Issues Related to Smoke and Air: How Do We Get from Here to There?

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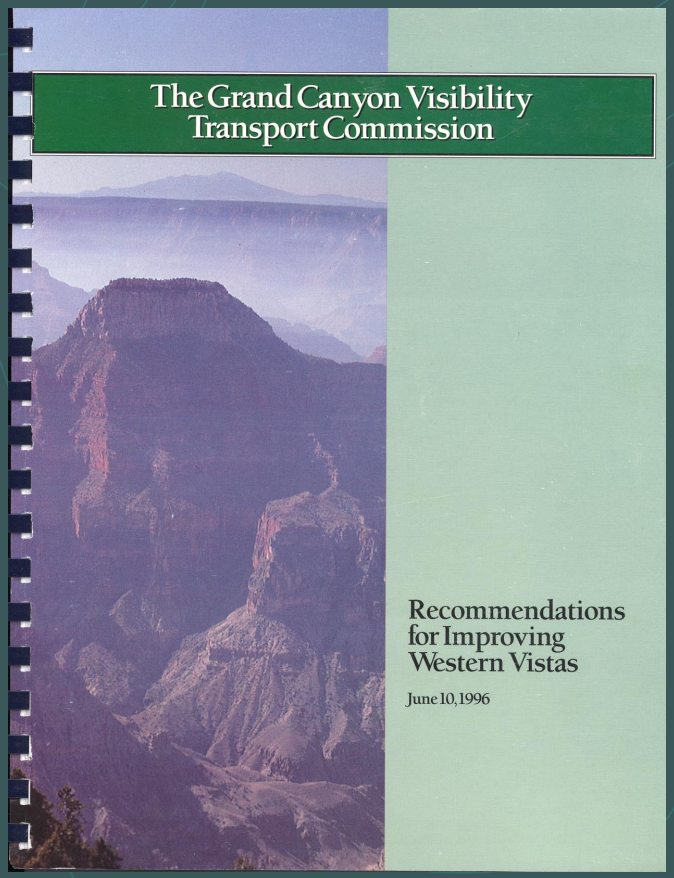
New Rules



- Arizona is developing its Regional Haze regulations based on the recommendations of the Grand Canyon Visibility Transport Commission ("Section 309")
- New regulations ("SIP") are due to EPA 12/03

Changes on the Horizon

- New smoke management segments must:
  - Add agricultural emissions to the mix
  - Establish annual emission goals and a budget
  - Identify and remove administrative barriers to alternatives to burning
  - Enhanced smoke management (smoke management plans that explicitly analyze visibility)

What's in a Name?

- Under the Clean Air Act, Arizona sets the rules. Their evaluation of a fire is based on two issues:
- Suppress or Manage: if we're not trying to put it out, we're responsible for the smoke
- Natural or Anthropogenic: The only managed fires likely to be considered natural are those burning for ecosystem maintenance with natural fuel loads.

“Traditional” Smoke Monitoring

- Heavy reliance on observations by fire staff.
- Augmented by photography
  - 24 hour film processing
  - Digital photos for better distribution
- Training on how smoke affects visibility

SMOKE OBSERVATION FORM RX-3

Grand Canyon National Park

Date: _____ Fire Name: _____ Monitor(s): _____ Page __ of ___

TIME	LOCATION	PLUME HEIGHT AGL*	PLUME DIR.	PLUME TYPE 1-5 (below)	% CLOUD COVER	OBSERVATIONS**

*AGL - Above Ground Level

** Include the following in Observations:

Highway visibility
Fireline visibility
Complaints
Mixing height
Sensitive area impacts
Forward & back scatter
Inversion height
Color & contrast

Plume Types:

GRCA FF 04/99

Adding Instruments to the Mix

- Grand Canyon has an extensive air quality monitoring network – how can we use it for fire?
- Not all monitoring equipment is suitable for smoke monitoring.
- Data needed that are
  - Relevant to smoke (PM, visibility)
  - Real, or near-real time
  - A historical perspective on data is nice

Visibility Monitoring: Transmissometer

- Transmissometer preferred because it measures:
  - Total extinction
  - Path rather than point
  - Real-time trends are available
- Other options are:
  - Nephelometer
  - DataRAM

Managing Visibility: The "Trigger"

- Visibility trigger is based on long-term visibility monitoring, beginning 10 -15 years ago.
- Visibility management is based on "percentiles", especially the 20th and 80th.
  - 20% means 20% of the time, visibility is better, these are "clean" readings
  - 80% means 80% are better, these are "dirty."
- EPA defines "reasonable progress" as preserving the best 20th and improving the 80th.

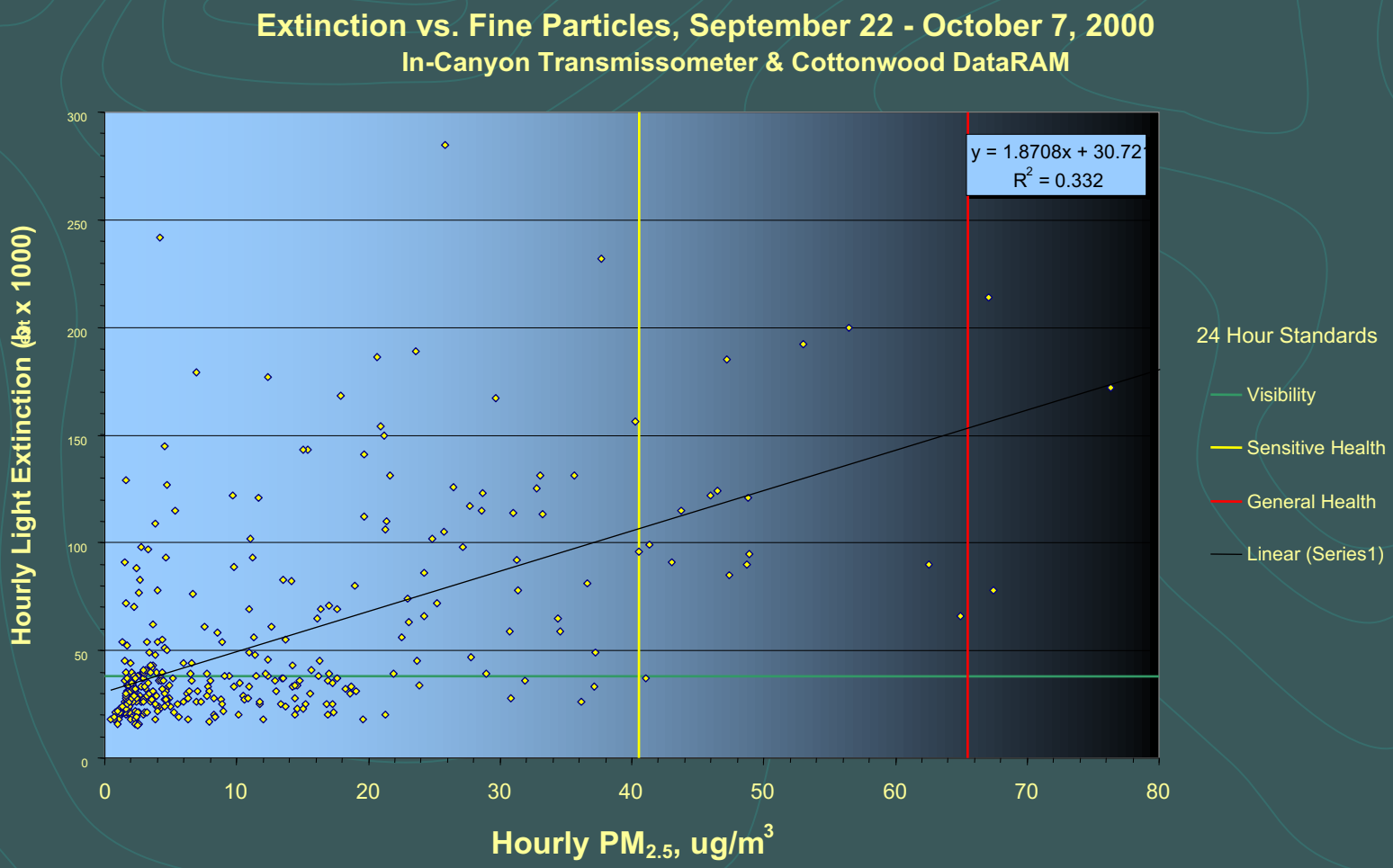
Applying the Trigger: Reality

- Visibility is measured 10 minutes/hour in a 5 km. "tube" that may or may not see all the smoke.
  - Reality: use average of last 24 hours (minimum of 20 readings)
- Visibility varies throughout the day - we can accept some bad hours, but not indefinitely
  - Reality: the previous 24 averages must rise out of the dirtiest category (the 80th percentile) at least once.

Particle Measurement with DataRAM

- Not an EPA referenced instrument
- Portable, with options for line, battery or solar power
- Options for remote download
- GRCA uses $PM_{2.5}$ head, it can also measure PM_{10}.

Visibility is Early Warning for Health

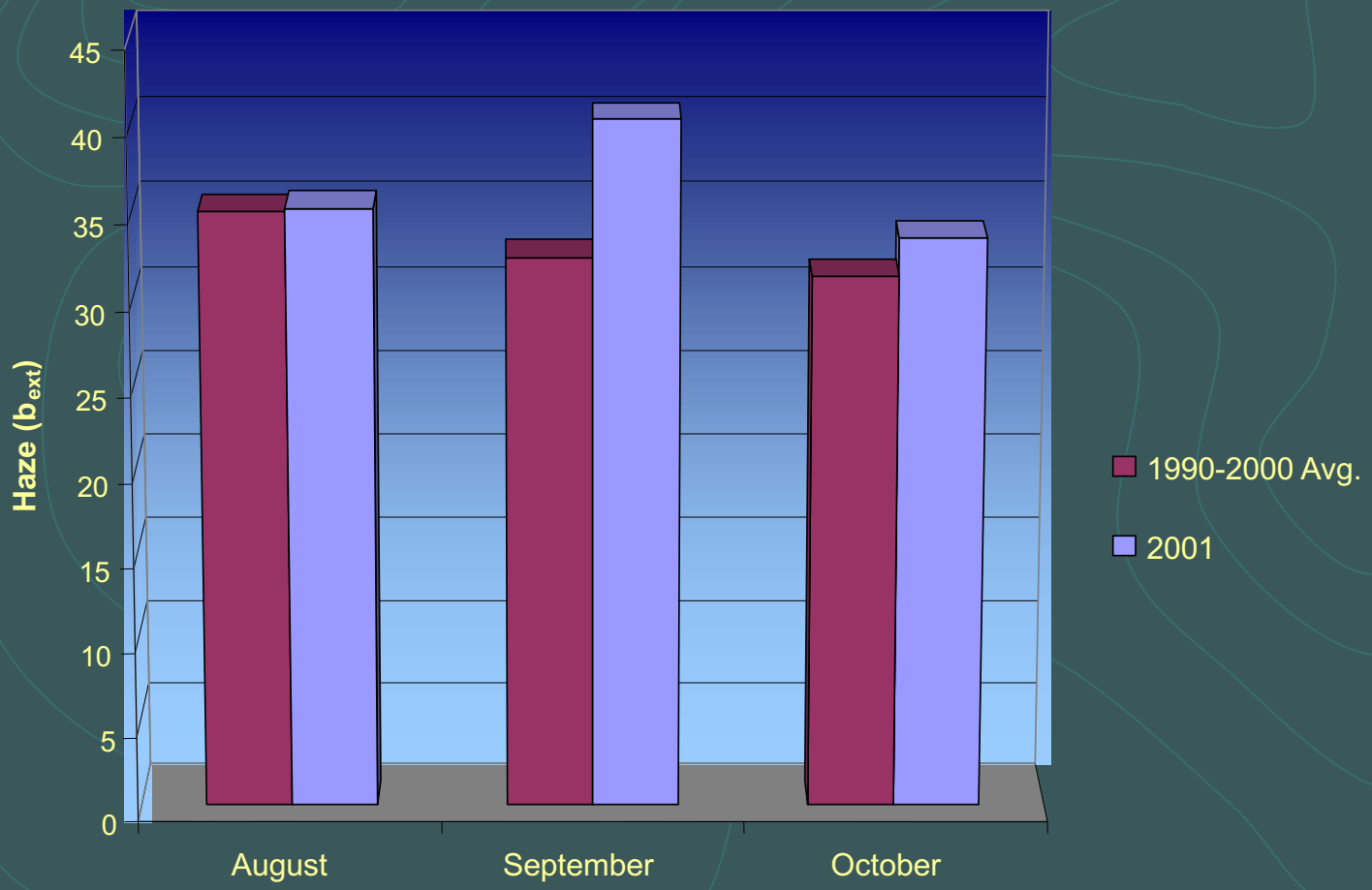


2001 Fires: 20/20 Hindsight

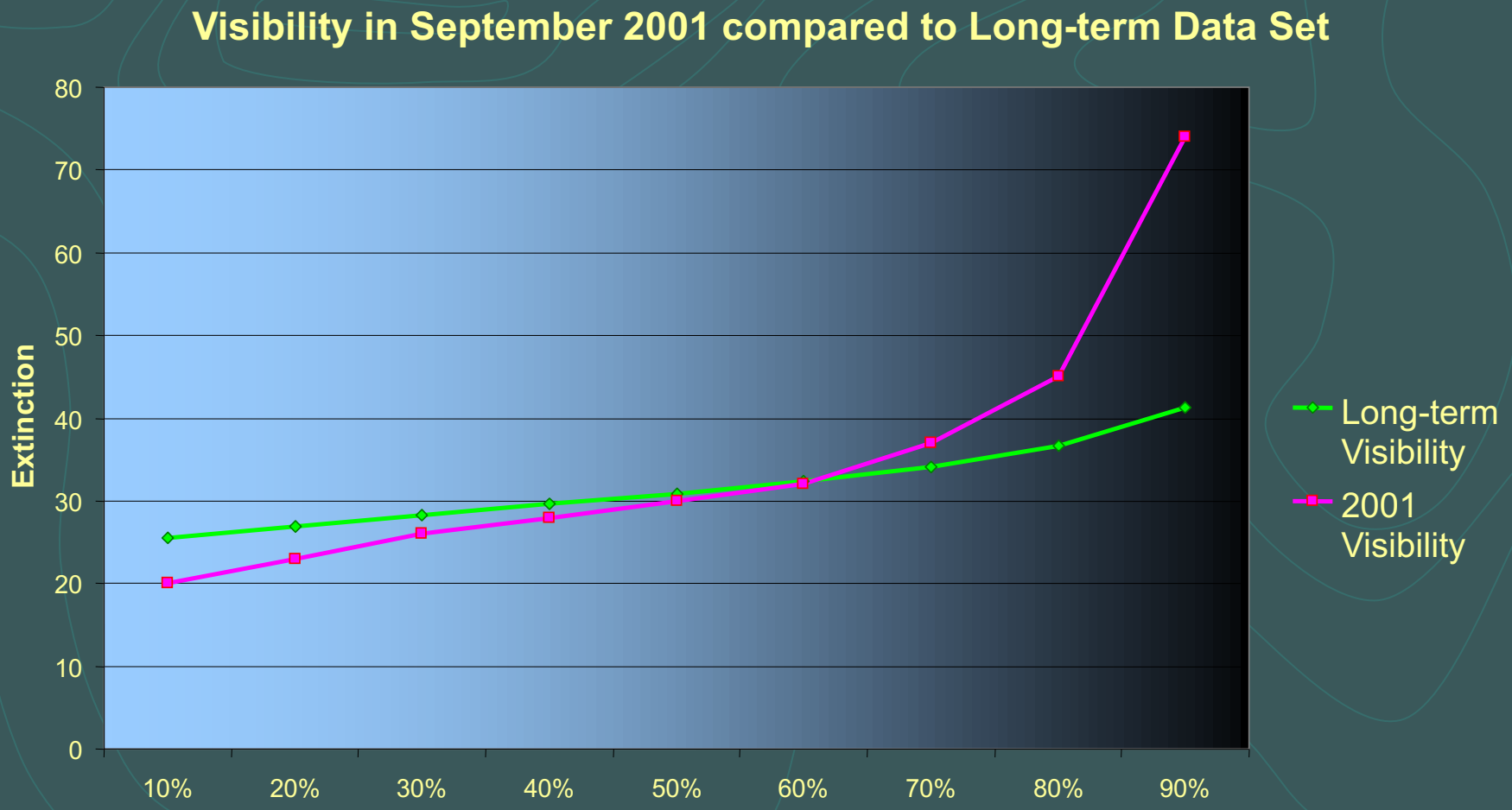
What Kind of Fires?

- Three North Rim fires
  - Lightning starts
  - No “artificial growth” except to manage safety
  - *BUT* unnatural fuel loads
- Anthropogenic Emissions
  - Unnatural fires
  - Managed for resource benefit

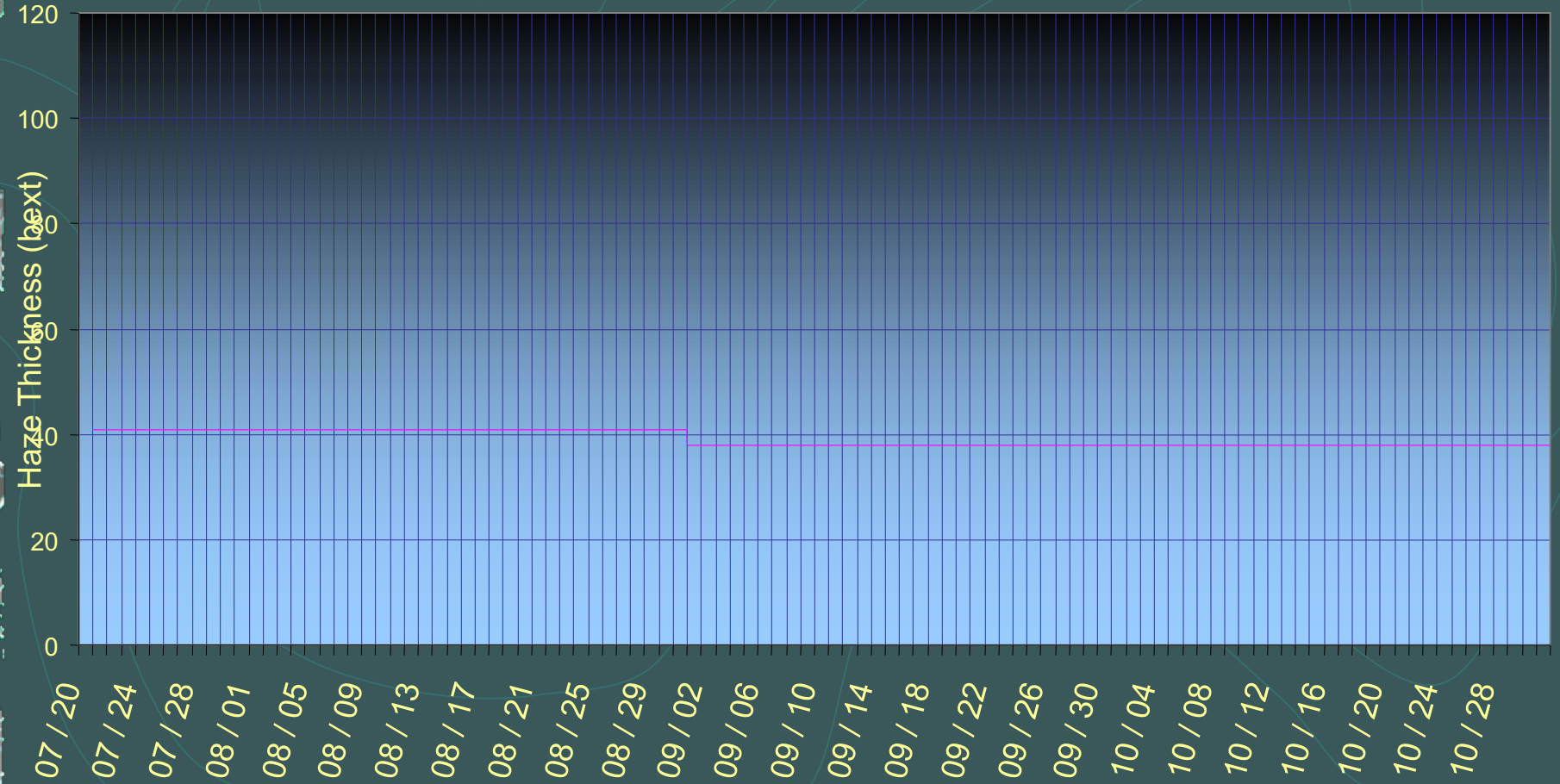
Air Quality Bottom Line: Dirty



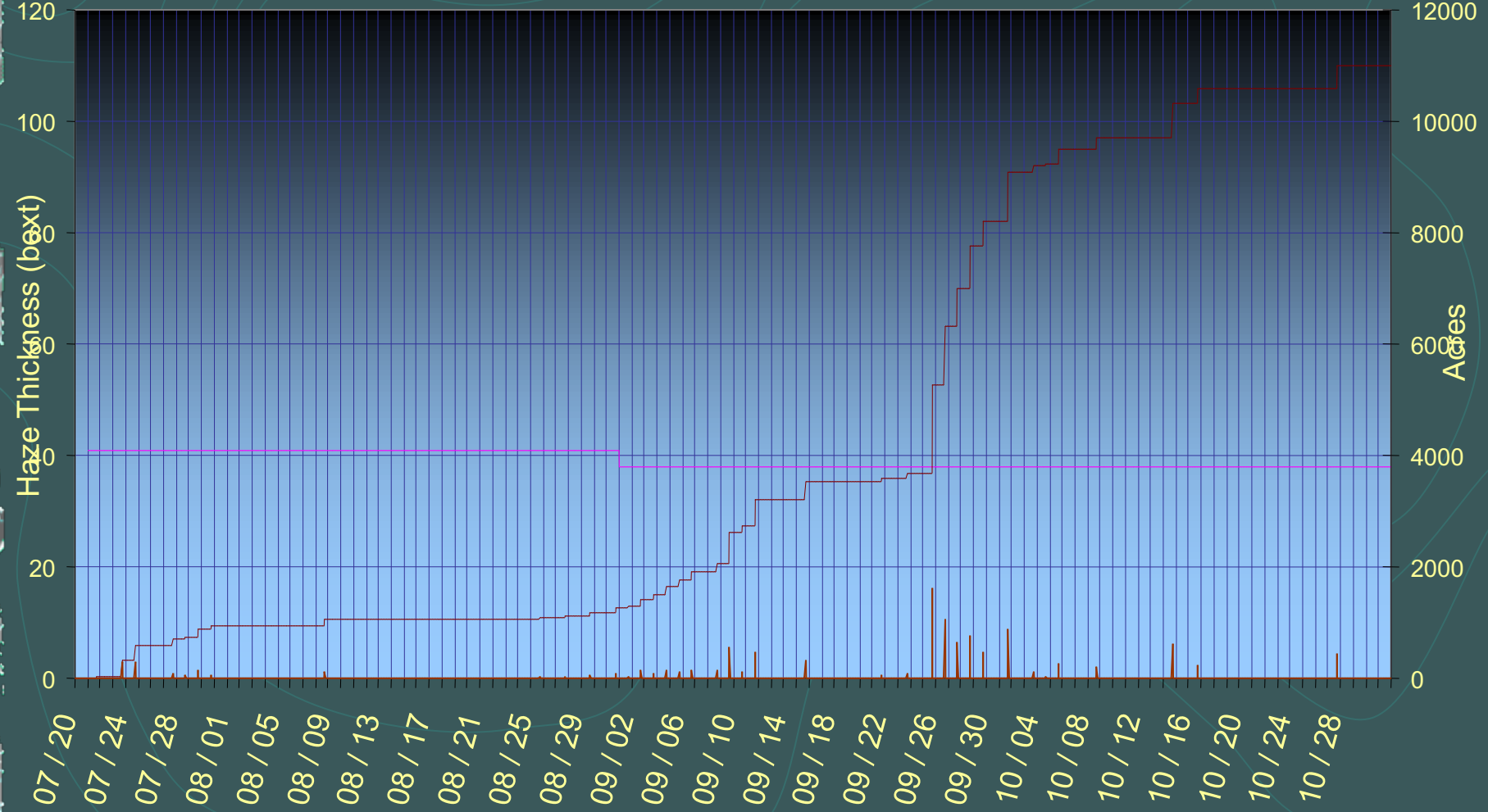
Air Quality Summary: Our Fault



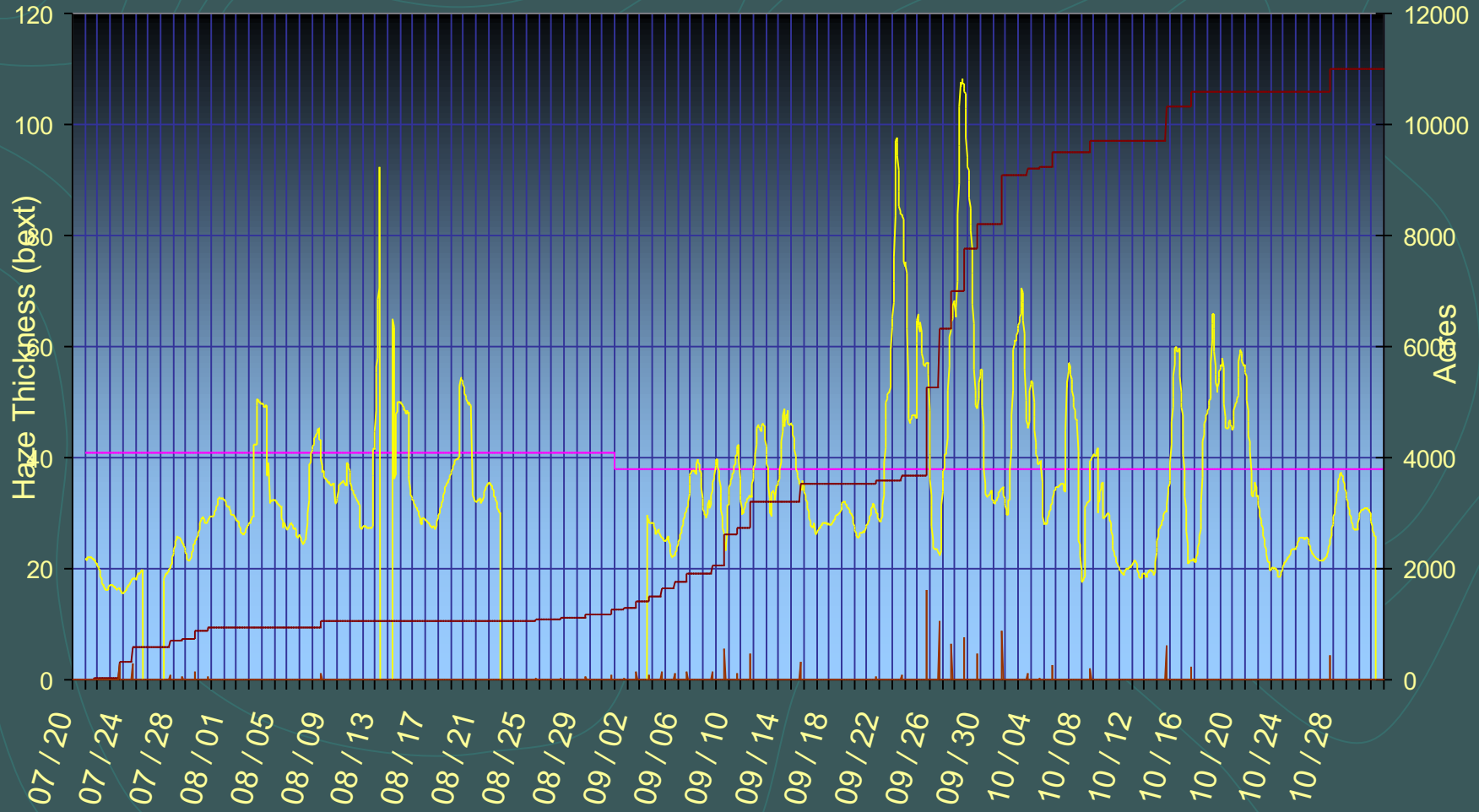
What Happened? Set Trigger



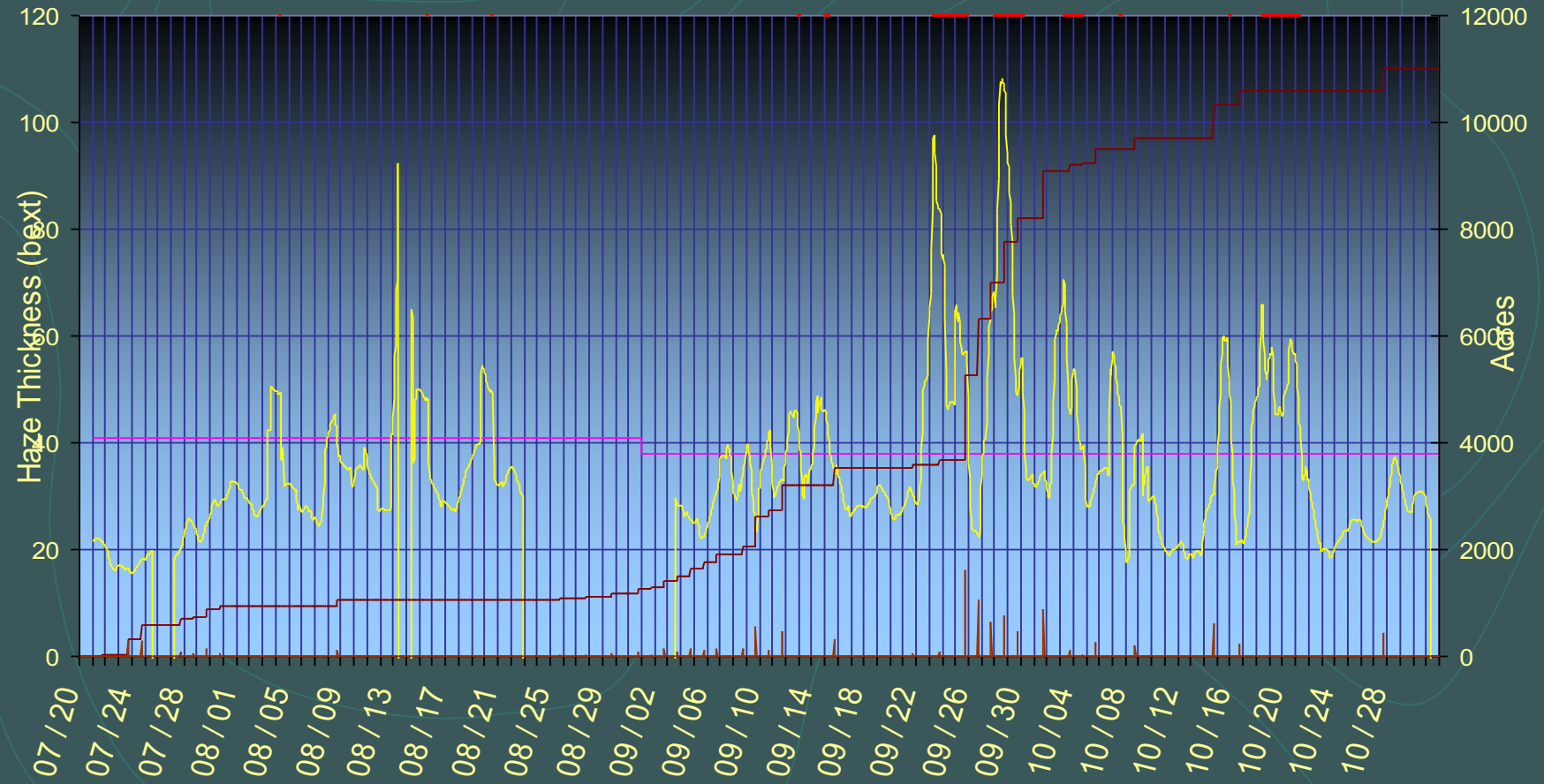
What Happened? Fires Grow



What Happened? Smoke



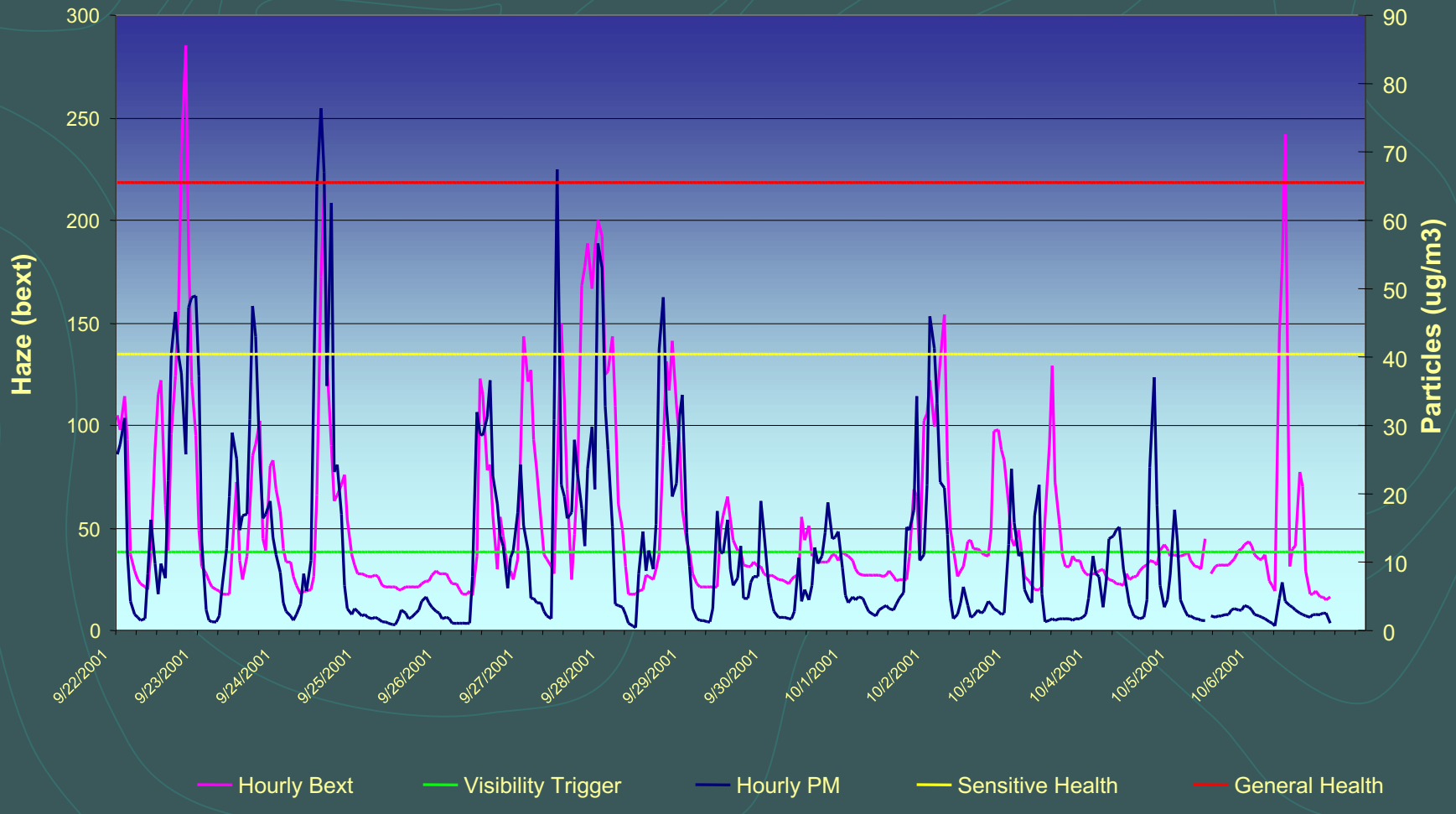
What Happened? Trigger Exceeded



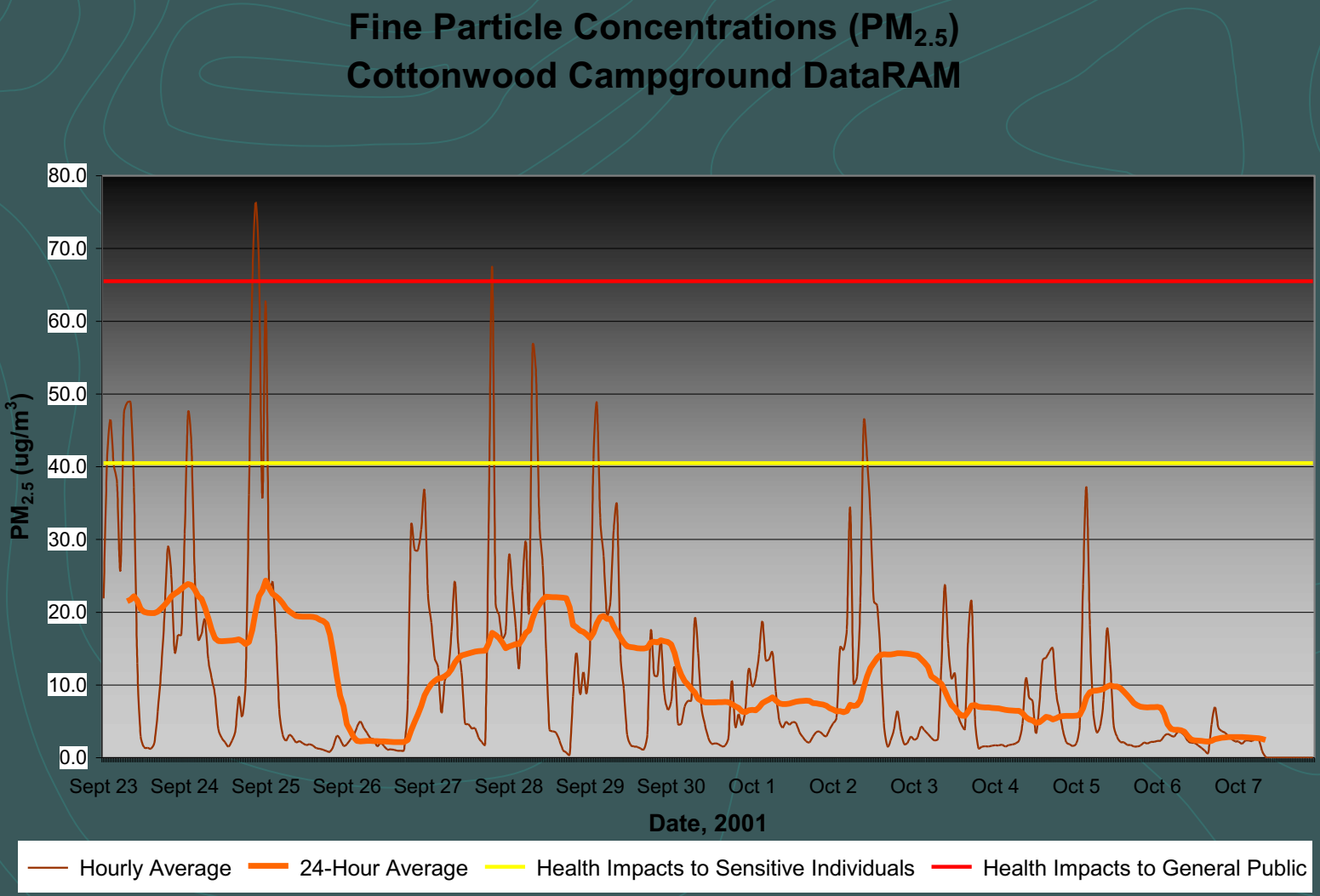
Was Grand Canyon Trigger-happy?

- These fires put the visibility trigger model to its first real test.
- Although the visibility trigger was “clear,” the consequences of exceeding it were not.
- Communication problems developed throughout the incidents, internally and externally.
- Health issues began to surface, complicating the issue.

Health and Visibility are Related



EPA $PM_{2.5}$ Health Standards were not Violated



Health Concerns

- Concerns for human health trump concerns for forest health.
- EPA thresholds were not exceeded, but NPS policy to “err on the side of visitor health” applied.
- Visitors to Grand Canyon are breathing thinner, drier air and often over-exerting themselves.
- A press release was issued warning of possible problems and solutions.

Communication is a result, not a process

- Smoke problems related to 2001's fires were often communications-driven, both internal and external to:
  - Park staff
  - Incident staff
  - Arizona Department of Environmental Quality
- Revamped visibility management plan may help in the future.

Thinking Ahead

- Consequences of violating an approved smoke management plan: the Arizona Department of Environmental Quality may require
  - containment
  - mop-up
  - fines
- Bad karma

Better Data Access

- Real-time Web Camera
- Real-time data access
  - transmissometer
  - nephelometer
  - ozone station
- Provided everything works!

New Smoke Management Program

- Improve fire managers' understanding of visibility
  - Narratives
  - Checklists
- Includes the old visibility trigger
  - Triggers are justified
  - Consequences are listed
  - Magic words are included
- Introduces actions to protect health
  - Still "insurance"
  - Based on EPA standards

Brewing Storm Clouds

- Not all resources can benefit when air quality does!
  - Fuel reduction vs. Fire
  - Wilderness Management vs. Control Lines
  - Wildlife vs. Out-of-Season Burns
  - Wildfire hazard vs. air pollution
- Expertise to monitor air quality: DataRAMs, transmissometers and webcams, oh my!

Public Acceptance

- The public values National Parks
  - Perceptions of purity and wilderness
- For the public to support a fire program they must know why fire is necessary
  - Educate the visiting public before, during and after
  - Involve the local folks – burn schedules and impact assessments

Live and Learn ...