

# **CENSARA: REGIONAL HAZE GLIDEPATH EVALUATION**

**HOW TO ADDRESS ANTHROPOGENIC/NON-ANTHROPOGENIC  
EMISSION SOURCES OUTSIDE A STATE'S CONTROL**

**2016 MIDWEST AND CENTRAL STATES AIR QUALITY WORKSHOP  
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# REGIONAL HAZE RULE

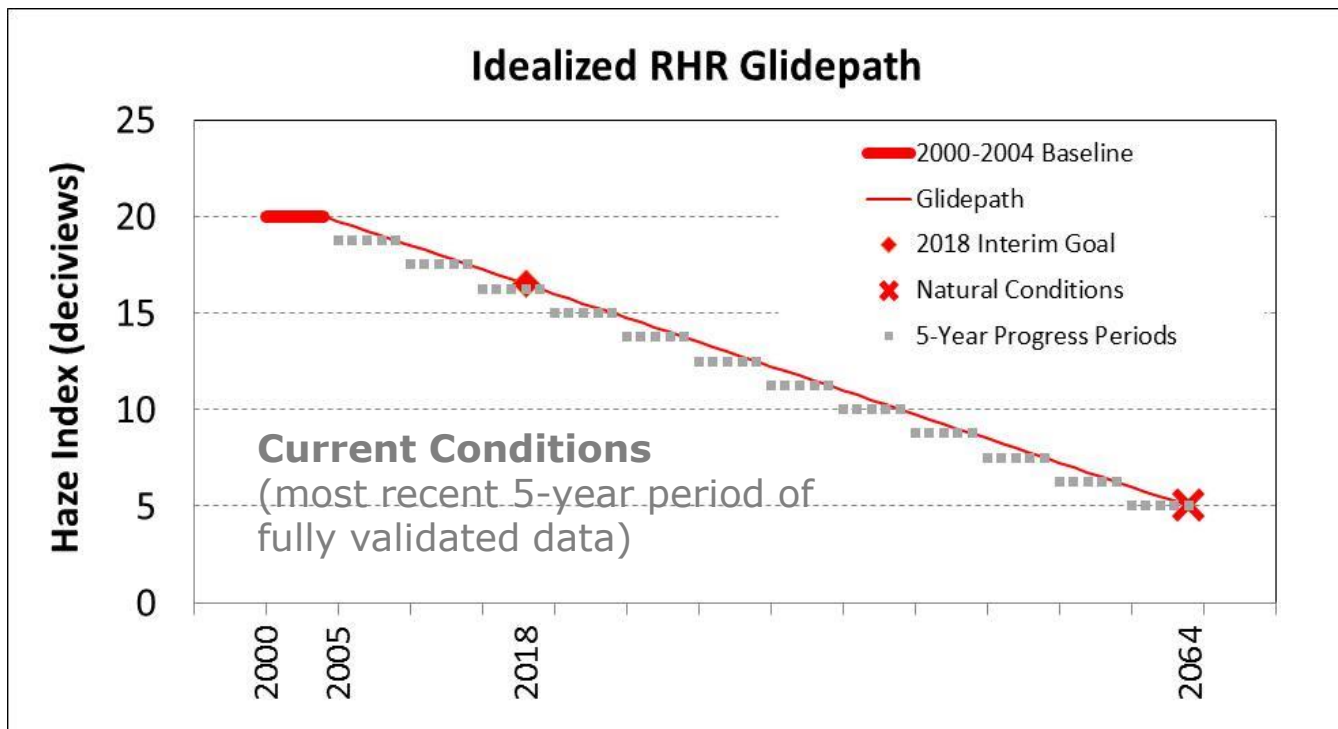
- Established by EPA in 1999 (40 CFR Part 51 Sections 308 & 309)
- Requires States to develop Implementation Plans (SIPs) to provide protection for Federal Class I Areas
  - Establish **Reasonable Progress** goals toward achieving **Natural Conditions** by the year 2064
  - Natural Conditions are defined as visibility conditions that would be experienced absent **human-caused impairment**
- Periodic SIP updates are due every 10 years
  - The next one is due in 2021 with 2028 milestone
- Strategies will evolve over time and methods are refined and clarified regarding how visibility protection is best achieved

# AMENDMENTS TO THE RHR

- Proposed on April 25, 2016
- Extend the requirements to all states (reasonably attributable visibility impairment, RAVI)
- The 2<sup>nd</sup> planning period would remain 2028
- Interim progress report deadlines : Jan/2025, Jul/2033, every 10 yrs
- Visibility Impairment due to anthropogenic impacts
- Account for International emissions
- EPA to provide additional guidance
  - Many details are still needed

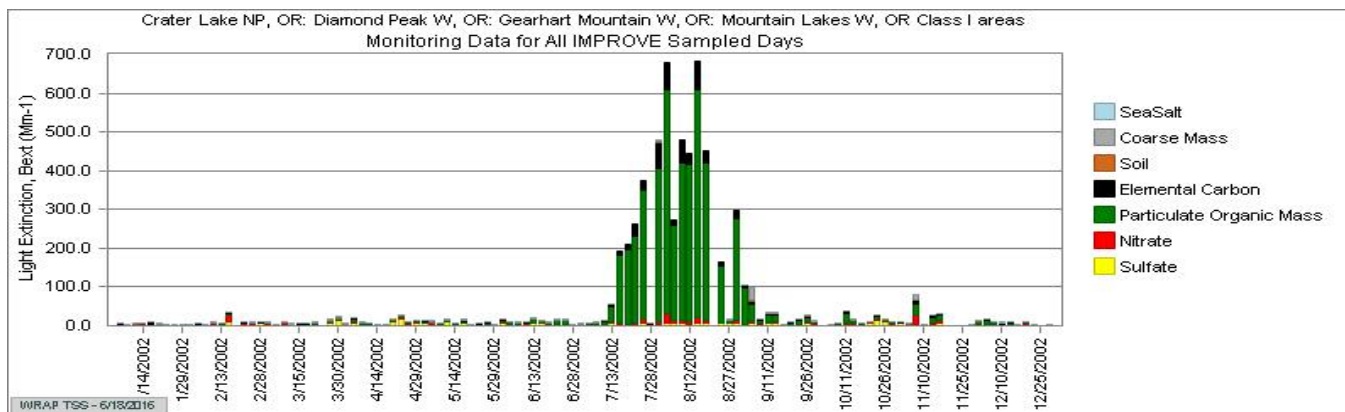
# UNIFORM RATE OF PROGRESS (URP) GLIDEPATH

EPA provided concept of linear progress toward 2064 visibility goal calculated using IMPROVE network data



# REGIONAL HAZE RULE GLIDEPATH

- Regional Haze Rule:
  - Progress toward natural conditions for “most impaired days”
    - Worst 20 percent (W20%)
  - No worsening in visibility for “least impaired days”
    - Best 20 percent (B20%)
  - based on IMPROVE measurements using light extinction equation
- In western U.S. W20% days frequently dominated by wildfires and windblown dust



# CENSARA RHR GLIDEPATH

- **Motivation:** Human-caused impairment v.s. Controllable sources
- **Objective:** Provide recommendations regarding how to account for the impact of uncontrollable sources on the glidepath
- Factors evaluated include:
  - Definitions of controllable vs. uncontrollable sources
  - Attribution methods
- RHR glidepath recommendations, including:
  - Modifications to treatment of “Natural Conditions”
  - Characterization of large episodic natural events (e.g., wildfires and dust storms)
  - Calculation of 20% most impaired/least impaired days

# DEFINITIONS OF UNCONTROLLABLE SOURCES

- Fires: fire is occurring as part of the natural landscape
  - Wildfires, Prescribed burns, Agricultural burning
    - Natural definition a policy call
- Windblown Dust Storms
- Sea Salt
- Lightning NOx
- Ocean Dimethyl sulfide (DMS)
- International Transport
  - Mexico and Canada
  - Asian and Saharan Dust

# ATTRIBUTION METHOD

- IMPROVE measurements cannot distinguish between controllable and uncontrollable contributions
  - Statistical methods to filter high OC/EC (fires) or Crustal (WBD)
  - Receptor modeling (CMB, PMF, Unmix)
  - Screening (“Exceptional Events”)
- Photochemical grid models (PGMs)
  - Source apportionment algorithms track contributions from all sources with accurate distinction of natural vs anthropogenic emissions
- Hybrid method: combined elements of PGM and observation
  - use CAMx PSAT visibility analysis data to scale the source contributions to match the IMPROVE measurements by species
  - previous studies: CENRAP, WRAP TSS, WAQS 2008 analysis



# PROPOSED METHODOLOGY

- Generate PGM mass attribution results
  - Separately for controllable and non-controllable sources
- Use PSAT visibility attribution data to scale the source contributions to match the IMPROVE measurements by species
  - Controllable: %Controllable (from PSAT) \* measured (from IMPROVE)
  - Uncontrollable: %Uncontrollable (from PSAT) \* measured (from IMPROVE)
- Use PSAT weighted “uncontrollable” as a more attainable 2064 goal than default natural conditions
  - Accounts for natural emissions and international transport

# CONTROLLABLE VS. UNCONTROLLABLE IN THE PSAT MODELING EXERCISES

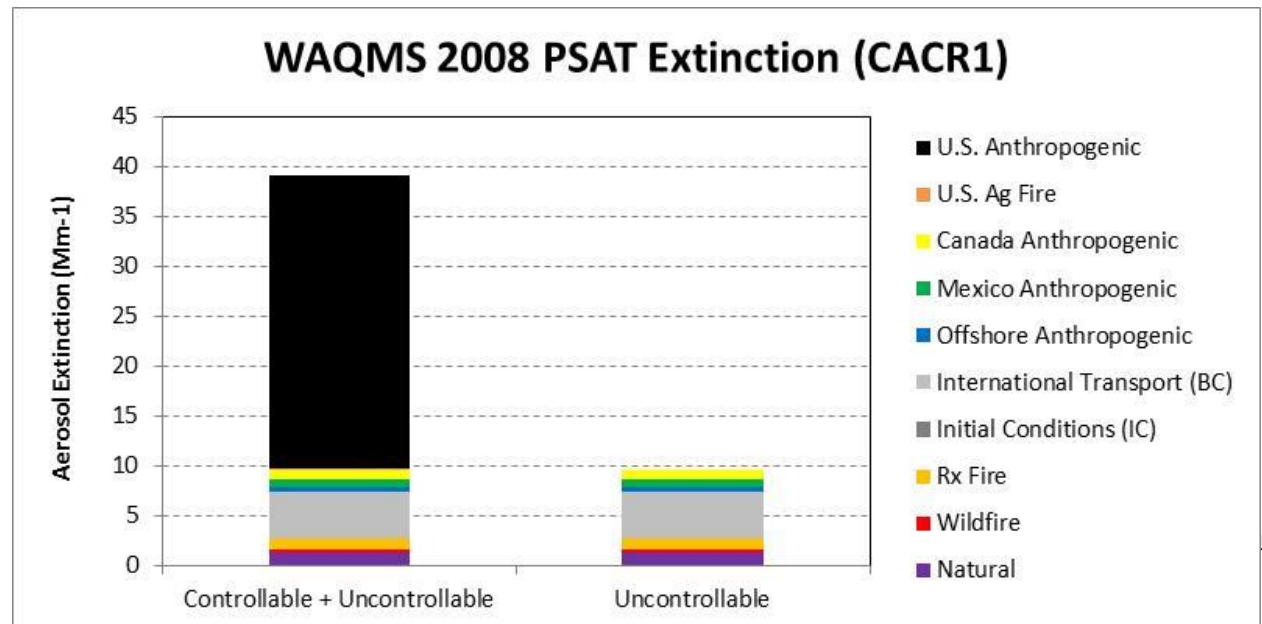
## Uncontrollable

- US+Non-US Natural
- All Non-US Fires
- US Wild and prescribed Fires
- Canada
- Mexico
- BCs/ICs
- Offshore shipping?

## Controllable:

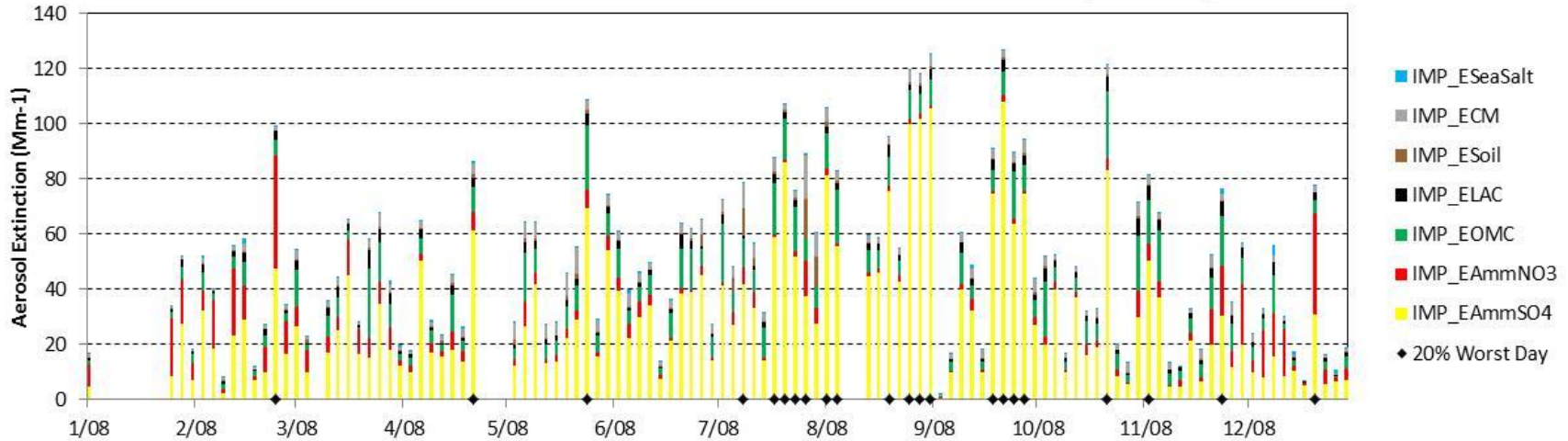
- US Anthropogenic
- US Agricultural Fires

## Example results from 2008 PSAT



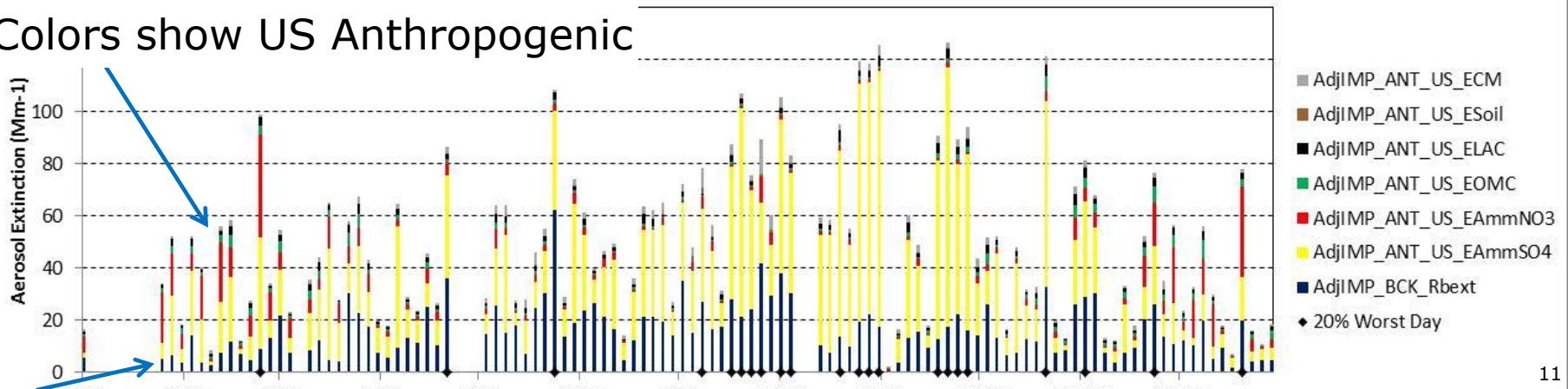
# CONTROLLABLE VS. UNCONTROLLABLE CONTRIBUTIONS TO AEROSOL EXTINCTION

IMPROVE Measured Aerosol Extinction (CACR1)



Approximated IMPROVE US Anthro. vs. Background Aerosol Extinction (CACR1)

Colors show US Anthropogenic



Fraction from "uncontrollable" sources, determined using PSAT

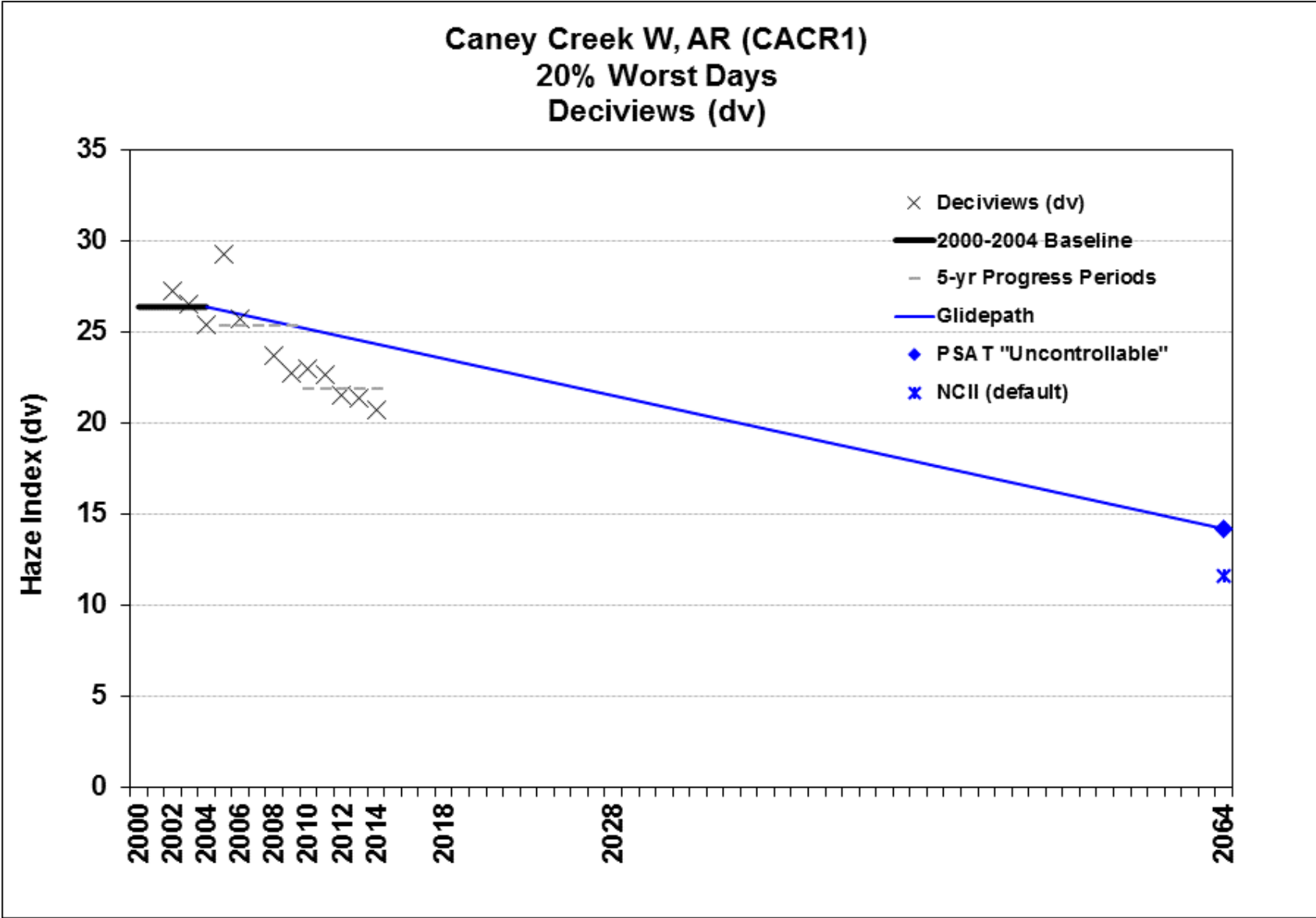
# DETERMINATION OF B20% AND W20% DAYS – PREVIOUS GUIDANCE

- For “Baseline” and “Current” conditions:
  - Distribution used to determine best and worst days is based on average distribution from 2000-2004 monitored data in terms of DV
  - The selection is often impacted by natural episodic events such as wildfires and dust transport
- For “natural” conditions:
  - Default estimates use broad regional averages that do not consider natural episodic events such as wildfires and dust transport (Trijonis)

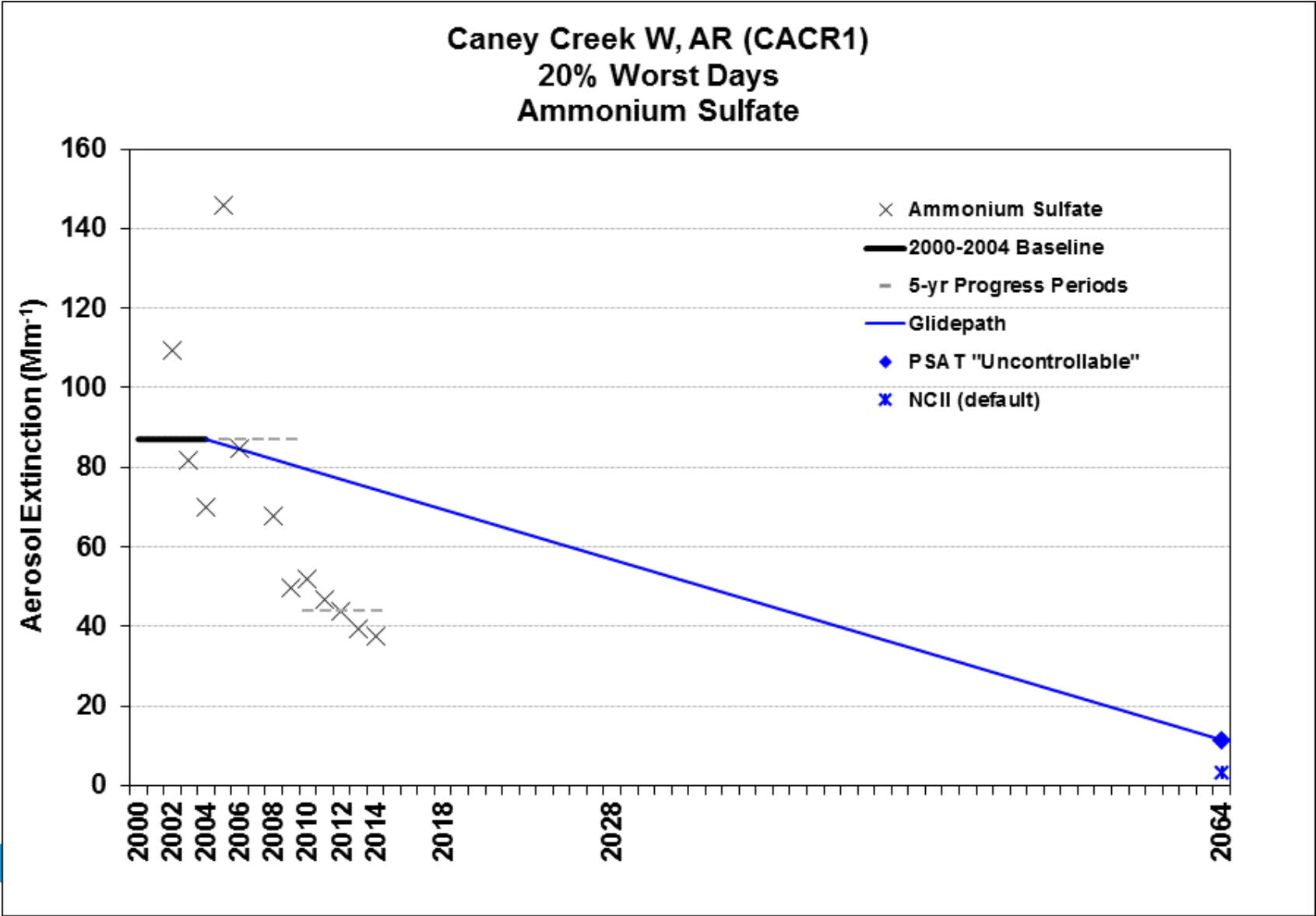
# ALTERNATIVE DETERMINATION OF MOST AND LEAST IMPAIRED DAYS

- Exclude vs Substitute
- Substitute outliers (e.g., Boylan method and EPA?) for “Background” conditions (2064):
  - Calculate average quarterly median between 2004-2008
  - Replace OMC+EC (TC) and CM for values  $> 5 \times \text{Median}$  (quarterly) with median values
  - Recalculate 20% worst days from the “uncontrollable” portion of the 2008 measurements
- Large events at CenSARA sites in 2008
  - CM: BIBE1 site (2 days) and the GUMO1 site (6 days).
  - TC: No CenSARA sites met the criteria for substitution
- Similar methodology for “Baseline” and “Current” conditions

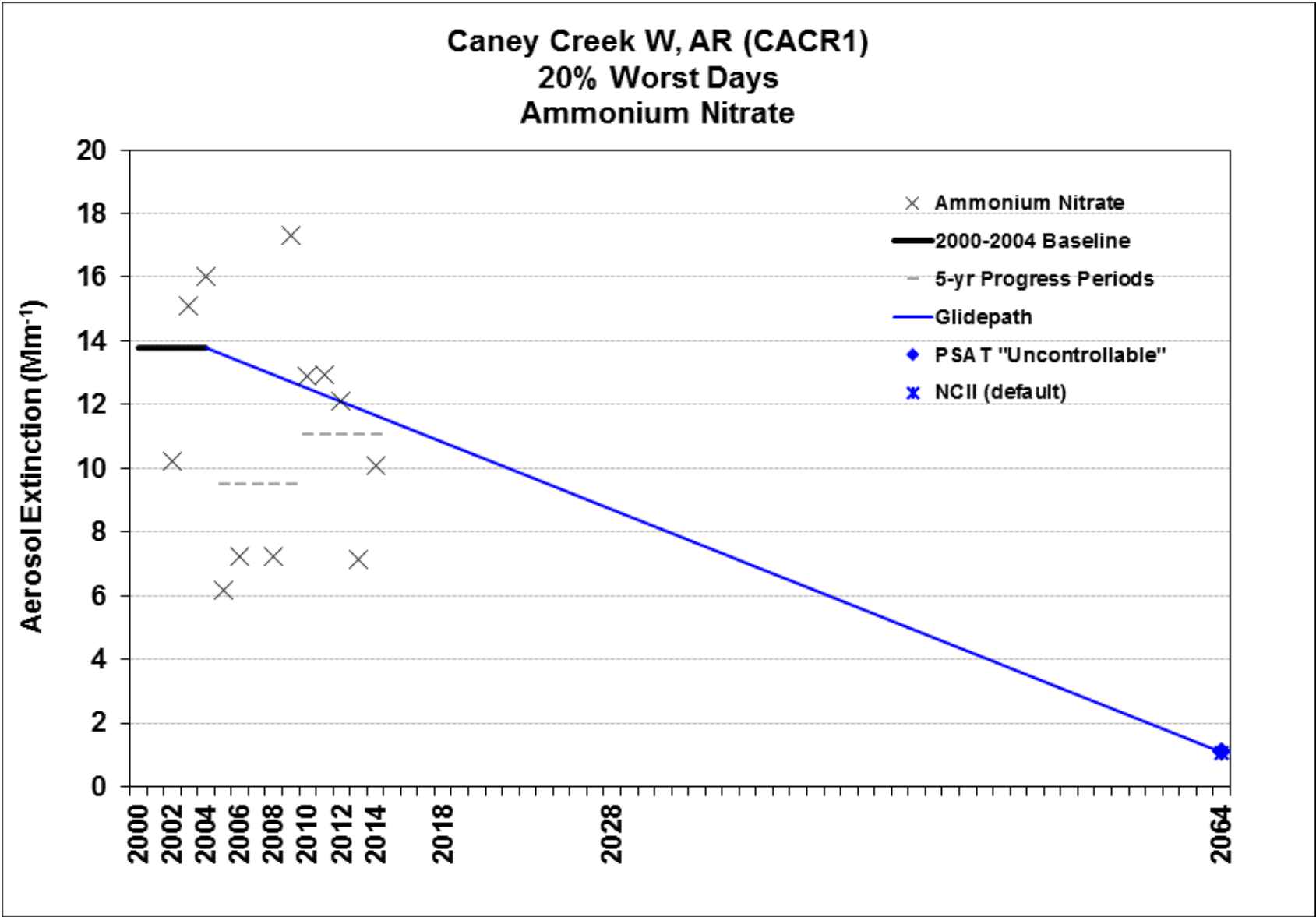
# Glideslope – Example Plots



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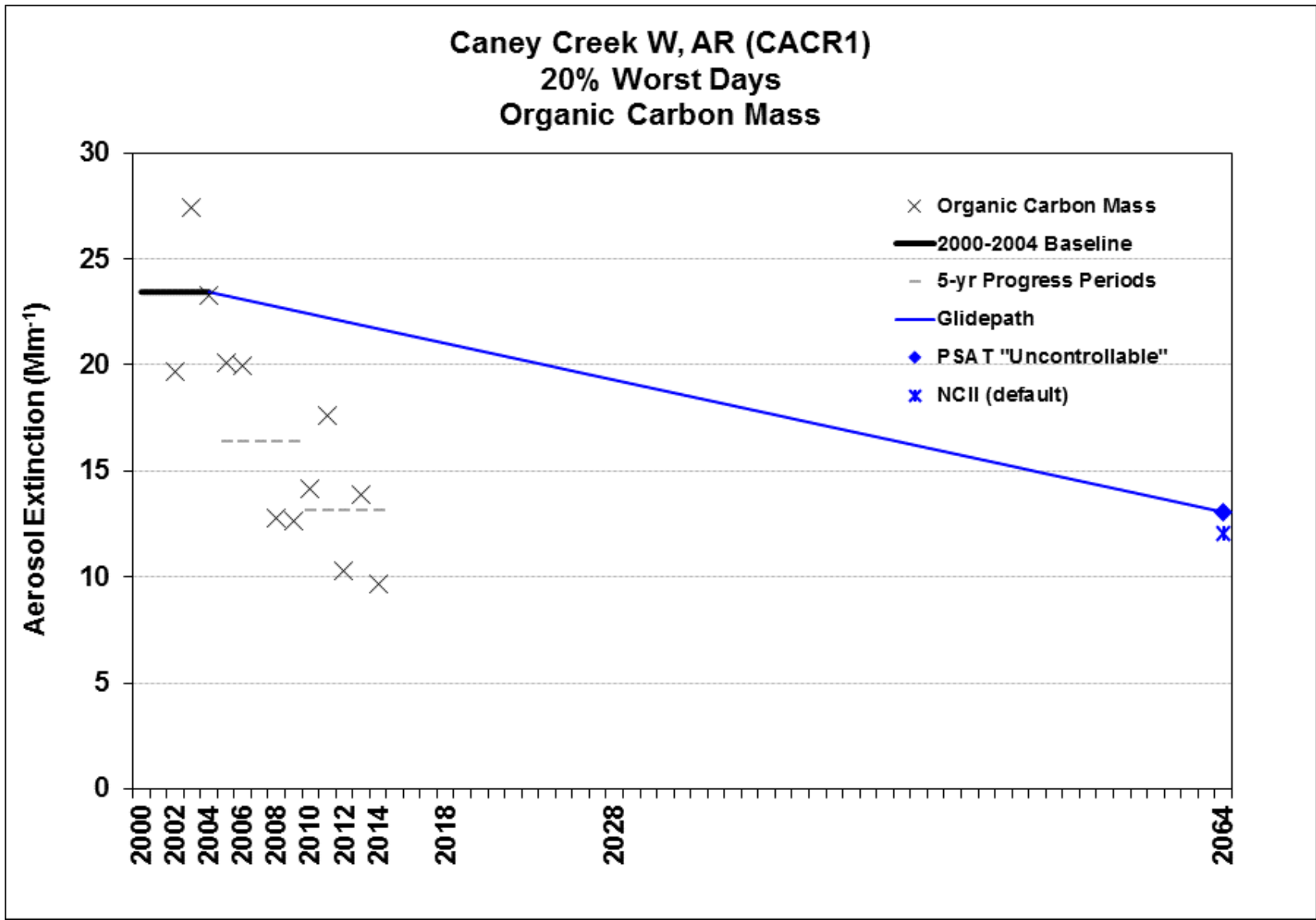


# Glideslope – Example Plots

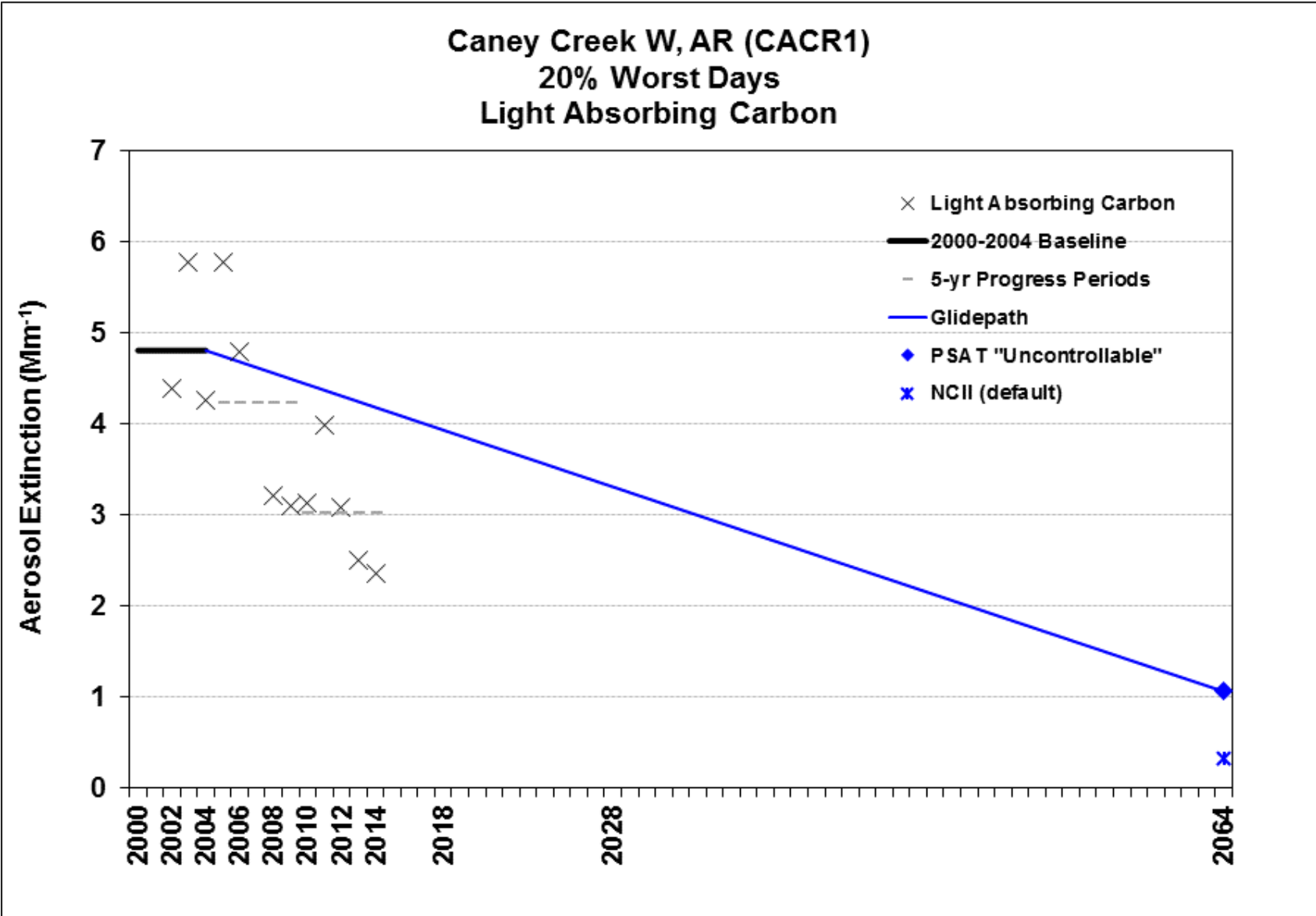




# Glideslope – Example Plots



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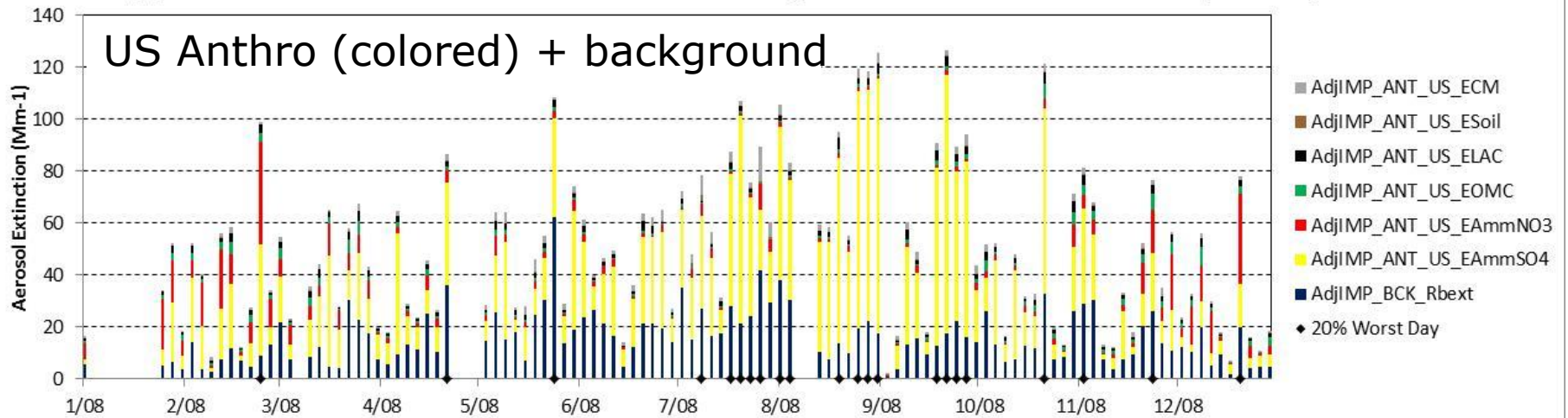
# CONCLUSION

- “... meteorological and air quality modeling that have occurred in the decades since 1980 make clear that **modeling is one possible technique for determining that reasonably attributable visibility impairment is occurring**” *40 CFR Parts 51 and 52*
- Advantages:
  - Consistent assumptions for all points along glidepath (e.g., meteorological conditions, emissions profiles, etc.)
  - Daily distribution for “uncontrollable” 2064 goal allows for determination of 20% best and 20% worst days
  - 2064 goal can be updated with each 10-year SIP
- Considerations and refinements:
  - Detailed model Performance evaluation is crucial
  - Identification and treatment of large natural events is subjective
  - Zero-anthropogenic simulation may be used to set 2064 goals

# Q&A

# CONTROLLABLE VS. UNCONTROLLABLE CONTRIBUTIONS TO AEROSOL EXTINCTION

Approximated IMPROVE US Anthro. vs. Background Aerosol Extinction (CACR1)



Approximated IMPROVE Background Aerosol Extinction (CACR1)

