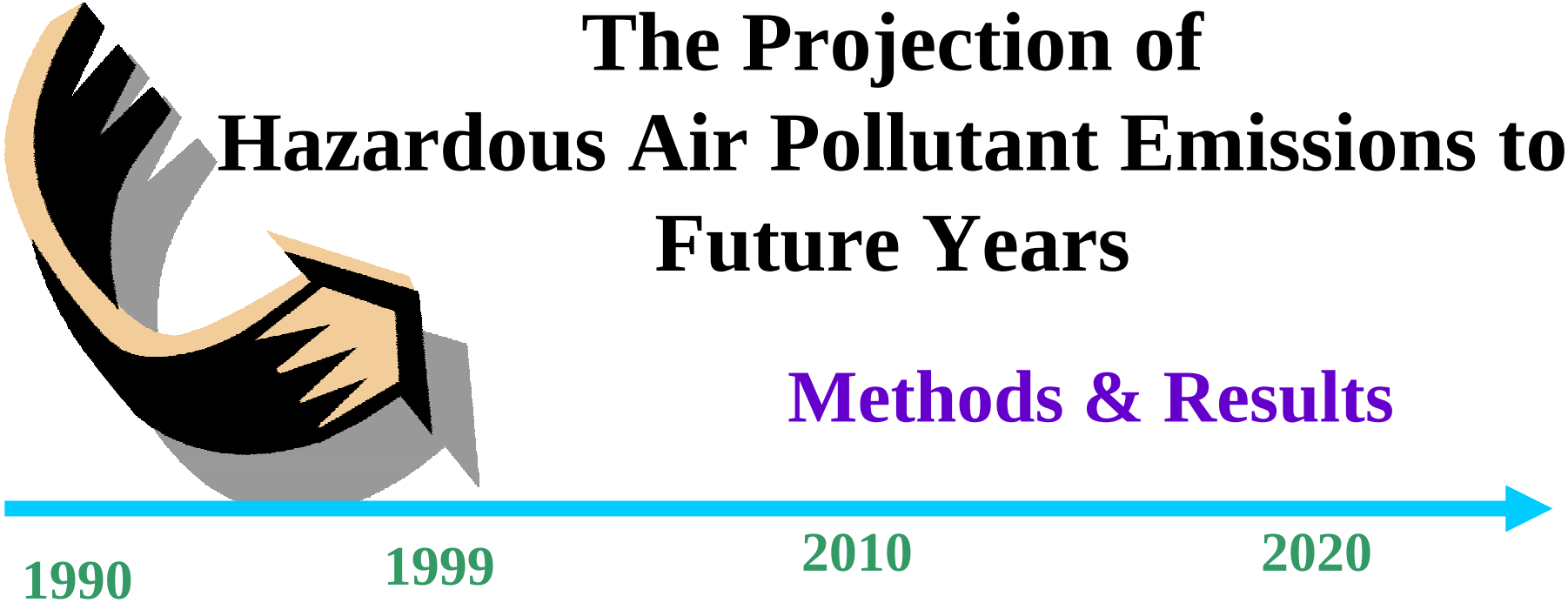
# The Projection of Hazardous Air Pollutant Emissions to Future Years

## Methods & Results

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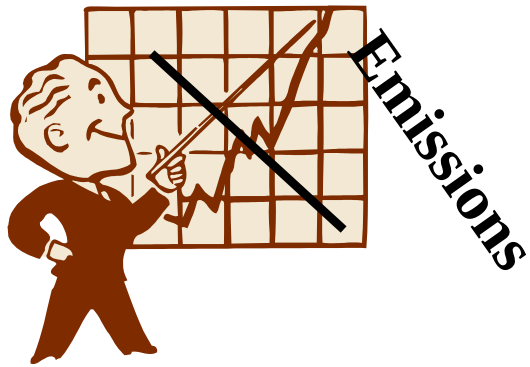
# Potential Uses of Projected Emissions for Hazardous Air Pollutants

- Show progress of programs
  - Promote our successes
  - Planning and reporting




- Help set priorities for future programs, along with other analyses
- Determine impacts of emission reduction strategies

# Procedure

# General Projection Equations

## Emissions-based

$$E_{future\ yr} = E_{base\ yr} * GF * \frac{(100\% - \%\ reduction)}{100}$$

## Activity-based

$$E_{future\ yr} = A_{base\ yr} * GF * EMF_{future\ yr}$$

***where***

The base year is **1999**, and

- GF = Growth Factor specific base year to a specific future year
- %reduction = reduction expected from CAA program
- A = activity
- EMF = emission factor in future year (incorporates reduction expected from CAA program)

# Data Used for Growth and Reductions

- Stationary sources:
  - Reductions: primarily from MACT/Section 129 Standards
  - Growth:  Economic models, fuel projections, sector-specific emission trends
- Mobile sources:
  - Reductions: motor vehicle standards, fuel controls, nonroad engines and equipment rules (both gas and diesel), motor vehicle inspection & maintenance programs.
  - Growth:  economic models, projected equipment populations, landing and takeoff forecasts

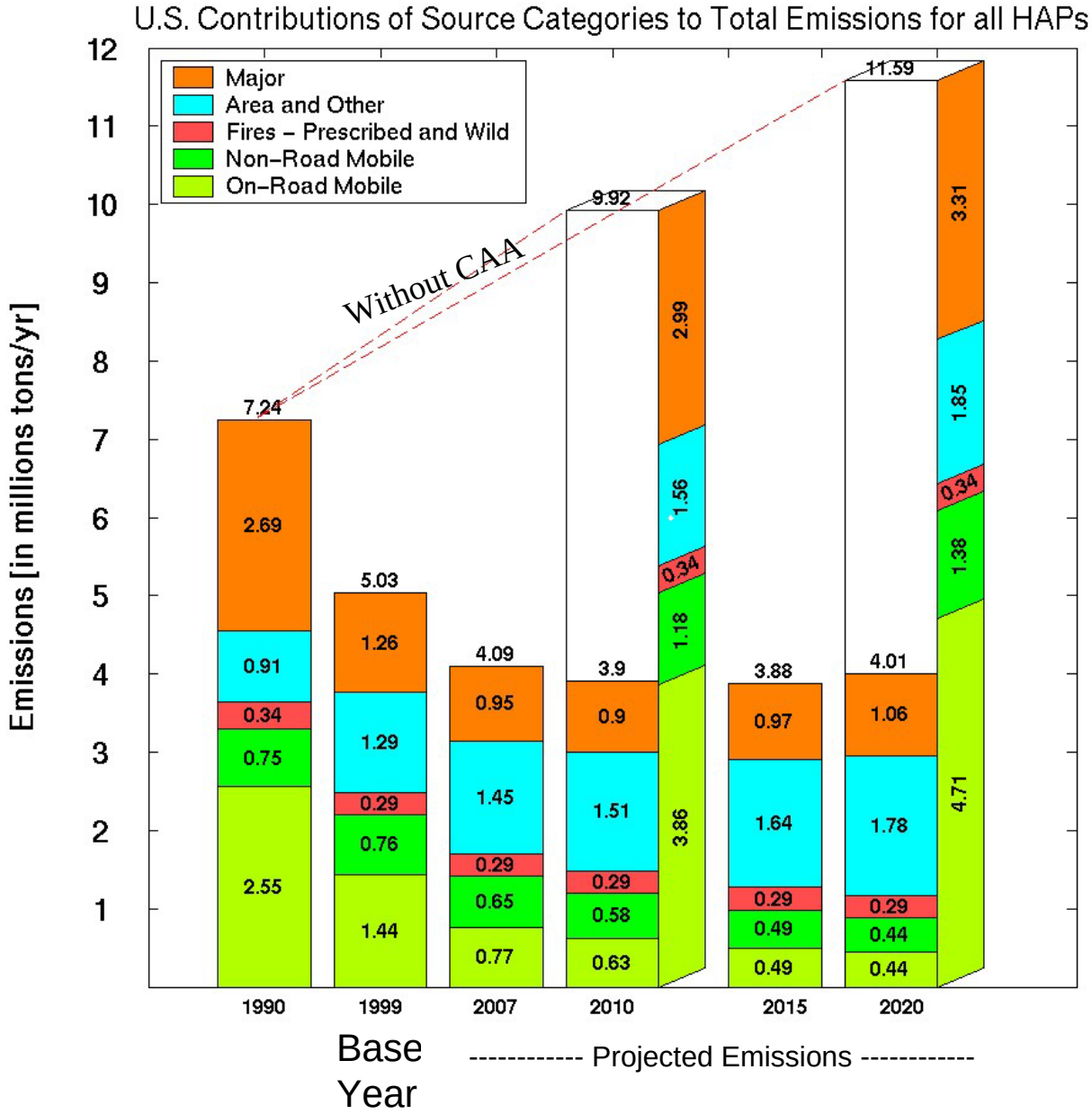
# Tools

- The 1999 NEI (same inventory used for 1999 NATA) is the base year inventory
- **Stationary sources:** Emission Modeling System for Hazardous Air Pollutants (EMS-HAP) assigns and applies growth and control factors
- **Mobile sources:** National Mobile Inventory Model (NMIM). Apply "projection ratios" to 1999 NEI by SCC/county/pollutant

# Results

- Emissions across all HAPs, aggregated by source sector
- Toxicity-weighted emissions for Cancer: emissions * unit risk estimate, aggregated by source sector
- Toxicity-weighted emissions for Noncancer (respiratory) effects:  emissions / reference concentration

# US (All 50 States) Emissions of HAPs by Source Sector

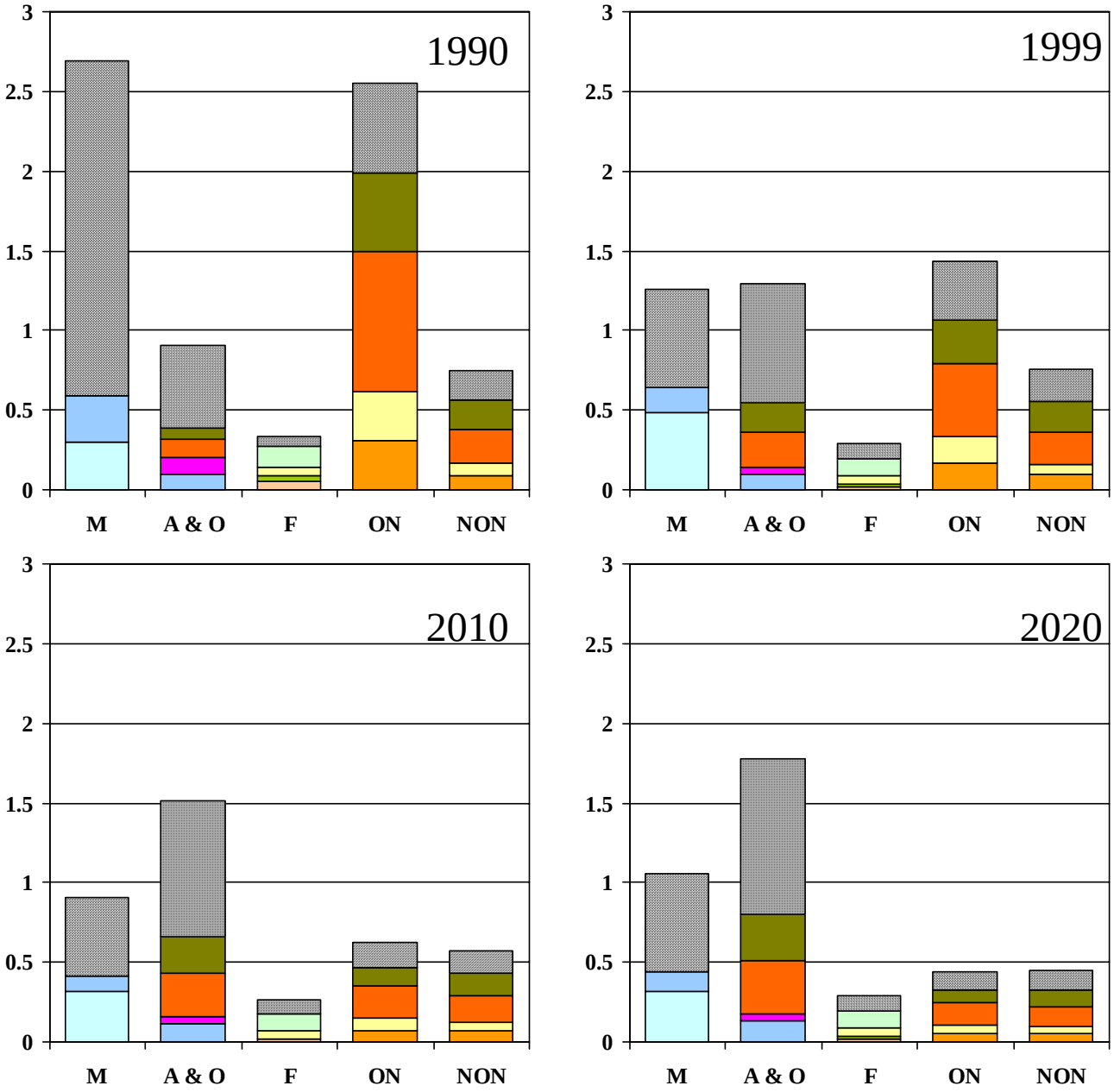



* After 2010, stationary source emissions are based only on economic growth. They do not account for reductions from ongoing toxics programs such as the urban air toxics program, residual risk standards and area source program, which are expected to further reduce toxics. In addition, mobile source reductions are based on programs currently in place. Programs currently under development will result in even further reductions.

## Key Findings

- CAA has been very effective in reducing overall tonnage of air toxics
- In absence of CAA, total emissions would be more than twice those projected in 2020

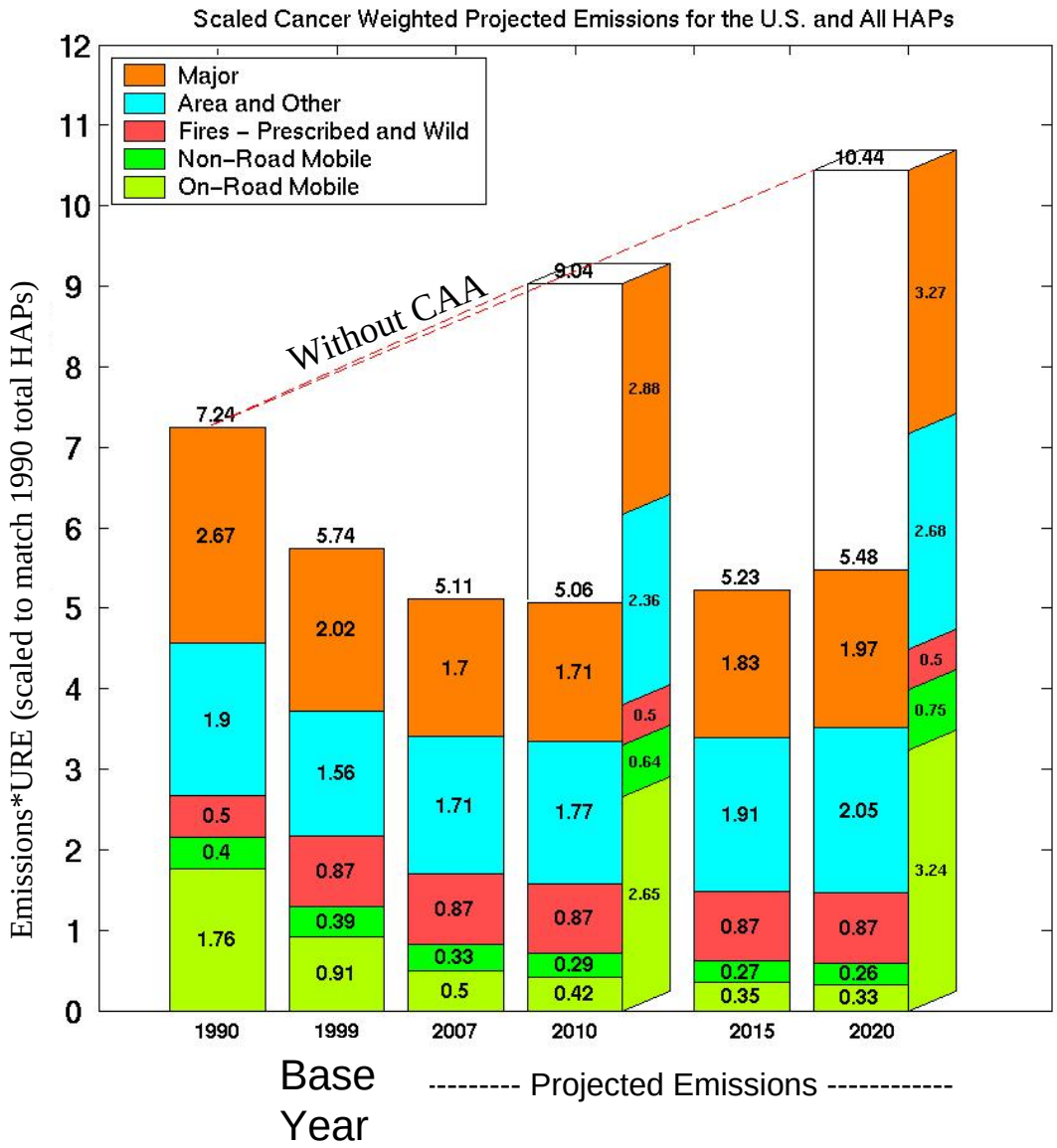
# HAP Contributions to Totals




**Key Findings:**

- No single HAP dominates
- HCl plays role in major sources
- Toluene plays role in mobile sources

# Toxicity-Weighted Emissions for Cancer for the U.S.

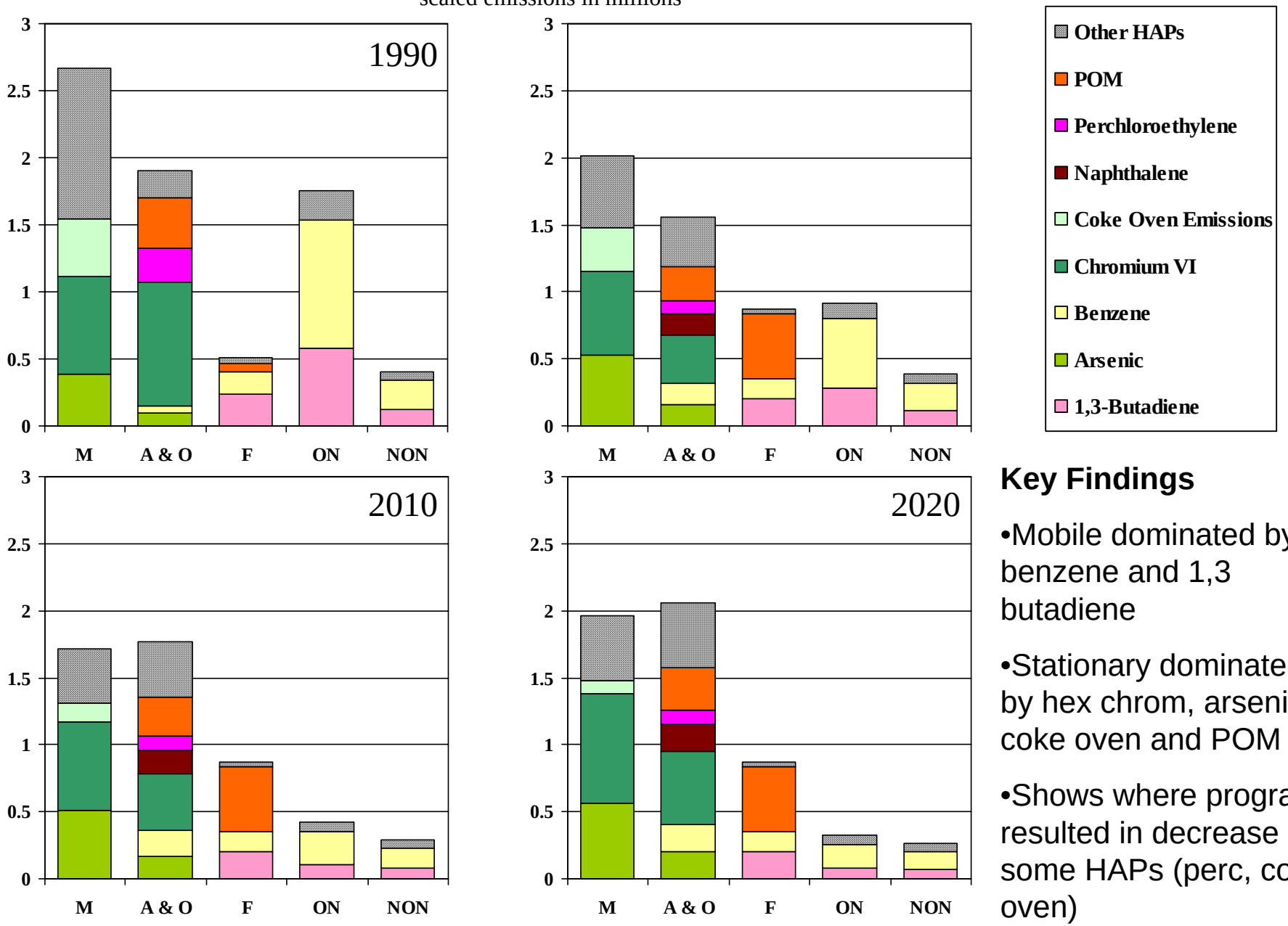



**Key Findings**

- MACT program effective in reducing overall tonnage, not as effective in reducing most toxic HAPs
- Initial area source efforts have reduced some of the most toxic HAPs (Perc and Chromium VI)
- Mobile source tox - weighted trends closely follow total HAP trends
- Fires plays larger role in toxicity-weighted situation; trends cannot be obtained due to methodology differences in emissions estimation. Apparent increase due to different treatment of PAH and is not an indication of increase in cancer risk.

# HAP Contributions to Tox-Weighted Emissions for Cancer

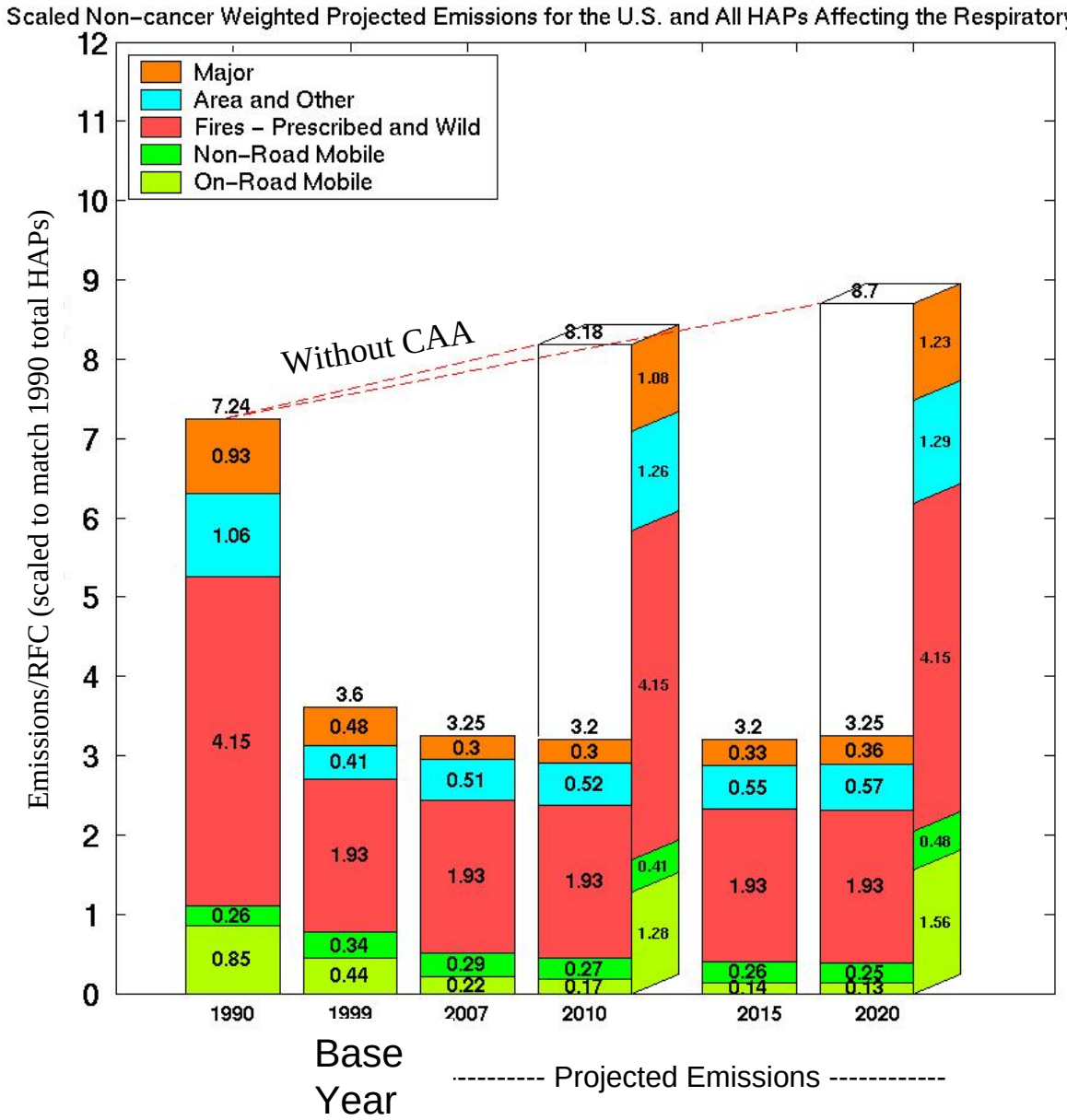
*scaled emissions in millions




## Key Findings

- Mobile dominated by benzene and 1,3 butadiene
- Stationary dominated by hex chrom, arsenic, coke oven and POM
- Shows where program resulted in decrease in some HAPs (perc, coke oven)

# Toxicity-Weighted Emissions for NonCancer

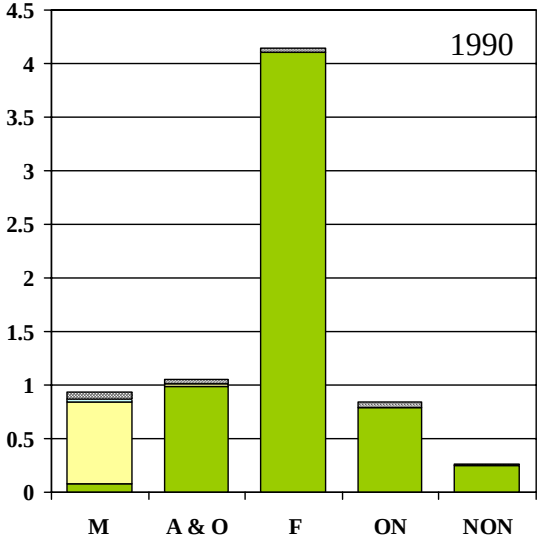


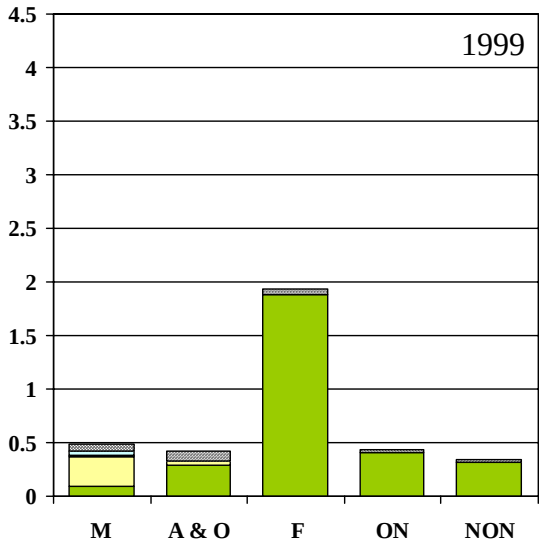

**Key Findings**

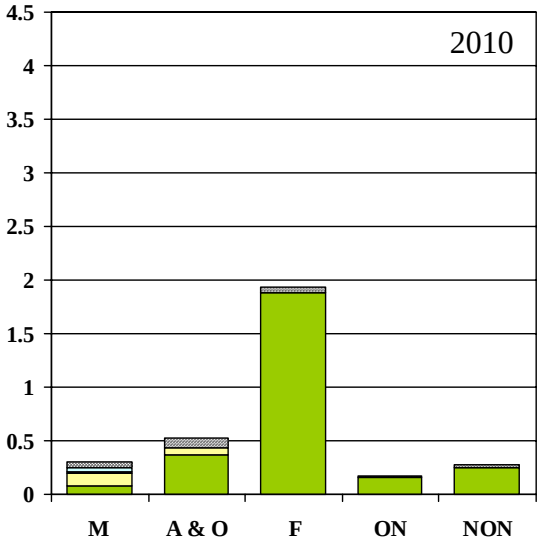
- MACT reductions larger for noncancer HAPs than total HAPs
- Area&other trend somewhat limited by methodology uncertainty
- Mobile source tox weighted trends closely follow total HAP trends
- Large decrease from 1990 to other years is primarily due to wildfires&prescribed burning due in part to methodology inconsistency
- Fire/burning is potentially an important contributor to noncancer risks

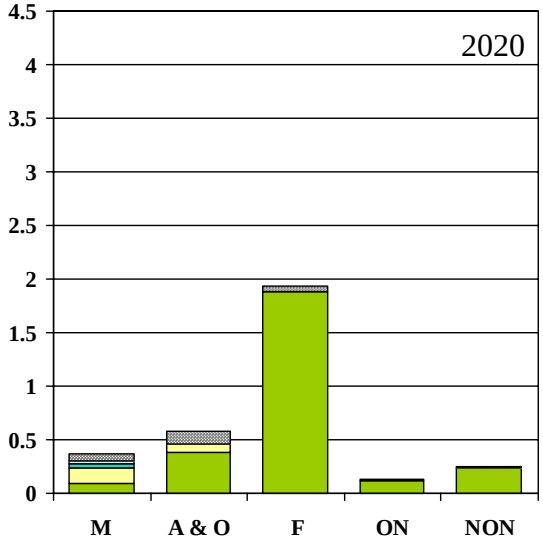
# HAP Contributions to Tox-Weighted Emissions for NonCancer

*scaled emissions in millions



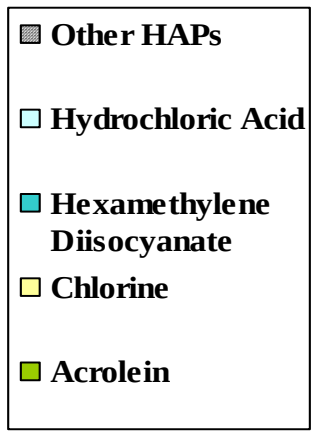




Key Findings:

- Acrolein dominates all categories except major. Trends in acrolein for fires and area&other may be more due to methodology than actual reductions/increases.
- Chlorine dominates major, reductions likely actual emission trends



# Uncertainties/Limitations

- Base year inventories:
  - 1990 inventory methodology inconsistent with 1999 inventory for some stationary source categories
  - Known errors in some categories (open burning)
  - Uncertainties in mobile source emission estimates
    - Nonroad and highway diesel engines
    - Nonroad activities
    - Allocation of mobile source activity to the local level
  - Proper population of MACT code to inventory records
- Growth factor information based on models for activity growth
- National-level estimates for MACT reductions
- Toxicity-weighted results account for chronic exposure, limited to inhalation pathway only

# Conclusions

- Projected hazardous air pollutant emissions from mobile and stationary sources
  - do not include residual risk, new area source standards, or mobile source programs currently being developed
- Clean Air Act Programs effective in reducing total and toxicity-weighted emissions
- Different sectors showed different levels of weighted and un-weighted reductions
  - Mobile source reductions appear to be including the most toxic HAPs
  - MACT program effective in reducing overall tonnage, but not as effective in reducing most toxic HAPs
  - Area source program and residual risk program are important in controlling future risks
- Fires/burning an important contributor to both cancer and noncancer risks, but better characterization of emissions needed