MARYLAND

Department of the Environment

The Climate Penalty

New Challenges to Cleaning up the Air

Tad Aburn, Director
Air and Radiation Management Administration, MDE

July 23, 2009

MDE

The Maryland Climate Action Plan

- Finalized in 2008
- Reports from 3 Working Groups
  - 42 recommended strategies on mitigation
  - 19 recommended strategies on Adaption
  - Effects of global warming on Maryland
- Other Issues:
  - The cost of inaction
  - Transition to a future Federal program

Adaptation Working Group

Rise in Sea Level

- Coastal Resources
- Impacts on people and nature

Loss of Aquatic Resources

- Chesapeake Bay Ecosystems
- Living Resources

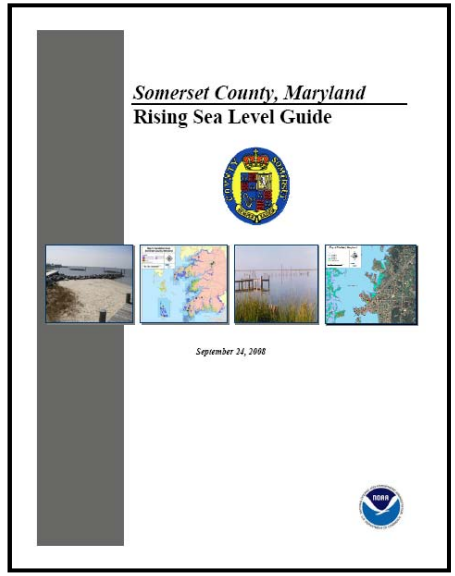
Potential for Extreme Weather

- Storm surges and floods
- Hurricane Isabel

Recommendations on Adaptation

19 recommendations

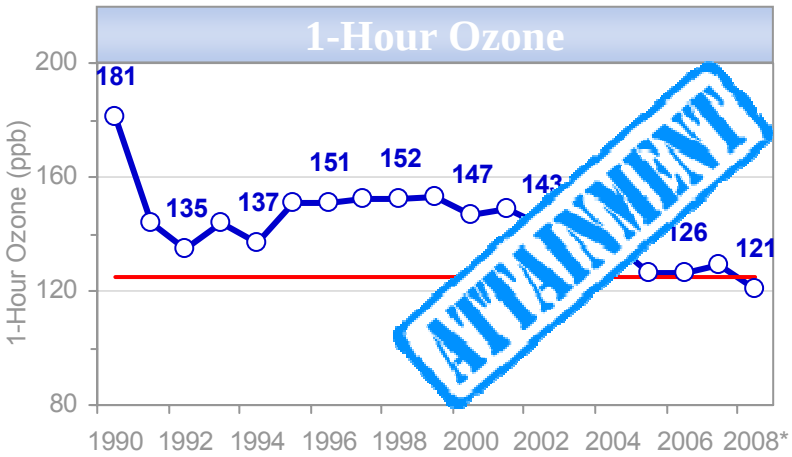
- Existing-Built Environment
- Future Growth & Development
- Human Health, Public Safety & Welfare
- Natural Resources & Resource-based Industries

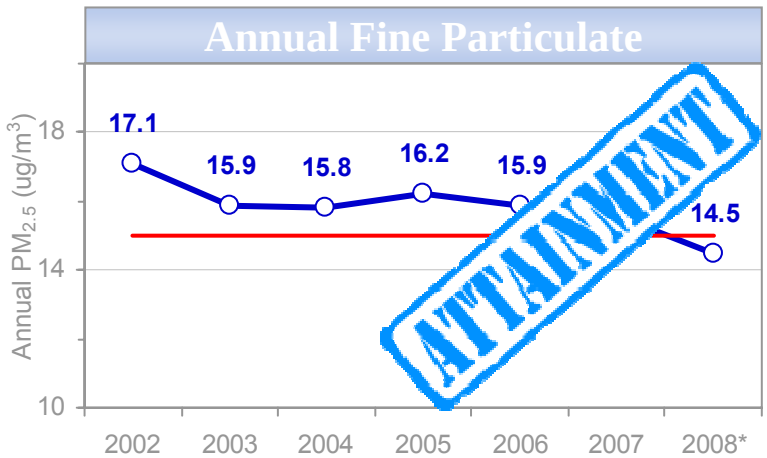


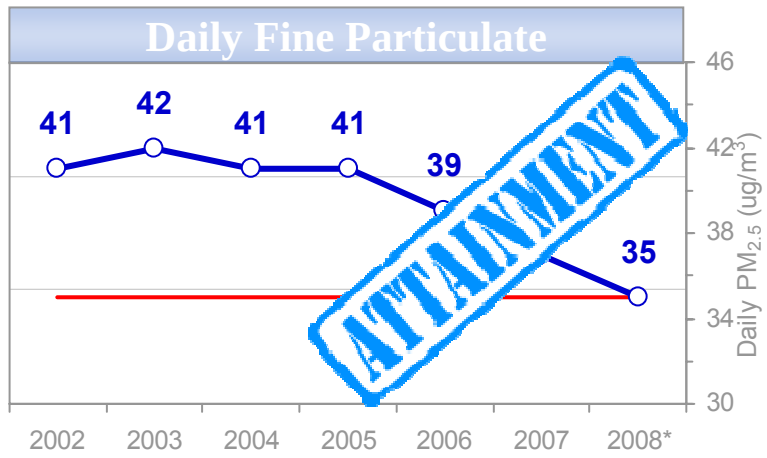
Examples of recommendations:

- Building code and floodplain management revisions
- Integrated planning for sea level rise
  - transportation/infrastructure siting & design
  - growth and development planning
- Climate change insurance advisory committee
- Forest and wetland protection
- Sustainable shorelines and buffer management
- Local government guidance

Progress in Cleaning Maryland's Air







*2008 data are preliminary.

The Air Quality Planning Process

- Measure air quality to determine starting point
  - How much improvement do we need?
- Develop emissions inventory
  - Where does it come from?
- Identify control programs
  - What can we do to reduce air pollution?
- Model these control strategies for a future year
  - If we do A, B and C – will we get clean air?

The Modeling

“Essentially, all models are wrong, some are useful.”

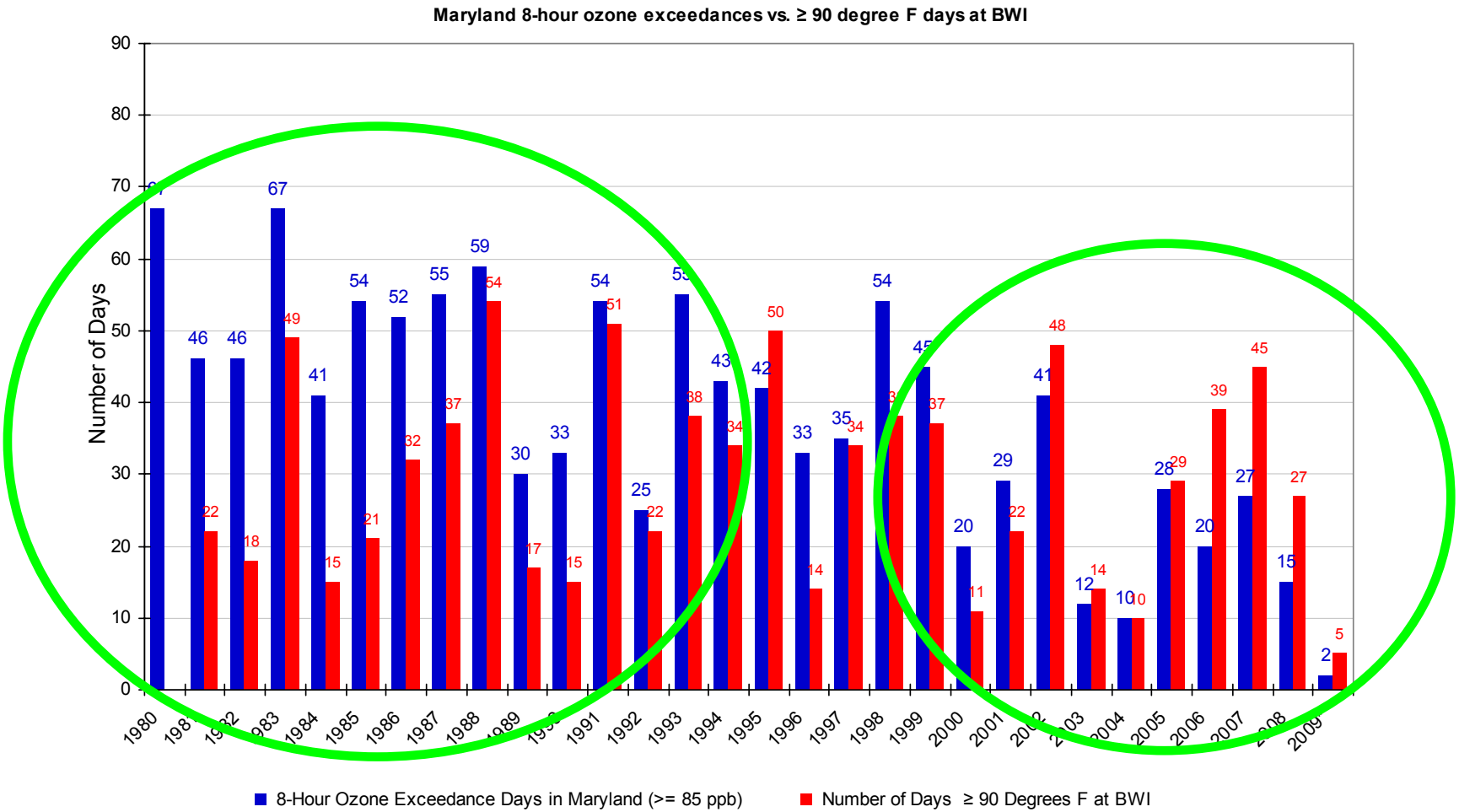
George Edward Pelham Box
(1919 -)
English chemist and statistician.

Box and Draper (1987). Empirical Model-Building and Response Surfaces, p. 424.

The Modeling - Inputs

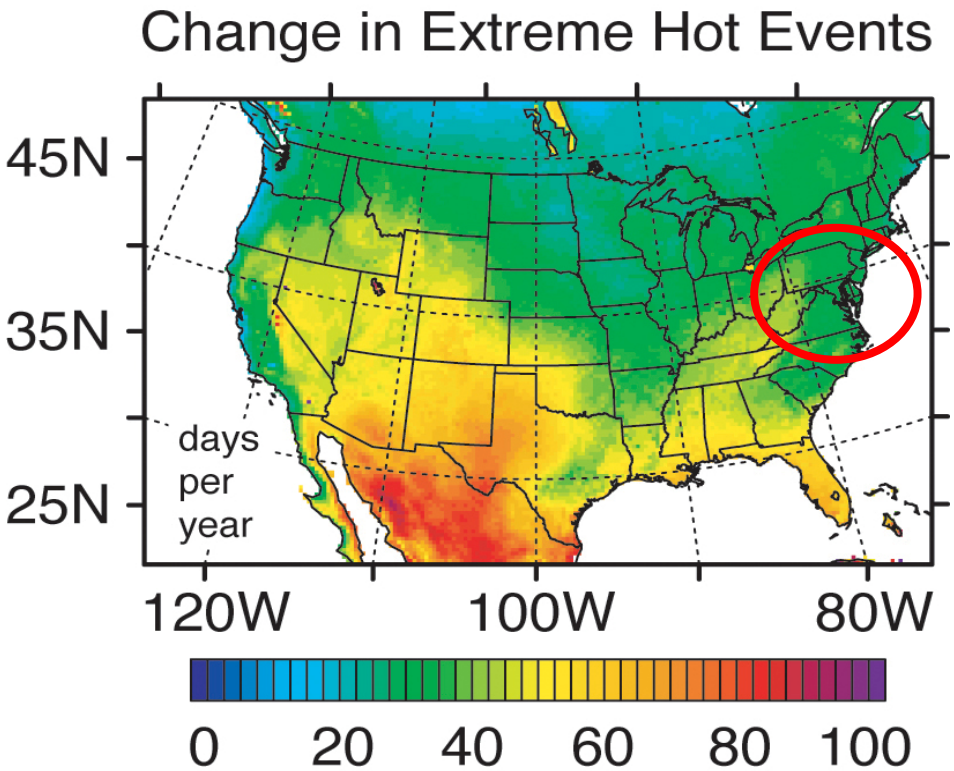
- Highly sophisticated photochemical modeling with multiple inputs
  - Emissions (often from a model)
    - Many states
  - Temperature and Meteorology (from a model)
    - Historical “worst” case
    - Generally the eastern half of the Country
  - Chemistry (also a model)
- Trying to predict the future
  - Ability to estimate the Climate Penalty is very important

Maryland 8-Hour Exceedances vs. ≥ 90 F Days



*Preliminary data through July 19, 2009

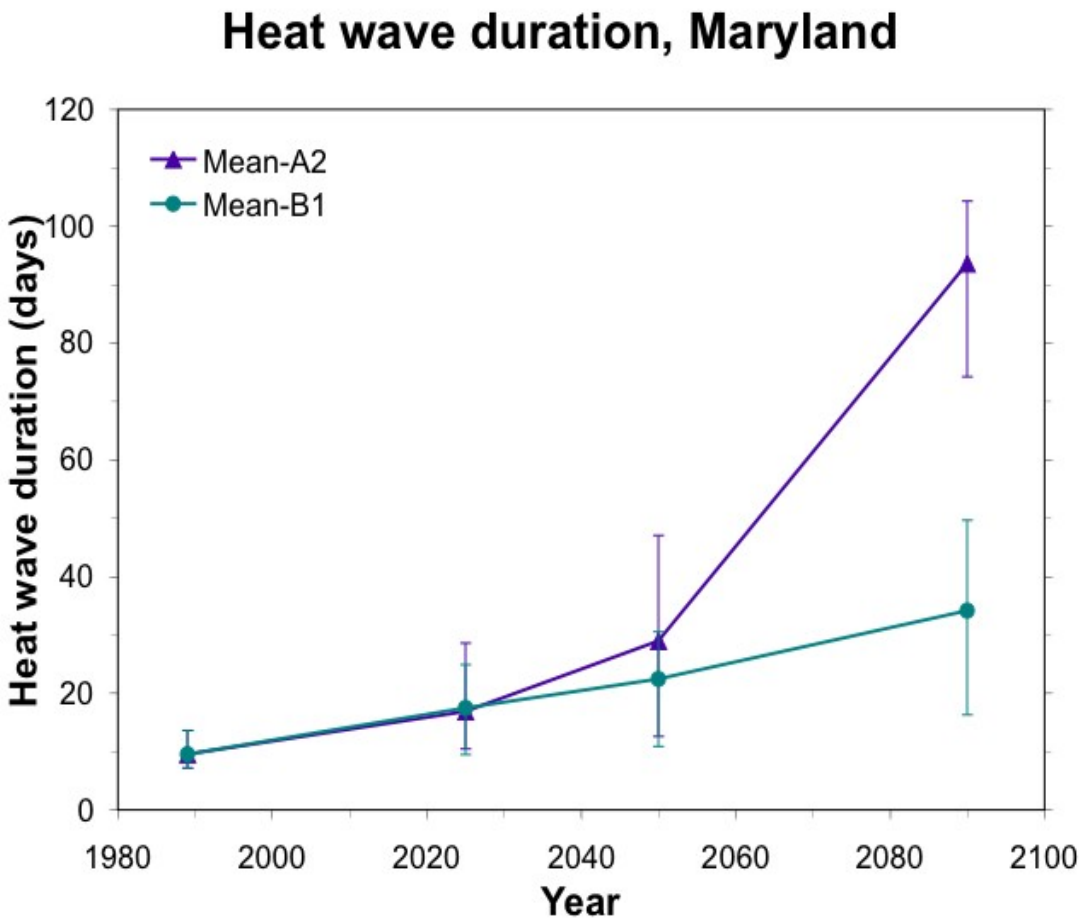
Temperature



Heat waves:

"Rare events, like the 2003 heat wave in Europe, will become much more common…" said Noah Diffenbaugh, the Purdue professor who led the study. "The frequency at which this scale of event occurs at high greenhouse gas concentrations is staggering. Rare events become the norm, and the extreme events of the future are unprecedented in their severity."

Heat Wave Duration



Consensus IPCC Predictions From V. Coles, CBL

Recent Model Predictions

- **Increase** of 3-5 ppb in 8-hr average ozone over the eastern US [*Hogrefe et al.*, *JGR*, 2004].

- **Increase** of 10-20 ppb in 8-hr average ozone over the eastern US by 2100 [*Pyle et al.*, *Phil. Trans.*, 2007].

- Increasing temperatures will **decrease PM2.5** due to dissociation of ammonium nitrate [*Dawson et al.*, ACP, 2007].

- Increasing temperatures and increasing precipitation will **increase** N deposition [*Civerolo et al.*, *Atmos. Environ.* , 2008].

Implications for Ozone

- A 2 ppb increase in ozone is
  - About the same amount as the air quality improvement modeled for many non-attainment areas justifying the entire NO_X SIP call
  - NO_X SIP call annualized capital costs modeled to be about $2.1 billion per year (1997$)
- 2 ppb increase, across the population of the Eastern US
  - Estimated to result in 8,000 to 16,000 additional premature deaths per year

Conclusions

- Climate change will add significant new challenges to further cleaning the air.
- Temperature increases and longer heat waves are of great concern
- Low hanging fruit for pollution controls is pretty much gone – New control programs will be very challenging
  - Will push us more towards efforts that attempt to change behavior
    - Driving and energy consumption
- Data on potential ranges of temperature change and duration of heat waves would be of great value in the air quality planning process