

**Natural Resources
and Sustainable Agricultural Systems
Research
in the
Agricultural Research Service**

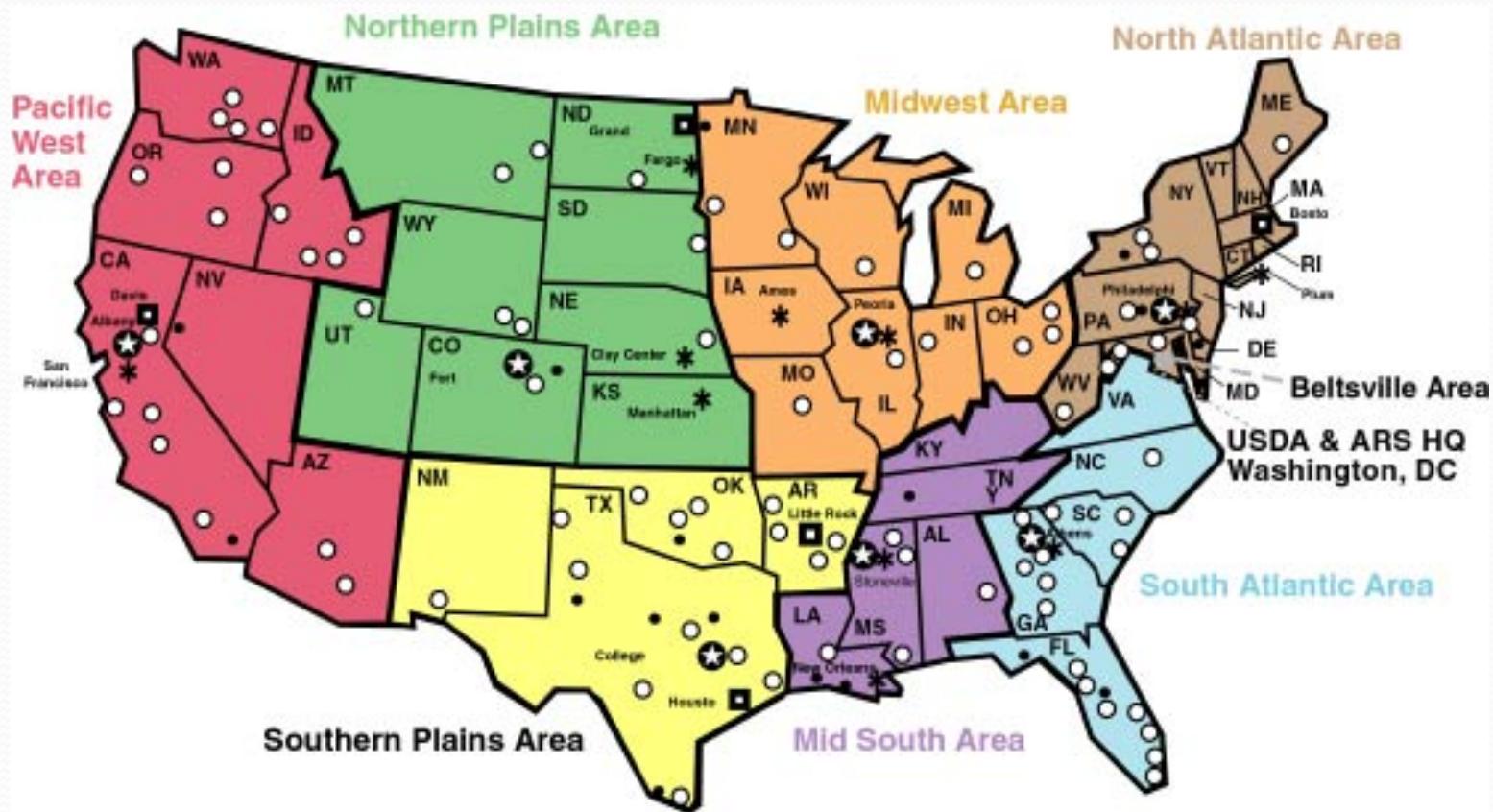
Climate Change, Soils, and Emissions

Greg Holt for Charlie Walthall

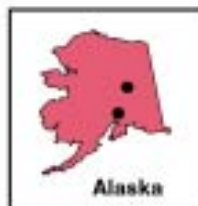
Natural Resources & Sustainable Agricultural Systems



ARS Locations



- ★ Area
- ✱ Research Centers
- Human Nutrition Centers
- Research Locations
- Research Worksites



ARS National Programs

Program Planning and Evaluation



Chavonda
Jacobs-Young

Associate
Administrator

Natural Resources &
Sustain. Agric. Sys. (~20%)

Crop Production &
Protection (~35%)

Animal Production &
Protection (~15%)

Nutrition, Food Safety
& Quality (~30%)



Currently
Vacant



Kay
Simmons



Steven
Kappes



Currently
Vacant

- Water Availability and Watershed Management
- **Global Change, Soil and Emissions**
- Bioenergy and Bioproducts
- Agricultural Waste and Byproduct Utilization
- Pasture, Forage and Range Land Systems
- Agricultural System Competitiveness and Sustainability

- Plant, Microbial & Insect Germplasm Conservation & Development
- Plant Biological & Molecular Processes
- Plant Diseases
- Crop Protection & Quarantine
- Crop Production
- Methyl Bromide Alternatives

- Food Animal Production
- Animal Health
- Arthropod Pests of Animals and Humans
- Aquaculture

- Human Nutrition
- Food Safety
- New Uses, Quality & Marketability of Plant & Animal Products

ARS Research Program Management

- Role of the Office of National Programs
 - Research relevance
 - Program coordination
 - Program impact
- Role of the Area Offices
 - Prospective quality assurance
 - Project and resource management

Benefits of National Programs



Coordination

Communication

Efficient use of resources

Results

Climate Change, Soils, and Emissions



Total Projects: 35

Total Locations: 29

Total Scientists: 98

- Enable Improvements of Air Quality via Management and Mitigation of Emissions from Agricultural Operations
- Develop Knowledge and Technologies for Reducing Atmospheric Greenhouse Gas Concentrations Through Management of Agricultural Emissions and Carbon Sequestration
- Enable Agriculture to Adapt to Climate Change
- Maintain and Enhance Soil Resources

Air Quality



Cotton Gin Sampling Project

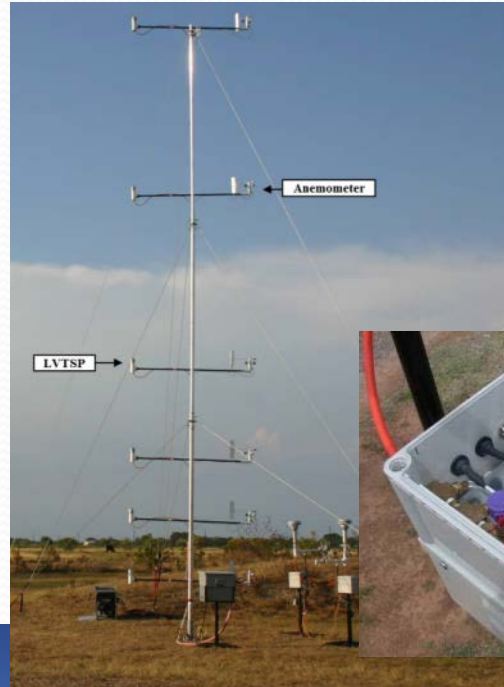
Objectives

- Develop $PM_{2.5}$ emission factors and verify current PM_{10} & TSP emission factors for cotton gins.
- Development of PM data sets that can be used in the design, development, and evaluation of current and future air quality dispersion models.
- Characterize the PM emitted from cotton gins across the cotton belt in terms of particle size distribution, particle density, and particle shape.
- Collect field data for comparison of PM_{10} and $PM_{2.5}$ EPA federal reference method data from stack and ambient sampling versus particle size distribution analyses.

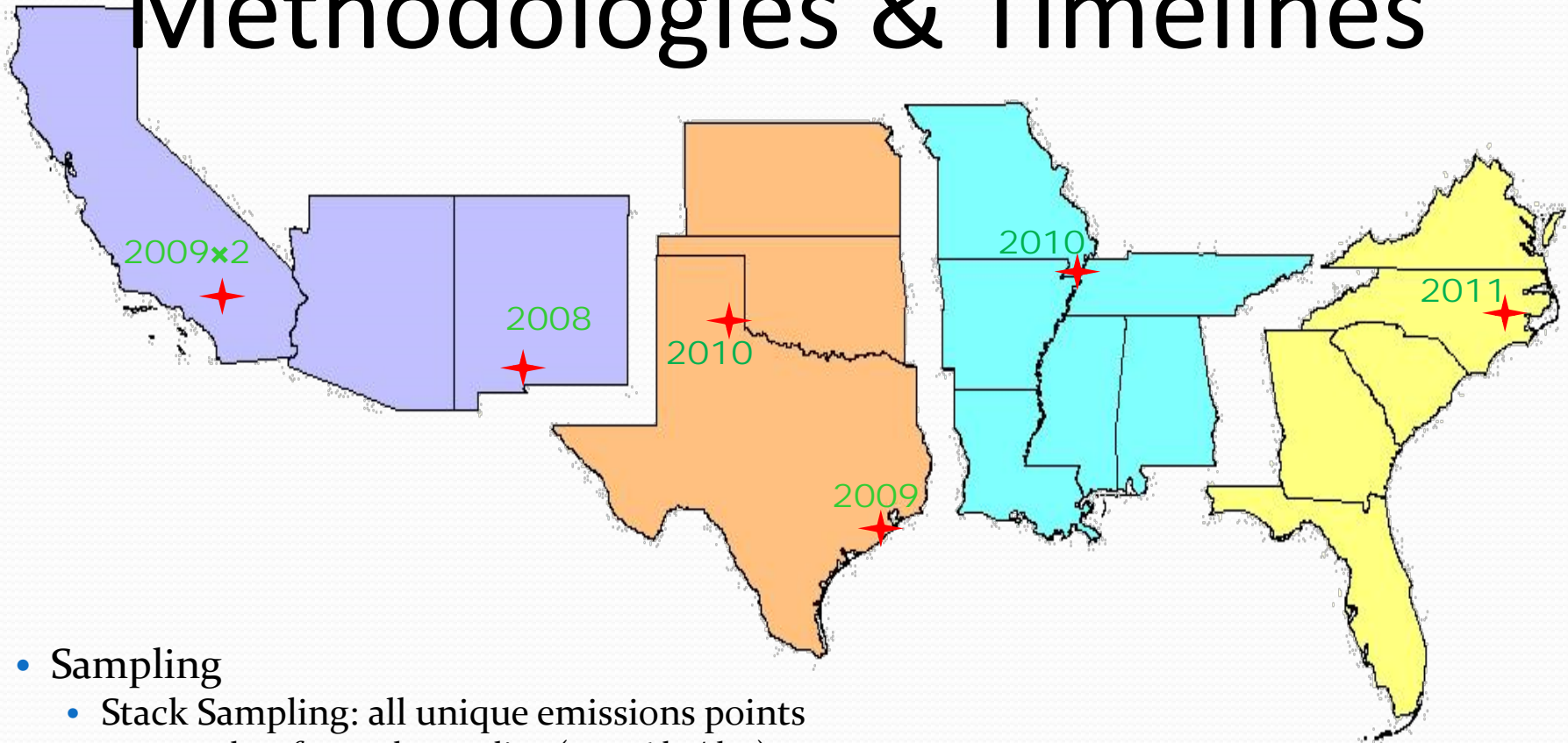
National Collaborators

- **Gin Labs**
 - Derek Whitelock – Mesilla Park
 - Clif Boykin – Stoneville
 - Greg Holt – Lubbock
- **Oklahoma State University**
 - Michael Buser
- Texas A&M University
- Texas, California, Southern, Southeastern, and National Ginners Associations
- Cotton Incorporated
- Cotton Foundation
- Primary and alternate gins selected for the study
- California Air Resources Board
- San Joaquin Valley Air Pollution Control District
- Texas Commission on Environmental Quality
- Missouri Department of Environmental Quality
- North Carolina Department of Environmental Quality
- NRCS Air Quality and Climate Change Unit in Portland, OR
- USDA-ARS Aerial Application Unit in College Station, TX
- EPA (National, Region 9, and Region 4)

Resources



Methodologies & Timelines



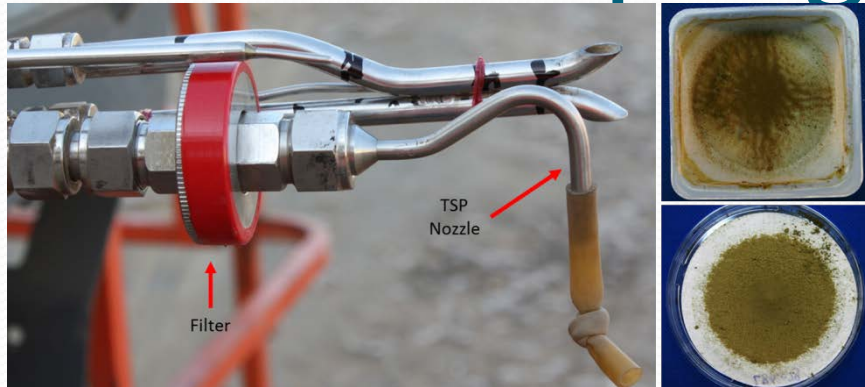
- Sampling

- Stack Sampling: all unique emissions points
12 to 15 days for stack sampling (est. 16 hr/day)
- Ambient Sampling: 125 sampling point array
 - 10 to 15 days (~24 hr/day)
- Ambient and stack sampling will overlap

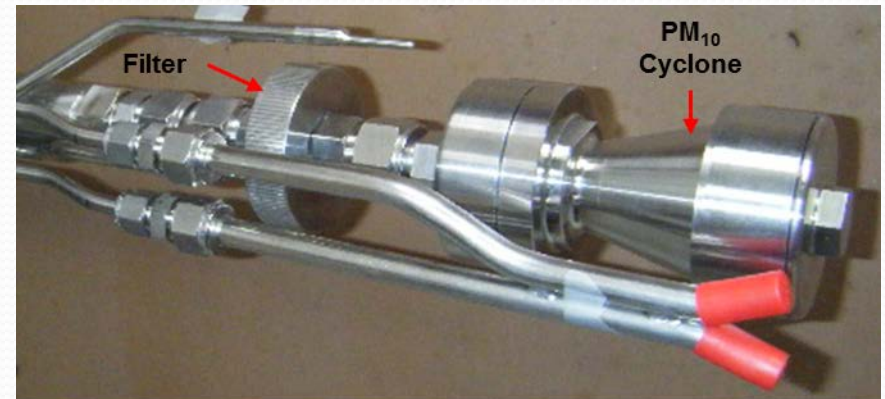
Stack Sampling



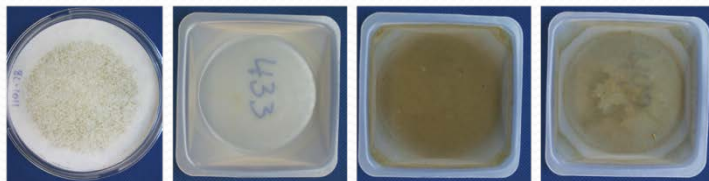
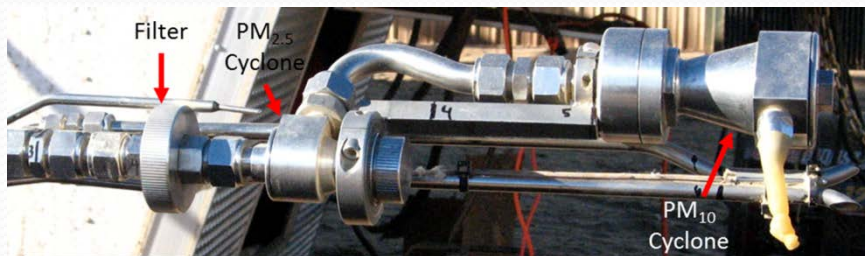
Stack Sampling



Total Particulate - Method 17



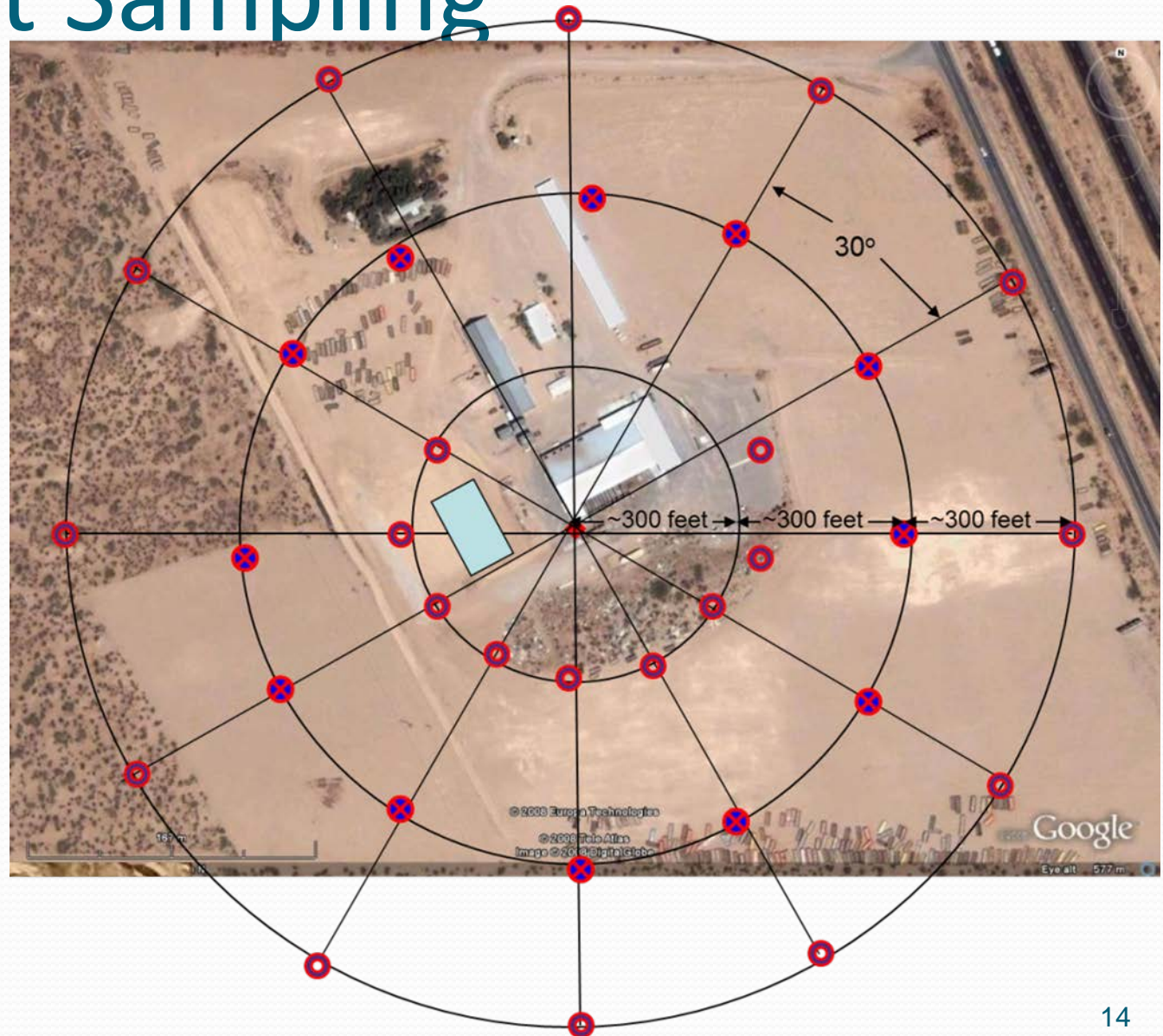
PM₁₀ – Method 201A



PM_{2.5} – OTM 27

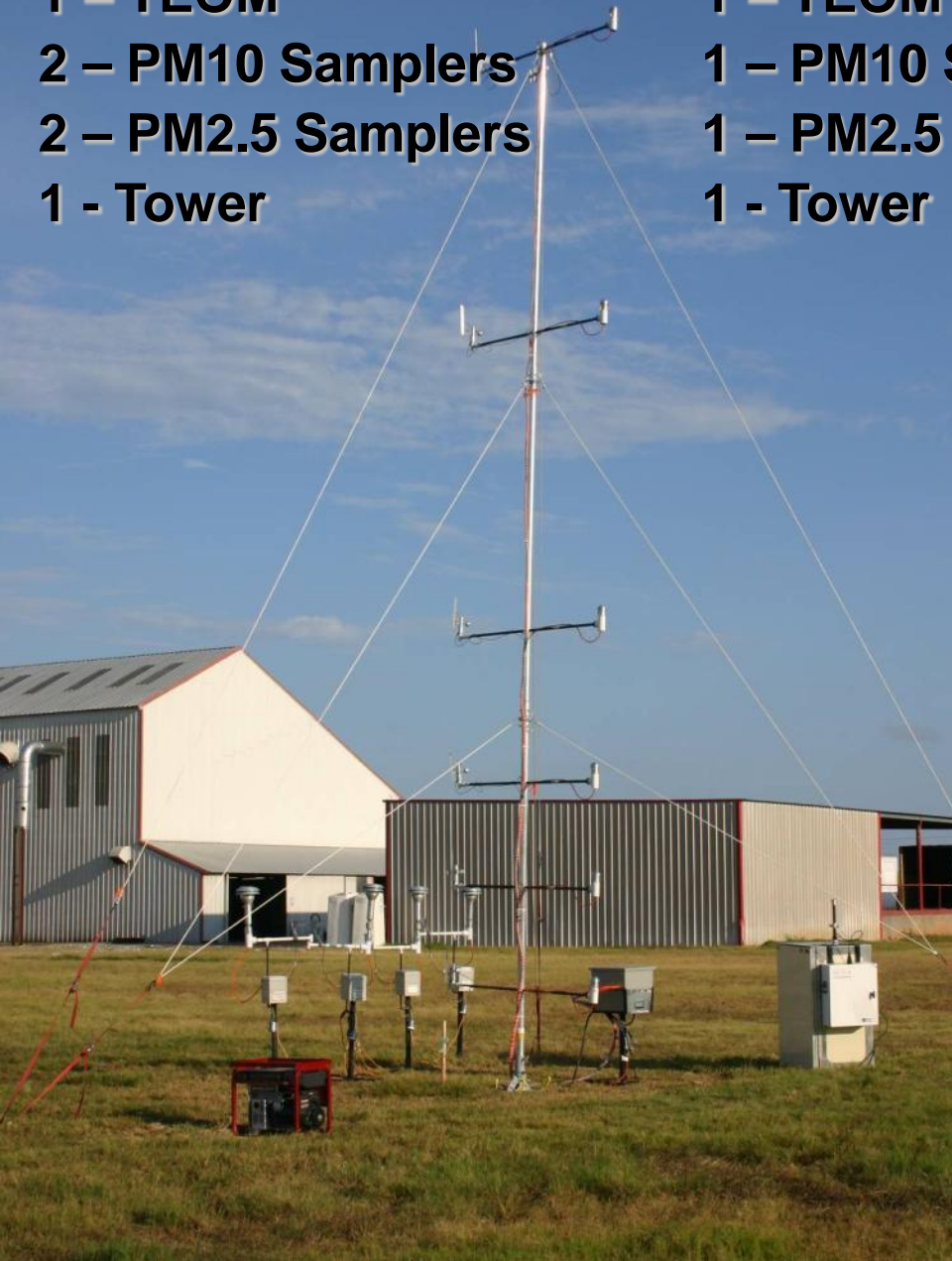
Ambient Sampling

-  Tower Sampler
-  Stand Alone Sampler



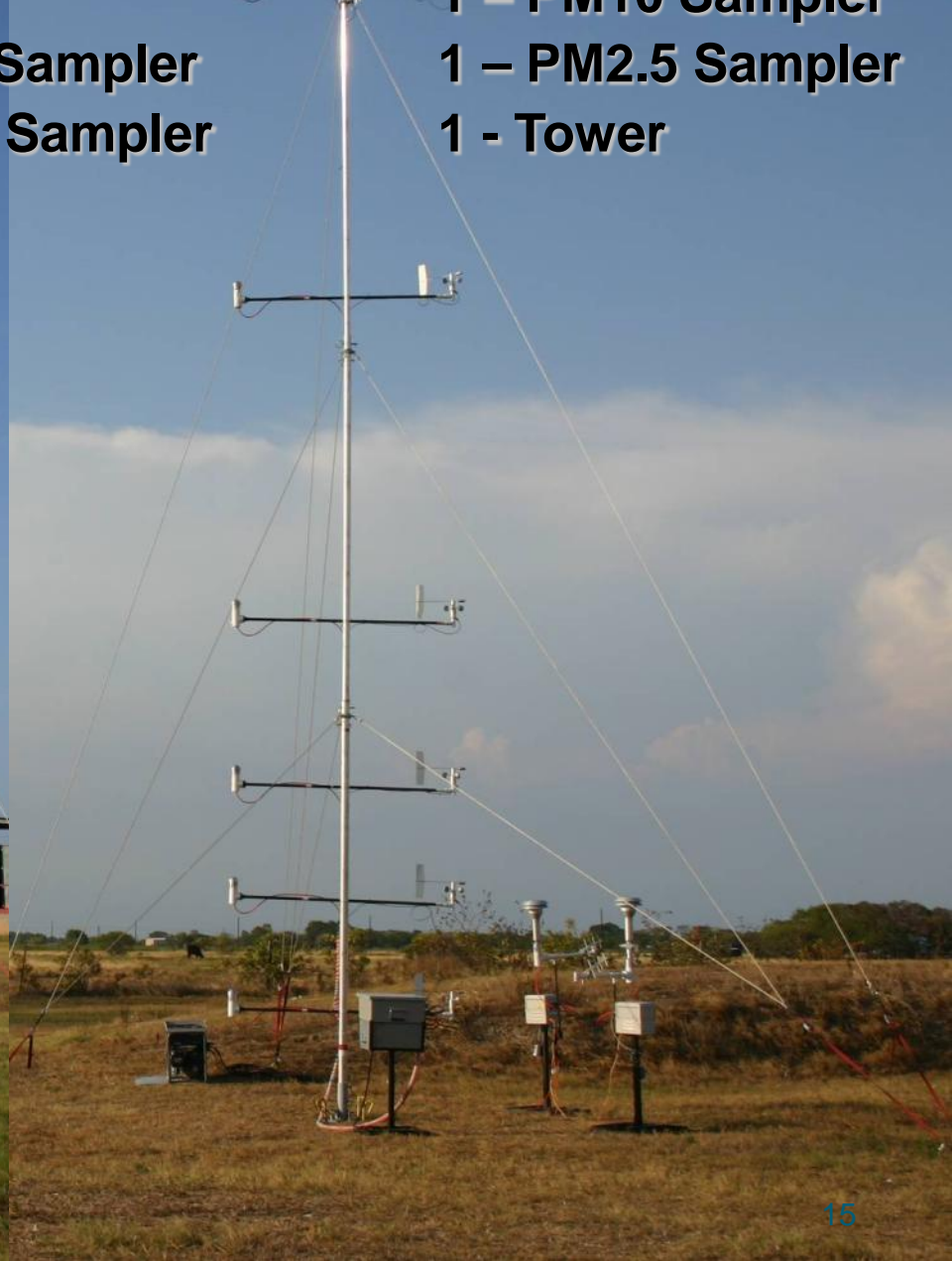
2 Tower Sites:

- 1 – TEOM**
- 2 – PM10 Samplers**
- 2 – PM2.5 Samplers**
- 1 - Tower**



2 Tower Sites:

- 1 – TEOM**
- 1 – PM10 Sampler**
- 1 – PM2.5 Sampler**
- 1 - Tower**

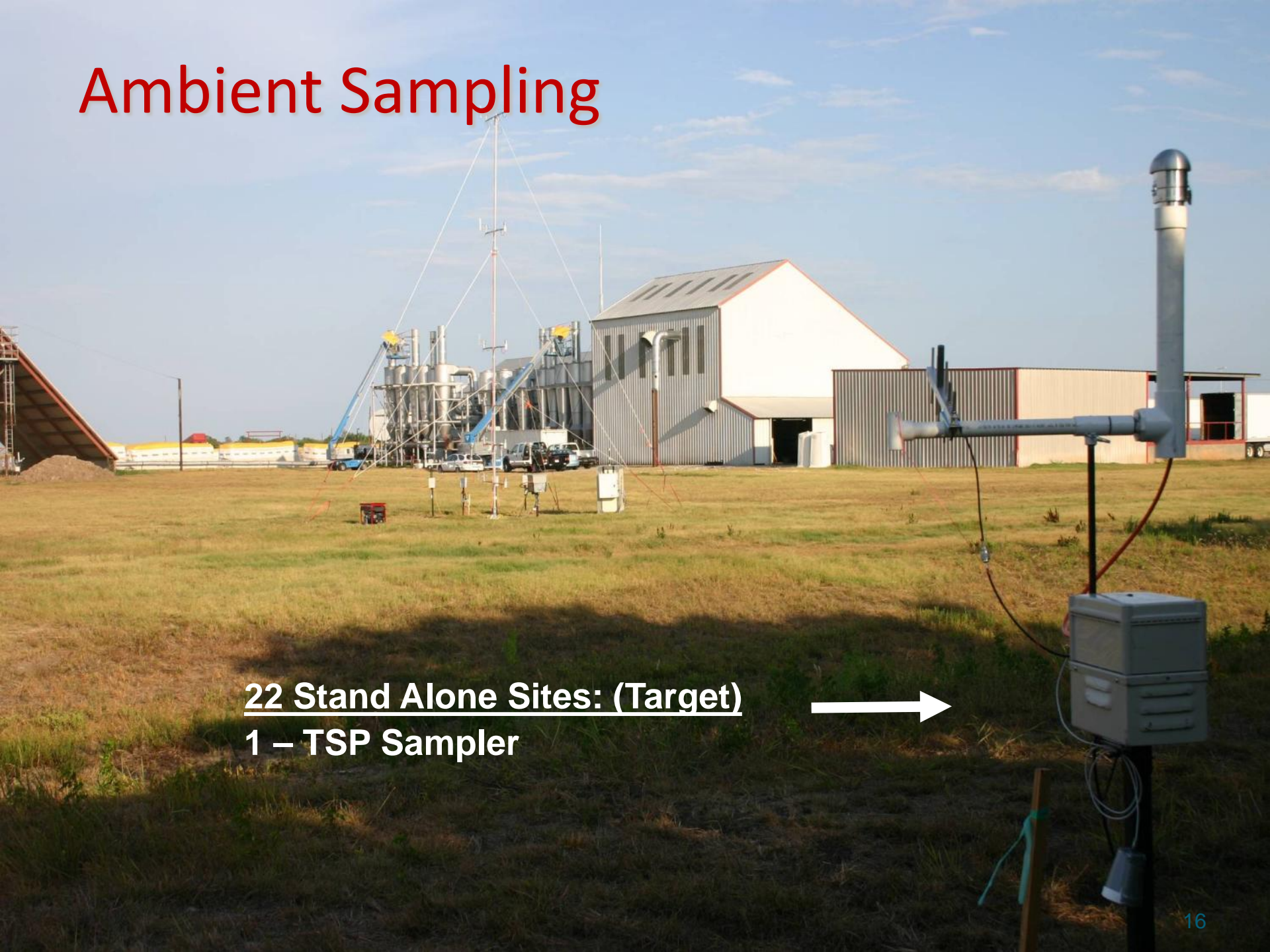


8 Tower Sites:

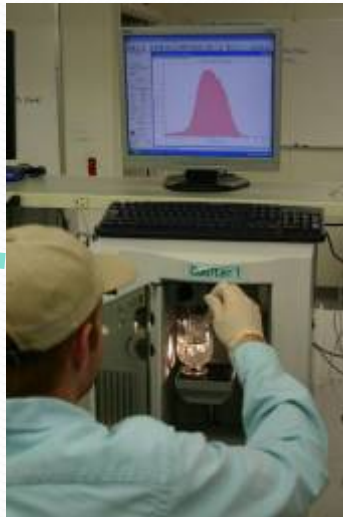
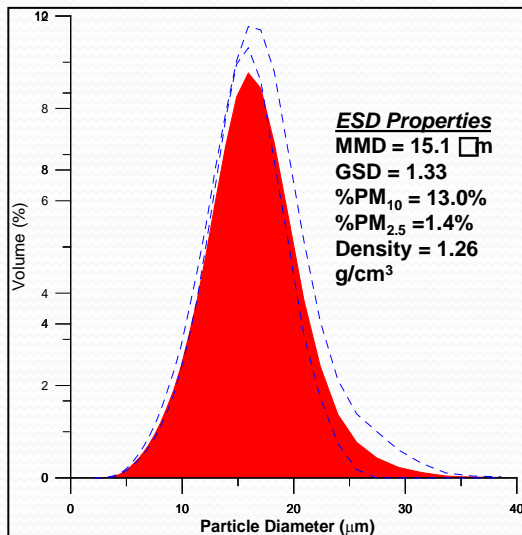
- 1 – PM10 Sampler**
- 1 – PM2.5 Sampler**
- 1 - Tower**

Ambient Sampling

22 Stand Alone Sites: (Target)
1 – TSP Sampler



Laboratory Analyses



Filter	Weight 1	Weight 2	Weight 3	Average	St Dev	Weight 1	Weight 2	Weight 3	Average	St Dev	Weight 1	Weight 2	Weight 3	Average	St Dev	Filter Weight
8L-1718	254737	254747	254744	254743	5	257466	257457	257462	257462	5	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	2719

Dir	Speed	Count
1	0.8	1
2	0.7	3
3	0.8	5
4	0.7	7
5	0.8	9
6	0.7	9
7	0.8	9
8	0.7	9
9	0.7	9
10	0.7	9
11	0.8	9
12	0.9	9
13	0.8	9
14	0.8	9
15	1.0	9
16	0.9	9
17	0.9	9
18	0.7	9
19	0.8	9
20	0.9	9
21	0.8	9
22	0.9	9
23	0.9	9
24	0.8	9
25	0.8	9
26	0.8	9
27	0.9	9
28	0.8	9
29	0.9	9
30	0.9	9
31	0.8	9
32	0.8	9
33	0.6	9
34	0.7	9
35	0.7	9
36	0.7	9
37	0.8	9
38	0.5	9
39	0.5	9
40	0.3	9
41	0.2	9
42	0.2	9
43	0.2	9
44	0.3	9
45	0.6	9
46	0.6	9
47	0.7	9
48	0.7	9
49	0.7	9
50	0.7	9

MMD (µm)	GSD	% < 2.5 µm	% 10-2.5 µm	% < 10 µm
10.81	1.84	1.8%	44.0%	45.2%
14.89	1.84	0.0%	26.9%	26.9%
15.84	2.62	4.68%	25.6%	30.2%
22.26	2.62	0.0%	18.7%	20.7%

Particle Diameter (µm)	ESD	AED
2.01137	2.76	2.76
2.03430	2.79	2.79
2.05750	2.81	2.81
2.08096	2.86	2.86
2.10469	2.89	2.89
2.12868	2.92	2.92
2.15295	2.96	2.96
2.17750	2.99	2.99
2.20233	3.02	3.02
2.22744	3.06	3.06
2.25283	3.09	3.09
2.27852	3.13	3.13
2.30450	3.17	3.17
2.33078	3.20	3.20
2.35735	3.24	3.24
2.38423	3.28	3.28
2.41141	3.31	3.31
2.43891	3.35	3.35
2.46672	3.39	3.39
2.49484	3.43	3.43
2.52328	3.47	3.47
2.55205	3.51	3.51
2.58115	3.55	3.55
2.61059	3.59	3.59
2.64035	3.63	3.63
2.67046	3.67	3.67
2.70091	3.71	3.71
2.73170	3.75	3.75
2.76285	3.80	3.80
2.79435	3.84	3.84

Assumptions:	Particle Density (g/cm ³)	Dynamic Shape Factor
	2.65	1.40

Counter	ESD	AED	ESD	AED
LS230	10.81	14.89	15.84	22.26
	1.84	1.84	2.62	2.62
% < 2.5 µm	1.18%	0.00%	4.68%	2.07%
% 10-2.5 µm	44.0%	26.9%	25.6%	18.7%
% < 10 µm	45.2%	26.9%	30.2%	20.7%

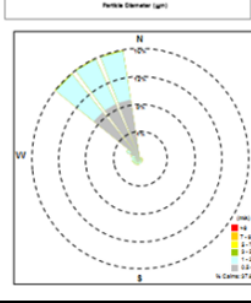
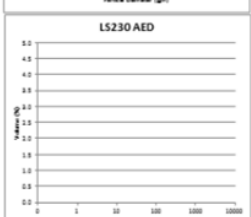
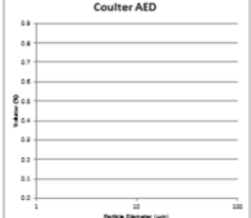
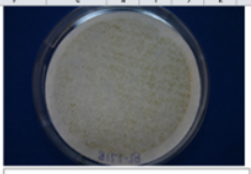
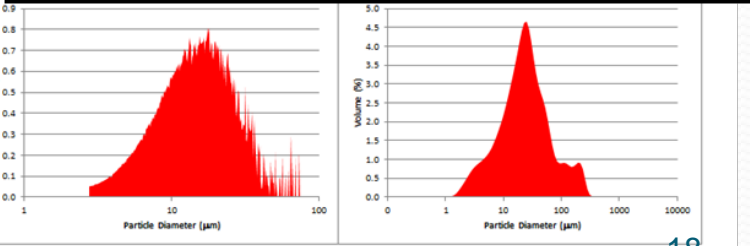
File Name	21022 - 1012011
Gen	2
Site	102
Sample Point	2
Day	1
Month	10
Year	2011
Height	2
Filter No.	8L-1718
Start Time	10/1/11:00 AM
Stop Time	10/2/11:00 AM
Run Time (min)	1359

Counter	ESD	AED	ESD	AED
LS230	10.81	14.89	15.84	22.26
	1.84	1.84	2.62	2.62
% < 2.5 µm	1.8%	0.0%	4.68%	2.07%
% 10-2.5 µm	44.0%	26.9%	25.6%	18.7%
% < 10 µm	45.2%	26.9%	30.2%	20.7%

	Average	Standard Deviation	Minimum	Maximum
Temperature (C°)	11.0	1.2	7.6	12.9
Temperature (F°)	51.7	2.2	45.7	55.3
Barometric Pressure (kPa)	95.6	0.9	92.5	96.7
Barometric Pressure (psi)	13.86	0.13	13.42	14.03
Relative Humidity (%)	70.2	1.7	66.1	74.7
Flow Rate (slpm)	17.01	0.22	15.45	17.33
Flow Rate (slpm)	16.78	0.19	15.26	16.91
Flow Control (%)	51.0	10.5	0.8	453.5
Wind Speed (m/s)	0.9	0.5	0.3	4.5
Wind Speed (mph)	2.0	1.2	0.6	10.0
Air Density (kg/m ³)	1.167	0.014	1.122	1.188
Air Density (lb/ft ³)	0.073	0.001	0.070	0.074

TSP	Concentration (µg/acm)	
	Gravimetric Counter	LS-230
PM ₁₀	114.190	30.726
PM _{2.5}	0.000	21.322
PM _{2.5}	0.000	2.363

TSP	Concentration (µg/dscm)	
	Gravimetric Counter	LS-230
PM ₁₀	115.780	31.153
PM _{2.5}	0.000	24.015
PM _{2.5}	0.000	2.619



Ambient Data
~8000 Total

Emission Factors (lb/bale)

Total	
	Gin
Test	1.743
AP42	2.4
Difference	
Test-AP42	-27%

PM ₁₀	
	Gin
PSD	0.660
Test	0.987
AP42	0.82
Difference	
Test-AP42	20%
PSD-Test	-33%
PSD-AP42	-20%

PM _{2.5}	
	Gin
PSD	0.044
Test	0.148
CA Estimate 36% of Total	0.861
Difference	
Test-CA	-83%
PSD-Test	-70%
PSD-CA	-95%

Output and Results (stack & ambient)

- 17 pubs – JCS special edition (PM 2.5) – Anytime
- 17 pubs – PM₁₀ – should be accepted this month
- 17 pubs – TSP – out for review
- 17 pubs – PSD's, submitted by end of Jan.
- Comparison Data pubs upcoming
- Finish ambient data checks (met data, sampler flow, processing rate of gin, PSD and gravemetric)
- Comparison – models vs. measured (in discussion)
- Texas made changes in air permits based on PSD data
- SJV – recommended no additional action for cotton gins (PM_{2.5})

Charles L. Walthall PhD

National Program Leader

**Climate Change, Soils and Air
Emissions Research Program**

USDA Agricultural Research Service

Office of National Programs

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