

# Hazardous Air Pollutants Benefits Assessment Houston-Galveston Case Study Benzene Emissions

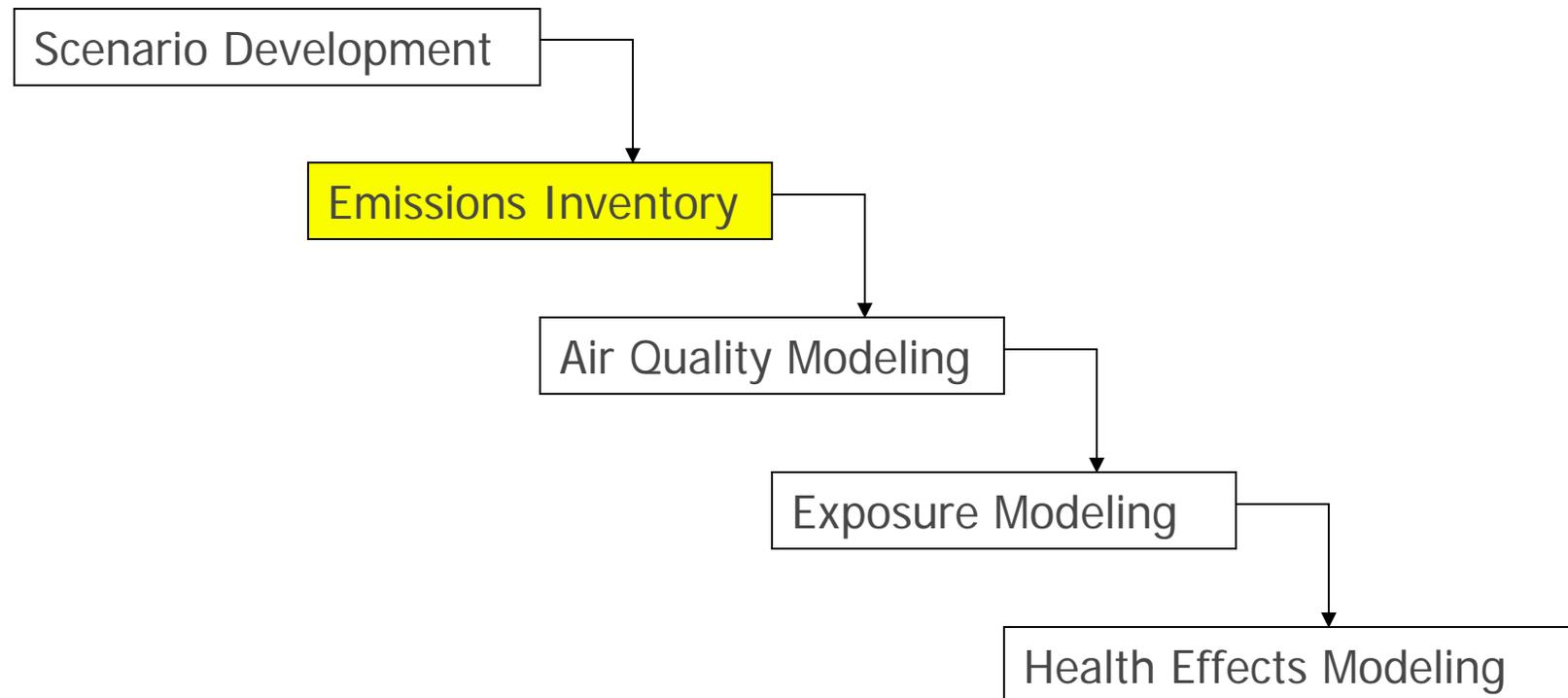
Presentation to the EPA Advisory  
Council on Clean Air Compliance  
Analysis

May 9, 2008

# Analytical Approach

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# Charge Question #2: Emissions Estimation

- ❖ Does the Council agree with the emission estimation approaches?
  - » Use of National Emissions Inventory
  - » Point, Nonpoint, On-road and Non-road approaches
  - » Attached Garages
  
- ❖ Any questions?

# Emission Estimation

## ❖ Point and Non-Point Sources

- » 1990 NEI for HAPs used for base year (1990) emissions estimates
- » Without-CAAA: 1990 NEI for HAPs used as base year file for estimating emissions for 2000, 2010, and 2020
- » With-CAAA: 2002 NEI used for 2000 and as the base year emissions file for 2010 and 2020 emission estimates
- » Non-point sources also includes aircraft, locomotives, commercial marine vessels

# Emission Estimation (Cont'd)

- ❖ On-Road Sources
  - » Generated seasonal hourly link-level (i.e., roadway segment) emissions data
  - » VMT estimates from HGAC and TTI for 2005
  - » Emissions factors from MOBILE 6.2
- ❖ Non-Road Sources (sources in NONROAD model only)
  - » Product of benzene speciation factors and VOC emissions estimates
  - » Speciation factors and fuel data inputs – EPA's NMIM
  - » VOC emissions from EPA's 2004 NONROAD model

# Base Year Point Source Data Set Selection

	EPA National Emission Inventory (1990, 2002)	Texas AQS Study (2000)
Pollutants:	Criteria plus HAPs	Criteria plus speciated VOC
Time Periods:	Annual, ozone season daily	Hourly emissions for August-September 2000 episode
Attributes Considered in Evaluation: Pollutant coverage Time period(s) Control device information Ability to be used in forecasts		

# Key On-Road Vehicle Modeling Methods

- ❖ Link-level data files from Aug-Sept episode (hourly)
  - » Weekday
  - » Friday
  - » Saturday
  - » Sunday
- ❖ Adjustments made:
  - » Four seasons
  - » Vehicle type allocation
  - » Typical day (weighted average)
  - » Our analysis years

# Attached Garage Emissions

- ❖ Nonroad sources
  - » Residential lawn and garden
  - » Recreational non-road vehicles
    - Exhaust
    - Evaporative
    - Refilling
- ❖ On-road vehicles (light-duty)
  - » Resting loss
  - » Diurnal loss
  - » Starts

# Emission Estimation - Results

## Houston-Galveston Benzene Emissions Summary (tons per year [tpy])

Sector	1990	2000		2010		2020	
		<i>without-CAAA</i>	<i>with-CAAA</i>	<i>without-CAAA</i>	<i>with-CAAA</i>	<i>without-CAAA</i>	<i>with-CAAA</i>
Point/Nonpoint	5,409	6,532	1,230	6,699	1,258	7,702	1,440
Nonroad	740	900	567	1,127	354	1,351	360
Onroad vehicles	2,375	1,541	762	1,449	328	1,988	282
Total	8,524	8,973	2,559	9,275	1,940	11,041	2,082

# CAAA-Associated Houston-Galveston Benzene Emission Reductions

	On-Road Vehicles	All Sectors Combined
1990-2000	68%	71%
2010	86%	79%
2020	88%	81%

# Key CAAA Programs in Reducing Houston-Galveston Area Benzene by Decade

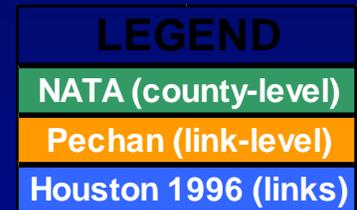
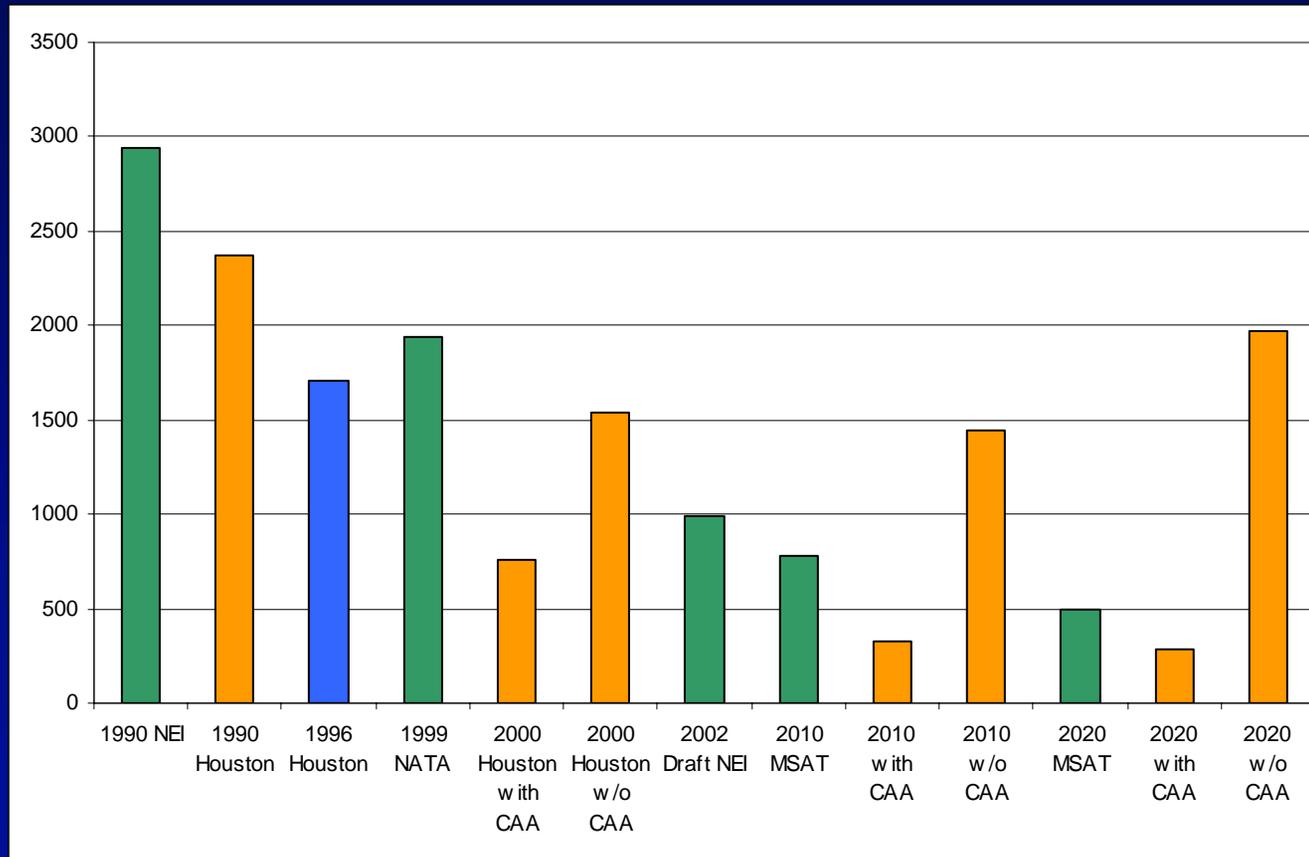
Sector	2000	2010	2020
Point/Nonpoint	MACT 1-hour O <sub>3</sub> measures	MACT 1 and 8-hour O <sub>3</sub> measures	?
Nonroad	Phase 1 SI engine standards	SI engine standards	SI engine standards
Onroad Vehicles	Federal RFG Tier 1/NLEV standards	Tier 2 and Fuel S limits	Tier 2 and Fuel S limits

## Percentage Contributions to Houston-Galveston Area Benzene Emissions with CAAA Scenario

Sector	1990	2000	2010	2020
Point/Nonpoint	63%	48%	65%	69%
Nonroad	9%	22%	18%	17%
Onroad Vehicles	28%	30%	17%	14%

- ❖ How does this study compare with other recent Houston-Galveston studies?

# Houston Onroad Emissions (tpy) by Inventory



# On-Road Vehicle Emissions Differences – This Study vs. Others

## ❖ Most Important Factors

- » Registration distributions
- » Fuel benzene summer levels
- » Recent reductions from control programs

## ❖ Least Important Factors

- » Vehicle speeds
- » I/M program assumptions
- » VMT fractions

# Uncertainties

- ❖ Baseline emissions inventories
- ❖ Categories incompletely characterized
  - » Portable fuel containers
  - » Tank and hose permeation
- ❖ MSAT rule emission reductions
- ❖ Vehicle cold temperature start effects
- ❖ Future growth rates and control factors

# Summary and Conclusions

- ❖ Benzene emissions have been reduced substantially by CAAA provisions since 1990
- ❖ For onroad and nonroad vehicles – further reductions are expected in future years
- ❖ Future changes in point/nonpoint source benzene in Houston-Galveston area depend on control approaches for 8-hour ozone
- ❖ Emission contribution by sector change dramatically by year