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# Policy options for the HRVOC emission trading program

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# Policy Options

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- Expand HRVOC trading program reactivity trading based allowance
- Expand HRVOC trading program to include highly reactive species such as chlorine and formaldehyde
- Expand HRVOC trading program to include fugitive emissions
- Reduce variability in emissions



# Background

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- HRVOCs include ethylene, propylene, butenes and 1,3-butadiene
- Cap and trade program involving ~80 facilities in Harris County begins in 2007
- Caps placed on non-fugitive sources of HRVOCs
- Caps will be very difficult to meet



# Proposal 1

- Current cap and trade program allows facilities to convert reductions in other VOC (OVOC) emissions into HRVOC credits on a reactivity weighted basis
- Conversion of OVOC emission reductions into HRVOC credits using an MIR scale is currently limited to 5% of HRVOC cap at each facility
- Proposal: eliminate or increase the cap on OVOC trading
- Air quality modeling analyses indicate that additional OVOC trading will NOT create ozone hot spots



# Specific analyses conducted in support of Proposal 1

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- Identify high and low-NO<sub>x</sub> sub-regions among facilities trading HRVOCs
- Assume all of the HRVOC/OVOC emissions are traded into a single region
- Run photochemical modeling

Wang, et al. “Photochemical Modeling of Emissions Trading of Highly Reactive Volatile Organic Compounds (HRVOCs) in Houston, Texas. Part 1. Potential for Ozone Hot Spot Formation and Reactivity Based Trading”, *Environmental Science and Technology*, 41, 2095-2102 (2007).



# Specific analyses conducted in support of Proposal 1

- **Will current program create ozone “hot spots”?** the simulations indicate that trading of HRVOC allowances between facilities resulted in less than 0.15 ppb (<0.13%) and 0.06 ppb (<0.06%) increases in predicted maximum, area-wide 1-h averaged and 8-h averaged ozone concentrations, respectively.
- **Will there be hot spots if OVOC trading is increased?** When emissions of HRVOCs are traded for other, less reactive emissions, on a reactivity weighted basis, air quality simulations indicate that daily maximum ozone concentrations increased by less than 0.3%.



# Proposal 2

- Analyses since TexAQS I in 2000 have indicated that industrial chlorine releases play a role in ozone formation in the HGA; best assessments are that in 2000, industrial chlorine releases were equivalent, in ozone formation potential, to 30-50 tons/day of NO<sub>x</sub> emissions. These emissions may have been reduced since 2000, but have not been included in air quality modeling analyses for the SIP
- Recent, and still controversial, interpretations of data from TexAQS I and TexAQS II suggest that primary emissions of formaldehyde (e.g., from flares) may play an important role in ozone formation



# Proposal 2

- Current cap and trade program allows facilities to convert reductions in other VOC (OVOC) emissions into HRVOC credits on a reactivity weighted basis; OVOCs could include primary emissions of formaldehyde and chlorine if they are properly inventoried
- Conversion of OVOC emission reductions into HRVOC credits is currently limited to 5% of HRVOC cap at each facility
- Proposal: eliminate or increase the cap on OVOC trading; develop better inventories of industrial chlorine and formaldehyde emissions
- Air quality modeling analyses indicate that including chlorine as an OVOC and allowing additional OVOC trading will NOT create ozone hot spots



# Specific analyses conducted in support of Proposal 2

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- Identify Cl emissions
- Trade Cl emissions, using an MIR scale, into high and low-NO<sub>x</sub> sub-regions
- Assume all of the Cl emissions are traded into a single region
- Run photochemical modeling

Wang, et al, “Photochemical Modeling of Emissions Trading of Highly Reactive Volatile Organic Compounds (HRVOCs) in Houston, Texas. Part 2. Incorporation of Chlorine Emissions”, *Environmental Science and Technology*, 41, 2103-2107 (2007).



# Specific analyses conducted in support of Proposal 1

- Will including Cl emissions in the trading program create ozone “hot spots”?

Decreases in peak 1-h averaged and 8-h averaged ozone concentrations associated with trading chlorine emissions for HRVOC allocations on a Maximum Incremental Reactivity (MIR) basis were up to 0.74 ppb (0.63%) and 0.56 ppb (0.61%), respectively. Air quality metrics based on population exposure decreased by up to 3.3% and 4.1% for 1-h and 8-h averaged concentrations. These changes are small compared to the maximum changes in ozone concentrations due to the VOC emissions from these sources (5-10 ppb for 8-h averages; up to 30 ppb for 1-h averages) and the chlorine emissions from the sources (5-10 ppb) for maximum concentrations over wide areas and up to 70 ppb in localized areas).



# Proposal 3

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- Current cap and trade program does not include fugitive releases; fugitive releases are now subject to a Leak Detection and Repair Program
- After the cap HRVOC emissions at capped facilities will be dominated by fugitives
- Proposal: Create a program to better inventory fugitive emissions using the HAWK camera, then allow HRVOC emission credits to be earned
- Air quality modeling analyses indicate that additional HRVOC trading, including fugitives, will NOT create ozone hot spots



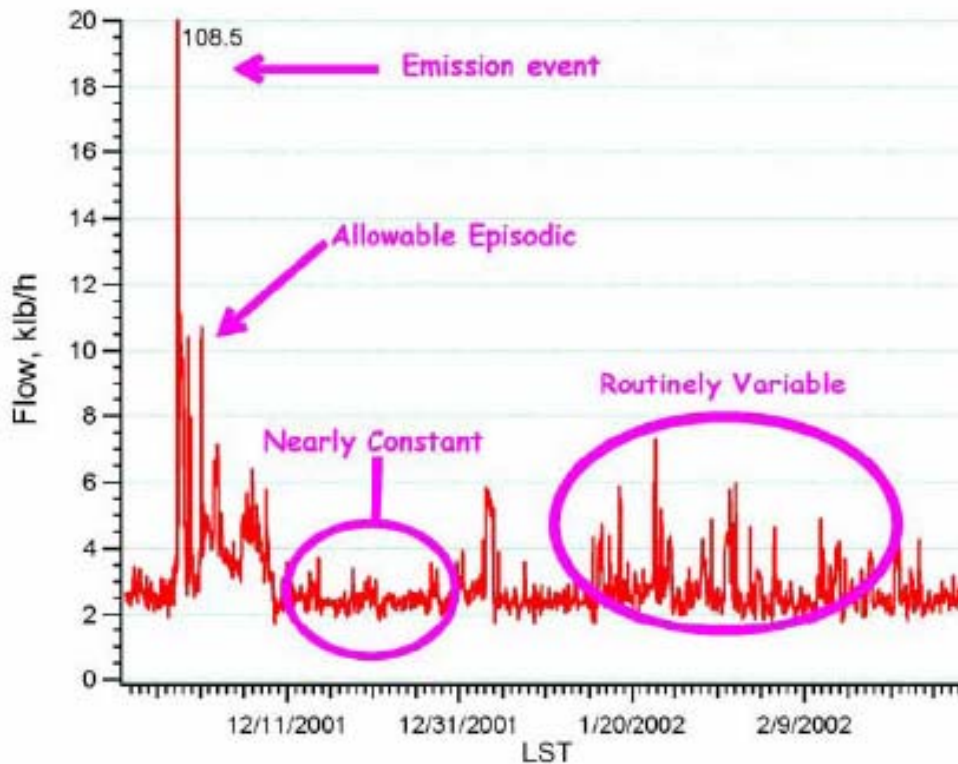
# Proposal 4: Reduce variability in HRVOC emissions

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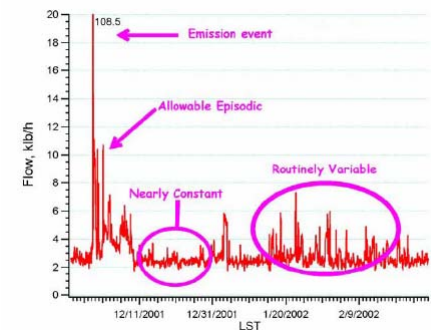
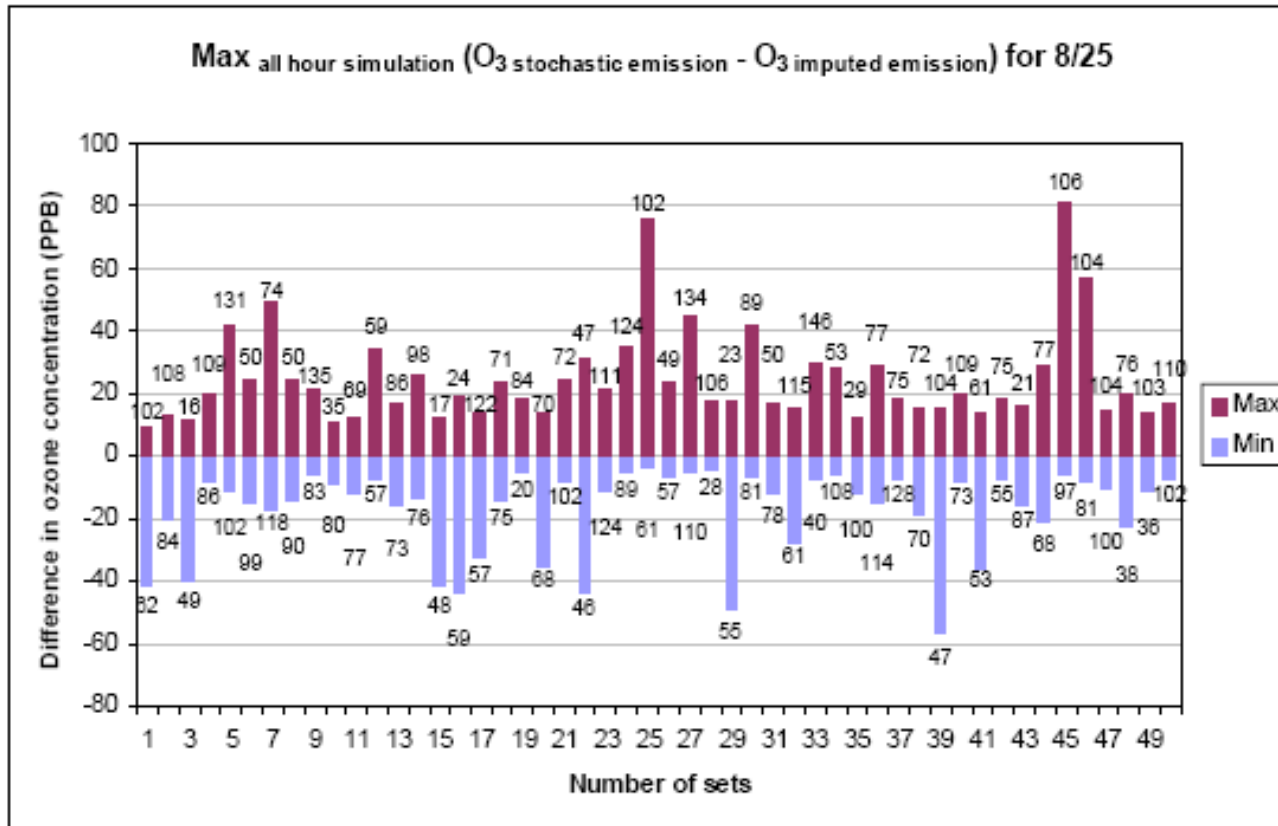
- Variability due to emission events – has the potential to cause ozone exceedances; events will be partially captured under HRVOC cap and trade program
- Variability in non-fugitive routine emissions is captured in HRVOC cap but reducing variability is not emphasized – routine variability has the potential to cause ozone exceedances



# Example of variability: Flow rate to a flare



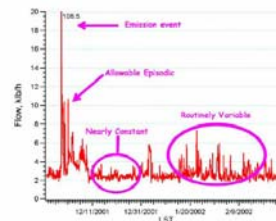
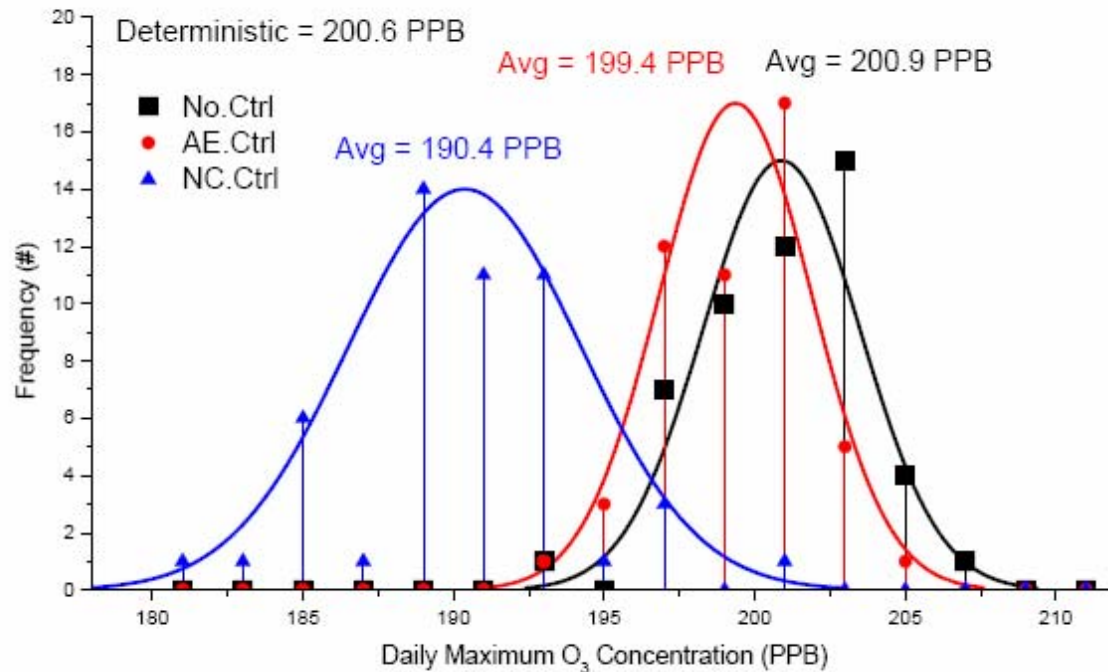
# Effect of non-event emission variability on ozone



M. Webster, et al., “The Effect of Variability in Industrial Emissions on Ozone Formation in Houston, Texas”, *Atmospheric Environment*, submitted (2007).



# Incorporating variability



# Find a mechanism to encourage reductions in reducing variability

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- Include all of the mass associated with event emissions in HRVOC cap?
- Other mechanisms to encourage a focus on reducing episodic emissions, such as flare minimization plans as in California?



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