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Direct Measurements of the Ozone Forming Potential from Dairy Emissions using a transportable Smog Chamber

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Tropospheric ozone continues to be an air pollution problem in the United States, particularly in California, Texas, and across the eastern seaboard. The obvious sources of ozone precursors have been largely controlled over the past several decades, leading to the critical examination of secondary sources. In particular, California lawmakers are now considering regulations that will address agricultural sources of ozone precursors, including dairy farms. Some recent estimates state that dairy cattle are second only to on-road vehicles as a leading source of ozone precursor emissions in California's San Joaquin Valley. The objective of this work was to directly measure the ozone formation potential of dairy air directly at the source. A transportable "smog" chamber was constructed and validated using organic gases known to be present in dairy emissions. The ozone formation potential of emissions from 8 non-lactating dairy cows and their fresh waste was then directly evaluated in the field at an animal enclosure on the campus of the University of California. The results demonstrate that the majority of the ozone formation is explained by ethanol (EtOH) in the emissions from the dairy cows. Ozone formation potential is generally small, with less than 20 ppb of ozone produced

under typical conditions when EtOH concentrations were $\sim$200 ppb and NO_x concentrations were $\sim$50 ppb. Simulations carried out with a modified form of the Caltech Atmospheric Chemistry Mechanism verify that these results match our current understanding of atmospheric ozone formation potential. Based on these results, the ozone formation potential of emissions from dairy cattle in California seems to be lower than previously estimated.