

South County Phase 2 Particulate Matter Study

APCD Board Presentation

March 24, 2010

Background

- State and Federal PM standards
 - Health-based
 - 24-hour and annual average
- Coarse (PM10) and Fine (PM2.5) particulate
- PM air quality on Nipomo Mesa
 - Significantly more exceedances of State PM standards than elsewhere in County
 - Significantly higher peak PM levels than elsewhere in County
- Health risk to Mesa residents

Health Effects of Particulate Matter

- Acute & chronic exposure to coarse and fine PM
 - Respiratory problems in children & adults (asthma, bronchitis)
 - Hospitalizations & emergency room visits
 - School absenteeism and work loss
 - Decreased lung function in children and adults
 - Premature death
 - Health care economic impacts
- Sand & crystalline silica
- Local health effects – epidemiological data unavailable
- Relationship to State & Federal Standards

Phase 1 Study

- PM10 & PM2.5 sampling throughout Mesa for 1-year
- All but one state and federal particulate health standard was exceeded.
 - Both PM10 and PM2.5 standard exceedances
 - State 24-hour PM10 standard exceeded 28% of sample days.
- Primary Cause: NW wind events carrying sand particles from upwind dunes at SVRA
- Impact of off-road vehicles on the dunes inconclusive
- Board direction in 2007 to conduct additional research

Phase 2 Study

- Primary Study Goals
 - Determine if OHV activity on dunes contributes to high PM levels on Mesa
 - Determine potential contributions of petroleum coke piles and agricultural activities
- Study Designed to meet goals

Study Design

- Sought out experts with extensive experience in these types of studies to help with the design and implementation of the study.
 - State Parks – Dune experts
 - GBUAPCD – 30 years working on Owens Dry Lakebed
 - Delta Group – Highly respected scientists dedicated to study of particulates
 - SBCAPCD – Assisted with Phase 1 review, strong expertise in meteorological issues

Study Design – Main Concept

- Compare dunes with OHV activity to dunes without OHV activity
 - Measure as many characteristics that contribute to PM emissions as possible
 - Rely on “weight of evidence” rather than a single measurement

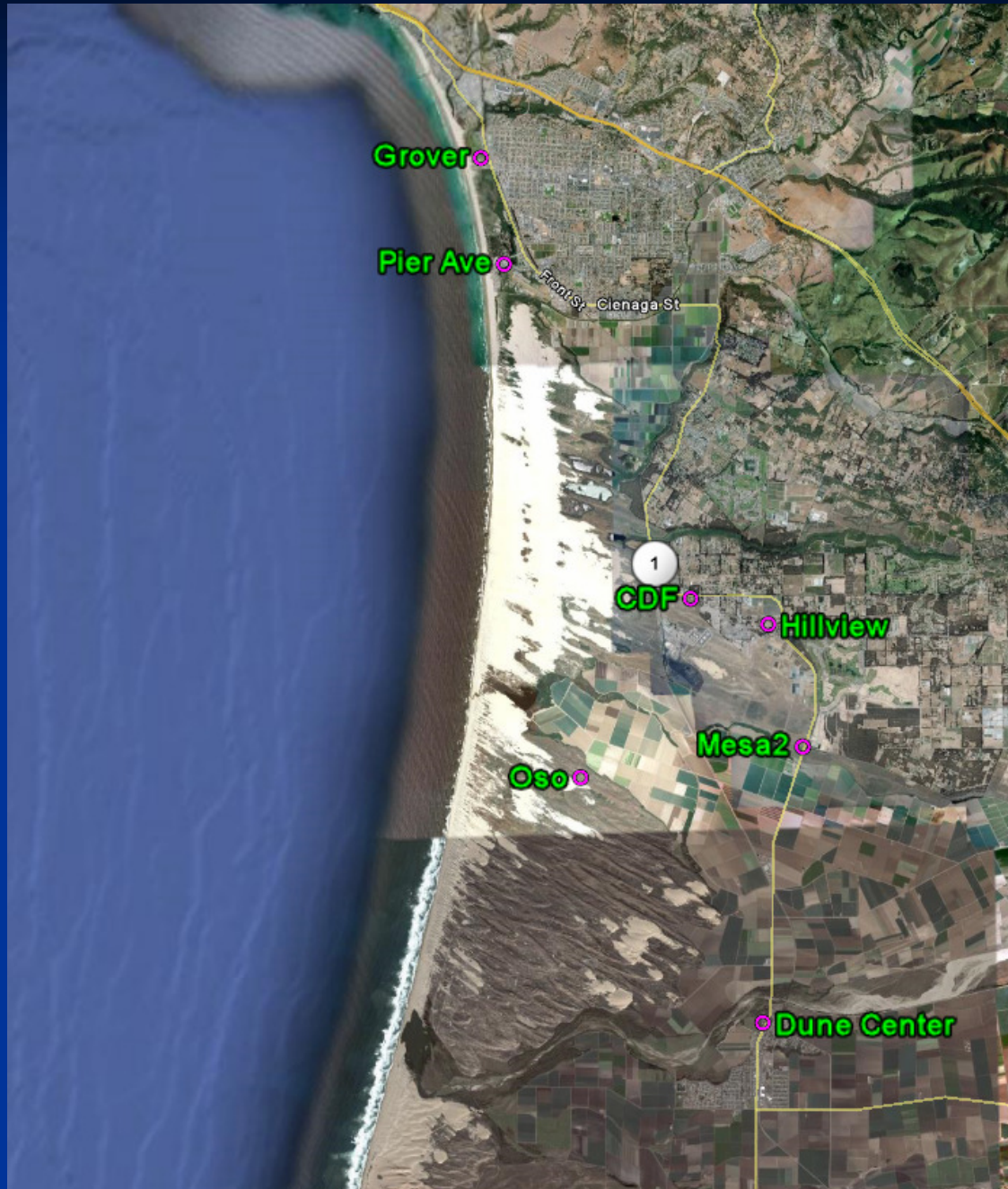
Three Studies Wrapped into One

- **SLO APCD** – Measure particulate levels and winds to see where high levels come from.
- **Delta Group** – Measure composition and size of airborne particles.
- **GBUAPCD/CARB** – Measure the physics of sand movement to understand emission mechanism.
- Multiple groups/methodologies significantly improve the robustness and validity of data

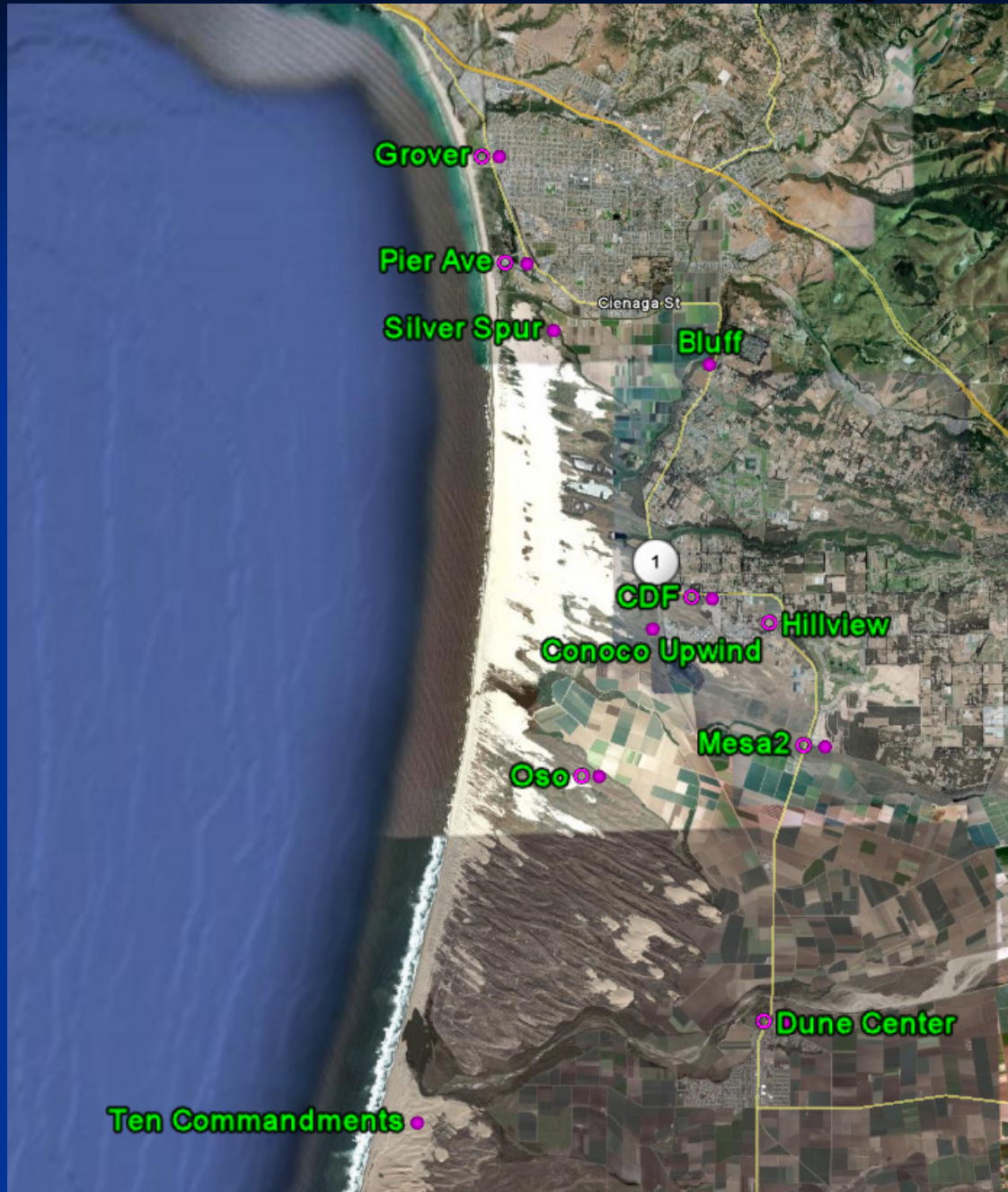
Monitoring Site Selection & Operations

- Honored all site recommendations from State Parks and their representatives
- There are differences between SVRA and “control” dunes
 - Size, density of vegetation, wind speed, proximity to monitor
- Study timeframe considered both annual PM conditions as well as high-wind, intensive periods

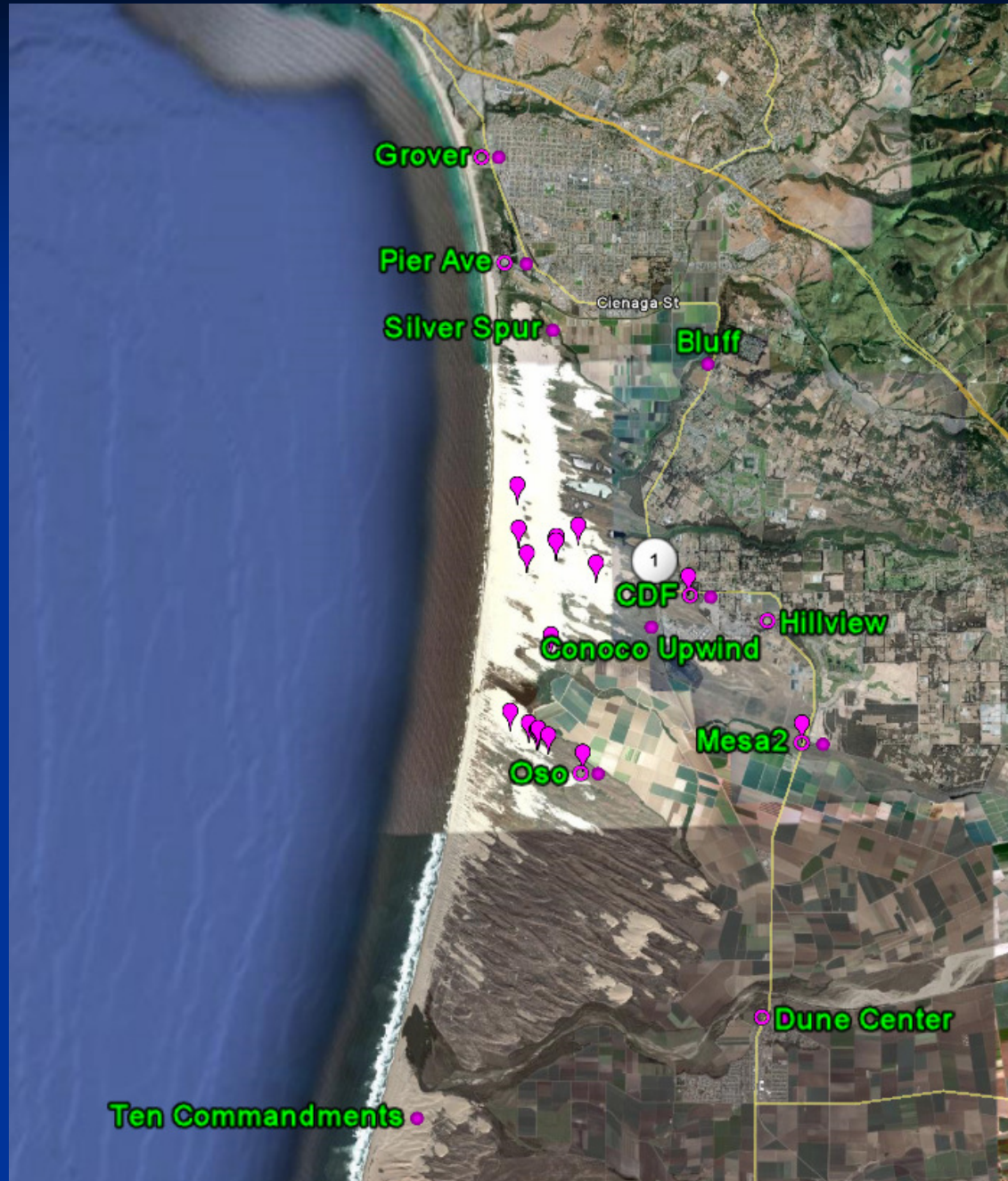
SLO APCD Monitoring Sites



SLO APCD and Delta Group Sites



SLO APCD, Delta, and Sand Flux Measurement Locations



Depth of Study Analysis

- Approximately 2 million data points gathered
- Each of the three independent studies performed their own independent analysis of the data
 - Data validated based on calibrations and quality control checks.
 - Countless hours spent looking at how the data fits together

Study Results

Study Results

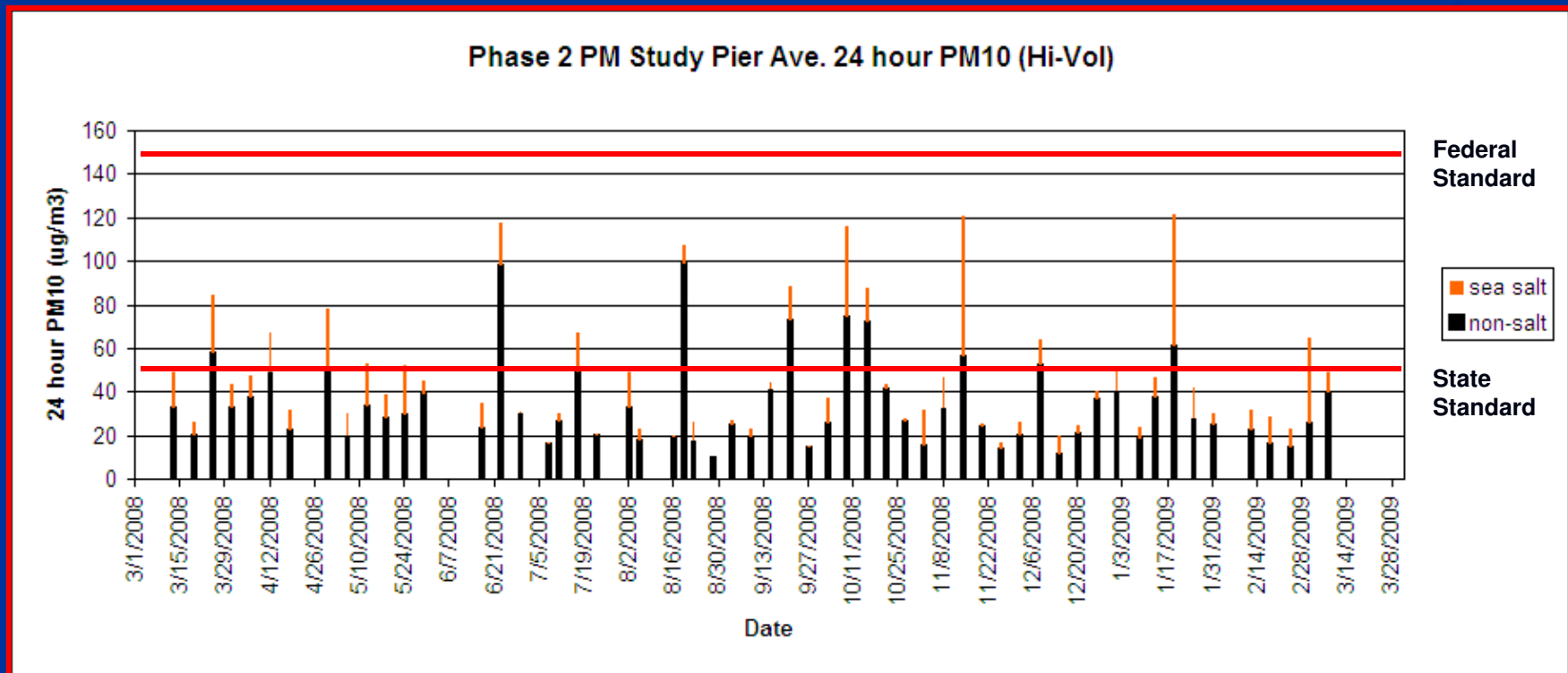
- Phase 2 Study Confirmed Phase 1 Results
 - Particle composition on high PM episodes mostly earth crustal composition
 - High PM episodes associated with strong NW winds
 - Main source of PM on high episodes is from the coastal dunes
 - Very similar number of exceedances of the state PM10 standard and highest concentrations
 - Measured high levels of both coarse and fine PM

Coke piles and ag. fields are not a significant source of PM

- Elemental tracers of coke (vanadium, nickel, sulfur) not found together in coarse fraction downwind from piles
- Bluff site downwind from agricultural fields recorded low PM values

Pier Avenue, Oceano

- Site appears to indicate a localized high PM area.
 - Partially due to sea salt
 - With salt excluded exceeds State PM₁₀ standard approximately 48 days a year



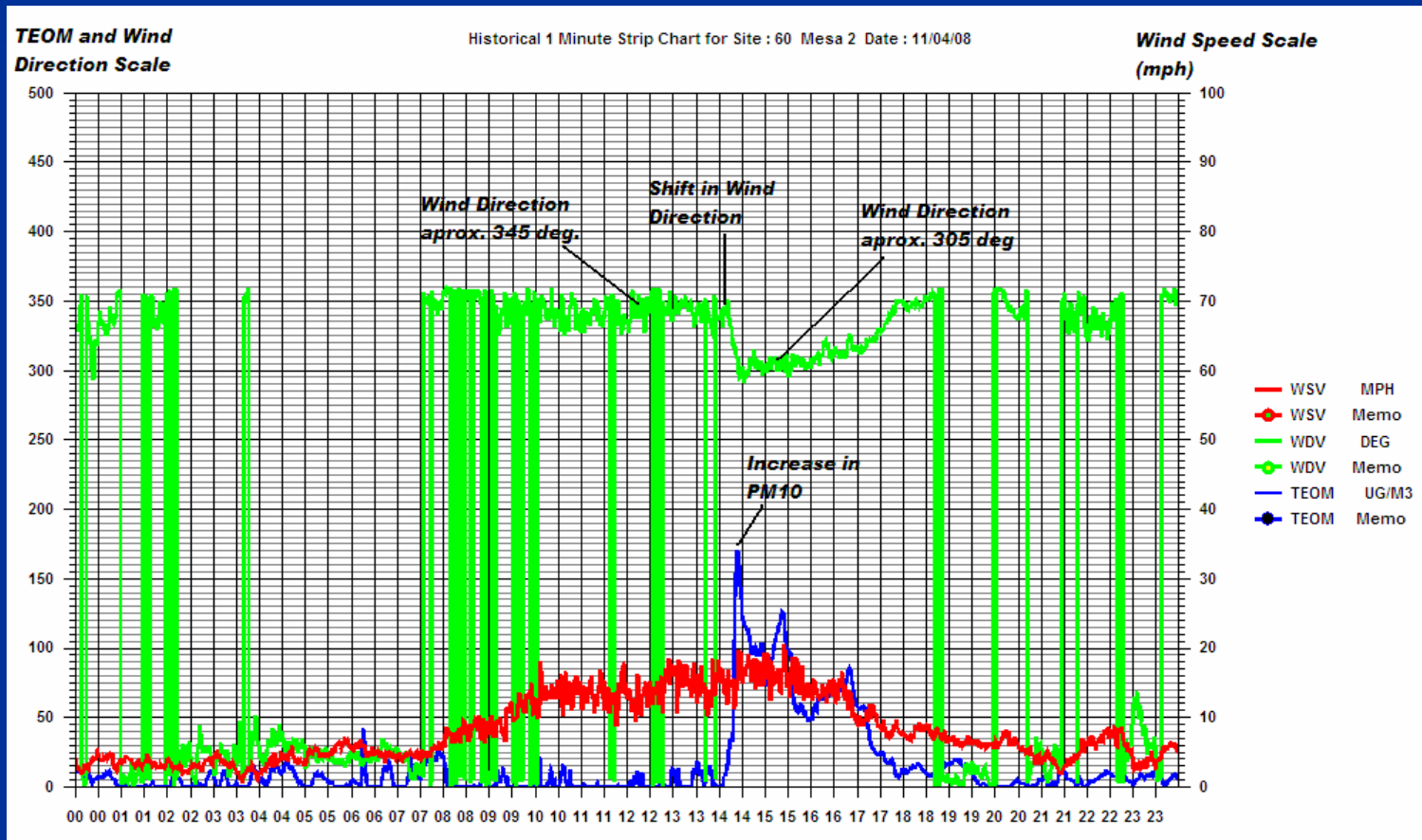
Pier Avenue, Oceano

- Monitors in close proximity all showed low levels of PM (excluding salt)
 - High readings at Pier Ave. are likely very localized
- Sand present on the south side of Pier Ave and/or vehicle traffic on the beach are possible sources
 - Can be confirmed by further study



Vegetated areas do not emit particulates

- Sand movement sensors upwind from Oso, Mesa2, and CDF did not collect sand
 - No sand movement, and therefore no emissions
- PM₁₀ monitors did not record high readings when air movement passed over vegetated areas



Higher PM from dunes with OHV activity

- Higher average PM_{10} readings were measured on the 50 highest use days as compared to the 50 lowest use days in the SVRA
 - 25% increase in average PM_{10} comparing highest to lowest vehicle activity days
 - No difference between high and low vehicle activity days seen at Oso control site

Higher PM from dunes with OHV activity

Data from all three independent analysis shows similar findings:

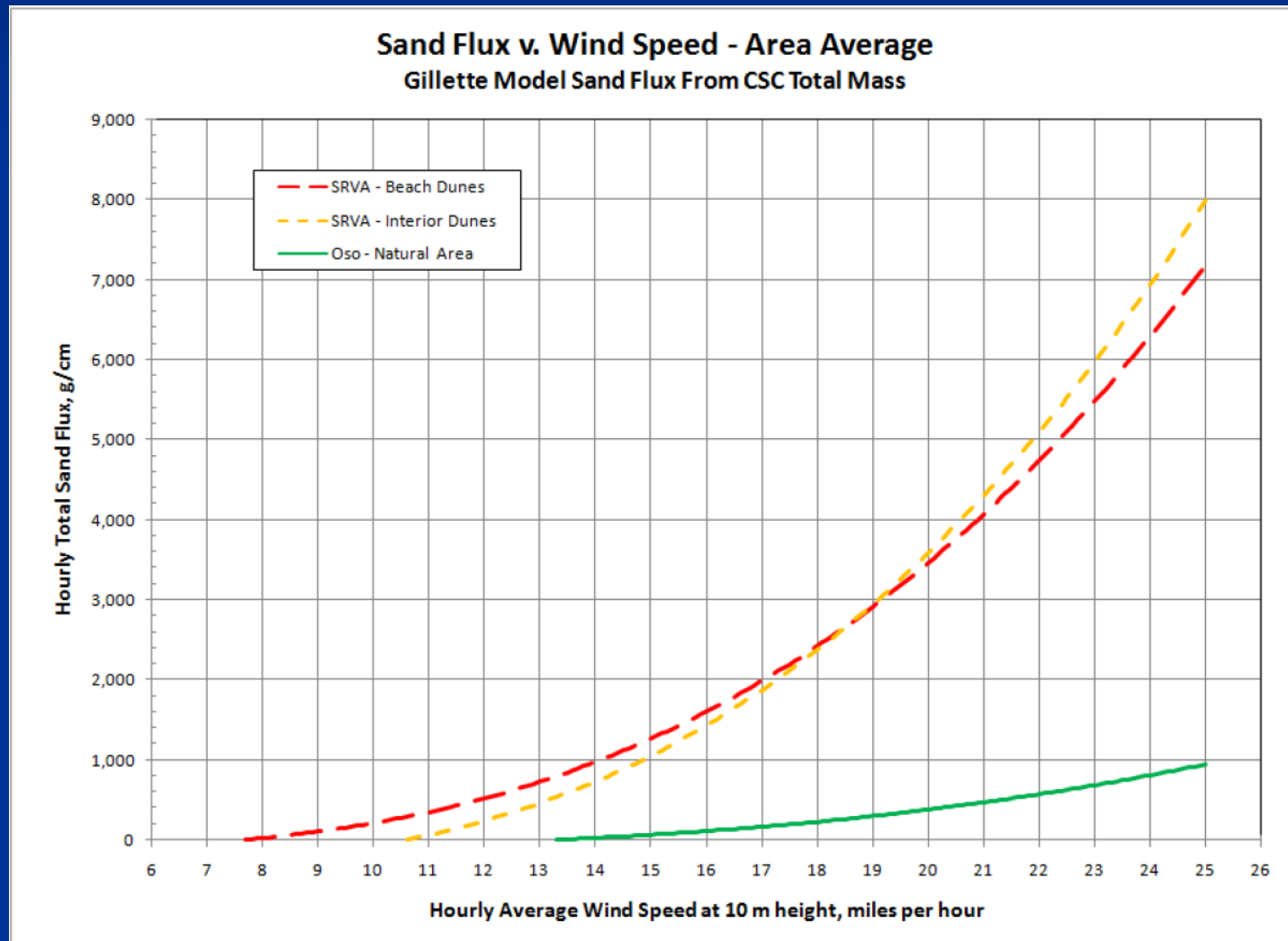
- Great Basin sand flux data shows wind moves sand in SVRA easier than in control area.
- Delta Group data shows PM levels downwind from the SVRA are higher than control areas.
- APCD data shows PM levels downwind from the SVRA are higher than control areas.

Higher PM from dunes with OHV activity

- Higher winds needed to begin sand movement in control area
- Data showed that periods of high sand movement was associated with high PM₁₀ readings
- Threshold at Oso similar to Keeler Dunes in GBUAPCD
- Emissions can only occur when sand is moving

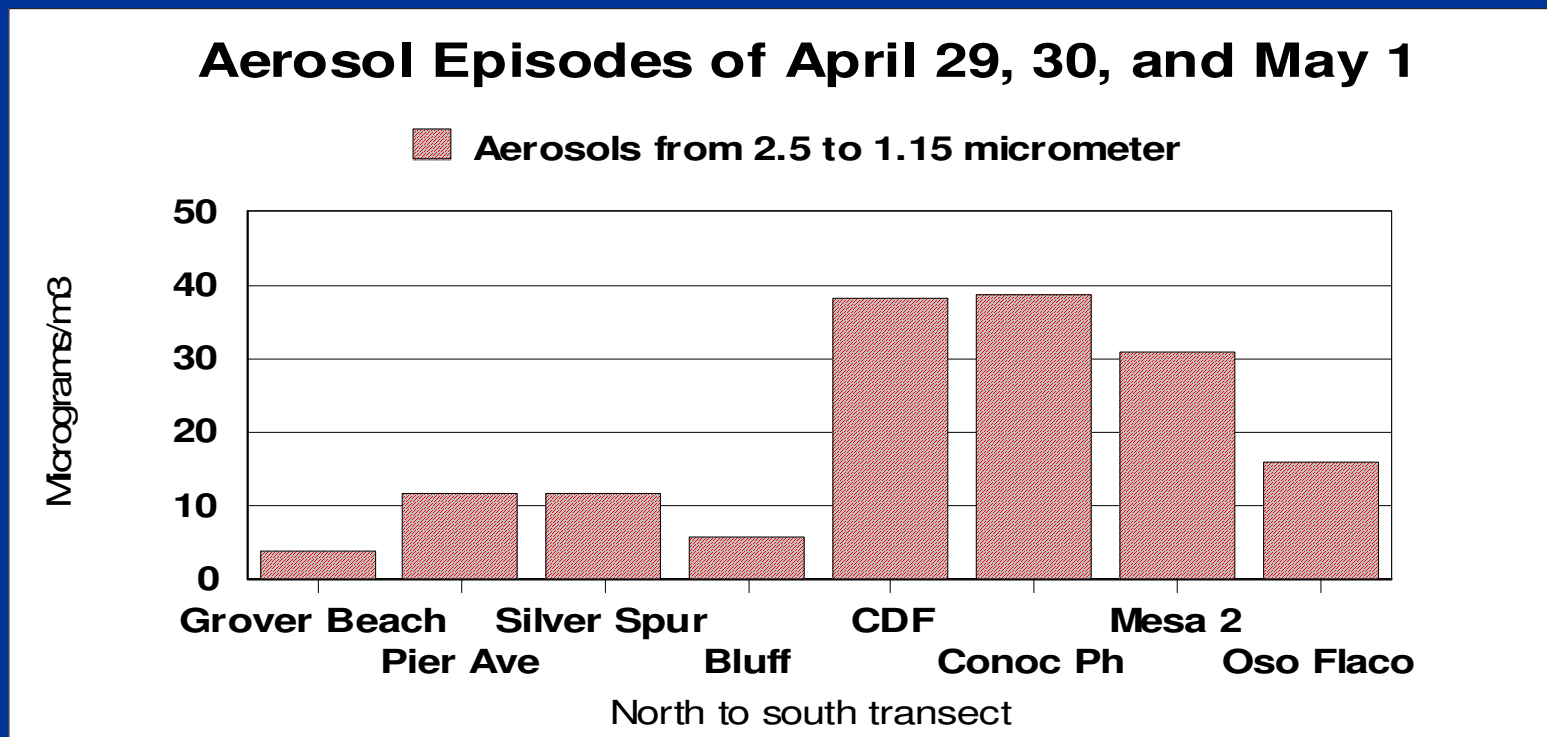
Location	Threshold Wind Speed at 10 meters
SVRA – Beach Dunes	7.7 mph
SVRA – Interior Dunes	10.6 mph
Control Area – Oso	13.3 mph

Dramatically more sand movement in the SVRA than the control area under the same winds



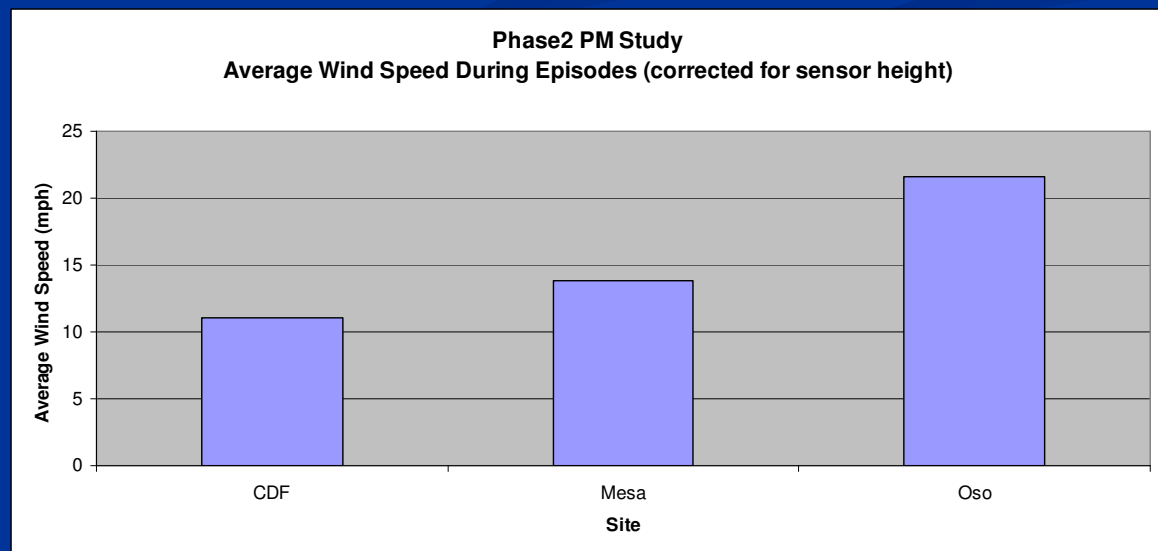
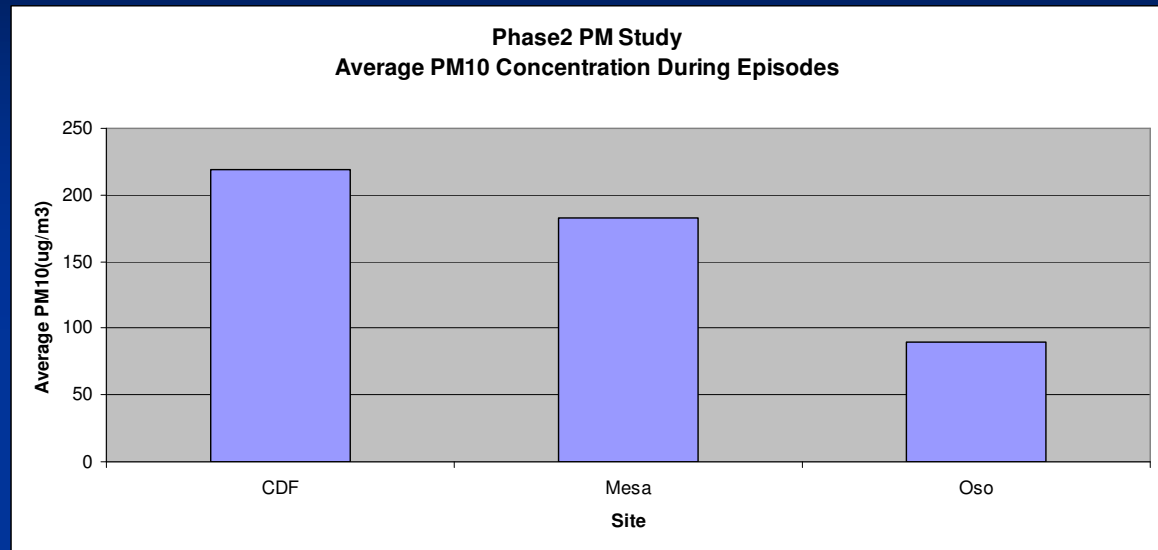
Higher PM from dunes with OHV activity

- Delta Group results consistent with Great Basin sand flux data



Higher PM from dunes with OHV activity

- APCD results consistent with Delta Group and Great Basin data
- Most high readings from Oso occurred when wind speed was greater than highest winds downwind from SVRA
- Dune Center control site showed even lower concentrations



Summary

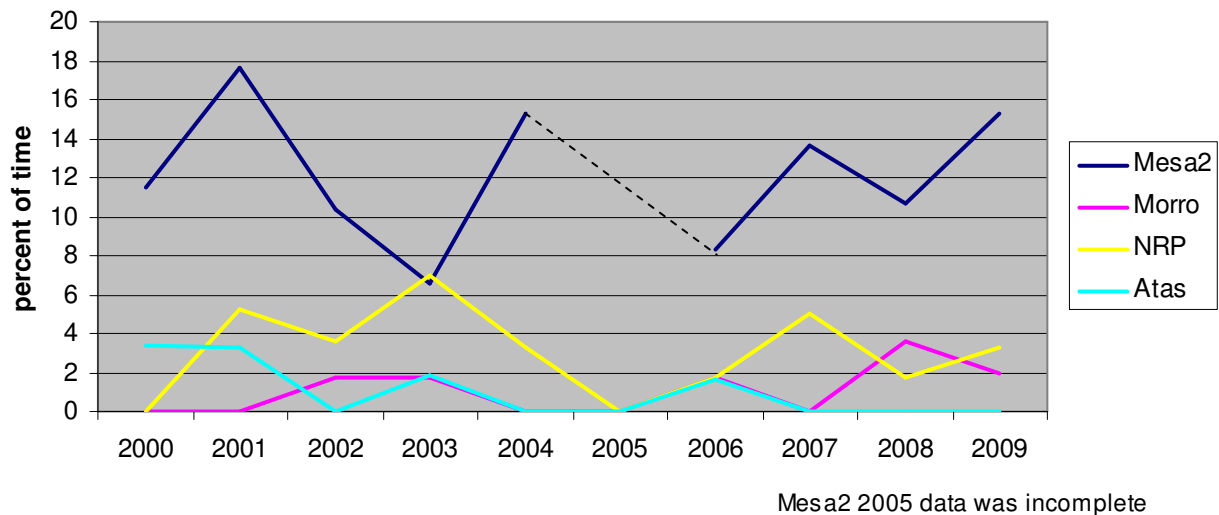
- Primary Conclusion

OHV activity in SVRA is major contributing factor to high PM concentrations observed on Mesa

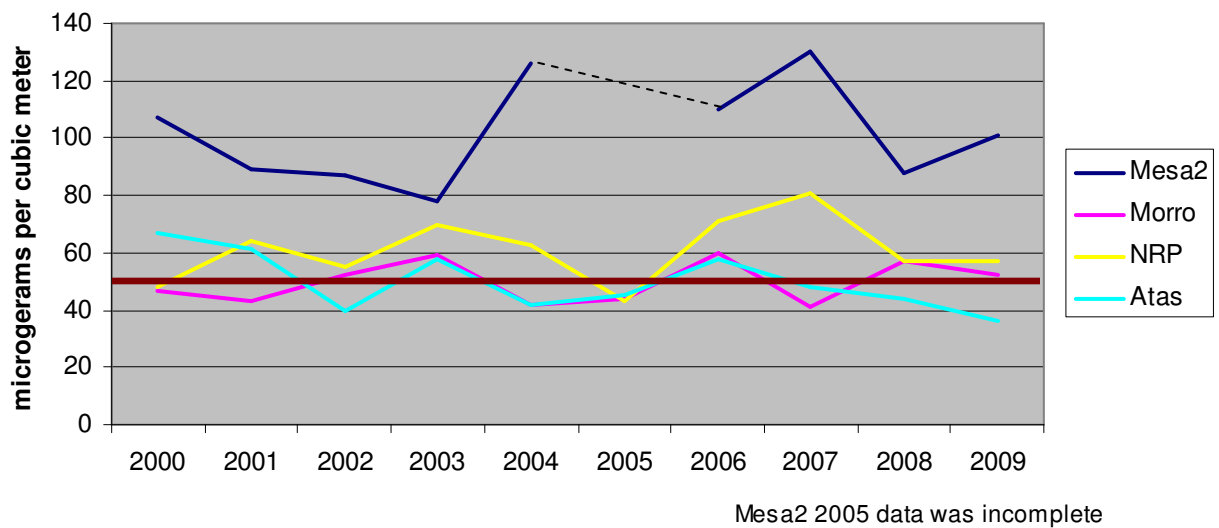
- Unanimous support of findings by 6 independent, highly qualified peer reviewers
- Weight of evidence is the key factor for confidence in the findings and conclusions

Questions?

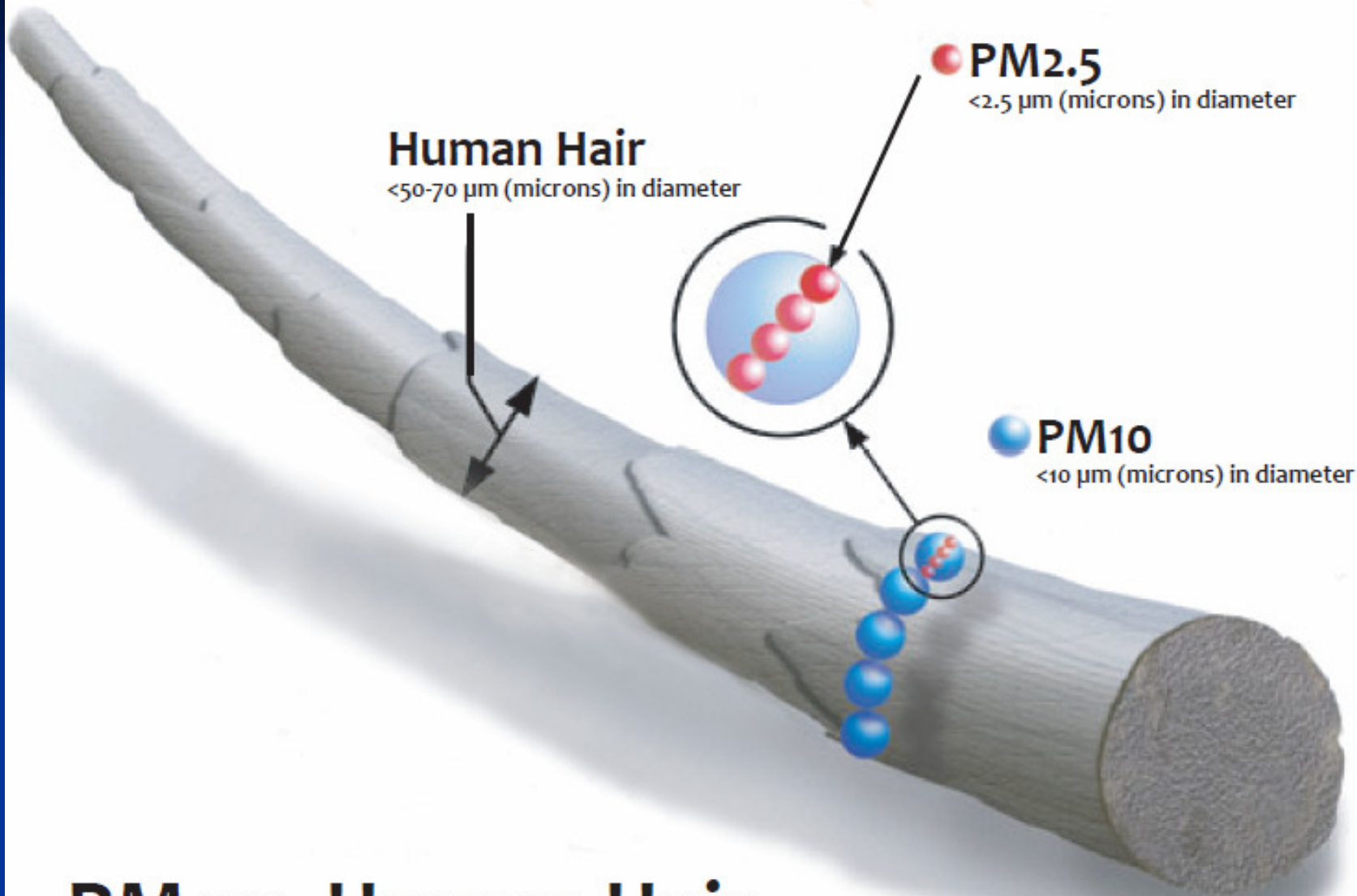
Violations of State 24-Hour PM10 Standard (50 ug/m3)



Maximum 24-Hour PM10 Concentration



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Human Hair
<math><50-70\ \mu\text{m}</math> (microns) in diameter

PM2.5
<math><2.5\ \mu\text{m}</math> (microns) in diameter

PM10
<math><10\ \mu\text{m}</math> (microns) in diameter

PM vs. Human Hair



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