

### **3.068 Sensitivity of Surface Ozone to Recent Increases of Volatile Organic Compound Emissions from the Growth of North American Oil and Natural Gas Industries.**

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Abstract:

After having peaked during 1970-1980 volatile organic compounds (VOC) had been steadily declining in many urban areas and at remote sites in the Northern Hemisphere (NH) mostly due to improved emission controls. In association with reductions of emissions of nitrogen oxides in most of the NH developed nations these atmospheric concentration changes have led to declining, respectively flattening, trends in tropospheric ozone in many densely populated urban and NH remote regions. A reversal of the previously observed declining NH atmospheric trends of light non-methane hydrocarbons occurred around 2009, and NH atmospheric NMHC have since been increasing at rates that are ~5 times faster than the previously observed declines. This increase in atmospheric NMHC has been primarily associated with increased emissions from the rapidly expanding oil and natural gas (O&NG) industry in North America. Emission trends were inferred from observed atmospheric concentrations and applied to the EMAC model to investigate the sensitivity of regional and large-scale changes in tropospheric ozone to the increased NMHC emissions. We find an average summer increase in surface ozone of up to 2.5 ppb near O&NG source regions from 2009 - 2014, and increases of >0.5 ppb extending far downwind over the North Atlantic, North Africa, and Middle East region. Furthermore, this added ozone production adds to occurrences of exceedance of the 70 ppbv National Air Quality Standard (NAAQS) in numerous U.S. non-attainment regions.