One Analyzer, One Motor and a Prayer

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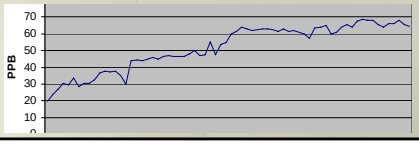
Washington State Department of Ecology
EPA National Quality Conference
Seattle, WA April 23, 2008



In a nutshell…

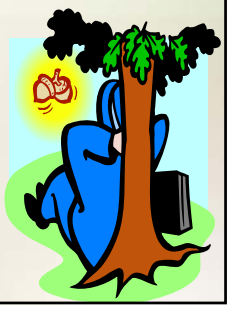
The survey was one person with one instrument attempting to get “snapshots in time” of ground level ozone concentrations.

The survey attempted to …

Demonstrate to the decision makers alternative tools that could be used to assess the ozone monitoring network.

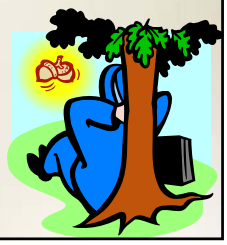
The Objectives

- Collect **accurate** and **comparable** ozone data to determine if the monitoring network is capturing ozone events.
- Determine if higher ozone concentrations are occurring within the “perimeter”.



The Objectives

- Determine the reliability and operation of less expensive ozone measuring methods.
- Survey at locations where no ozone monitoring has been done before.



Decisions to be made from the collected data

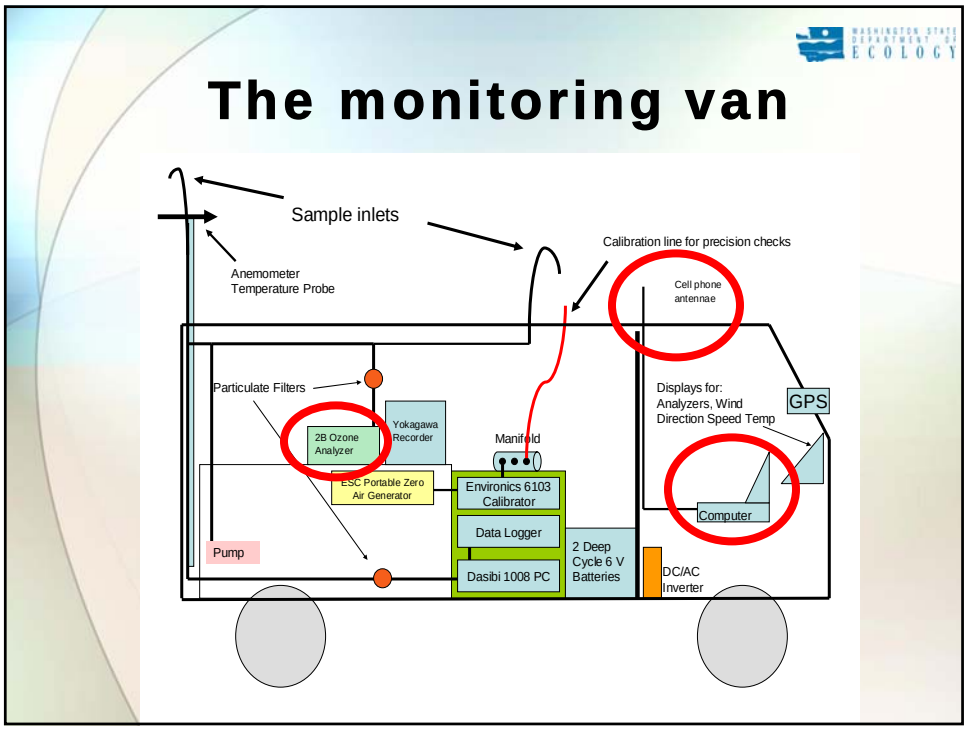
- If current ozone sites do not appear to capture ozone events, move them.
- If areas of “interest” appear, follow-up in 2008.

"One Analyzer"

- 2B Technologies Model 202
- Lightweight (4.7 lbs)
- Easy to operate
- Records and stores data
- Low power needs
- 120 or 12 volts
- Survey instrument. No EPA equivalency

The 2B is compact, lightweight and versatile

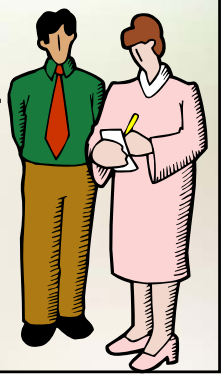

“One Motor”


The monitoring van
Sample inlets
Anemometer
Temperature Probe
Calibration line for precision checks
Cell phone
antennae
Particulate Filters
Yokagawa
Recorder
2B Ozone
Analyzer
ESC Portable Zero
Air Generator
Manifold
Environics 6103
Calibrator
Data Logger
Dasibi 1008 PC
Pump
2 Deep
Cycle 6 V
Batteries
DC/AC
Inverter
Displays for:
Analyzers, Wind
Direction Speed Temp
GPS
Computer

"The Prayer"

Quality Assurance Project Plan (QAPP)

- Though only a small project a QAPP was written before the project began.
- Outlined Data Quality Objectives.
- Listed Data Quality Indicators.
- Was sent to management to comment and sign.



The Graded Approach

- The US EPA OAQPS developed a four-tiered graded approach for developing Quality Assurance Project Plans based on the data collection objectives.
- This study would be of short duration and results used to evaluate and select choices for possible future air monitoring. **The Mobile Ozone Survey is graded Category 3.**

Data Quality Objectives

- Demonstrate that the data collected by the van is comparable to data collected at sites in the ozone network.
- Demonstrate good precision and accuracy.
- Demonstrate that the data collected is representative of the area (homogeneous).

"Bad data is worse than no data at all"

Comparability

- The portable analyzers' response must compare within 5 ppb of a network analyzer.
- Frequent checks of the van vs. analyzer's in the network would be made.

Precision

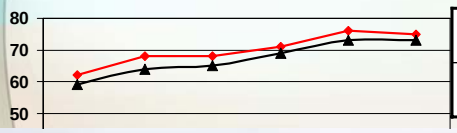
- Frequent checks of the van analyzer (2B) vs. the transfer standard (on board) would be made on a regular basis and must be within 7%.

Accuracy

- An independent audit would be performed and the analyzer must agree within 7% of "true".

Mission # 4

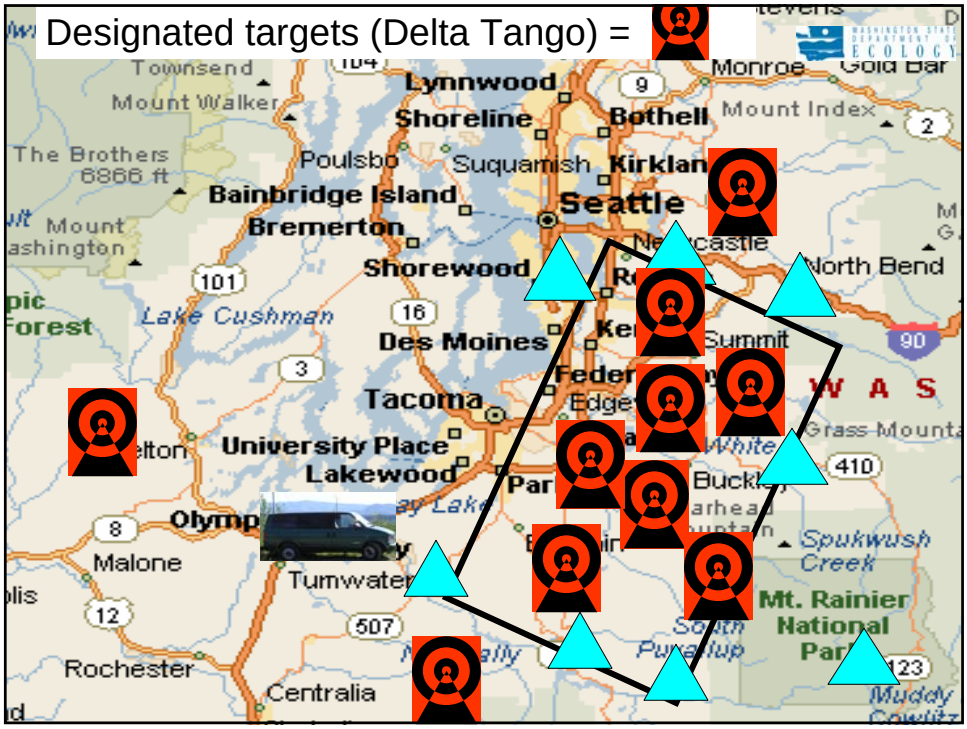
Would relocating the current monitor result in higher ozone values?



Pack Forest					
62	68	68	71	76	75
59	64	65	69	73	73
Van		Hugo Peak			

Designated Targets (Delta Tango)

- Emphasis was in Pierce, King and Thurston counties.
- Secondary targets included counties in central and eastern Washington.
- Several reconnaissance missions across the State.

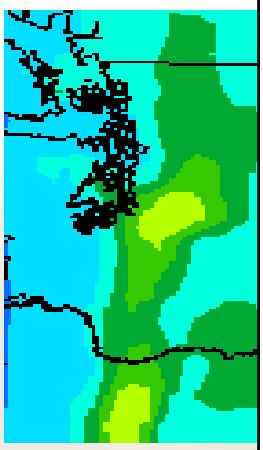


An "arsenal" of tools for the attack

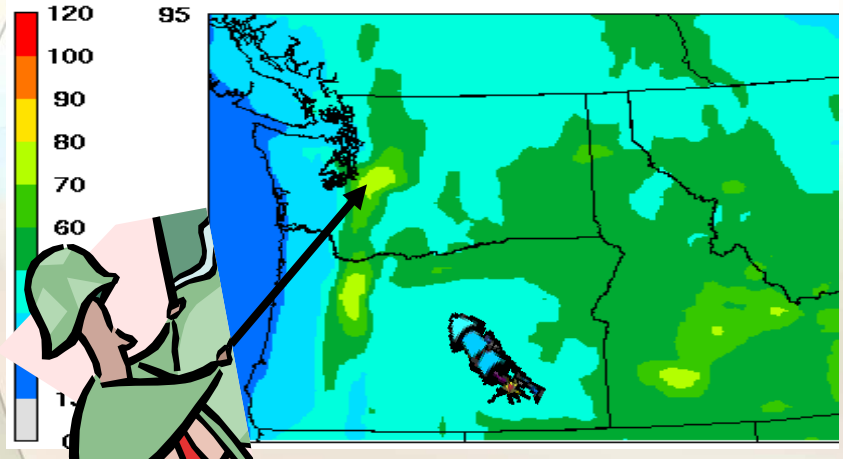
- Experimental ozone forecast model from NOAA National Weather Service Air Quality Forecast Guidance.
- Air Indicator Report for Public Awareness and Community Tracking (AIRPACT).
- AIRNow-Tech Navigator.

Selecting the Target

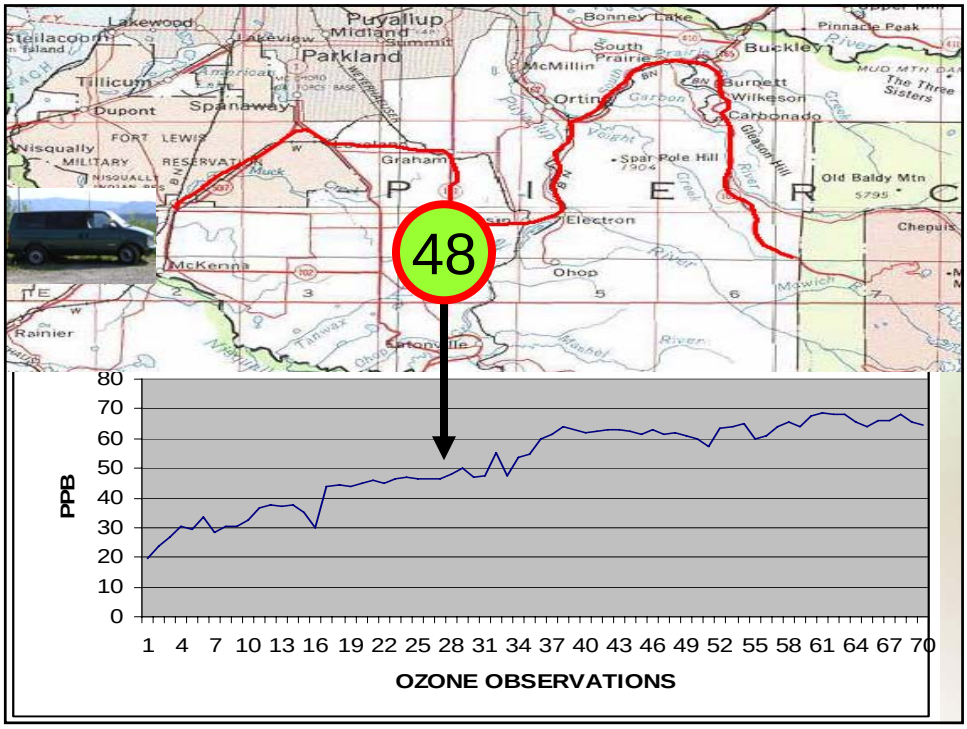
- Consult NOAA ozone fo y.
- Perform check/c te to demons y or precisio
- Move va here ozone is expected to occur.

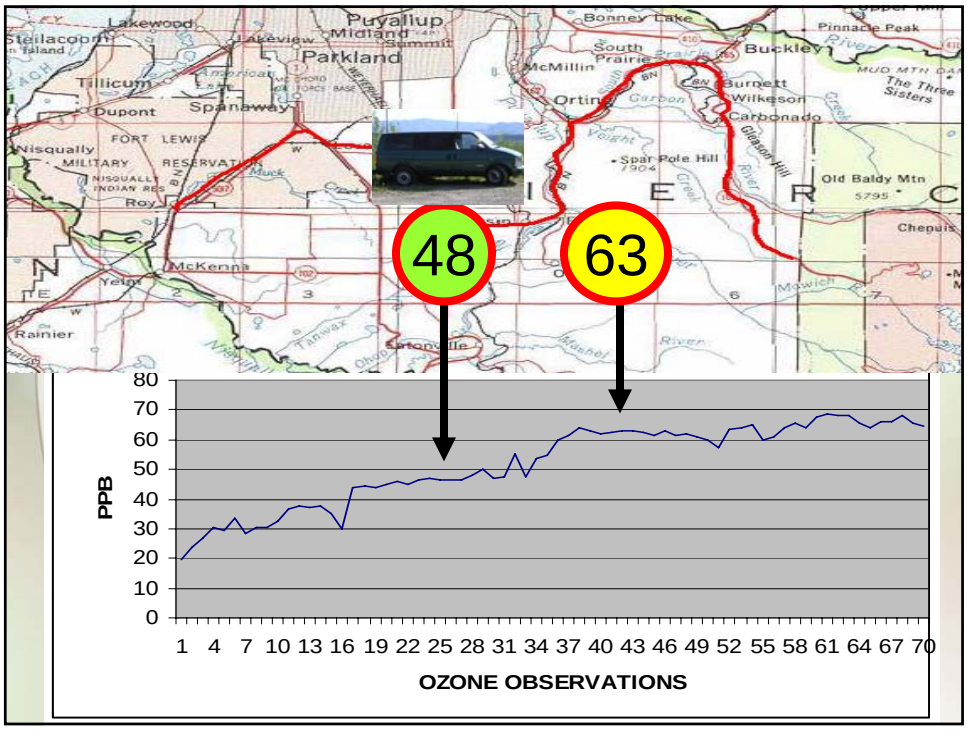


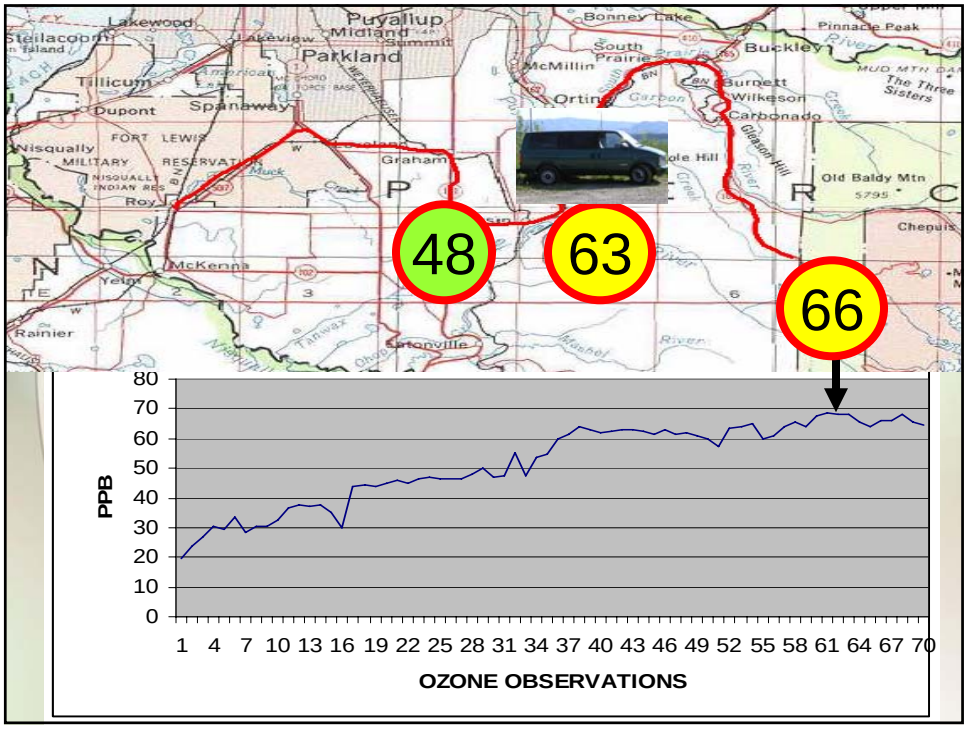
July 4 Mission #7: South Puget Sound

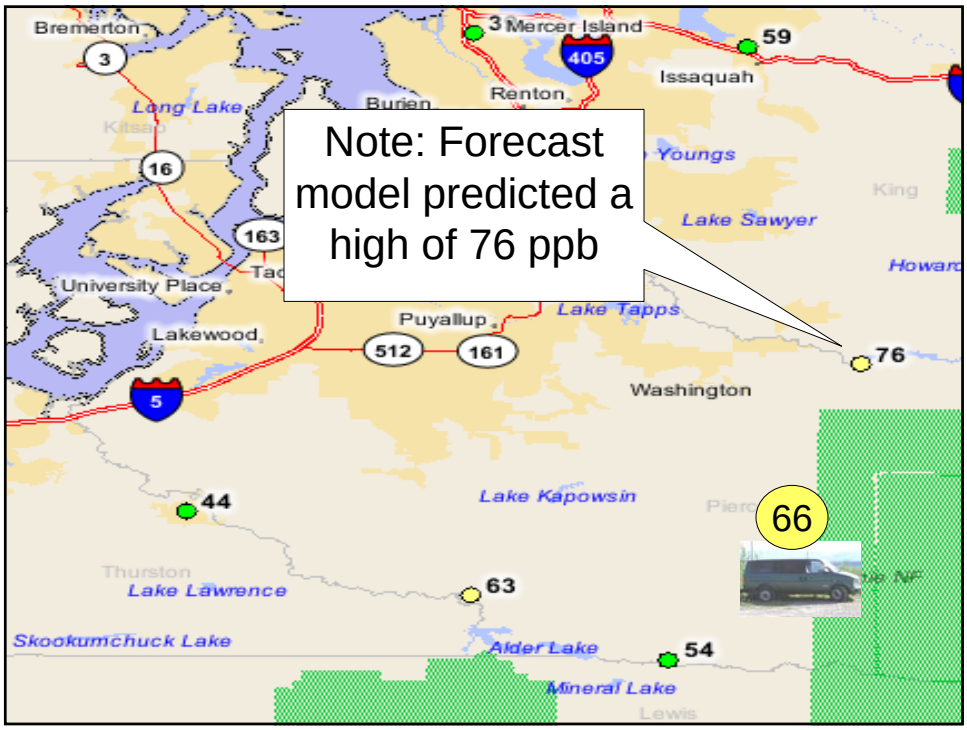


"Let's be careful, the flak will be heavy today!"


48
PPB
80
70
60
50
40
30
20
10
0
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70
OZONE OBSERVATIONS


48
63
PPB
80
70
60
50
40
30
20
10
0
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70
OZONE OBSERVATIONS

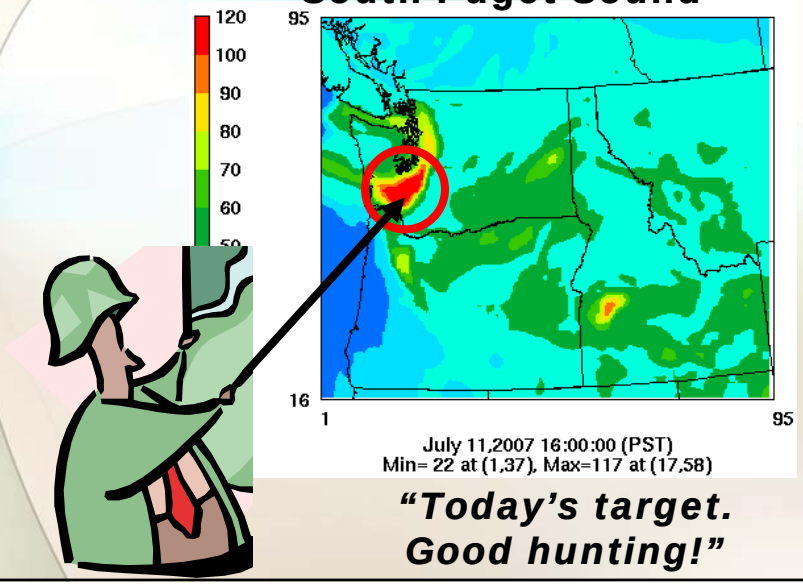

Puyallup
Parkland
Bonney Lake
Buckley
Tillicum
Spanaway
Dupont
Graham
Ortin
Carbonado
Old Baldy Mtn
Chepuis
McKenna
Yelm
Rainier
Orting
48
63
66
PPB
80
70
60
50
40
30
20
10
0
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70
OZONE OBSERVATIONS


Bremerton
3
Mercer Island
405
59
Issaquah
Renton
Burien
Long Lake
16
163
University Place
Lakewood
Puyallup
512
161
5
Note: Forecast model predicted a high of 76 ppb
Youngs
King
Lake Sawyer
Howard
Lake Tapps
76
Washington
44
Lake Kapowsin
66
Thurston
Lake Lawrence
63
Skookumchuck Lake
Alder Lake
54
Mineral Lake
Lewis

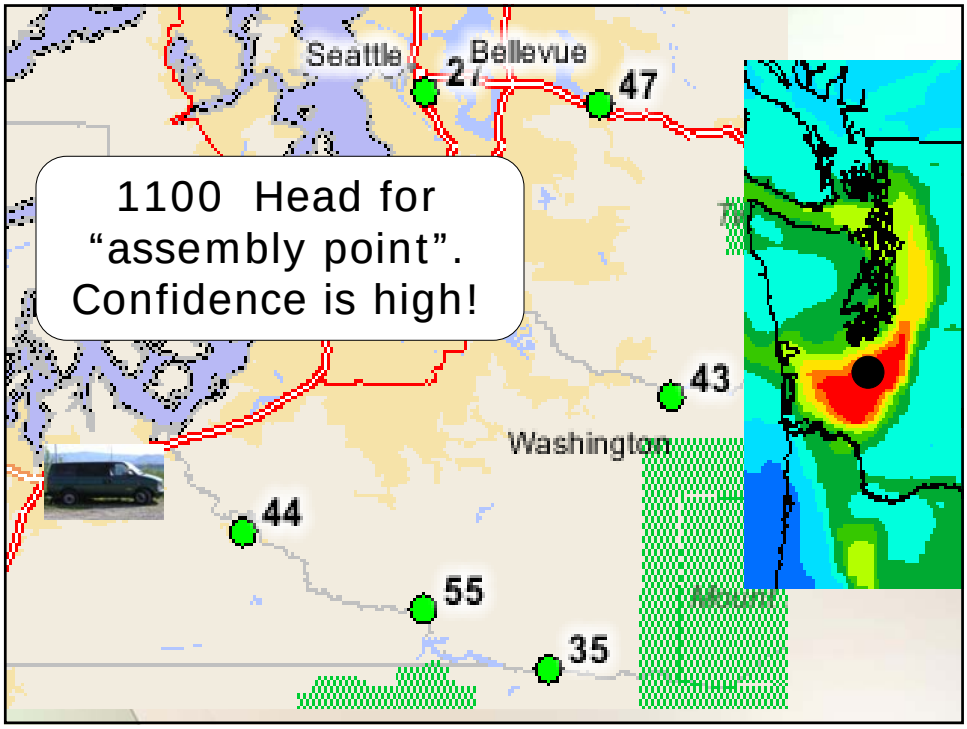
Mission Critique

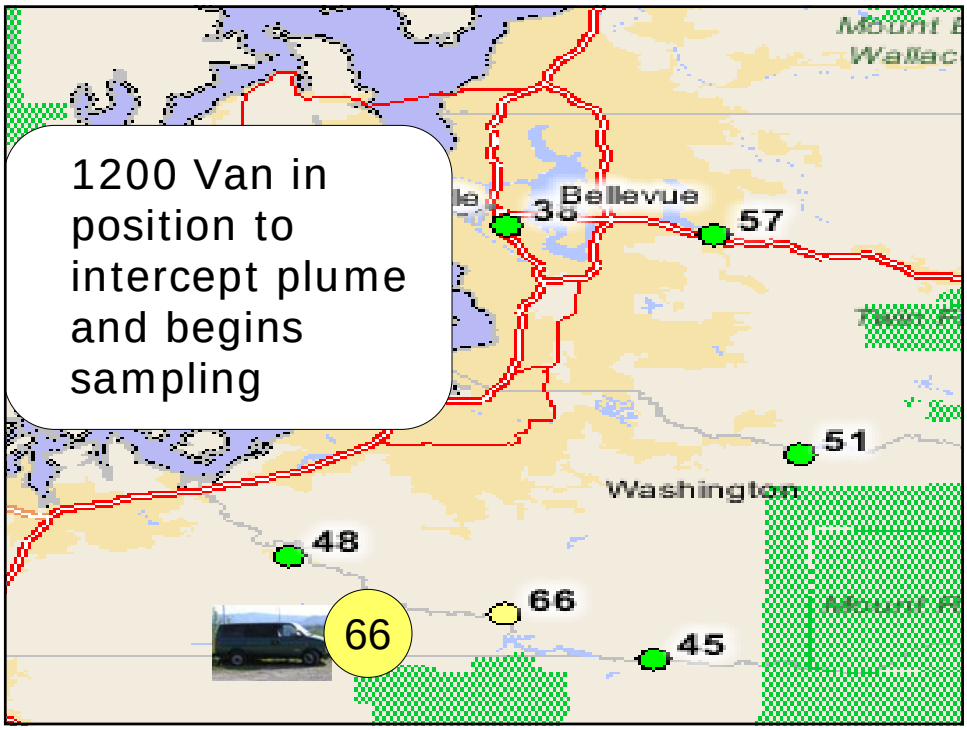
- The van was on target (near plume) and measured between existing network sites.
- No higher ozone values were found.
- AIRPACT predicted ozone concentration was very **accurate** (76 ppb vs. 76 ppb).

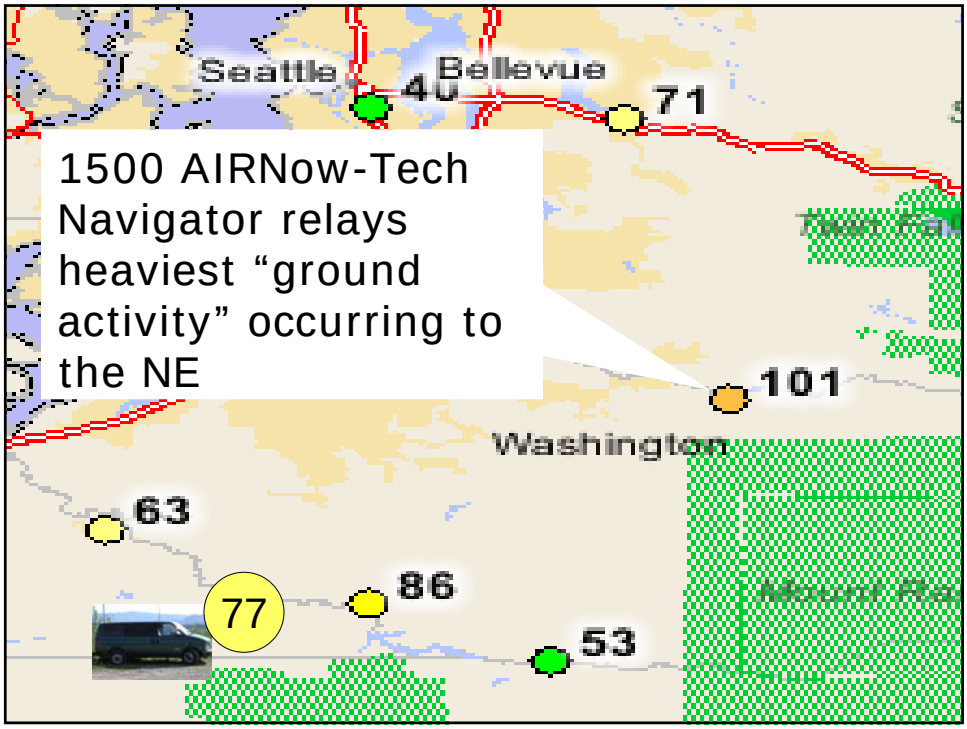
July 11 Mission #10: South Puget Sound

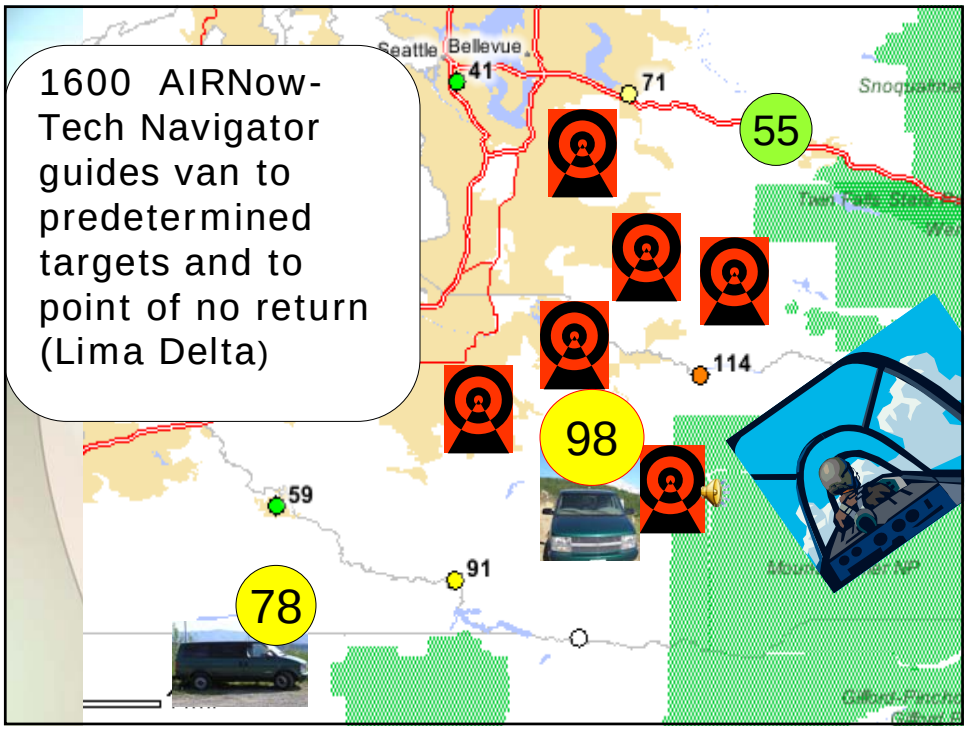


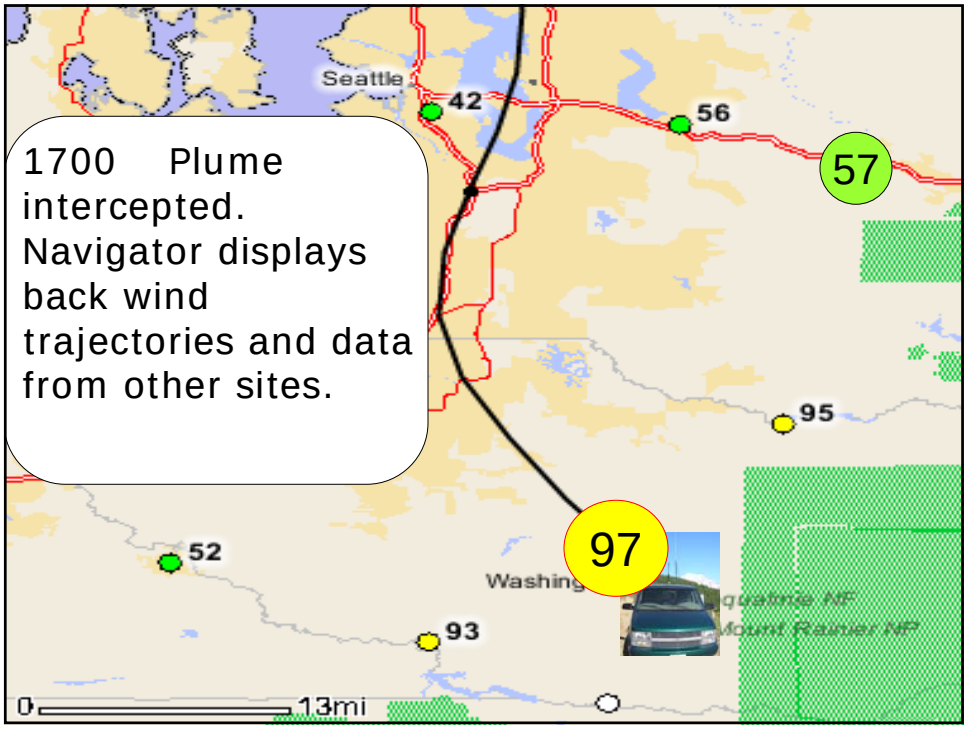
"Today's target. Good hunting!"


Seattle
Bellevue
47
1100 Head for "assembly point". Confidence is high!
43
Washington
44
55
35


1200 Van in position to intercept plume and begins sampling
Bellevue
57
51
Washington
48
66
66
45


1500 AIRNow-Tech Navigator relays heaviest “ground activity” occurring to the NE
Seattle
Bellevue
40
71
101
Washington
63
77
86
53


1600 AIRNow-Tech Navigator guides van to predetermined targets and to point of no return (Lima Delta)
Seattle
Bellevue
41
71
55
114
98
59
91
78



Mission Critique

- The van was in the “hot” spot and measured between the existing network sites.
- The plume was slightly NE of the area that was predicted
- Unpredicted winds came up from the Chehalis Gap
- AIRPACT prediction was **accurate** (114 ppb vs. 117 ppb)

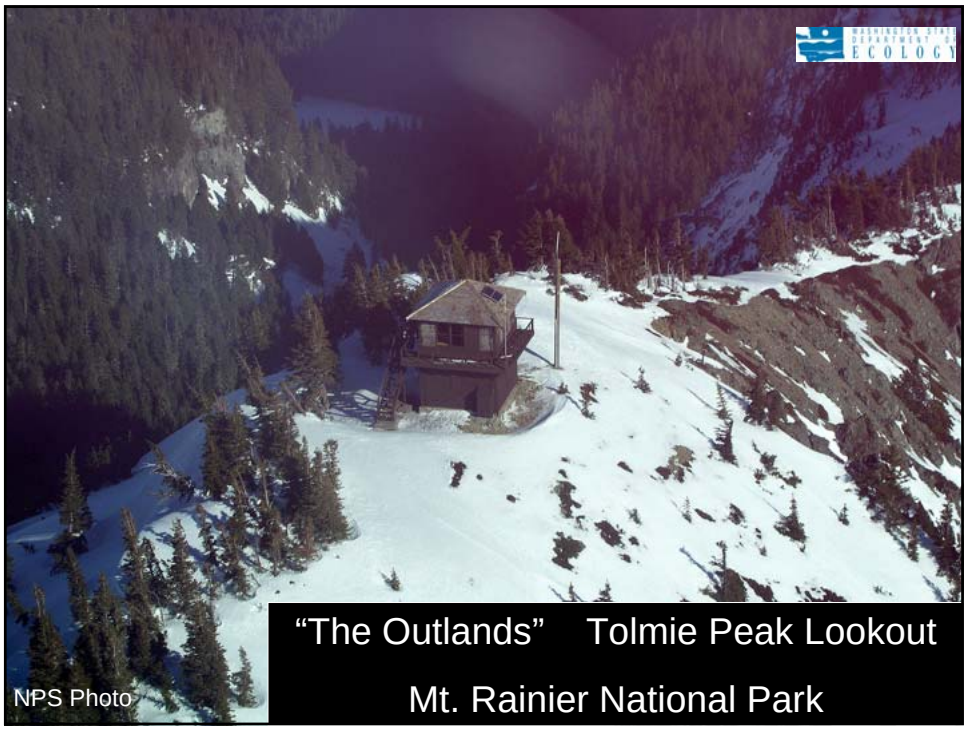
The Puget Sound Basin

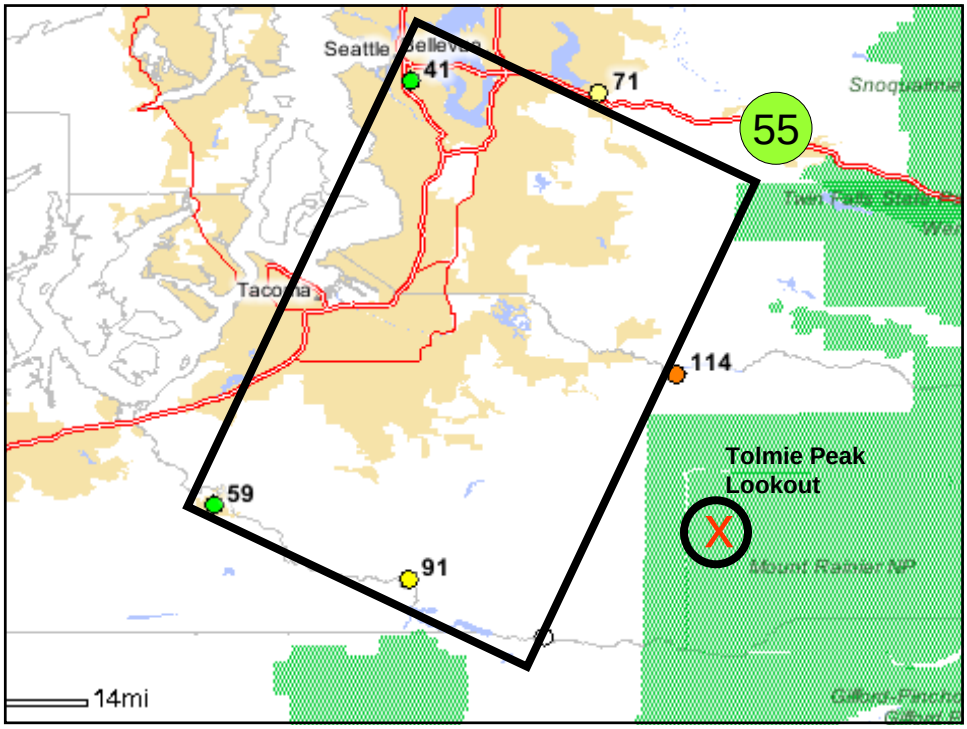
- The Pack Forest ozone site does a good job of capturing ozone events.
- Higher ozone concentrations were not found within the “perimeter”
- Highest concentrations occurred between Enumclaw and Pack Forest

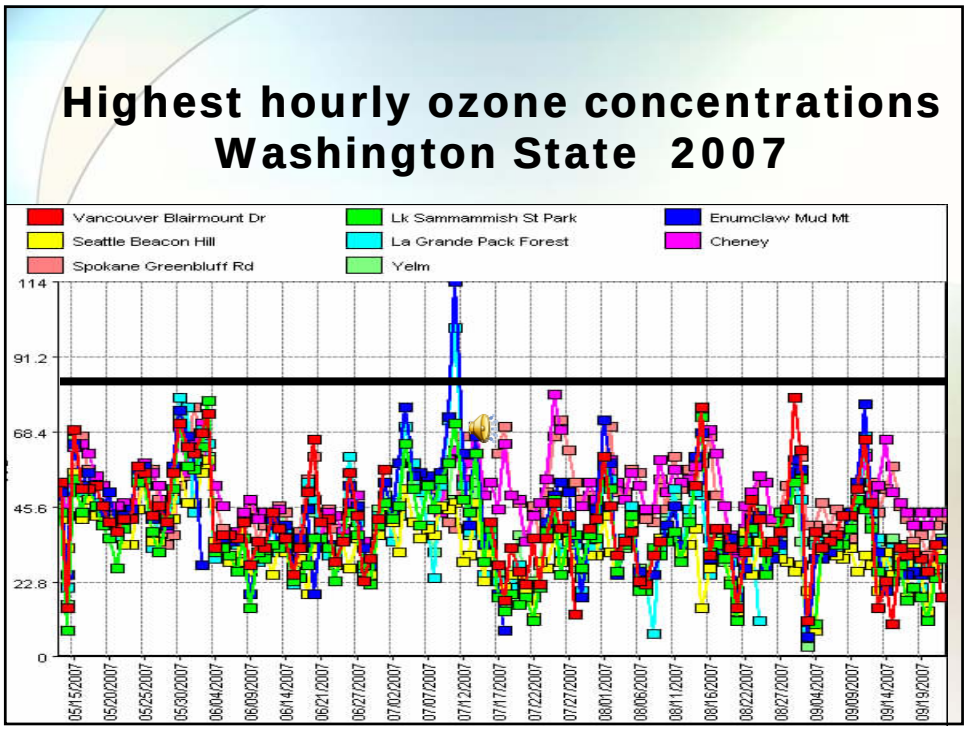
The Puget Sound Basin

- Some of the higher ozone concentrations observed during the survey were observed near the NW corner of Mt. Rainier National Park.
- Higher ozone concentrations may be occurring outside the “perimeter” in the “Outlands”.


Highest Ozone In Outland!
Berkley Breathed


"The Outlands" Tolmie Peak Lookout
Mt. Rainier National Park
NPS Photo

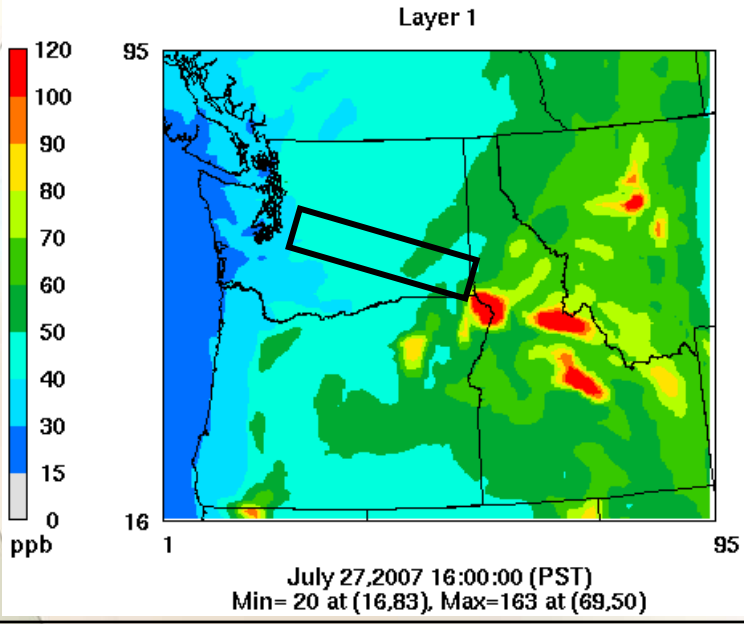

Seattle
41
71
55
Tacoma
114
Tolmie Peak
Lookout
59
91
Mount Rainier NP
14mi

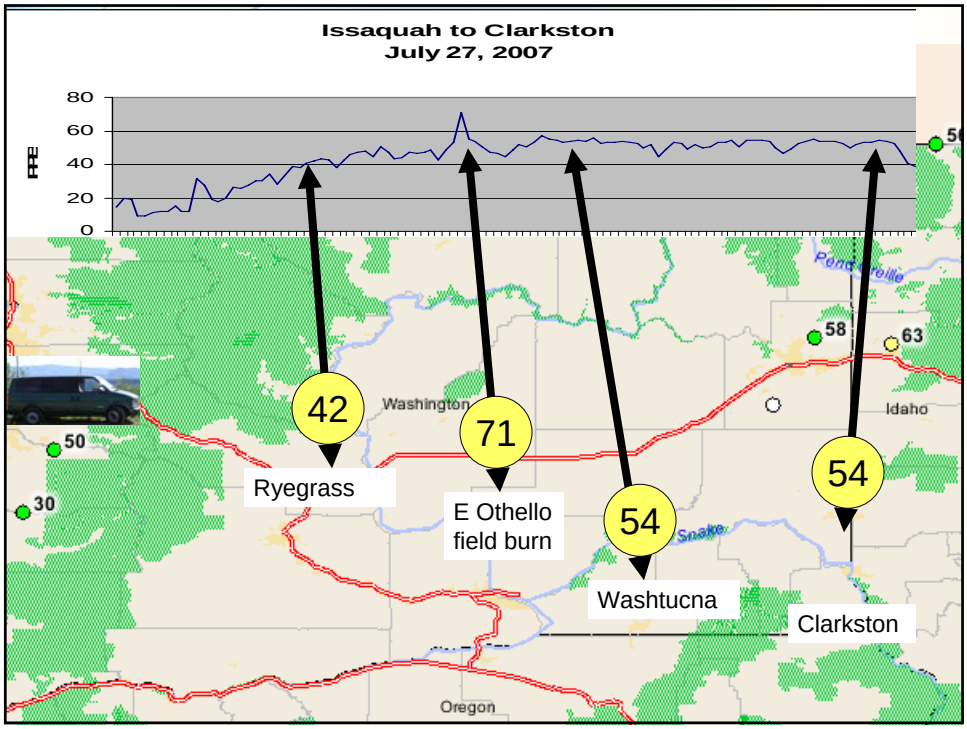

Highest hourly ozone concentrations
Washington State 2007
Vancouver Blairmount Dr
Seattle Beacon Hill
Spokane Greenbluff Rd
Lk Sammamish St Park
La Grande Pack Forest
Yelm
Enumclaw Mud Mt
Cheney
114
91.2
68.4
45.6
22.8
0
05/15/2007
05/20/2007
05/25/2007
05/30/2007
06/04/2007
06/09/2007
06/14/2007
06/21/2007
06/27/2007
07/02/2007
07/07/2007
07/12/2007
07/17/2007
07/22/2007
07/27/2007
08/01/2007
08/06/2007
08/11/2007
08/16/2007
08/22/2007
08/27/2007
09/04/2007
09/09/2007
09/14/2007
09/19/2007

Central and Eastern Washington

- Several transects made.
- Included Naches, Yakima, Othello, Ellensburg and Moses Lake.
- Ozone forecasts for the region were very accurate showing highest ozone concentrations between 50 and 60 ppb.

July 27 AIRPACT Predicts 40-50 PPB

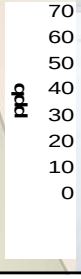



Issaquah to Clarkston
July 27, 2007
80
60
40
20
0
PM2.5
42
Ryegrass
71
E Othello
field burn
54
Washtucna
54
Clarkston
Washington
Idaho
Oregon
50
30
58
63


Next Mission:
Tri-Cities
Washington
X

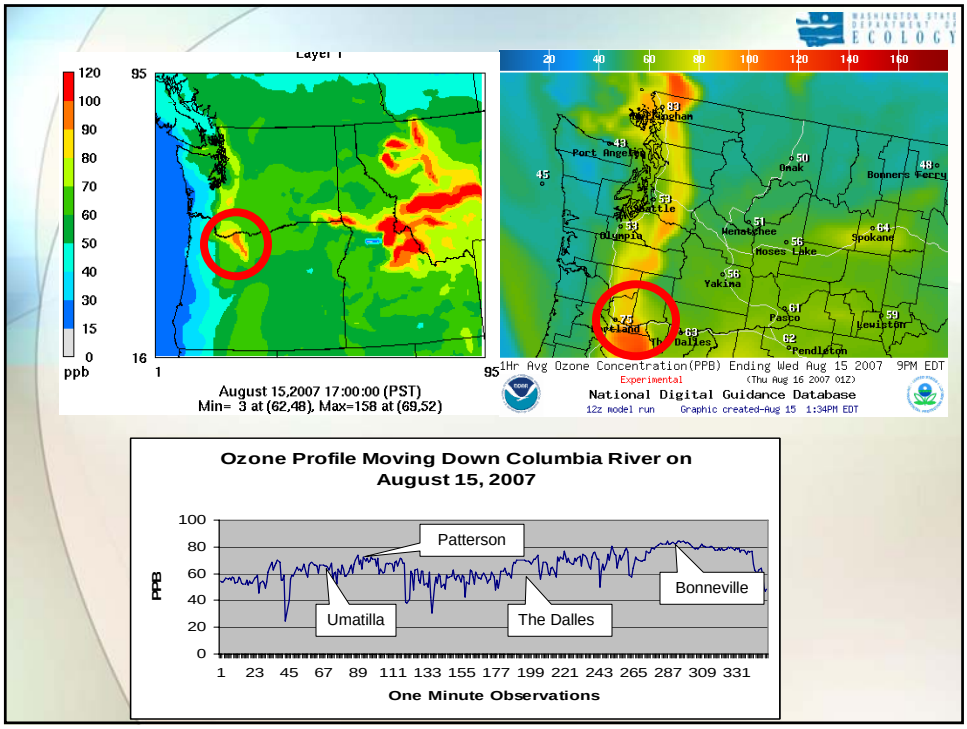
2B analyzer is portable

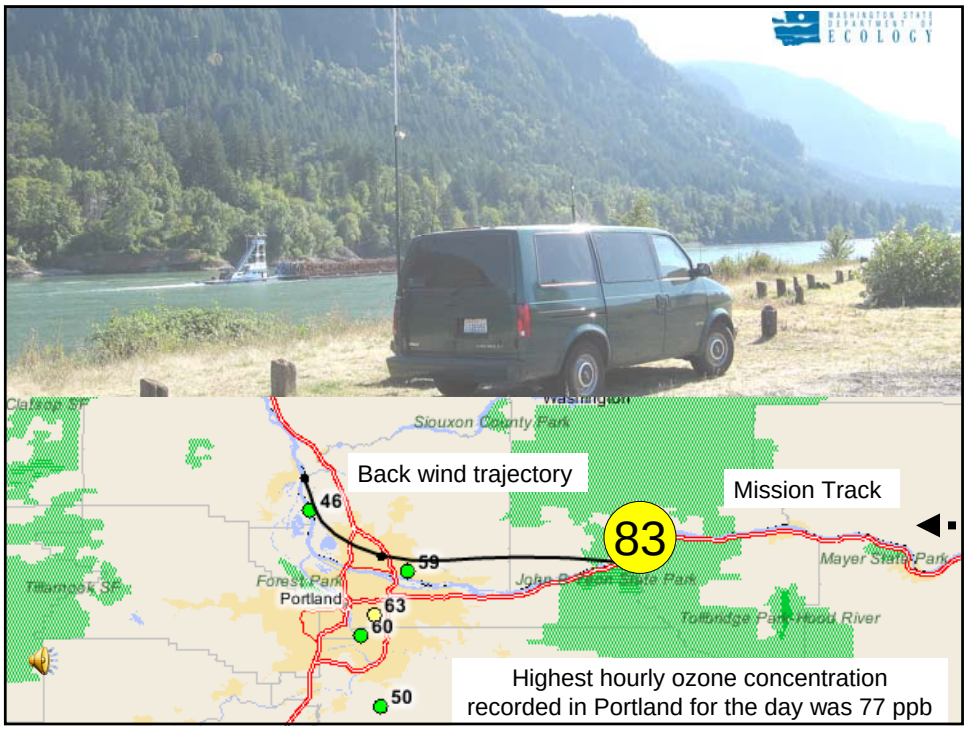
- C
- T
- D



Portland / Vancouver Columbia River Gorge

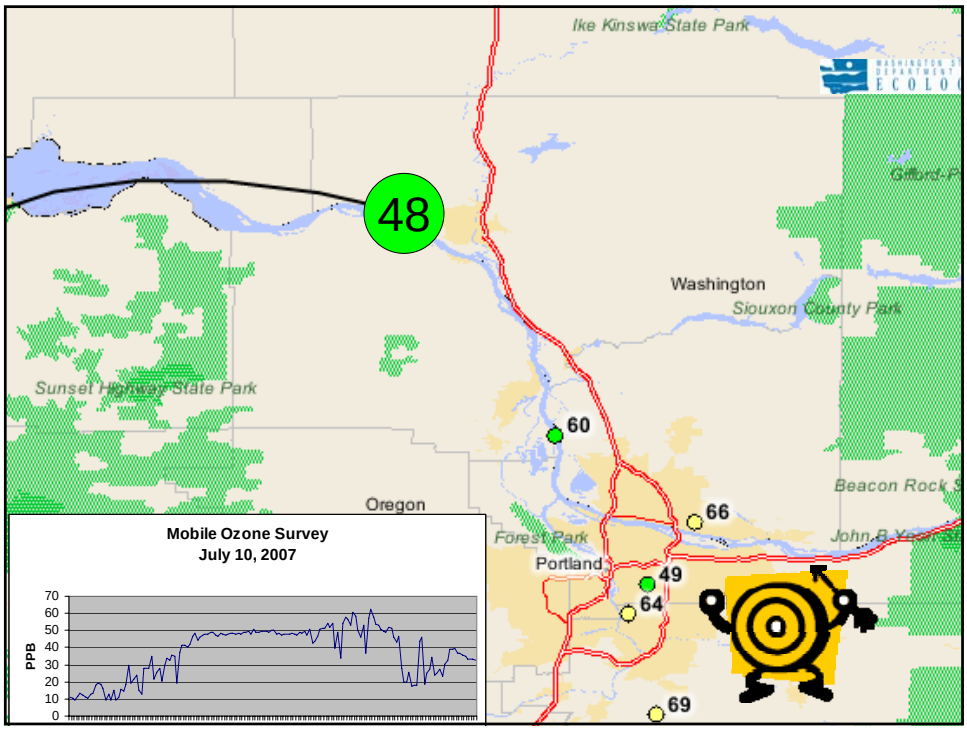
- Winds during the summer months are primarily up-gorge.
- Ozone model forecasts predicted ozone plumes moving up-gorge.


ppb
August 15,2007 17:00:00 (PST)
Min= 3 at (62,48), Max=158 at (69,52)
1Hr Avg Ozone Concentration(PPB) Ending Wed Aug 15 2007 9PM EDT
National Digital Guidance Database
Ozone Profile Moving Down Columbia River on August 15, 2007
Patterson
Bonneville
Umatilla
The Dalles
PPB
One Minute Observations


Back wind trajectory
Mission Track
83
46
59
63
60
50
Portland
Highest hourly ozone concentration recorded in Portland for the day was 77 ppb

Mission Critique

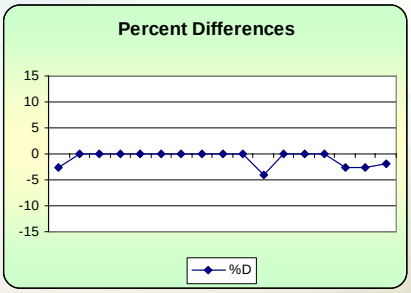
- The van intercepted the predicted plume as it moved east through the Gorge.
- The ozone concentrations found in the Gorge was higher than what was recorded in Portland for the day.
- The NOAA ozone forecast for Portland/Vancouver was **accurate** (77 ppb vs. 77 ppb)



Analyzer proves reliable in hostile conditions

- Simple to operate.
- Subjected to heat and vibration with no malfunction or maintenance.
- Well within Data Quality Indicator limits.
- Comparability was excellent.
- Passed independent EPA audit.
- It doesn't get any better than that!

Comparability (site comparison)

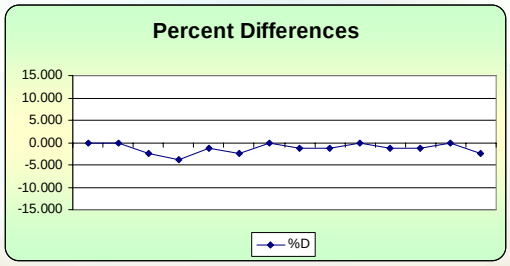


CV% = 1.76 Signed bias= -1.38

< 1.5 %

EPA's Data Assessment Statistical Calculator

Precision (van O_3 standard)



CV% = 1.63 Signed bias= -1.81

< 2%

Accuracy (NPEP audit)

PRELIMINARY OZONE AUDIT RESULTS

NPEP O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.407	0.404	-0.7
0.179	0.178	-0.6
0.072	0.072	0.0
0.001	0.002	

< 1%

In a nutshell…

- Monitoring was conducted on 23 days.
- Data was captured in 18 counties.
- The highest hourly average recorded was 97 ppb.
- Accuracy of the data was excellent.

Accomplishments

- Confirmed that the highest ozone concentrations are occurring along the perimeter of the ozone monitoring network.
- Answered questions concerning the location of ozone monitors.
- Demonstrated model forecasts for regions of eastern Washington appear accurate.
- Intercepted and recorded ozone plumes moving up the Columbia River Gorge.
- Demonstrated additional tools decision makers can use to assess their ozone monitoring network.

Additional Data Users

- Modelers from NOAA National Weather Service Air Quality Forecast Guidance.
- Modelers from the Air Indicator Report for Public Awareness and Community Tracking (AIRPACT).
- National Park Service.

Special thanks to the "ground support"

- Mark Shanis and Mike Papp
  USEPA Office of Air Quality Planning and Standards
- Melinda Ronca-Battista
  Tribal Air Monitoring Support Center
- Chris Hall and Scott Dubble
  USEPA Region 10

What a show, what a fight
Boy, we really hit our target for tonight
With just one motor along
We can still carry on
Coming' in on a wing and a prayer

Adaptation of WWII song "Coming In on a Wing and a Prayer"

"Mission Accomplished"