

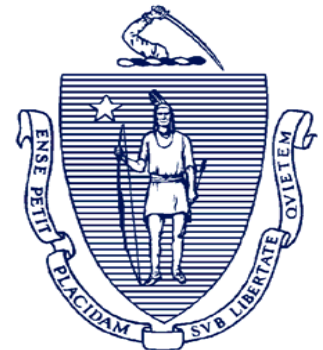
Power Plants and Air Quality

Presentation to
Cape Wind Stakeholder Group
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Hyannis, MA

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Topics to Cover

- Pollutants of concern and their impacts
- MA emission inventory and the impact of power production
- Comparison of emission levels for various power alternatives

Pollutants of Concern and Regulatory Standards

- Federal (US-EPA) - National Ambient Air Quality Standards (NAAQS)
 - Designed to be protective of public health & the environment
 - Sulfur dioxide (SO₂)
 - Particulate Matter
 - Carbon Monoxide
 - Ozone (NO_x and VOC)
 - Nitrogen dioxide (NO₂)

Pollutants of Concern and Regulatory Standards

- Ozone and PM_{2.5}
 - Existing standards and MA levels
- CO₂ and Hg - emerging issues

Overview of Power Plant Impacts

- Acid Deposition
- Climate Change
- Mercury
- Nitrification, Eutrophication
- Ozone
- PM 2.5
- Regional Haze
- Visibility

Health Effects of Exposure to Ozone

- Coughing



- Nose, and throat irritation



- Chest pain

- Reduced lung function



- Increased susceptibility to respiratory illnesses

- Aggravation of asthma

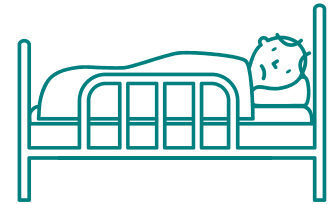
- Children and people with chronic lung diseases are particularly at risk



Health Effects of Exposure to Fine Particles



- Premature death
- Respiratory related hospital admissions and emergency room visits for cardiac and other conditions
- Aggravated asthma
- Acute respiratory symptoms
- Chronic bronchitis
- Decreased lung function (shortness of breath)
- People with existing heart and lung disease, as well as the elderly and children, are particularly at risk



Fine particles, or haze, impairs health and visibility

The Boston skyline on a clear day
(Jan. 12, 2001)



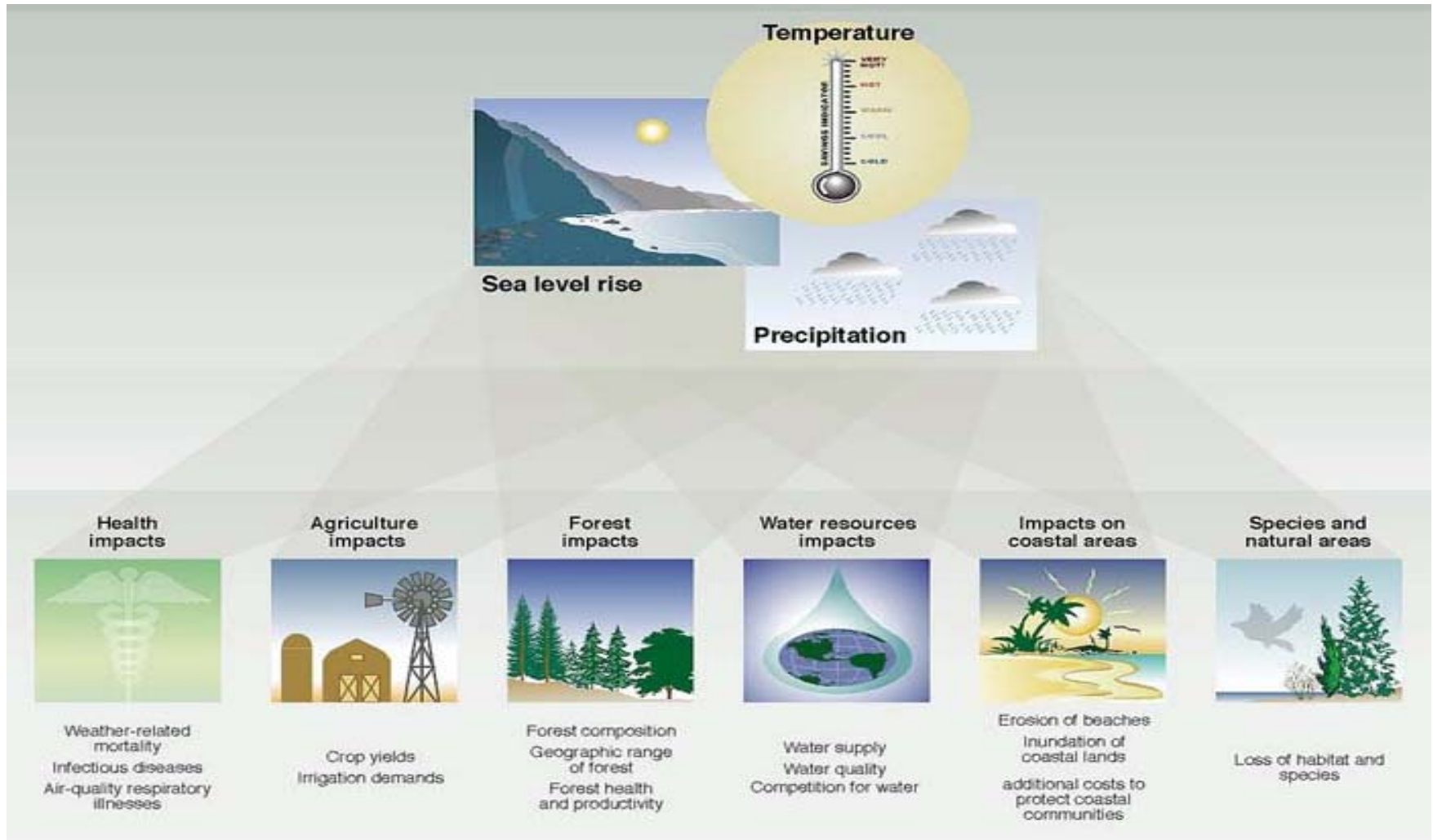
Hourly conc. of fine particles in the 9-11 $\mu\text{g}/\text{m}^3$ range

The Boston skyline on a hazy day
(March 8, 2001)



Hourly conc. of fine particles 55.4 $\mu\text{g}/\text{m}^3$

CO₂ emissions contribute to global climate change – which is projected to have serious and wide-ranging impacts on human health and the environment

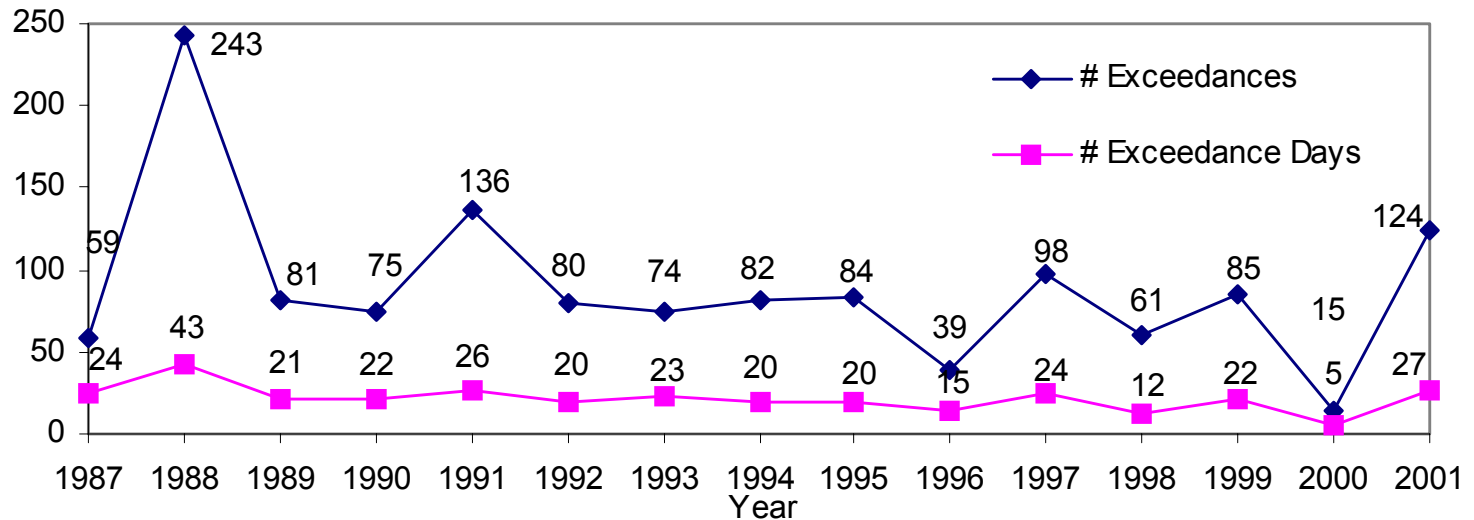


Mercury poses serious risks to human health and the environment

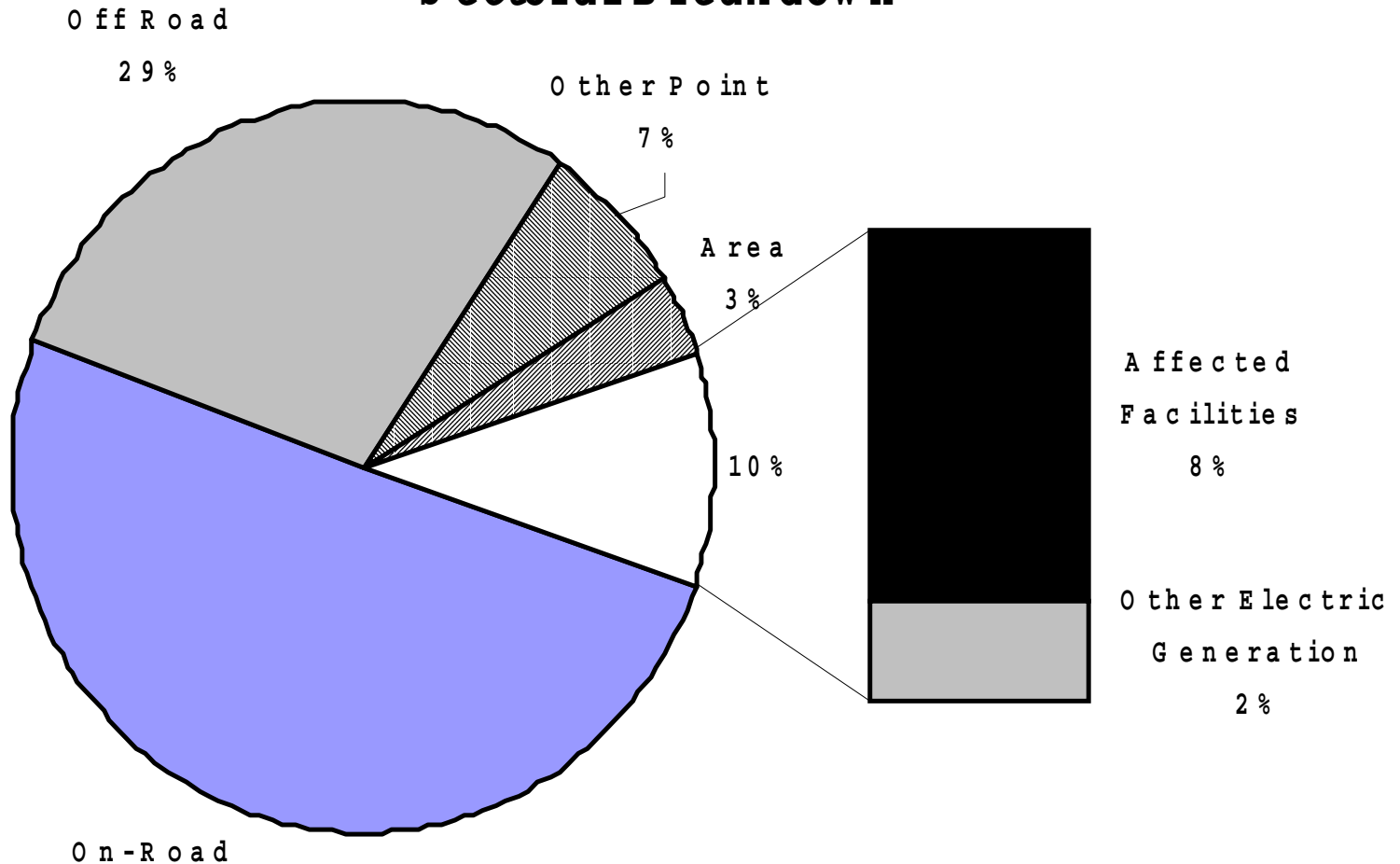
- Mercury bioaccumulates – concentrates – in fish and animals that eat them – including humans
 - 41 states now have mercury-based health advisories for fresh-water fish, including all New England states
- High dose exposures can cause serious neurological and developmental effects:
 - Mental retardation, limb deformities
 - Blindness, cerebral palsy, seizures
- Low dose exposures can cause:
 - Adverse developmental effects on attention, fine-motor functions, visual-spatial abilities and verbal memory
- Other possible effects: carcinogen, heart disease, adult immune system, and reproductive system

8-hr O₃ Exceedance Days & Total Exceedances 1987-2001

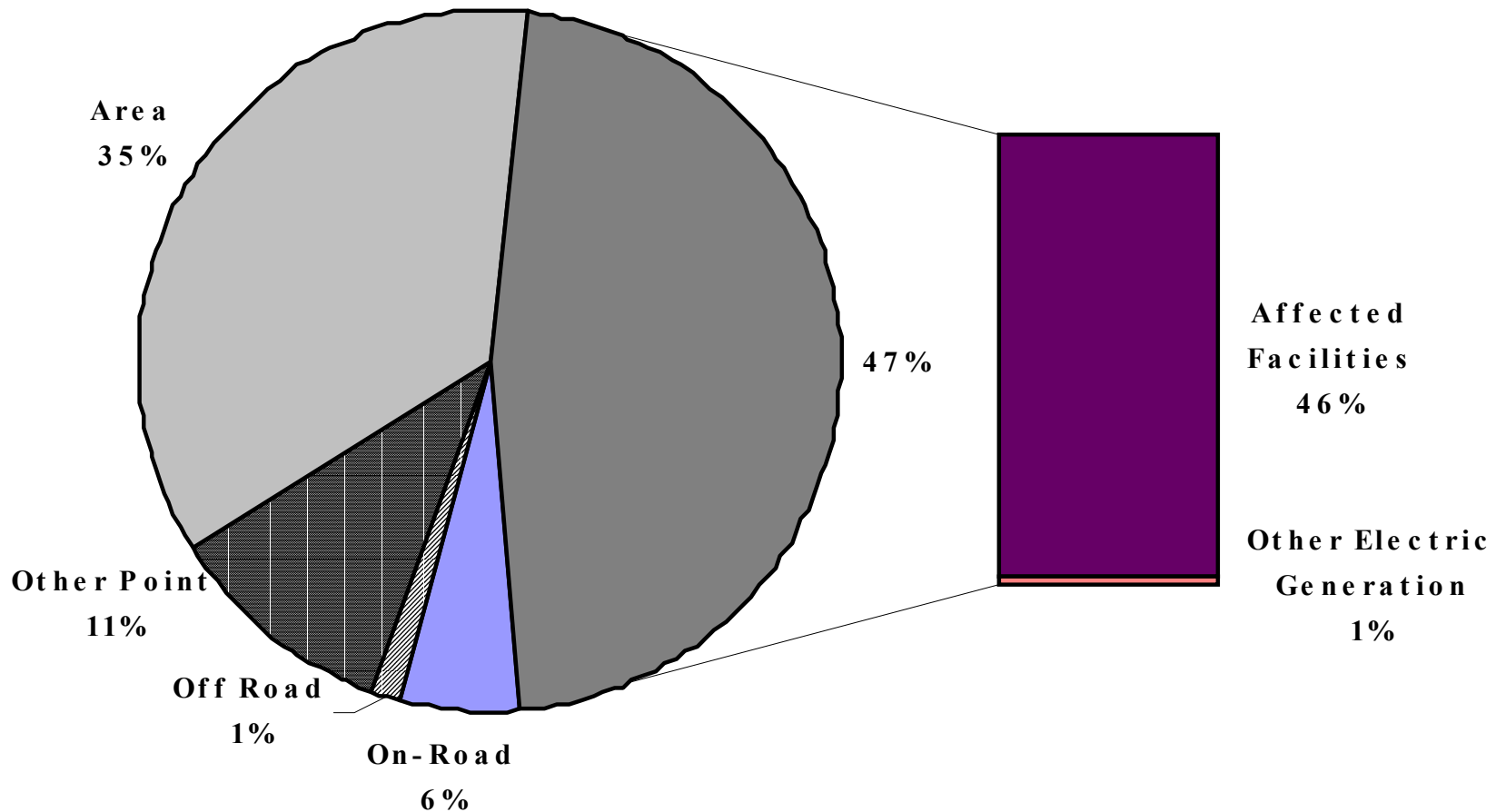
Ozone exceeded the 8-hour standard (0.085 ppm)



Massachusetts 1996 Daily NOx Emissions Sectoral Breakdown



Massachusetts 1996 SO₂ Emissions Sectoral Breakdown



Relative Emission Rates (Tons per Year)

Pollutant	Wind Facility	NEPOOL Marginal Rate
NO _x	0	599
SO ₂	0	1953
CO ₂	0	468,720

420 MW of generating capacity 1500 Hrs

Conclusions

- Electricity generation is a significant piece of the air pollutant emissions inventory.
- Renewable energy (including wind) projects produce electricity w/o the emissions of air contaminants typically emitted from fossil fuel fired electricity generating facilities.

Conclusions (Continued)

- Air quality benefits will result from renewable energy projects.
- Predicting where those improvements will occur is difficult to predict.
- Predicting the specific facility displaced by a new electricity generating facility (renewable or other) is difficult to predict