Estimating Future Year Emissions and Control Strategy Effectiveness based on Hourly Industrial Emissions Data

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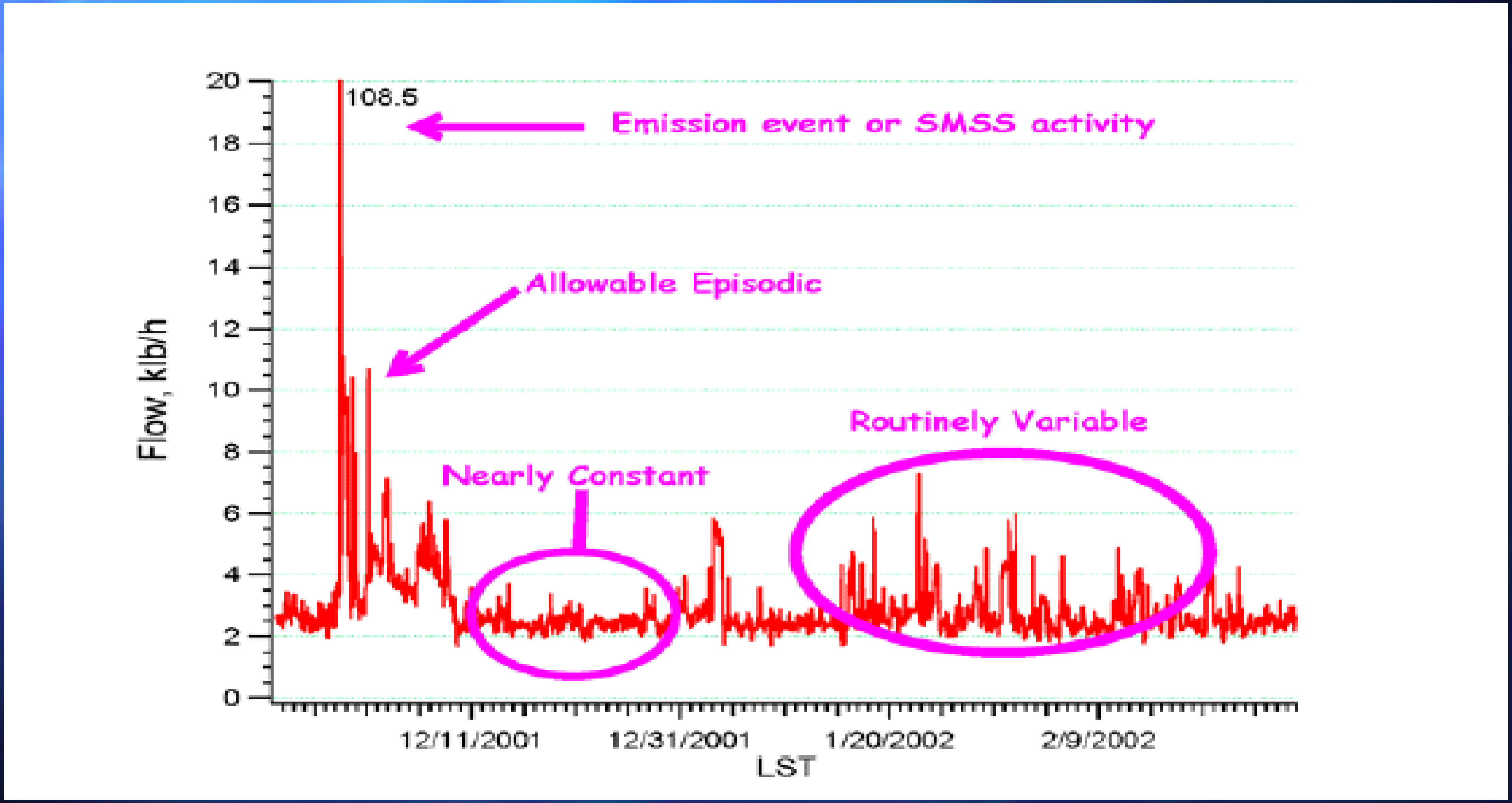
Background

- Current and future year emissions inventories and the effectiveness of emission control strategies are key areas of uncertainty for SIP initiatives
- Proposed project builds on previous HARC-sponsored H12 and H13 projects

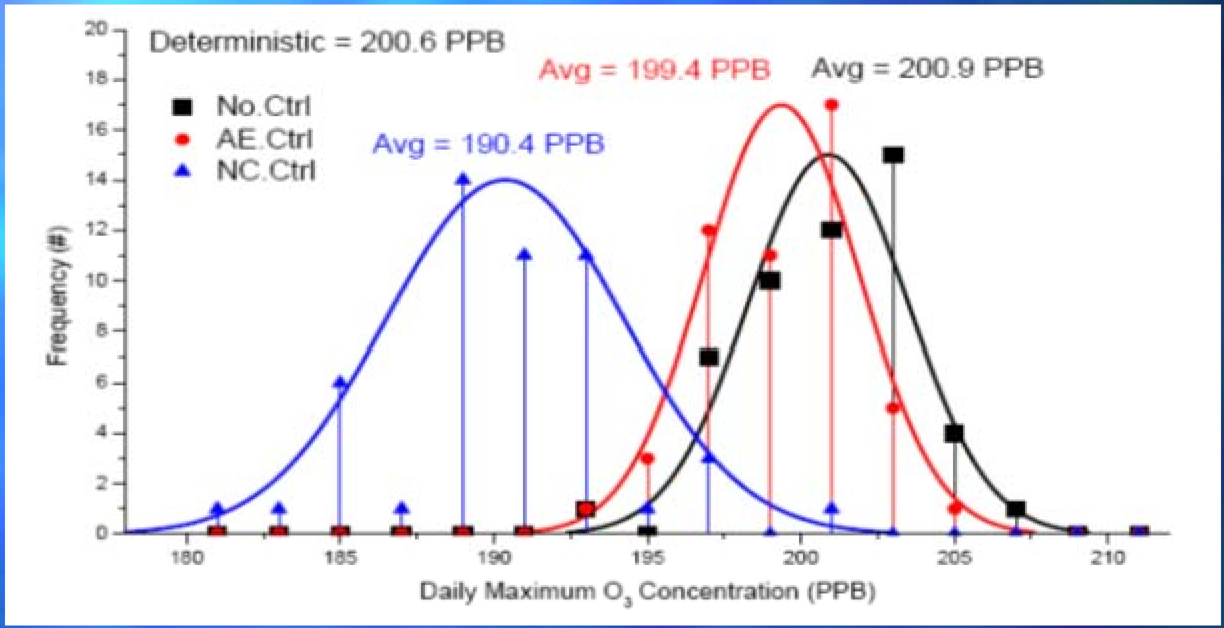
Emission Inventories

- Observational evidence and process data indicate temporal variability in point source VOC emissions
- Episodic emission events
  - Occur infrequently at any single facility, but multiple times per week collectively in the region
  - Small percentage predicted to lead to ozone increases of 10 ppb or more (Nam et al., 2006).
- Variable continuous emissions
  - Webster et al. (2007) characterized modes of routine hydrocarbon emissions for non-EGU industrial sources.
  - Nam et al. (2008) examined air quality implications of accounting for variability.

Example: Components of Mass Flow Rates to a Flare



Air Quality Implications:
Accounting for emissions variability can matter



Distribution of daily maximum ozone concentrations across the HG-1km domain for no control case (black), allowable episodic emissions controls (red), and nearly constant emission controls (blue). Emission reductions for the red case are 1.5 tons (VOC + NOx) and 11.5 tons for the blue case

Same magnitude of emissions reduction applied to deterministic inventory resulted in reduction of max daily ozone concentration of 0.1 ppb for red case (vs 1.5 ppb change with variable inventory) and 1.9 ppb for the blue case (vs. 10.5 ppb for the variable inventory).

Air Quality Implications
(from Nam et al. 2008)

- When emission variability is accounted for in air quality modeling, control of allowable episodic and nearly constant emissions are both predicted to be much more effective in reducing the expected value of daily maximum ozone concentrations than if similar reductions in the mass of emissions are made and constant emissions are assumed.

- The change in the expected value of daily maximum ozone concentration per ton of emissions reduced, when emissions variability is accounted for, is 5-10 times the change predicted when constant (deterministic) inventories are used.

- Strategies that eliminate the infrequent largest emissions are more effective at reducing the highest localized ozone concentrations than changes in nearly constant emissions.

Key Issues

- Stochastic inventories developed under H-12 and H-13 were based on a data set from a small number of flares and cooling towers.

- How can future case hourly emissions be projected?

- Will control strategy effectiveness, especially for flares, depend on whether all components of the time varying emissions are reduced equally or whether peak emission rates are curtailed?

Project Objectives and Tasks

- Model more extensive emissions variability data that is now available in the hourly emission inventory.
- Determine current temporal emission profiles for flares and identify types that lead to significant ozone formation.
- Evaluate assumptions about the effectiveness of control strategies and impacts on ozone concentrations (e.g., examine how the effectiveness of reducing peak emission rates compares to the effectiveness of reducing the nearly constant component of emissions).

Time Frame and Deliverables

- Deliverables:
  - Reports covering the temporal allocation of emissions by facility type, control strategy effectiveness as applied to variable emissions, and the air quality modeling.
- Time Frame
  - These reports will be delivered over an 18 month period. We will try to accommodate TCEQ requests for deliverables that may be relevant to SIP initiatives.