

NO_x Emissions from Switch Yard Locomotives Observed with the TRAX Air Quality Platform

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The locomotive industry plays an important role in the transport of people and products nationwide. Within locomotive rail yards, switch yard locomotives (“switchers”) are used to move freight trains around to facilitate the loading and unloading of cargo. Switchers have large diesel engines that are built to last a long time, but that also means that older diesel engines currently in operation lack modern pollution control technologies. Along Utah’s urbanized Wasatch Front the switchers are primarily older models that operate within Tier 0 or 0+ Environmental Protection Agency emission standards that have high nitrogen oxides (NO_x) emissions.

The TRAX (Utah light rail) based air quality measurement platform measures a suite of air pollutants and greenhouse gases (carbon dioxide [CO₂], methane [CH₄], ozone [O₃], fine particulate matter [PM_{2.5}]) and from June 2016-June 2017 the project was loaned a nitrogen dioxide (NO₂) analyzer to investigate the spatial patterns of NO₂ across the metropolitan area. The TRAX Green and Red lines travel adjacent to the Union Pacific rail yard in the central Salt Lake Valley and were thus fortuitously able to monitor emissions in this area. Averaged over time we observed high NO₂ concentrations, most likely due to emissions from switcher rail cars. Observations of co-located O₃ depletions due to titration provide further support for the measurements. Finally, we were able to isolate the contributions from the rail yard and the nearby I-15/I-80 interstate interchange by pairing NO₂ and CO₂ measurements.

Upgrading switcher engines to modern Tier 4 pollution control technology would reduce NO_x emissions by an estimated 90%, and would be within the range of emission reduction costs for area sources adopted by the Utah Air Quality Board. Should these upgrades occur, measurements from the TRAX air quality project could be used to observe emissions before and after these mitigation strategies to evaluate the real-world air quality improvements.

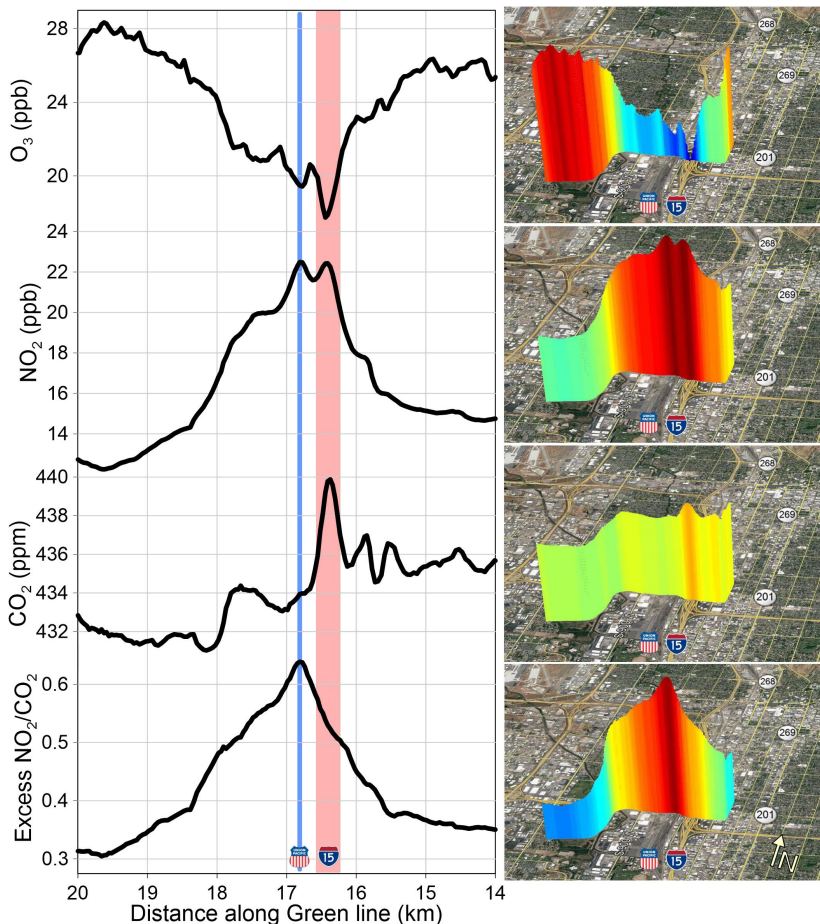


Figure 1. Relationships between species illustrating sources of NO₂ and CO₂ along a subsection of the Green TRAX line. The location of the Union Pacific rail yard and I-15 interstate highway are indicated with a blue line and red shading respectively in the left panel and with icons in both the left and right panels.