, D.R. Blake, J. Peischl, and T.B. Ryerson. 2016. "Methane emissions from the 2015 Aliso Canyon blowout in Los Angeles, CA." *Science* 351 (6279):1317-1320.
- CPUC. 2017. Safety & Enforcement Division, Natural Gas Leakage Abatement, Summary of Best Practices, Working Group Activities And Revised Staff Recommendations. In *In partial fulfillment of Senate Bill 1371 (Leno, 2014) & Order Instituting Rulemaking (OIR) 15-01-008.*, edited by California Public Utilities Commission (CPUC).
- Epperson, D., M. Lev-On, H. Taback, J. Siegell, and K. Ritter. 2007. "Equivalent Leak Definitions for Smart LDAR (Leak Detection and Repair) When Using Optical Imaging Technology." *Journal of the Air & Waste Management Association* 57 (9):1050-1060.
- ERG. 2007. Emissions from Oil and Gas Production Facilities, Prepared for Texas Commission on Environmental Quality. Eastern Research Group, Inc. (ERG).
- Etminan, M., G. Myhre, E. J. Highwood, and K. P. Shine. 2016. "Radiative forcing of carbon dioxide, methane, and nitrous oxide: A significant revision of the methane radiative forcing." *Geophys. Res. Lett.* 43:12,614-12,623. doi: doi:10.1002/2016GL071930.
- Finley, Bruce, Aldo Svaldi, and Christopher Osher. 2017. "Severed gas line is blamed for fatal explosion; Colorado orders thousands of wells, miles of pipelines inspected." *Denver Post*, May 2, 2017. Accessed May 7, 2018. <https://www.denverpost.com/2017/05/02/firestone-explosion-oil-wells-pipelines-inspected/>.
- ICF International. 2016. Economic Analysis of Methane Emission Reduction Potential from Natural Gas Systems. Prepared for ONE Future Inc., Washington, DC. <http://www.onefuture.us/wp-content/uploads/2016/06/>

- IPCC. 2006. IPCC Guidelines for National Greenhouse Gas Inventories. In *National Greenhouse Gas Inventories Programme*, edited by et al. S. Eggleston. Japan: Intergovernmental Panel on Climate Change (IPCC).
- Kang, M., S. Christian, M.A. Celia, D.L. Mauzerall, M. Bill, A.R. Miller, Y. Chen, M.E. Conrad, T.H. Darrah, and R.B. Jackson. 2016. "Identification and characterization of high methane-emitting abandoned oil and gas wells." *Proceedings of the National Academy of Sciences (PNAS)* 113 (48):13636-13641.
- Karion, A., C. Sweeney, E.A. Kort, P.B. Shepson, A. Brewer, M. Cambaliza, S.A. Conley, K. Davis, A. Deng, M. Hardesty, and S.C. Herndon. 2015. "Aircraft-Based Estimate of Total Methane Emissions from the Barnett Shale Region." *Environmental Science & Technology* 49 (13):8124-8131.
- Karion, A., C. Sweeney, G. Pétron, G. Frost, M. Hardesty, J. Kofler, B.R. Miller, T. Newberger, S. Wolter, R. Banta, and A. Brewer. 2013. "Methane emissions estimate from airborne measurements over a western United States natural gas field." *Geophysical Research Letters* 40 (16):4393-4397.
- Kemp, C., A. Ravikumar, and A. Brandt. 2016. "Comparing Natural Gas Leakage Detection Technologies Using an Open-Source "Virtual Gas Field" Simulator, Department of Energy Resources Engineering, Stanford University." *Environ. Sci. Technol.* 50:4546–4553. doi: DOI: 10.1021/acs.est.5b06068.
- Lan, X., R. Talbot, P. Laine, and A. Torres. 2015. "Characterizing Fugitive Methane Emissions in the Barnett Shale Area Using a Mobile Laboratory." *Environmental Science & Technology* 49 (13):8139-8146.
- Lavoie, T.N., P.B. Shepson, M.O. Cambaliza, B.H. Stirm, A. Karion, C. Sweeney, T.I. Yacovitch, S.C. Herndon, X. Lan, and D. Lyon. 2015. "Aircraft-Based Measurements of Point Source Methane Emissions in the Barnett Shale Basin." *Environmental Science & Technology* 49 (13):7904-7913.
- Limits, Carbon. 2014. Quantifying Cost-effectiveness of Systematic Leak Detection and Repair Programs Using Infrared Cameras. edited by Clean Air Task Force.
- Marchese, A.J., T.L. Vaughn, D.J. Zimmerle, D.M. Martinez, L.L. Williams, A.L. Robinson, A.L. Mitchell, R. Subramanian, D.S. Tkacik, J.R. Roscioli, and S.C. Herndon. 2015. "Methane Emissions from United States Natural Gas Gathering and Processing." *Environmental Science & Technology* 49 (17):10718–10727. doi: DOI: 10.1021/acs.est.5b02275.
- Mitchell, A.L., D.S. Tkacik, J.R. Roscioli, S.C. Herndon, T.I. Yacovitch, D.M. Martinez, T.L. Vaughn, L.L. Williams, M.R. Sullivan, C. Floerchinger, and M. Omara. 2015. "Measurements of Methane Emissions from Natural Gas Gathering Facilities and Processing Plants: Measurement Results." *Environmental Science & Technology* 49 (5):3219–3227. doi: doi: 10.1021/es5052809.
- Munnings, C., and A. Krupnick. 2017. Comparing Policies to Reduce Methane Emissions in the Natural Gas Sector, Resources for the Future.
- NEA. 2018. Key Regulations and Goals on Short-Lived Climate Pollutants in Norway. Norwegian Environment Agency (NEA).
- NSW-EPA. 2015. Methane Fact Sheet. New South Wales, Australia Environmental Protection Agency (NSW-EPA).
- NTSB. 2011. Pacific Gas and Electric Company Natural Gas Transmission Pipeline Rupture and Fire, San Bruno, California, September 9, 2010. Washington, D.C.: National Transportation Safety Board (NTSB).
- NTSB. 2015. Natural Gas-Fueled Building Explosion and Resulting Fire. Washington, D.C.: National Transportation Safety Board (NTSB).
- OEPA. 2018. General Permit Program, Division of Air Pollution Control (DAPC). Ohio Environmental Protection Agency (OEPA).
- PDEP. 2013. Air Quality Program, General Plan Approval and/or General Operating Permit BAQ-GPA/General Permit 5 (GP-5), Natural Gas Compression and/or Processing Facilities. Pennsylvania Department of Environmental Protection (PDEP).
- PDEP. 2015. Air Quality Program, Frequently Asked Questions, General Permit-5 (GP-5) and Category No. 38 of Exemption Criteria. edited by Pennsylvania Department of Environmental Protection (PDEP).

- Pétron, G., A. Karion, C. Sweeney, B.R. Miller, S.A. Montzka, G.J. Frost, M. Trainer, P. Tans, A. Andrews, J. Kofler, and D. Helmig. 2014. "A new look at methane and nonmethane hydrocarbon emissions from oil and natural gas operations in the Colorado Denver-Julesburg Basin." *Journal of Geophysical Research: Atmospheres* 119 (11):6836-6852.
- Ravikumar, A.P., J. Wang, M. McGuire, C.S. Bell, D. Zimmerle, and A.R. Brandt. 2018. "Good versus Good Enough? Empirical Tests of Methane Leak Detection Sensitivity of a Commercial Infrared Camera." *Environmental Science & Technology*. doi: DOI: 10.1021/acs.est.7b04945.
- Ravikumar, A.P., J. Wang, and A.R. Brandt. 2017. "Are Optical Gas Imaging Technologies Effective For Methane Leak Detection?" *Environmental Science & Technology*, 51 (1), pp 718-724. DOI: 10.1021/acs.est.6b03906.
- Rella, C.W., T.R. Tsai, C.G. Botkin, E.R. Crosson, and D. Steele. 2015. "Measuring Emissions from Oil and Natural Gas Well Pads Using the Mobile Flux Plane Technique." *Environmental Science & Technology* 49 (7):4742-4748.
- Rieker, G. B. 2014. Frequency-comb-based remote sensing of greenhouse gases over kilometer air paths. *Optica* 1.
- Robertson, A.M. 2017. "Variation in Methane Emission Rates from Well Pads in Four Oil and Gas Basins with Contrasting Production Volumes and Compositions." *Environmental Science & Technology* 51 (15):8832-8840.
- Roscioli, J.R., T.I. Yacovitch, C. Floerchinger, A.L. Mitchell, D.S. Tkacik, R. Subramanian, D.M. Martinez, T.L. Vaughn, L. Williams, D. Zimmerle, and A.L. Robinson. 2015. "Measurements of methane emissions from natural gas gathering facilities and processing plants: measurement methods." *Atmospheric Measurement Techniques* 8 (5):2017.
- RPSEA. 2016a. "Mid-Continent Basin - Methane Emissions Reconciliation: Facility Level Emissions." RPSEA Onshore Technology Workshop, Denver, CO, May 26, 2016
- RPSEA. 2016b. "NETL In-house Air Emission Research Projects: Air Quality Impacts of Shale Development." RPSEA Onshore Technology Workshop, Denver, CO, May 26, 2016
- Schwietzke, S., G. Pétron, S. Conley, C. Pickering, I. Mielke-Maday, E.J. Dlugokencky, P.P. Tans, T. Vaughn, C. Bell, D. Zimmerle, and S. Wolter. 2017. "Improved Mechanistic Understanding of Natural Gas Methane Emissions from Spatially Resolved Aircraft Measurements." *Environmental Science & Technology* 51 (12):7286-7294.
- Thornton, City of. 2017. An Ordinance Repealing and Reenacting Article X of Chapter 18 of the Thornton City Code Pertaining to Oil and Gas Regulations and Making Conforming Amendments to Section 18-901 Definitions. edited by Colorado City of Thornton.
- Townsend-Small, A., T.W. Ferrara, D.R. Lyon, A.E. Fries, and B.K. Lamb. 2016. "Emissions of coalbed and natural gas methane from abandoned oil and gas wells in the United States." *Geophysical Research Letters* 43 (5):2283-2290.
- USDOT. 2018. General Pipeline FAQs, Basic information about the use of pipelines and their contents. In *Pipeline and Hazardous Materials Safety Administration*, edited by U.S. Department of Transportation: Washington, D.C.
- USEPA. 1971. Standards of Performance for New Stationary Sources Washington, D.C.
- USEPA. 2009. Mandatory Reporting of Greenhouse Gases. Washington, D.C.: U.S. Environmental Protection Agency (USEPA).
- USEPA. 2014. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015 Table A-134: 2014 Data and Calculated CH<sub>4</sub> Potential Emissions (Mg) for the Natural Gas Production Stage.
- USEPA. 2015a. Alternate Means of Control (AMOC) for Equistar Chemicals LP Bayport Polymers Facility (AMOC-6) and The Dow Chemical Company - Texas Operations (AMOC-8). Dallas, Texas: U.S. Environmental Protection Agency (USEPA) - Region 6.
- USEPA. 2015b. Greenhouse Gas Reporting Rule: 2015 Revisions and Confidentiality Determinations for Petroleum and Natural Gas Systems - Final Rule. In *Federal Register* Washington, D.C.: U.S. Environmental Protection Agency (USEPA).
- USEPA. 2015c. Technical Support Document - Optical Gas Imaging Protocol U.S. Environmental Protection Agency.

USEPA. 2016a. New Source Performance Standards (NSPS) for the Oil and Natural Gas Sector U.S. Environmental Protection Agency.

USEPA. 2016b. Oil and Natural Gas Industry Sources Covered by the 2012 New Source Performance Standards (NSPS) for Volatile Organic Compounds (VOCs) and the 2016 NSPS for Methane and VOCs, by Site. U.S. Environmental Protection Agency (USEPA).

USEPA. 2017a. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015 U.S. Environmental Protection Agency (USEPA).

USEPA. 2017b. USEPA Method 21 – Volatile Organic Compound Leaks. U.S. Environmental Protection Agency (USEPA).

UTDEQ. 2018. Division of Air Quality, On-line information regarding General Approval Order, Crude Oil and Natural Gas Well Site and Tank Battery. Utah Department of Environmental Quality (UTDEQ).

WYDEQ. 2017. Online Rule Information. Wyoming Department of Environmental Quality (WYDEQ).

Yacovitch, T.I., S.C. Herndon, G. Pétron, J. Kofler, D. Lyon, M.S. Zahniser, and C.E. Kolb. 2015. "Mobile Laboratory Observations of Methane Emissions in the Barnett Shale Region." *Environmental Science & Technology* 49 (13):7889-7895.

Zavala-Araiza, D., R.A. Alvarez, D.R. Lyon, D.T. Allen, A.J. Marchese, D.J. Zimmerle, and S.P. Hamburg. 2017. "Super-emitters in natural gas infrastructure are caused by abnormal process conditions." *Nature Communications* 8. doi: doi:10.1038/ncomms14012.

Zavala-Araiza, D., D.R. Lyon, R.A. Alvarez, K.J. Davis, R. Harriss, S.C. Herndon, A. Karion, E.A. Kort, B.K. Lamb, X. Lan, A.J. Marchese, S.W. Pacala, A.L. Robinson, P.B. Shepson, C. Sweeney, R. Talbot, A. Townsend-Small, T.I. Yacovitch, D.J. Zimmerle, and S.P. Hamburg. 2015. "Reconciling divergent estimates of oil and gas methane emissions." *Proceedings of the National Academy of Sciences (PNAS)* 112 (51):15597-15602.

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