Air Dispersion Modeling Verification Study

Oct 22, 2003

Objective

Compare results from ambient air sampling and air dispersion modeling to understand how modeling predictions relate to measured ambient air concentrations

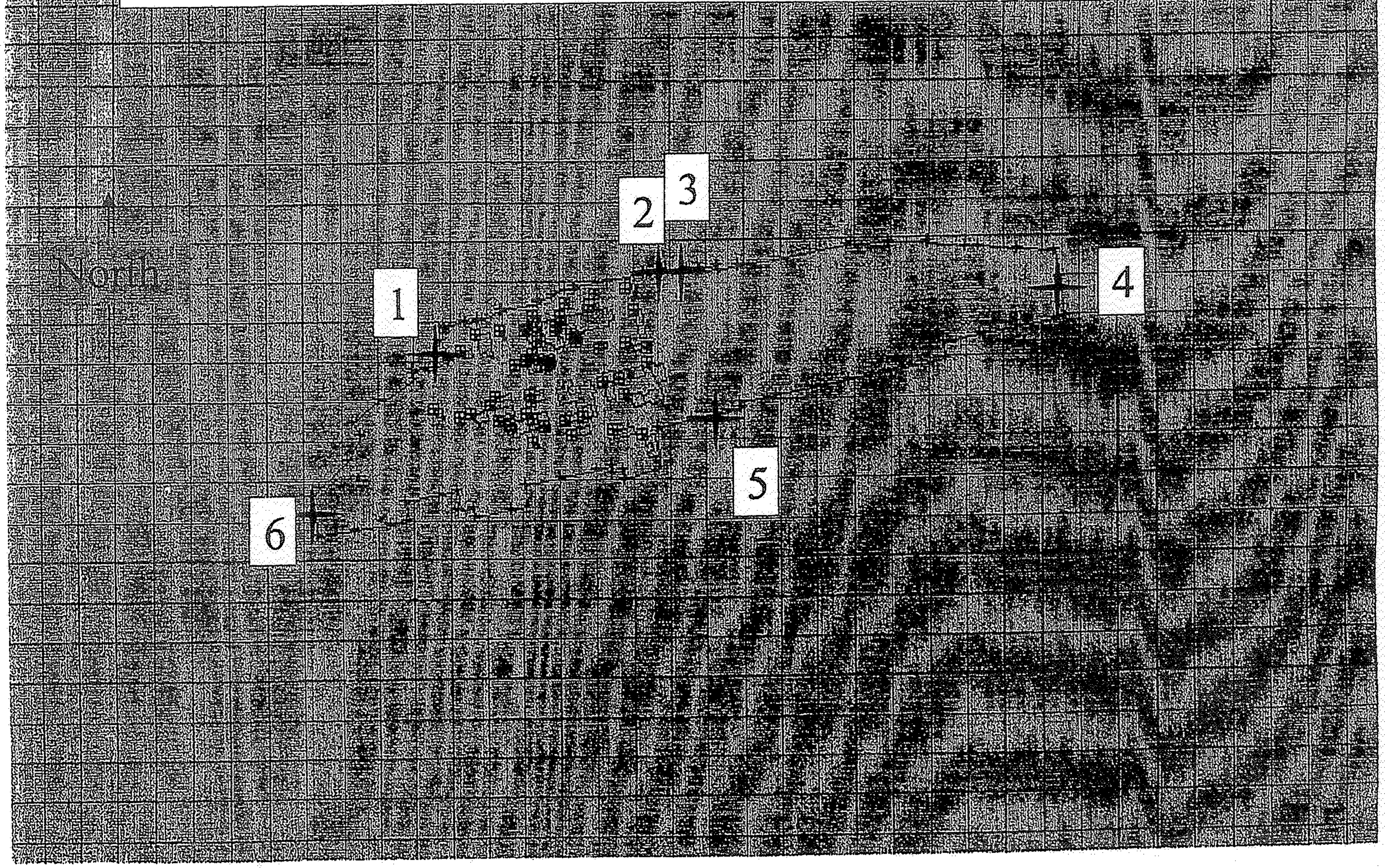
Verification Study Scope

- Air Sampling Program
- Analytical Methods
- Modeling
- Analysis of Results

Air Sampling Locations

- Simultaneous coverage of all 4 major wind directions (N, S, E, W)
- Capture point of predicted maximum concentration from modeling
- Include co-located samplers at predicted maximum
- Total of six locations

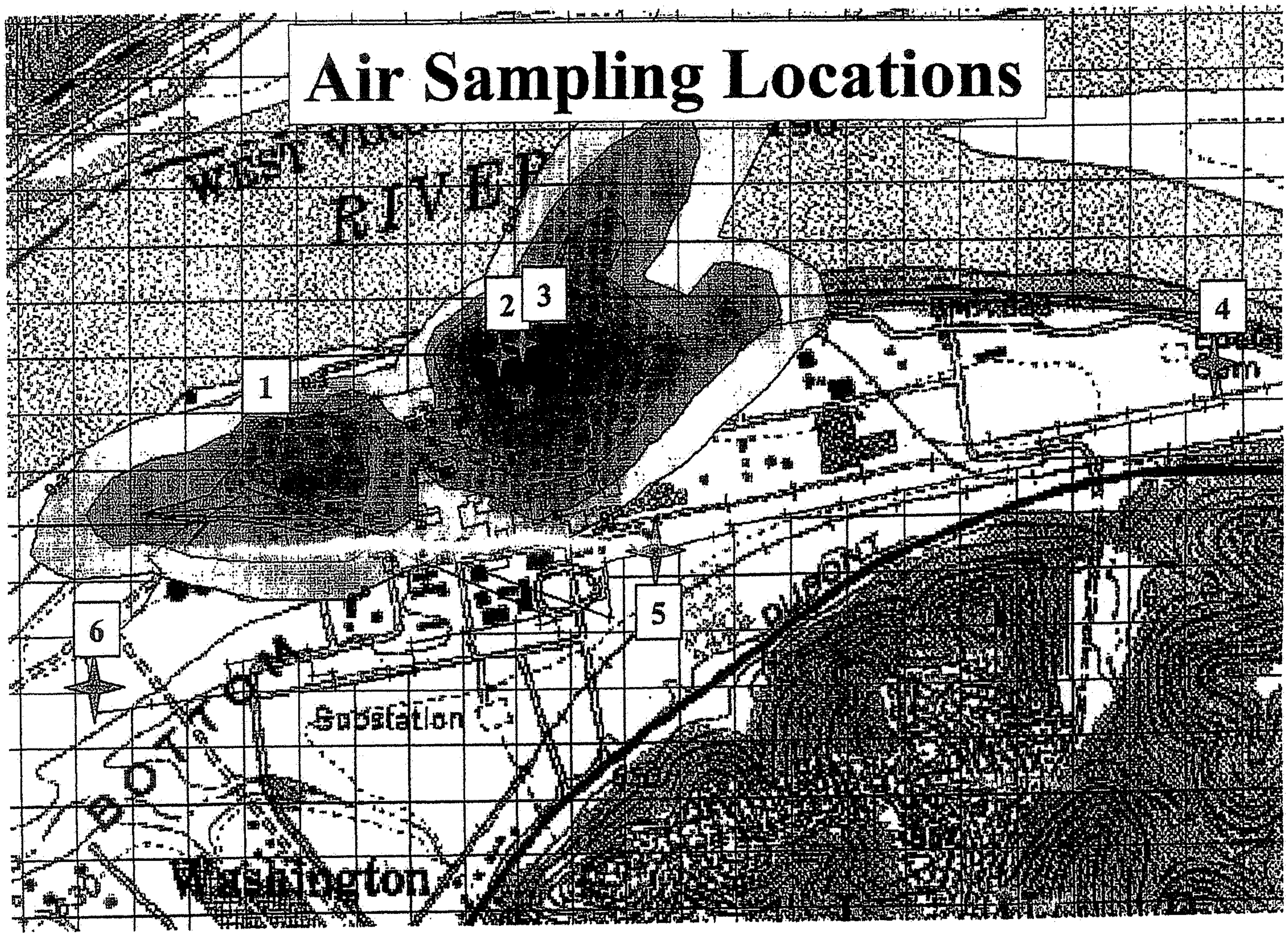
Air Sampling Locations



ASH026725

EXP015794

Air Sampling Locations



Air Sampling Strategy

- Measure ambient air levels
- 24-hour sampling duration
- Seven (7) sampling events scheduled over 6 weeks
- Vary day of week to capture variations in daily operations (none expected) and variations in meteorology
- Record site-specific meteorological and operational data

Monitoring Strategy: Samples taken every 6 days for 6 weeks.

MONTH 1

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

MONTH 2

			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Monitoring Strategy: Samples taken every 6 days for 6 weeks.

On site training

For internal use: potential schedule

Oct/Nov

S	M	T	W	Th	F	S
						1
						8
						15
						22

28 29 30 31

2 3 4 5 6 7 8

9 10 11 12 13 14 15

16 17 18 19 20 21 22

23 24 25 26 27 28 29

30

December

1 2 3 4 5 6

7 8 9 10 11 12 13

14 15 16 17 18 19 20

21 22 23 24 25 26 27

28 29 30 31

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Total Samples

(1) field blank per event

(5) primary samples per event

(1) duplicate sample per event*

(7) samples x (7) sampling events = 49 total samples

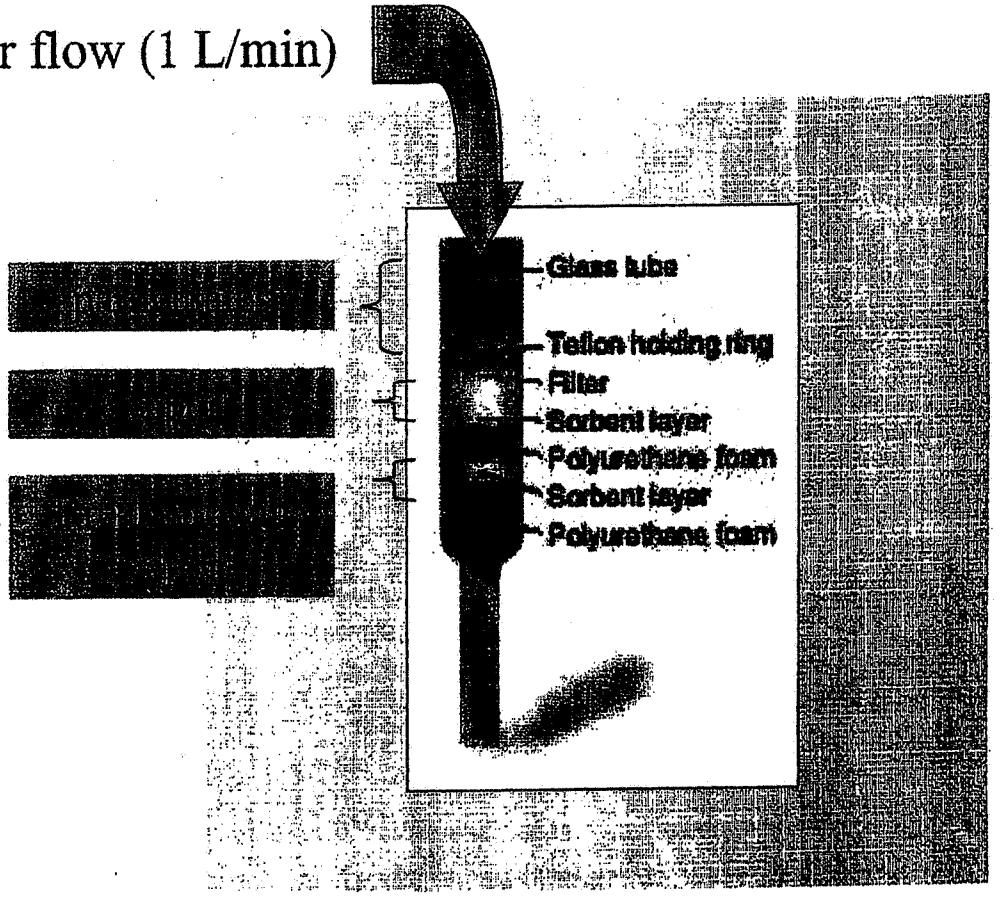
* Sample location 3 is co-located with location 2 and serves as a duplicate sample

Equipment

- "Sorbent" sampling method to capture PFOA on ion-exchange media
- OSHA Versatile Sampling tube (OVS)
- Captures particles and vapors
- Remote power source will be provided
- Weatherproof stations for sampling equipment

OVS Tube

Air flow (1 L/min)



Analytical Method

- Validated method being used
- Acetone extraction followed by liquid chromatography/mass spectrometry (LC/MS)
- Detection limit of 0.1 ug/m^3

Modeling Program

- Using U.S. EPA ISCST3 Model
- Model will simulate actual field conditions
  - Site-specific surface meteorological data (wind speed and direction, temp, stability)
  - Off-site upper air meteorological data
  - Emissions data
    - Site specific operational data will be used to relate production data to emissions levels using "capacity factor"
    - Capacity factor based on prior stack testing and mass balance
  - 24-hour averaging time
  - Predictions at actual height and location of air monitoring intake

Comparison of Results

- Comparing 35 pairs of measured and modeled data
  - (5) primary sampling points x (7) sampling events
- Will use statistical tools to evaluate correlation/differences between measured and modeled data

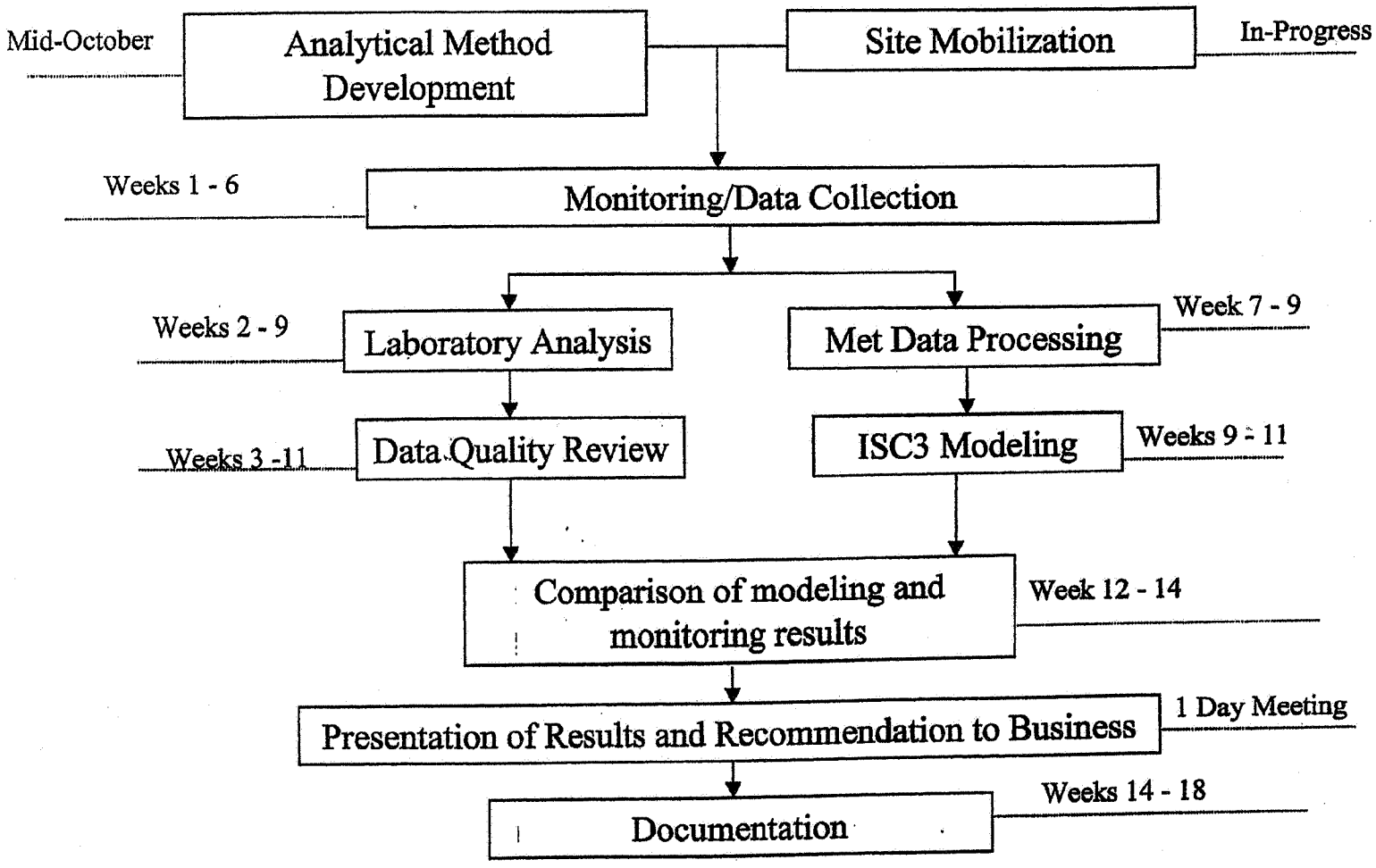
Internal?
Questions we are trying to answer

- Are modeled and measured data well-correlated? (+/- X%)
- What is the probability or confidence level that the model predictions will be equal to or greater than the measured value?
- Does model "accuracy" change at different concentration levels?

Statistical Analyses

- Plot of measured vs. modeled data to test linear correlation
- Statistical goodness of fit criteria (R-squared)
- Simple sign test for residuals
  - Calculate (measured - modeled)
  - Trend in residuals: positive, negative, neutral
- Plot of residuals vs. modeled data to test goodness of fit at different concentrations
- Test specific hypotheses; examples
  - Model predicts within 20% of measured value.
  - Model over predicts 50% of the time.

Project Timing



remaining internal questions

- Are there site communications we need to think about prior to sampling?

EXTRA SLIDE

Feasibility of Deposition Modeling

- Wet and dry deposition rates are small - maximum rate 0.18 gram/m^2-yr for year 2000
- Direct field measurement on 24-hr basis immeasurable, so direct comparison with short-term modeling not feasible
- Use model verification to add degree of confidence

EXTRA SLIDE

Deposition Modeling

- Both wet and dry deposition algorithms depend on the ability of the model to calculate ambient air concentrations
  - Dry deposition flux = Ambient hourly concentration x deposition velocity
  - Wet deposition flux = f(scavenging coefficient x ambient concentration integrated in the vertical)

- Verification of ambient air model will help confirm basis for deposition calculations