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Air Chemistry

## Natural Gas Production Impacts on levels of ozone in the Troposphere

### Summary of Problem/Impact

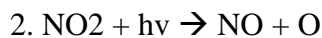
United States dependency on foreign oil and increased energy consumption has allowed significant growth to the natural gas industry. However, recently the clean air and water acts that regulated certain aspects of natural gas production has been deregulated in 2005 by the Bush administration to encourage fast growth to reduce dependency of foreign oil and be energy independent. It's this deregulation along with residents getting sick that has caused increased concerns about fracking fluid contaminants leaching into well water and "produced" water that is being evaporated in the air. By looking at what chemical compounds are in fracking fluid, we can get an idea of what chemical categories are increasing ozone near natural gas production areas.

### Chemistry

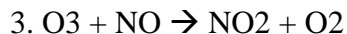
The formation of ozone in the troposphere results from only one known reaction: addition of atomic oxygen (O) to molecular oxygen (O<sub>2</sub>) in the presence of a third "body" (M). [M is any "body" with mass, primarily nitrogen or oxygen molecules, but also particles, trace gas molecules, and surfaces of large objects. M absorbs energy from the reaction as heat; without this absorption, the combining of O and O<sub>2</sub> into O<sub>3</sub> cannot be completed.]



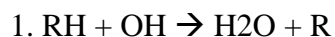
The oxygen atoms are produced primarily from photolysis of NO<sub>2</sub> by the ultraviolet portion of solar radiation (hν).



Reaction 3 converts ozone back to oxygen and NO back to NO<sub>2</sub>, completing the "nitrogen cycle."



### volatile organic cycle that produces ozone



2.  $R + O_2 + M \rightarrow RO_2 + M$
3.  $RO_2 + NO \rightarrow NO_2 + RO$
4.  $OH + HCHO \rightarrow H_2O + HCO$
5.  $HCO + O_2 \rightarrow HO_2 + CO$
6.  $HO_2 + NO \rightarrow NO_2 + OH$

### **Politics**

- Energy Policy Act of 2005 provided exemptions-no longer classified as “injection wells”
- FRAC act proposed in 2009 wants to put back on regulations to classify it as a injection well, this will fall under regulations under the clean water act then.
- EPA conducted a study in 2004 on the impacts of hydraulic fracturing but it was only for fluid below ground. Found uncertainties in how the fluid moves through rocks.
- EPA expected to have a new study done by 2012 and released in 2014. This will conduct impact reports for both above and below of natural gas impacts.