

Atmospheric Deposition of Phosphorus in Loxahatchee National Wildlife Refuge

by

William W. Walker, Jr.
Environmental Engineer
Concord, Massachusetts

and

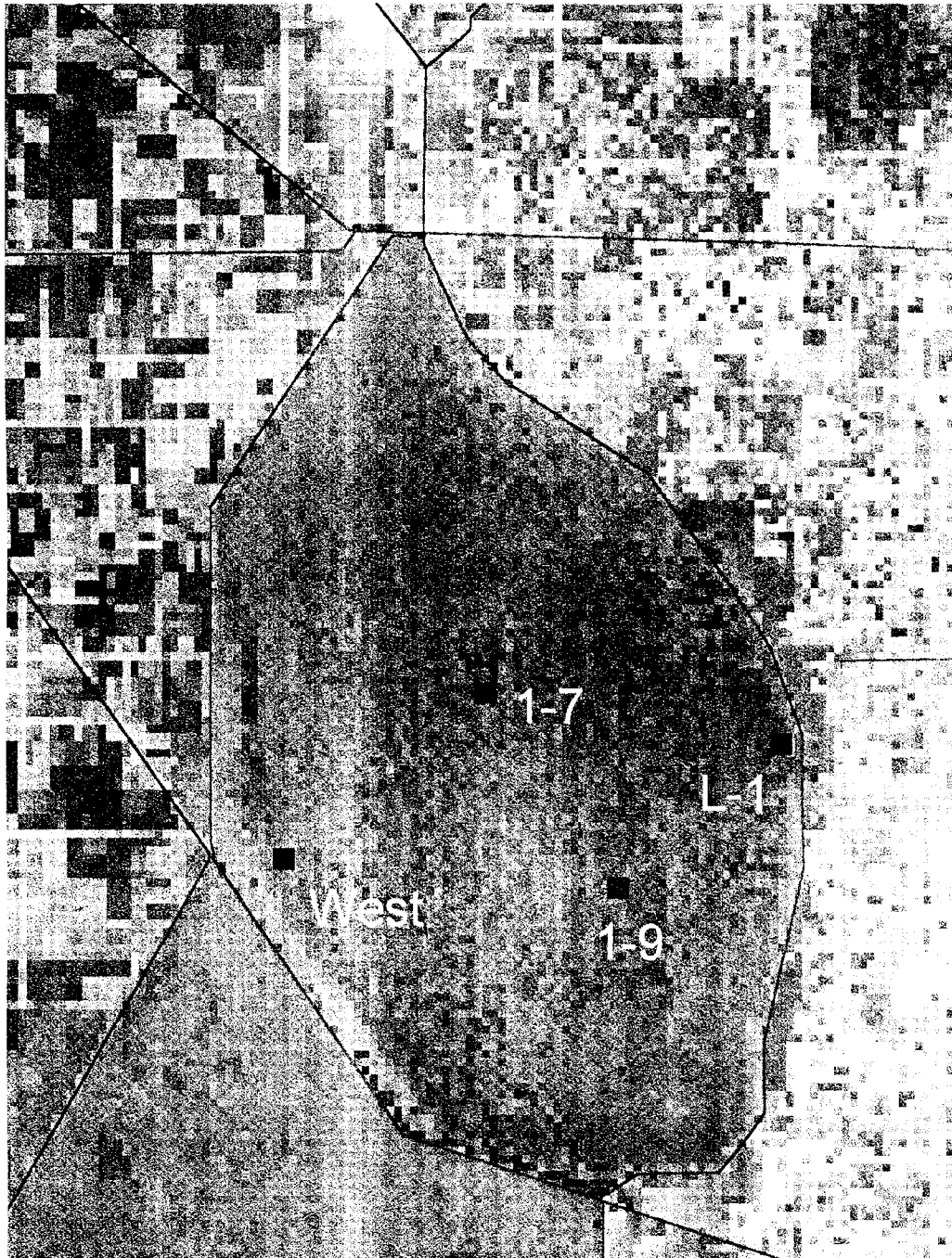
Susan D. Jewell
Senior Biologist
ARM Loxahatchee National Wildlife Refuge
Boynton Beach, Florida

presented at

"Atmospheric Deposition into South Florida:
Measuring Net Atmospheric Inputs of Nutrients"

South Florida Water Management District
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Loxahatchee National Wildlife Refuge

Atmospheric Deposition Monitoring Sites

Image: 1992



Deposition Sampling Efficiency

Sample Interval 02/03/93 to 07/16/97
 Sample Duration 1599 days
 Sample Duration 4.4 years
 Total Rainfall 758 cm @ at Refuge Headquarters, L-1
 Average Rainfall Rate 3.3 cm/wk
 Annual Rainfall 173 cm/yr
 Annual Rainfall 68 in/yr

Station	----- Wet Deposition -----						---- Dry Depos. ---	
	Sampled Days		Volume (cm)		Rate (cm/wk)		Sampled Days	
	<u>Days</u>	<u>% of Total</u>	<u>Collect.</u>	<u>% of Total</u>	<u>Collect.</u>	<u>% of Avg</u>	<u>Days</u>	<u>% of Total</u>
West	1312	82%	551	73%	2.9	88%	520	33%
1-7	1371	86%	561	74%	2.9	86%	930	58%
1-9	1301	81%	526	69%	2.8	85%	1144	72%
L-1	1245	78%	512	67%	2.9	86%	536	34%

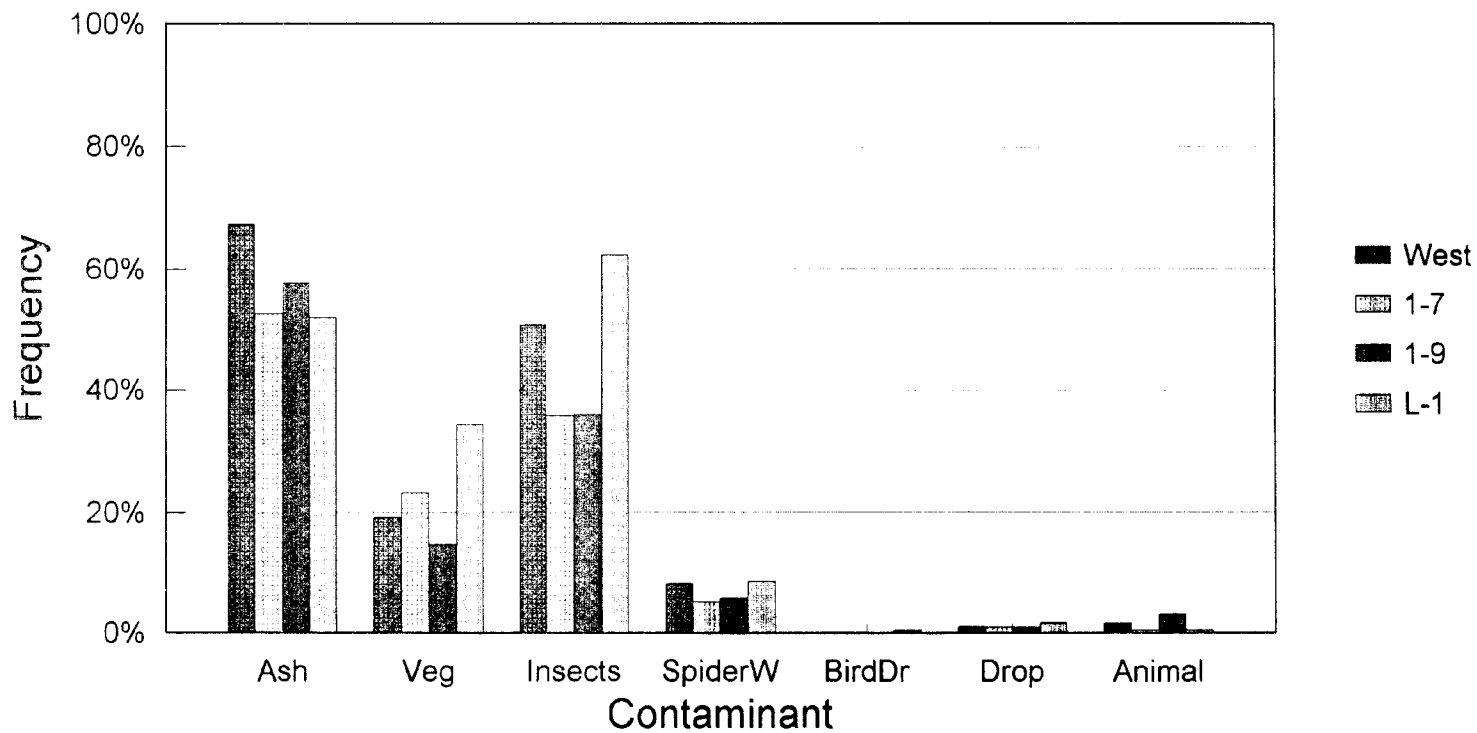
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Data-Reduction Procedure

Procedure	Number of Samples		Average P Deposition mg/m ² -yr			Total Conc ppb
	Wet	Dry	Wet	Dry	Total	
Assemble Data File & Select Records with Concentration & Volume Data	737	505				
Exclude Invalid Dry Samples (Volume in Dry Collector > 100 ml)	737	490	43	57	99	65
Exclude Samples with Droppings or Animal Material	717	431	41	36	76	51
Adjust for Remaining Contaminants (Vegetation, Insects, Spider Webs)	717	431	34	23	57	38
Select Paired Samples (Both Wet & Dry)	390	390	14	23	37	25

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Wet Bucket Contamination Frequencies by Station

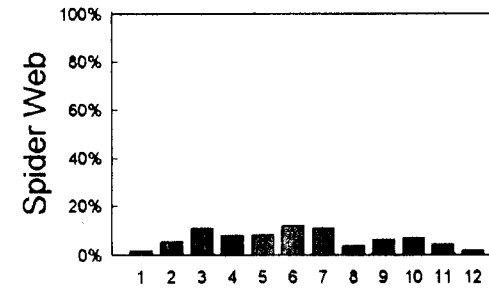
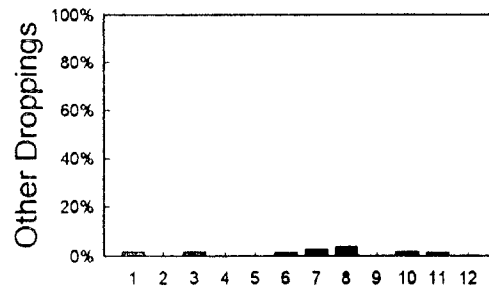
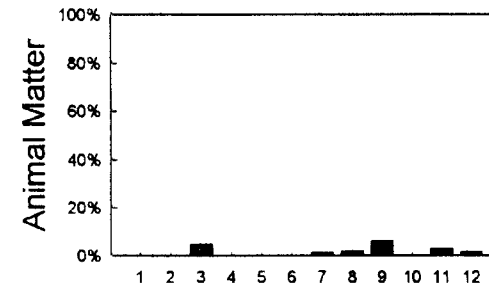
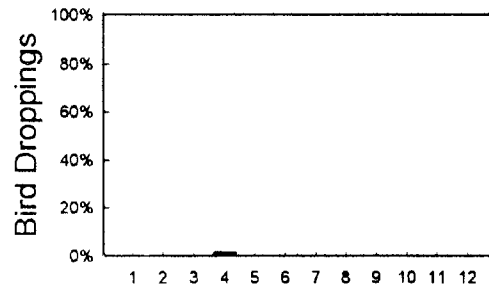
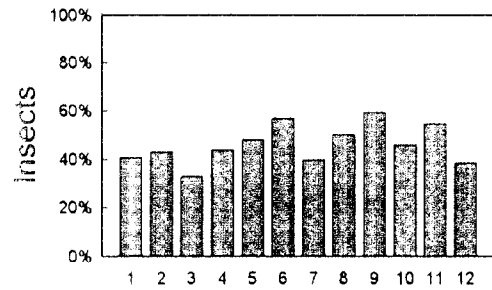
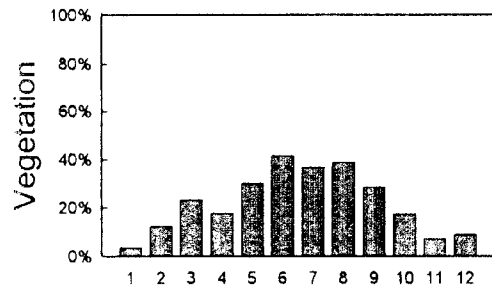
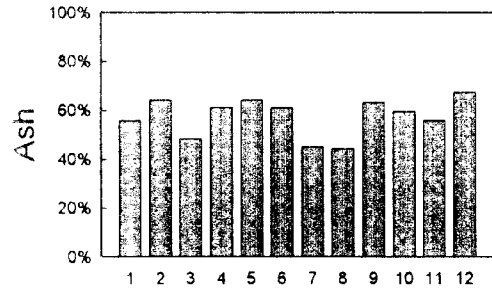


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Monthly Contamination Frequencies

Wet Collector

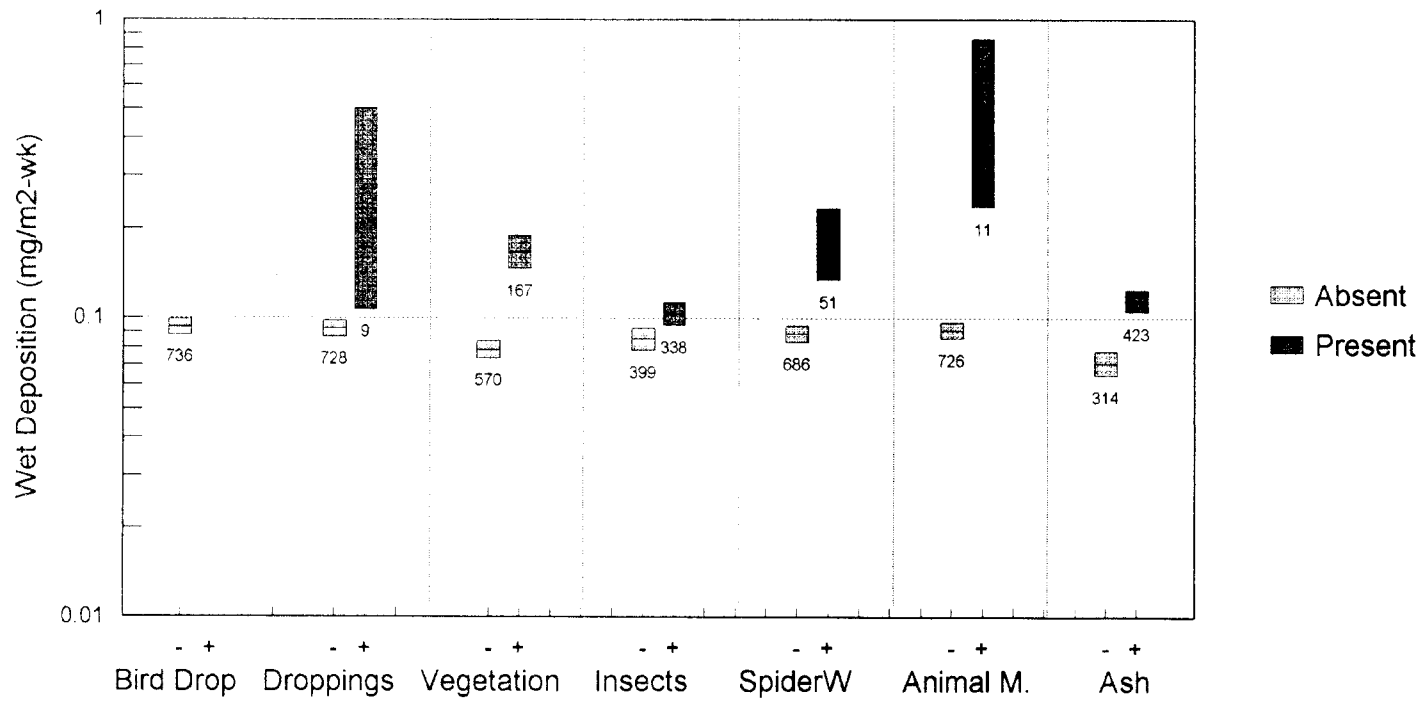
Total Samples: 737



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Wet Deposition Contaminant Analysis

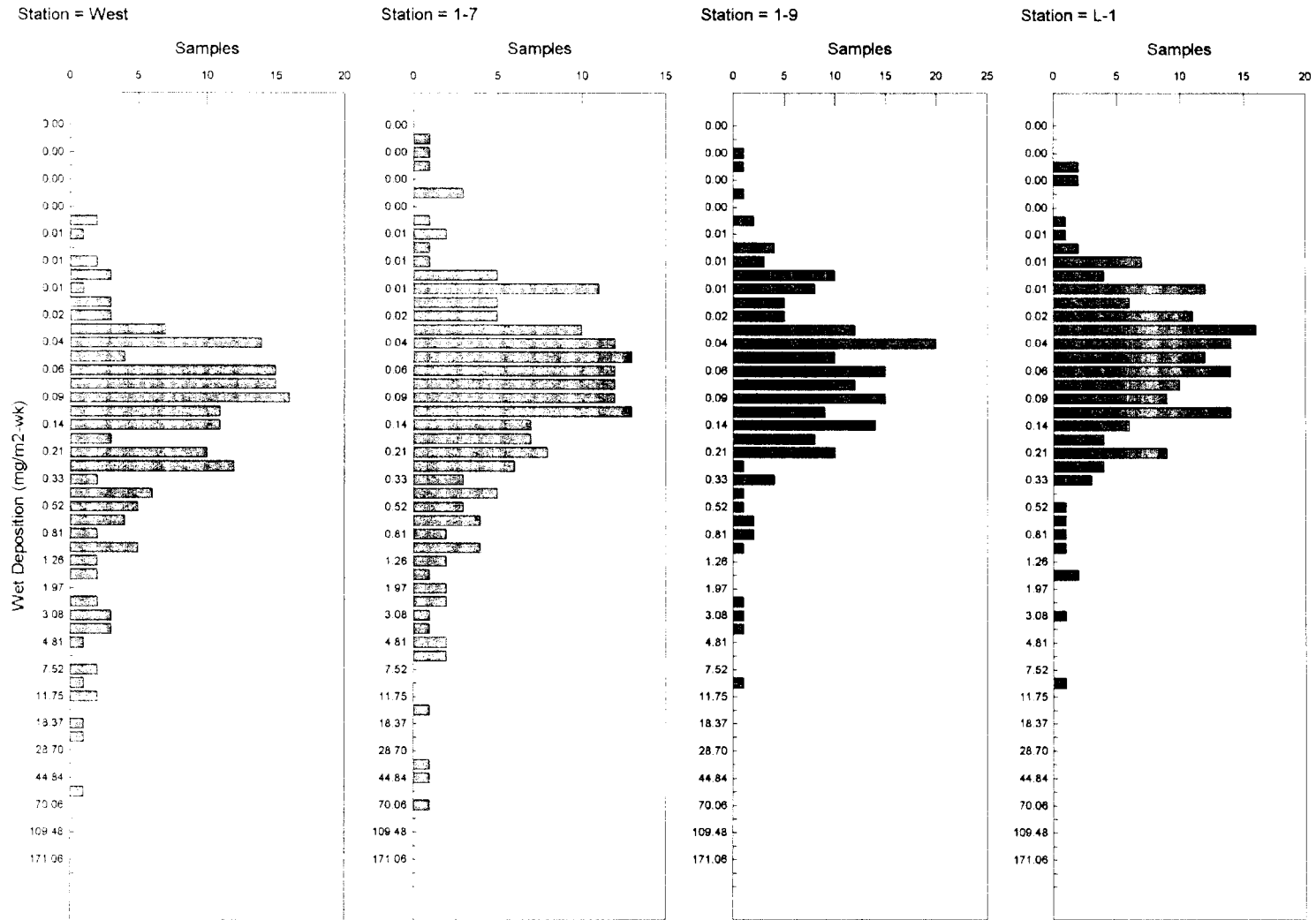
Samples Excluded: None



Geometric Means +/- 1 Std Error, # = Number of Samples

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Frequency Distributions: Wet Deposition (mg/m²-wk)

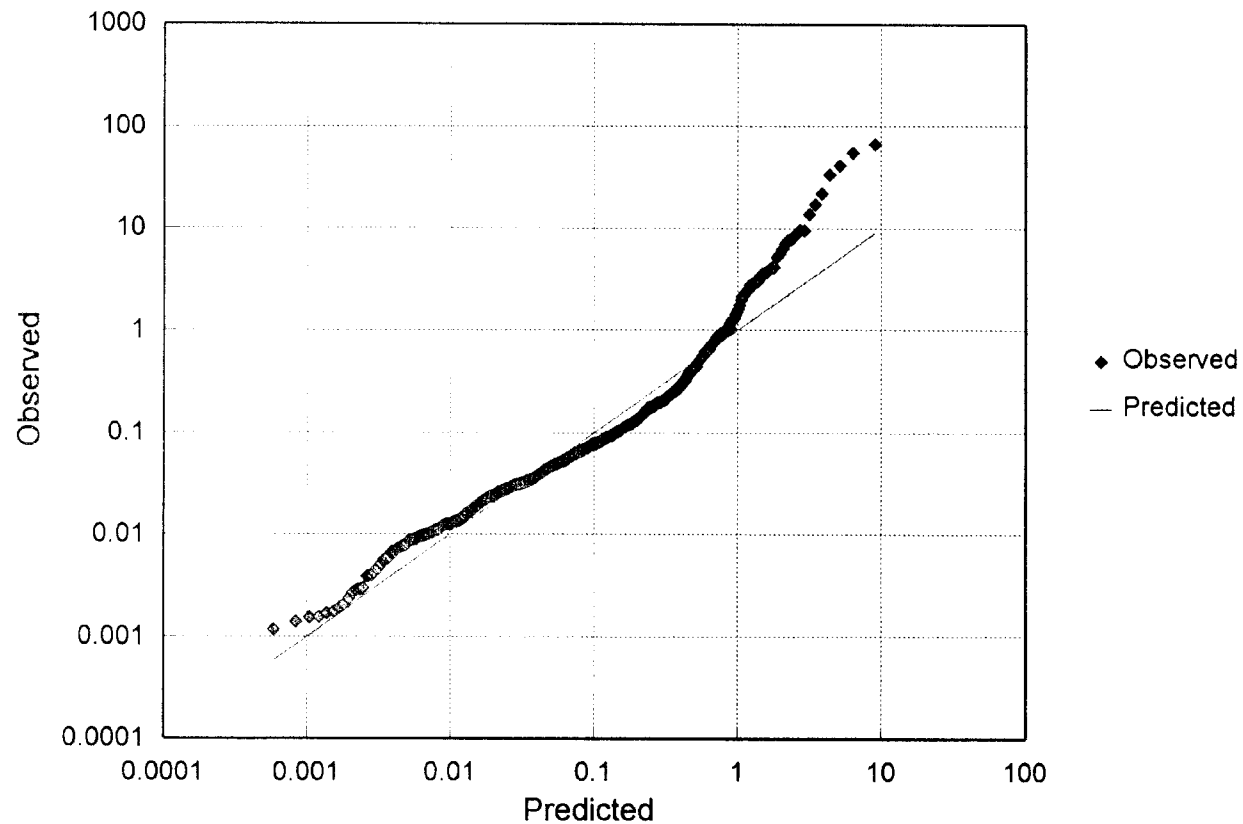


Adjusted for Contamination

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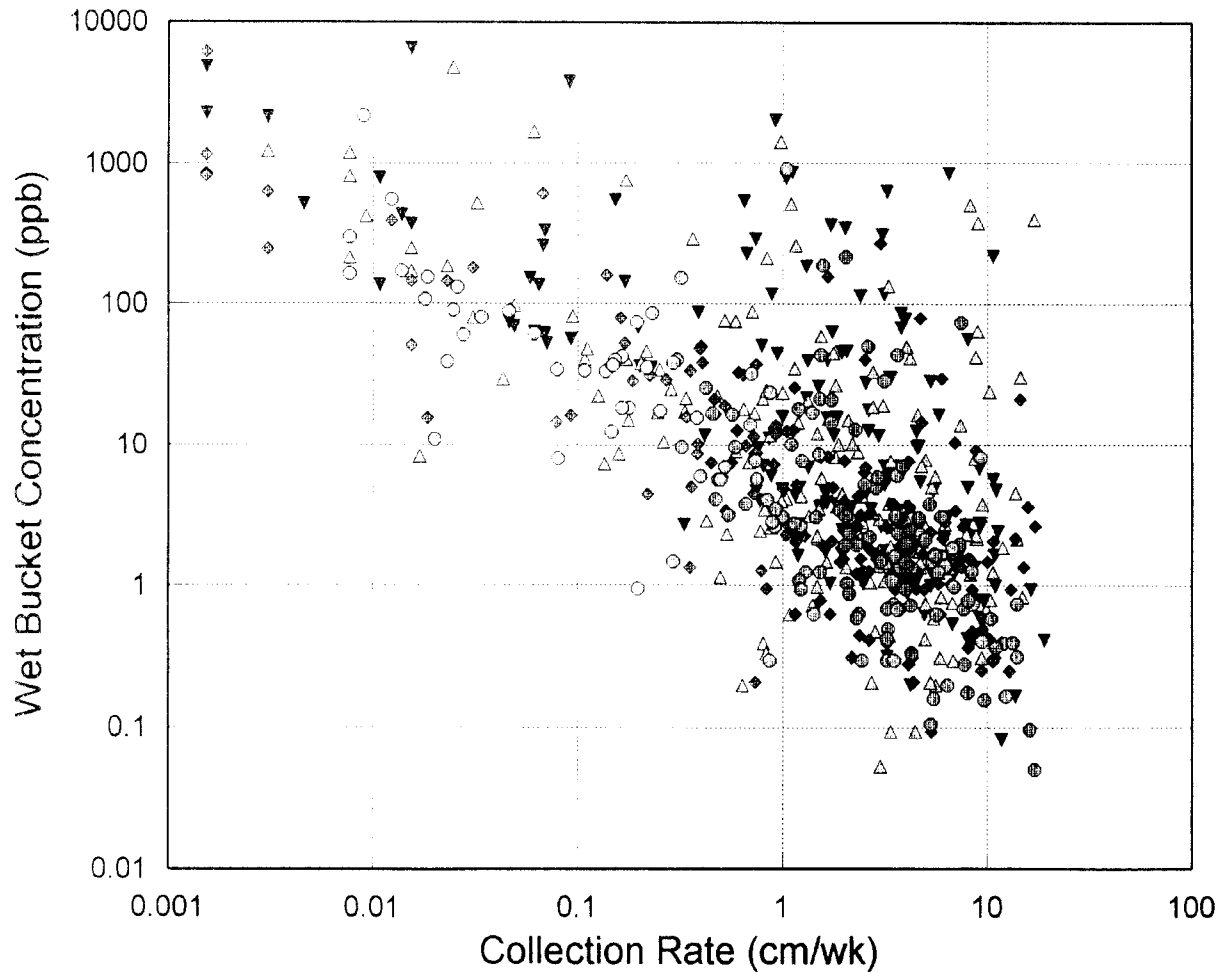
Log-Normal Frequency Plot
Wet Deposition Rate (mg/m²-wk)

Station = ALL
Adjusted for Contamination



Samples	717	Annual Mean	33.7	mg/m ² -yr		
Std Dev (natural log)	1.612	Standard Error	7.9	mg/m ² -yr		
Rates in mg/m ² -wk	Mean	Std Dev	CV	Skewness	Std Error	CV(Mean)
Arithmetic Mean	0.648	4.046	6.239	12.04	0.151	0.23
Geometric Mean	0.073	0.117	1.612	0.92	0.004	0.06

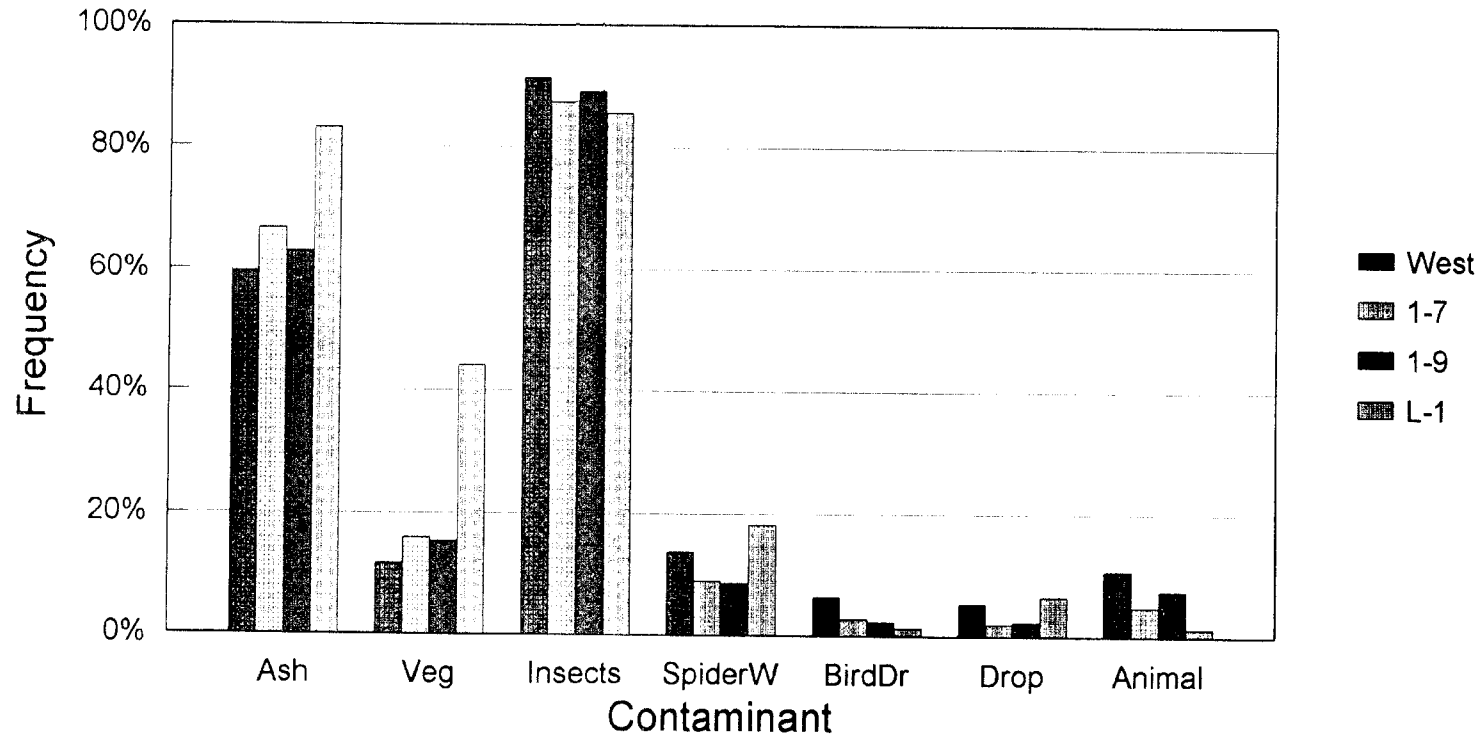
DMAPT



Adjusted for Contamination

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Dry Bucket Contamination Frequencies by Station

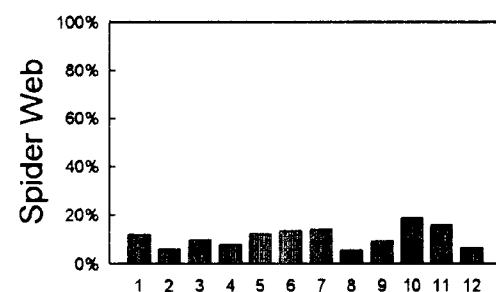
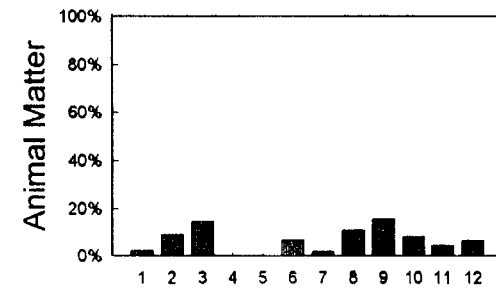
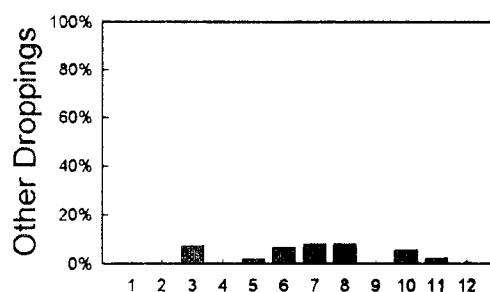
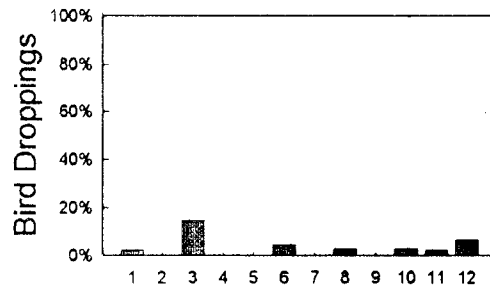
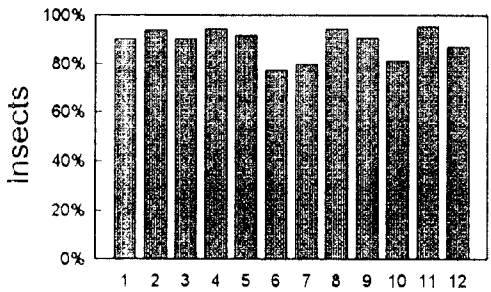
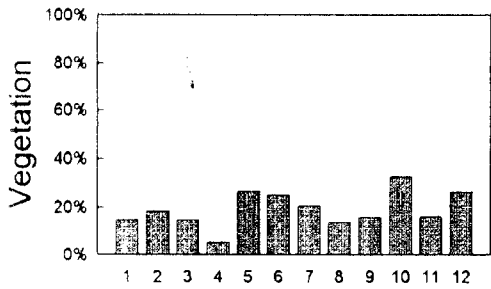
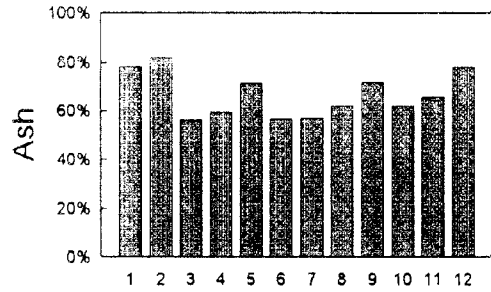


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Monthly Contamination Frequencies

Dry Collector

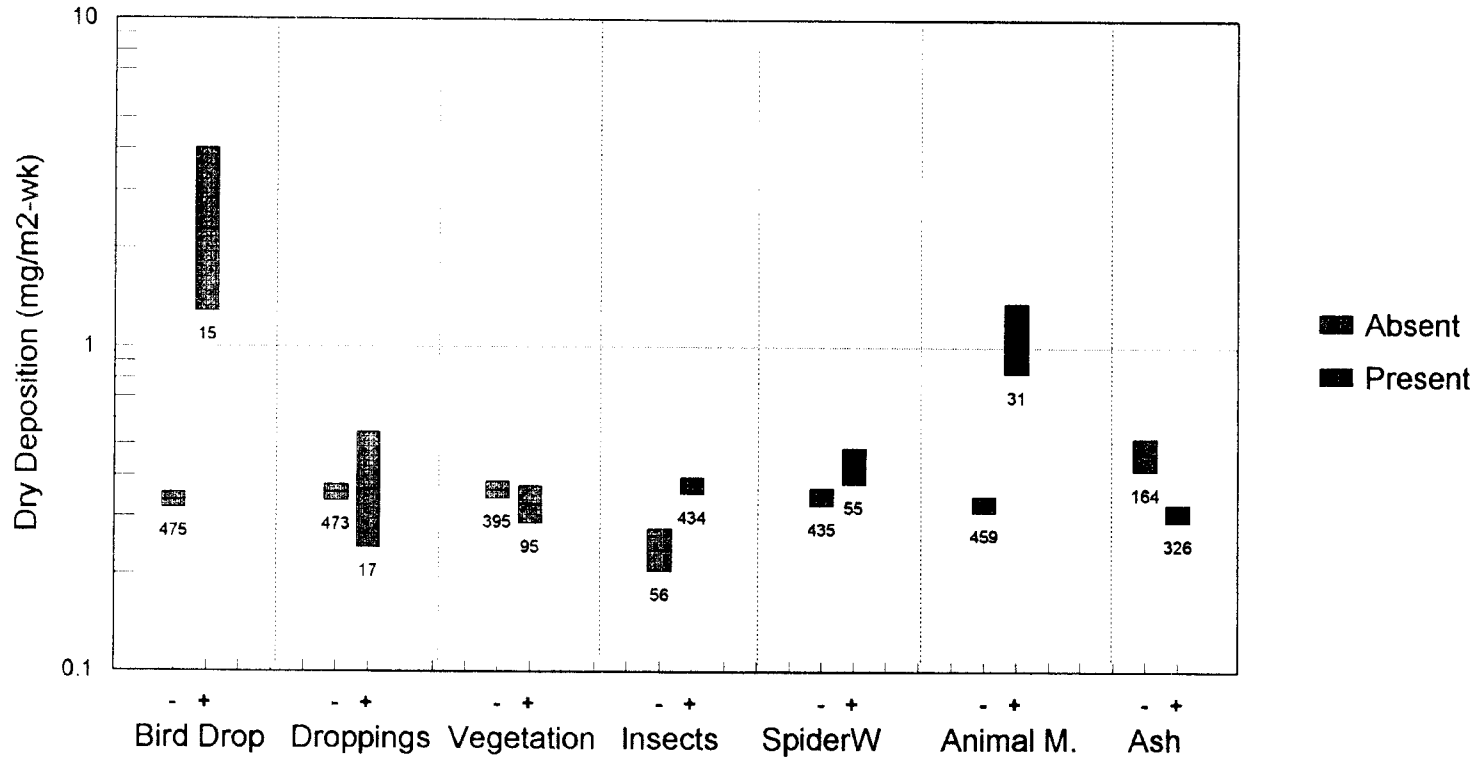
Total Samples: 490



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Dry Deposition Contaminant Analysis

Samples Excluded: None



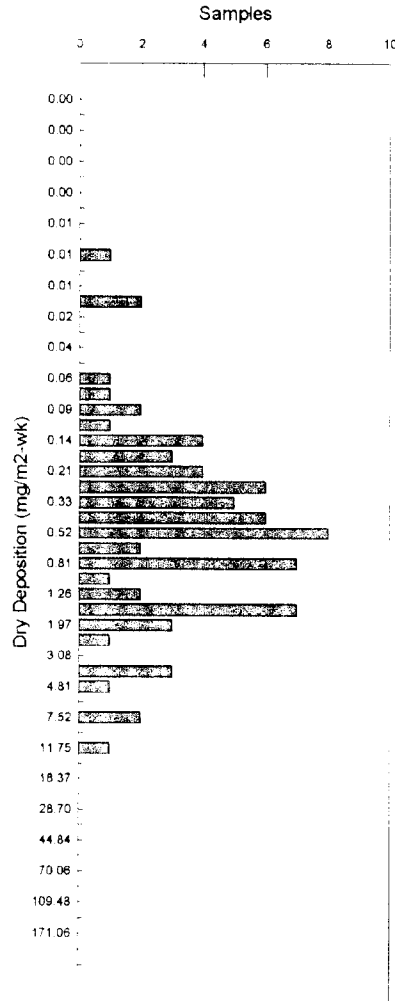
Geometric Means +/- 1 Std Error, # = Number of Samples

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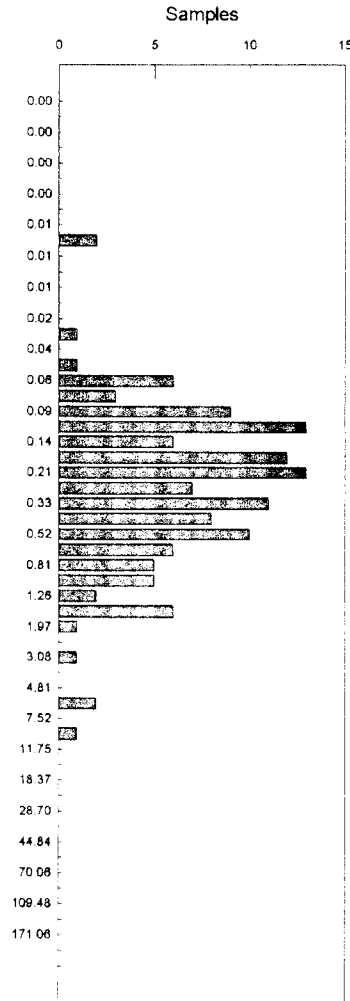
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Frequency Distributions: ~~Wet~~ Deposition (mg/m²-wk)

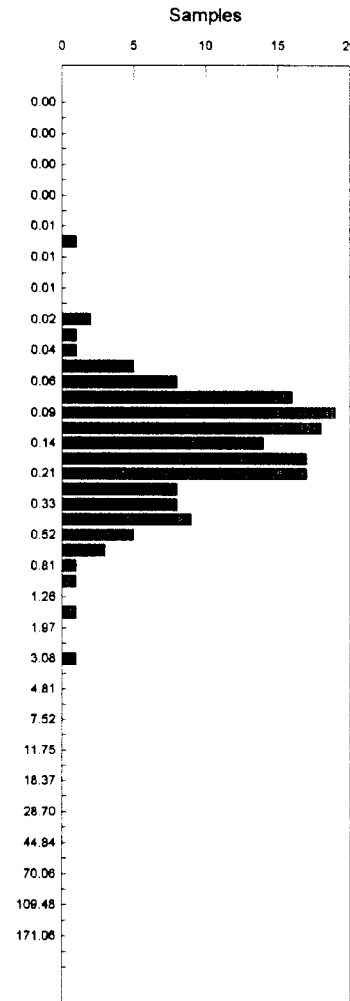
Station = West



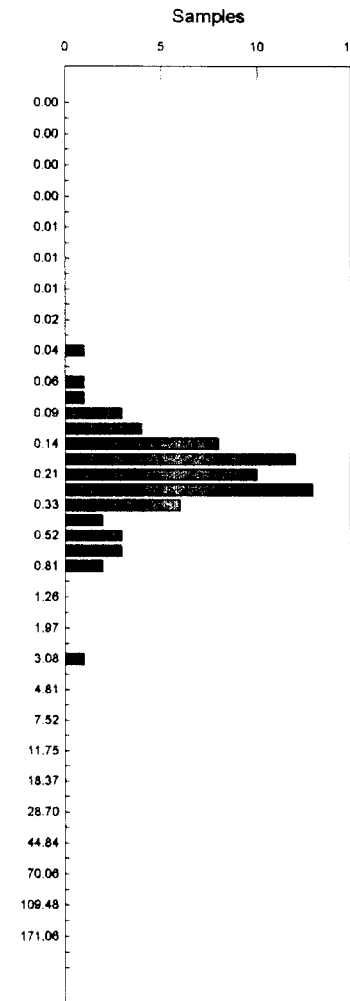
Station = 1-7



Station = 1-9



Station = L-1

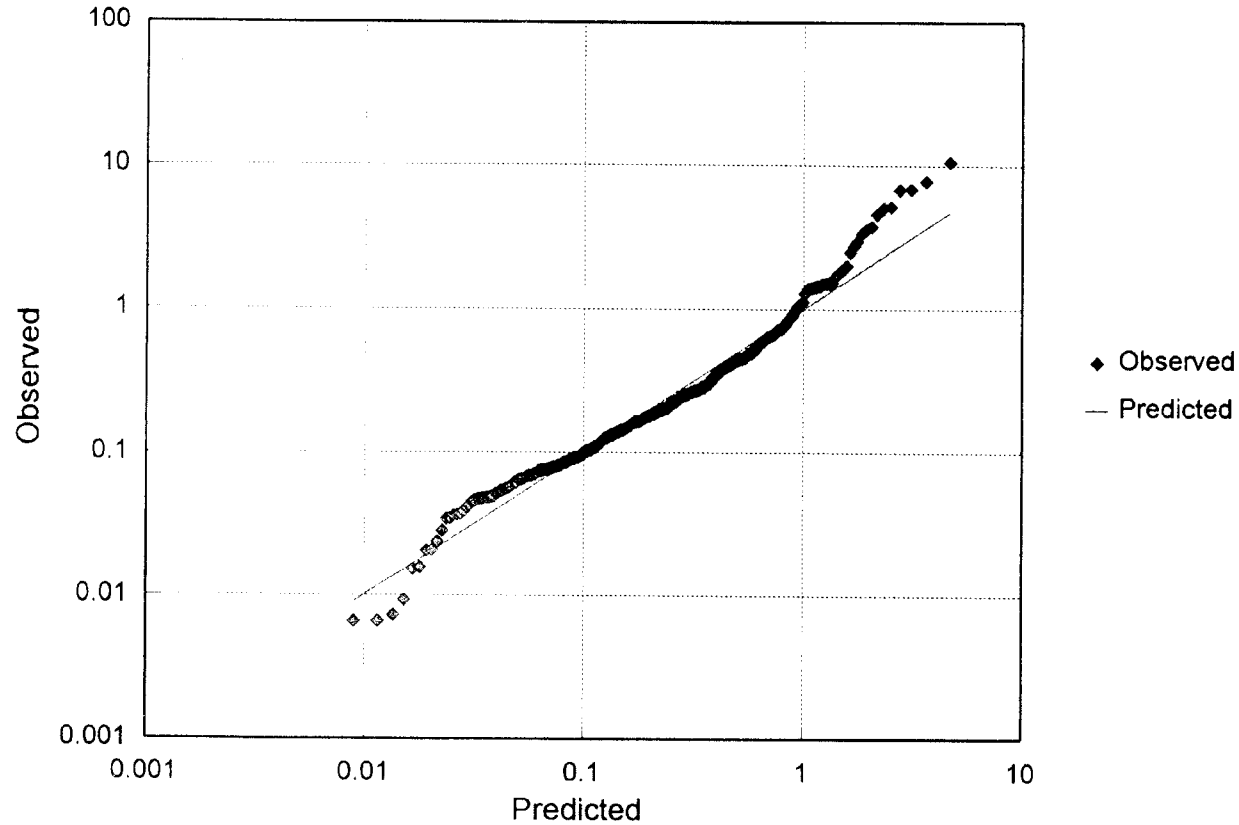


Adjusted for Contamination

DMATT

Log-Normal Frequency Plot
 Dry Deposition Rate (mg/m²-wk)

Station = ALL
 Adjusted for Contamination



Samples	431	Annual Mean	22.9	mg/m ² -yr		
Std Dev (natural log)	1.106	Standard Error	2.4	mg/m ² -yr		
<u>Rates in mg/m²-wk</u>	<u>Mean</u>	<u>Std Dev</u>	<u>CV</u>	<u>Skewness</u>	<u>Std Error</u>	<u>CV(Mean)</u>
Arithmetic Mean	0.440	0.964	2.188	6.15	0.046	0.11
Geometric Mean	0.205	0.226	1.106	0.49	0.011	0.05

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Procedure for Calculating Atmospheric Deposition Rates

Applied Separately to Wet & Dry Deposition Data

Stratified Estimate Based upon Season

Wet Season: May - October

Dry Season: November - April

Measurement = Wet or Dry Deposition Rate (mg/m²-week)

Calculate Mean & Standard Error for Each Season

Annual Average Rate = Average (Wet Season, Dry Season)

Total Deposition = Wet Deposition + Dry Deposition

Rainfall Conc. = Wet Deposition Rate / Volume Collection Rate

Bulk Conc. = Total Deposition Rate / Volume Collection Rate

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Summary for Station 1-9, Paired Wet & Dry Samples

Season	Collection		<u>Average Deposition Rates (mg / m²-week)</u>					
	Events	Rate cm/wk	Wet		Dry		Total	
			<u>Mean</u>	<u>SE</u>	<u>Mean</u>	<u>SE</u>	<u>Mean</u>	<u>SE</u>
Dry Season	64	2.21	0.13	0.06	0.29	0.05	0.42	0.08
Wet Season	74	3.78	0.14	0.04	0.12	0.01	0.26	0.04
Annual Mean	138	2.99	0.13	0.04	0.21	0.03	0.34	0.04
Annual Total (mg / m ² -yr)			7.0	1.8	10.7	1.4	17.7	2.3

Season	<u>Volume-Wtd-Mean Conc (ppb)</u>					
	Wet		Dry		Total	
	<u>Mean</u>	<u>SE</u>	<u>Mean</u>	<u>SE</u>	<u>Mean</u>	<u>SE</u>
Dry Season	5.8	2.6	13.1	2.3	18.9	3.5
Wet Season	3.7	1.1	3.2	0.3	7.0	1.1
Annual Mean	4.5	1.2	6.9	0.9	11.4	1.5

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