

# Ozone Data Documentation and Validation

Operator Training

April 5<sup>th</sup>, 2005

1. Data documentation and validation  
– why?

2. Documentation

1. Log books
2. Strip charts

3. Validation

1. Initial data validation and web tools
2. Data comparability
3. Missing and invalidated data

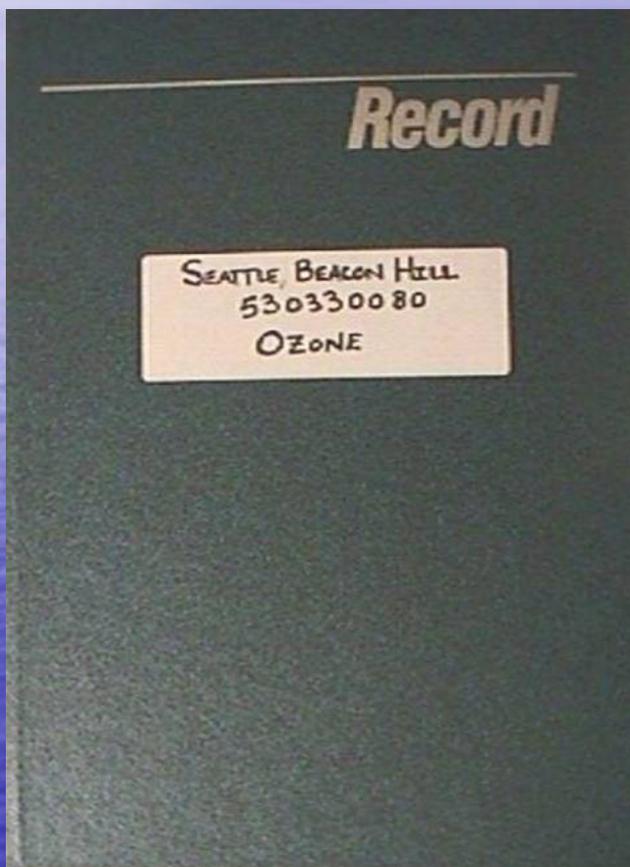
# Documentation and Validation: Why is it important?

- Good data means good air quality management
- Good air quality management translates into cleaner, healthier air to breathe
- Need ability to prove the quality of data (i.e., cases of litigation)
- If you didn't document it, you didn't do it!

# Documentation

1. Your Log Book
2. Your Strip Charts

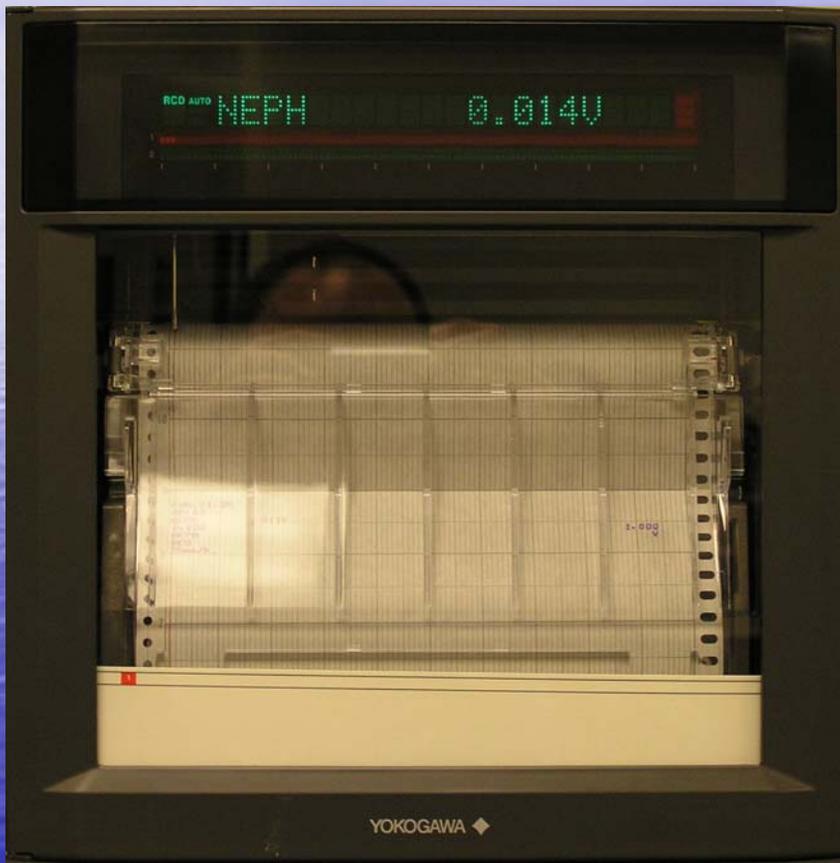
# The Log Book



- Each station must have a log book
- Keep in a highly visible location
- Clearly label with station name, number, and parameter
- All operational and maintenance activities must be documented

# Strip Charts

## Why?



- The primary legal record
- Data can be manually reduced in event of data collection failure
- Graphical representation of data – facilitates problem diagnosis

# Do you have a problem?

Monthly Running Average Report  
Run Date: 03/16/05 14:11  
( 1 Hour Rolling Averages )

SITE NAME: SOMESITE : 53-999-9999  
ADDRESS:  
LAT/LONG:  
ELEVATION:

PARAMETER NAME: OZONE  
PARAMETER CODE: 44201  
METHOD: 56 UNITS: PPM

MONTH: Septembe  
YEAR: 2004  
DECIMAL POSITIONER: 3  
PROJECT: 05

Hourly Averages  
Beginning Hour (PST)

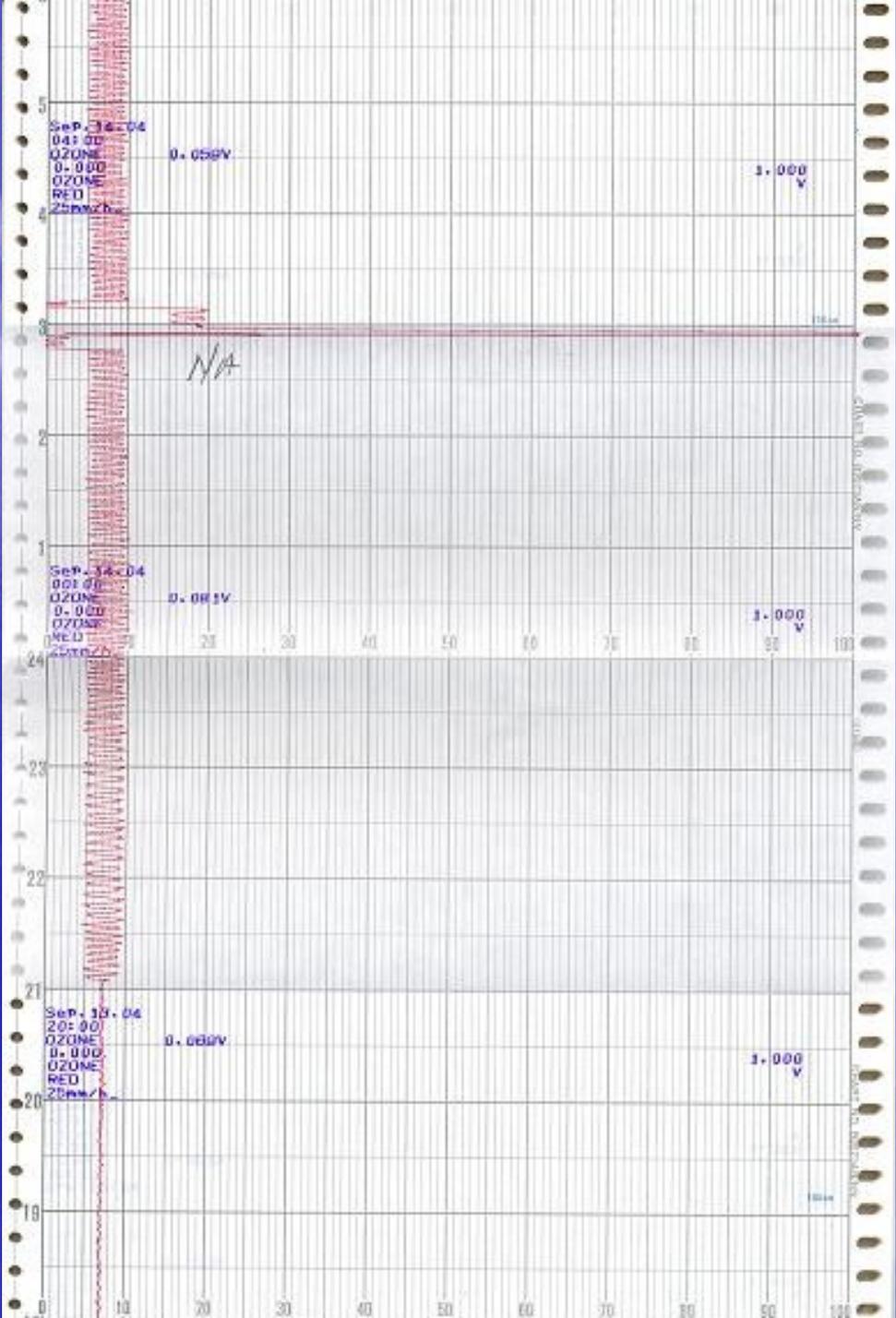
DA	C	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVG	MAX	RDS				
01	WE	24	23	15C	17C	15	14	19	33	37	41	40	39	39	41	43	43	43	43	42	43	44	44	43	42	0.034	0.044	24				
02	TH	42	42	40C	39C	38	36	36	37	37	37	35	36	36	36	35	35	34	32	30	29	33	30	31	30	0.035	0.042	24				
03	FR	30	31	30C	27C	26	28	29	29	28	29	27	25	26	25	25	27	30	31	30	31	32	31	30	29	0.029	0.032	24				
04	SA	30	30	29C	30C	30	29	30	30	32	33	30	30	30	32	34	37	37	36	36	35	36	35	35	36	0.033	0.037	24				
05	SU	36	36	36C	34C	35	35	35	35	35	34	34	34	36	35	36	36	37	38	36	36	37	38	45	44	0.036	0.045	24				
06	MO	45	47	49C	48C	51	47	52	42	43	47	49	46	43	40	43	45	43	39	39	39	42	44	53	56	0.046	0.056	24				
07	TU	50	48	53C	52C	51	52	51	42	36	35	33	33	35	36	34	35	37	38	39	39	38	38	36	34	0.041	0.053	24				
08	WE	35	35	35C	38C	39	38	36	32	32	31	32	33	36	38	36	35	31	28	32	31	31	30	34	36	0.034	0.039	24				
09	TH	34	35	34C	33C	32	32	32	31	31	30	29	30	34	35	36	37	37	35	34	35	37	36	35	36	0.033	0.037	24				
10	FR	37	46	54C	61C	62	62	62	59	59	57	53	43	43	42	39	36	36	42	39	37	26	23	18	16	0.044	0.062	24				
11	SA	15	15	17C	18C	25	37	44	45	43	43	44	45	45	45	46	43	42	42	40	38	39	42	41	41	0.037	0.046	24				
12	SU	44	47	44C	41C	40	39	39	38	36	35	35	36	38	37	37	37	36	35	34	36	36	37	37	38	0.038	0.047	24				
13	MO	41	40	39C	41C	40	37	34	33	33	34	31	31	30	31	34	34	33	33	34	35	35	35	36	36	0.035	0.041	24				
14	TU	37	37	37C	37C	36	37	38	38	37	38		D		D	36	36	37	34	35	37	37	36	34	34	0.036	0.038	21				
15	WE	32	32	33C	36C	36	36	41	39	39	39	38	37	41	41	39	38	36	35	34	33	33	34	34	33	0.036	0.041	24				
16	TH	33	34	33C	34C	34	35	34	32	33	33	30	30	30	30	30	34	32	31	34	36	39	38	38	37	0.034	0.039	24				
17	FR	36	38	40C	39C	40	39	40	39	37	37	37	39	39	37	36	34	34	31	32	32	33	32	30	33	0.036	0.040	24				
18	SA	32	33	34C	36C	35	36	35	34	32	31	32	31	33	32	30	31	32	32	32	32	32	33	35	36	0.033	0.036	24				
19	SU	37	38	39C	38C	41	41	40	37	33	29	32	32	31	31	32	32	30	28	29	30	31	32	33	34	0.034	0.041	24				
20	MO	31	30	29C	29C	28	28	31	29	29	29	29	30	31	31	34	32	32	31	29	28	28	28	30	29	0.030	0.034	24				
21	TU	28	28	27C	26C	26	28	28	31	32	33	30	28	24	23	23	24	24	25	26	26	26	35	42	41	0.029	0.042	24				
22	WE	40	40	39C	34C	24	24	24	20	20	20	19	19	19	19	20	19	19	21	25	23	23	24	27	25	0.025	0.040	24				
23	TH	26	25	26C	27C	30	32	33	34	34	33	34	35	36	36	35	35	33	32	34	37	38	37	43	44	0.034	0.044	24				
24	FR	42	41	42C	45C	45	44	43	42	41	38	37	37	39	40	42	41	41	39	41	44	46	43	46	45	0.042	0.046	24				
25	SA	43	40	41C	40C	40	40	37	33	39	40	40	37	38	39	40	40	37	33	34	34	37	47	52	54	0.040	0.054	24				
26	SU	43	36	28C	31C	48	50	50	51	48	46	45	43	42	40	39	42	43	44	43	42	47	48	47	47	0.043	0.051	24				
27	MO	47	48	48C	48C	48	48	48	47	47	46	45	44	43	44	45	46	47	47	46	46	45	45	45	45	0.046	0.048	24				
28	TU	44	45	46C	46C	46	45	45		P	43	43		D		D		D	42	42	42	40	38	38	39	44	46	46	48	0.043	0.048	20
29	WE	44	33	35C	45C	31	30	30	30			D		D		P											0.045	9				
30	TH																										-0.999	0				
AVG		36	36	36	37	37	37	38	36	36	36	35	35	35	35	36	36	36	35	35	35	36	37	38	38	0.036						
MAX		50	48	54	61	62	62	62	59	59	57	53	46	45	45	46	46	47	47	46	46	47	48	53	56	0.062						
DAYS		29	29	29	29	29	29	29	28	29	28	26	26	26	28	28	28	28	28	28	28	28	28	28	28			674				

STANDARD DEVIATION 0.062

NOTES:

NOTES: \*\*\* INDICATE INVALID DATA OR LESS THAN 75 PERCENT VALID DATA INCLUDED.  
STATUS CODES 'P' - POWER DOWN, 'D' - DISABLED, 'B' - BAD STATUS, 'C' - CALIBRATION, '-' - MINIMUM, '+' - MAXIMUM,  
'R' - RATE OF CHANGE, 'E' - FIELD EXCEEDED, 'N' - DATA NOT FOUND, 'A' - CALIBRATION OUT OF TOLERANCE, ' ' - NO ERROR

You bet  
you do:



# Documenting Strip Charts

1. Time Checks
2. Zero, Precision, and Span Checks
3. Equipment Failure
4. Chart Collection
5. Chart Stamps

# Chart Time, Paper/Ink Supply checks

During Each Site Visit:

- Mark strip chart
- Record date and time followed by initials
- If chart time is wrong, advance it to proper time in PST
- Do not reverse the strip chart
- Make sure enough paper remains so it won't run out before next site visit
- Replace paper, pen, and/or plotter if necessary

# Zero and Precision Checks

- Disable the data logger
- Record the data logger time (PST), date, and your name on the the chart
- Record instrument tag number
- Record both indicated and actual values for zero, precision, and span
- Transfer the precision values to the Precision Check Form



# Properly documented Monthly Precision Check Summary Form

## Monthly Precision Check Summary

AIRS NUMBER: 530010001

PARAMETER: Ozone YEAR: 2004 MONTH: July

STATE TAG OR ID #: E120444

LOCATION: Mt. Washington OPERATOR: Dave Davies

DATE			ACTUAL CONC.	INDICATED CONC.	UNITS	*PASSED? Y or N	COMMENTS
Month	Day	Year					
7	4	2004	.090	.091	ppm	Y	Manual Check
7	12	2004	.089	.090	ppm	Y	Automated Check
7	18	2004	.091	.091	ppm	Y	Manual Check
7	25	2004	.088	.090	ppm	Y	Automated Check

\*Shaded area to be completed by QA Personnel

### PRECISION CHECK EQUIPMENT:

Gas Cylinder Serial #: \_\_\_\_\_

Calibrator Model: Dasibi 1008PC

Calibrator Serial #: 5310

Permeation Tube #: \_\_\_\_\_

Decimal Placement:	
CO	2
SO2	3
NO2	3
O3	3
NEPH	3

COMMENTS:

- Do not adjust the instrument until the full calibration check has been completed
- Record any instrument adjustments on the strip chart
- Verify any adjustments with an additional zero and precision
- Remember to re-enable the data logger (this will save you a trip back to your site)

# Collecting and processing Strip Charts

- Collect strip charts
- Stamp charts

# Chart Stamps (3 Kinds)

1. Chart Identification Stamp
2. Precision Check Stamp
3. Chart Time Error Stamp



# Precision Check and Chart Time Error Stamps

PRECISION CHECK

Calibrator Model #: \_\_\_\_\_

Calibrator State Tag #: \_\_\_\_\_

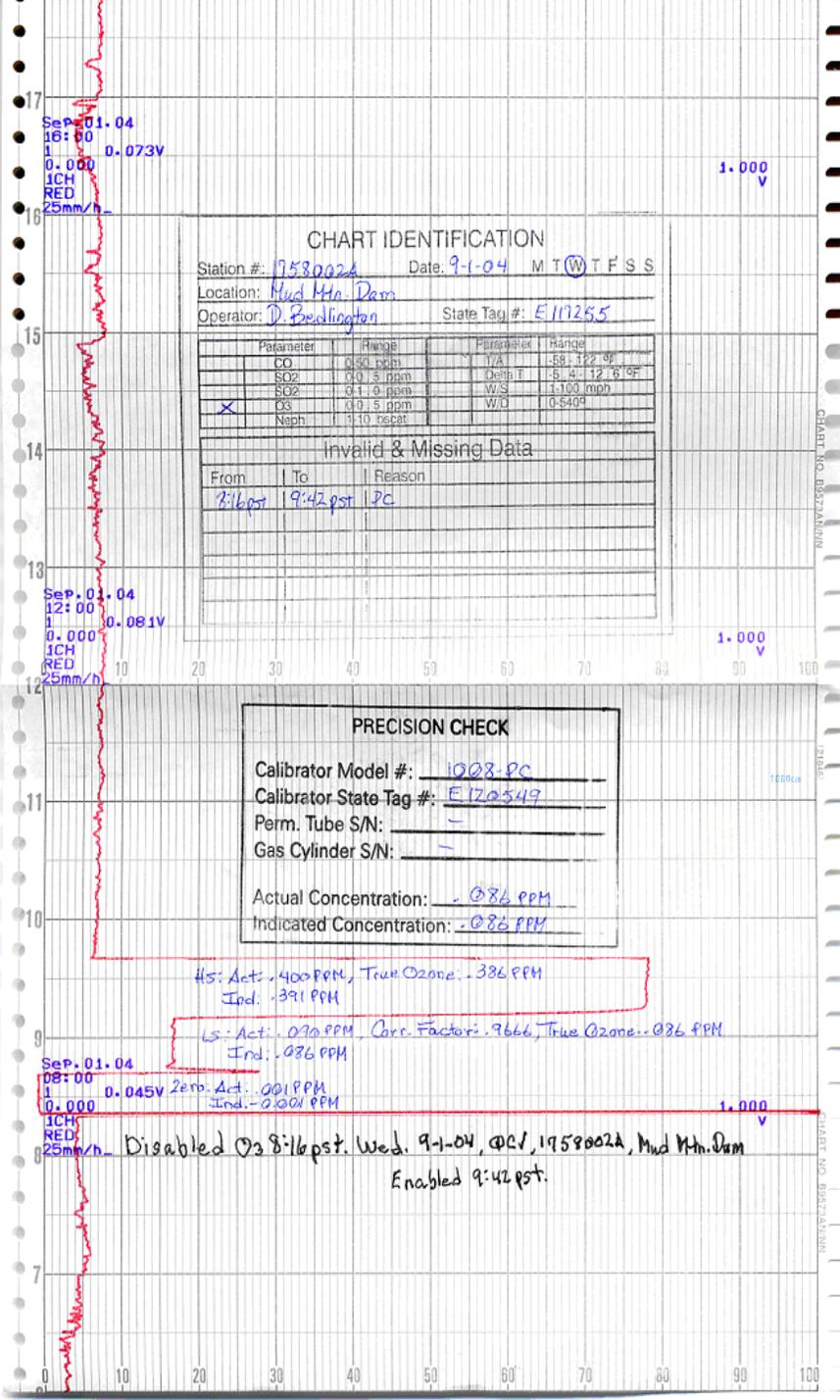
Perm. Tube S/N: \_\_\_\_\_

Gas Cylinder S/N: \_\_\_\_\_

Actual Concentration: \_\_\_\_\_

Indicated Concentration: \_\_\_\_\_

CHART TIME ERROR



- Place a Chart Identification Stamp on the first and last day of the month
- On all precision check days, place a Chart Identification Stamp below the 2400hr line and place Precision Stamp below The Chart Identification Stamp (shown at left)
- Do not overwrite the pollutant trace
- Fill in relevant fields on the stamps
- Record time errors, missing, and/or invalidated data
- Transcribe precision values to the Monthly Precision Check Summary Form

# Validation

1. Initial Validation – use the web!
2. Data Comparability
3. Missing and Invalid Data

# Site Operator Website

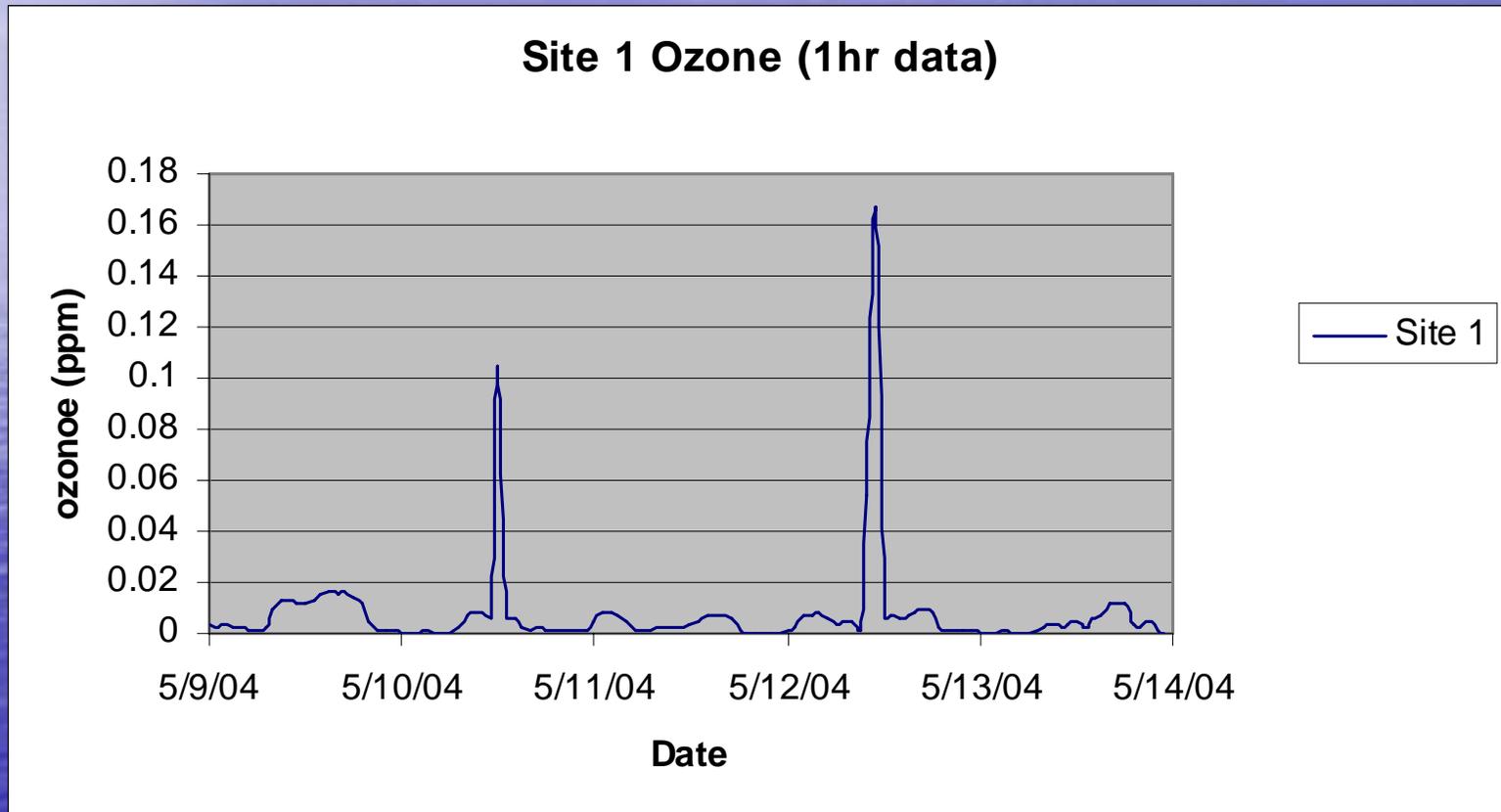
- On a daily basis, take a few moments to review the sites you are responsible for on the web at

<https://fortress.wa.gov/ecy/aqp/Site/>

- Reviewing your data on a daily basis can prevent data loss and reduce your workload

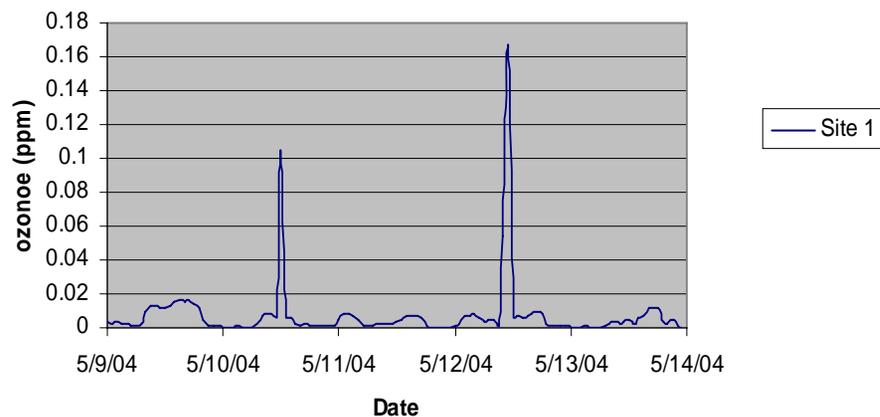
For example:

# Do you have a problem?

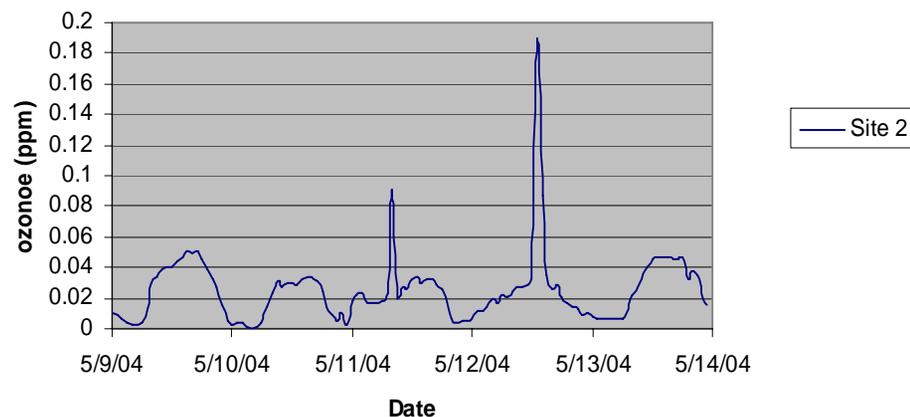


# You bet you do

Site 1 Ozone (1hr data)

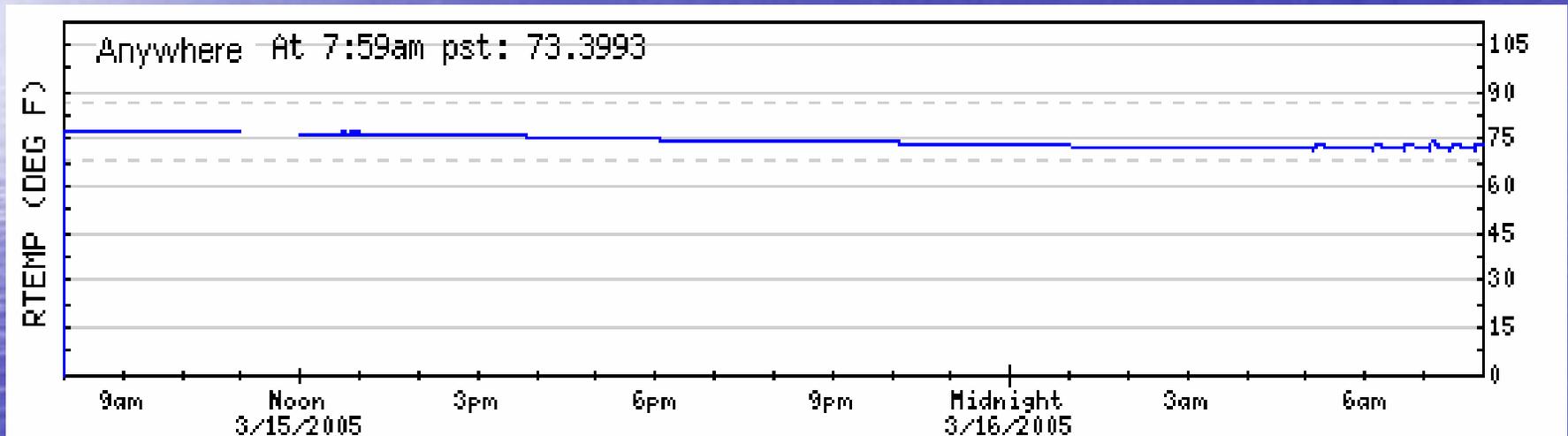


Site 2 Ozone (1hr data)



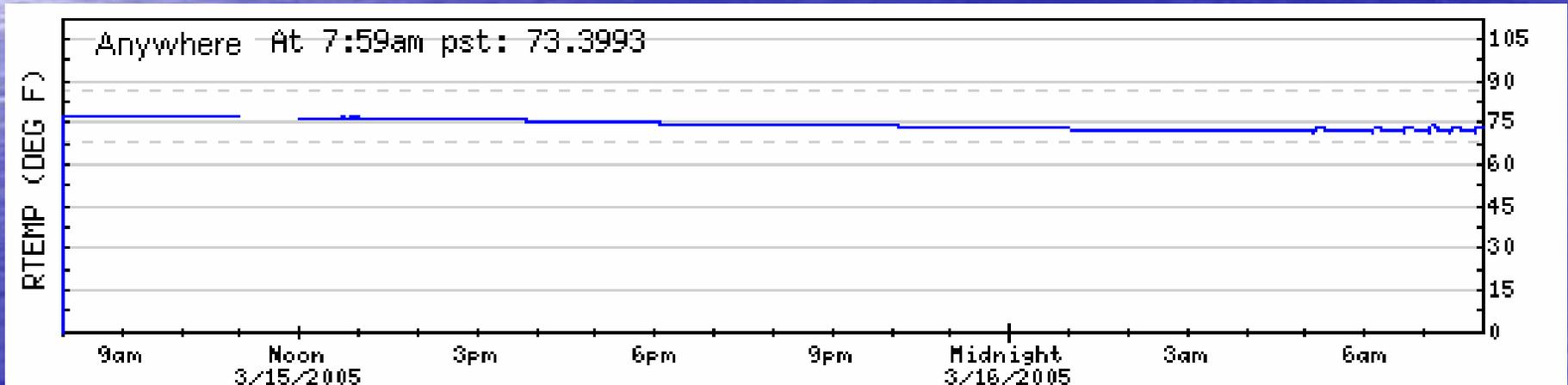
Site 1 is within 20 miles of Site 2, but the ozone concentration at Site 2 is  $\sim 2.5 \times$  higher??? Why?

# Do you have a problem?

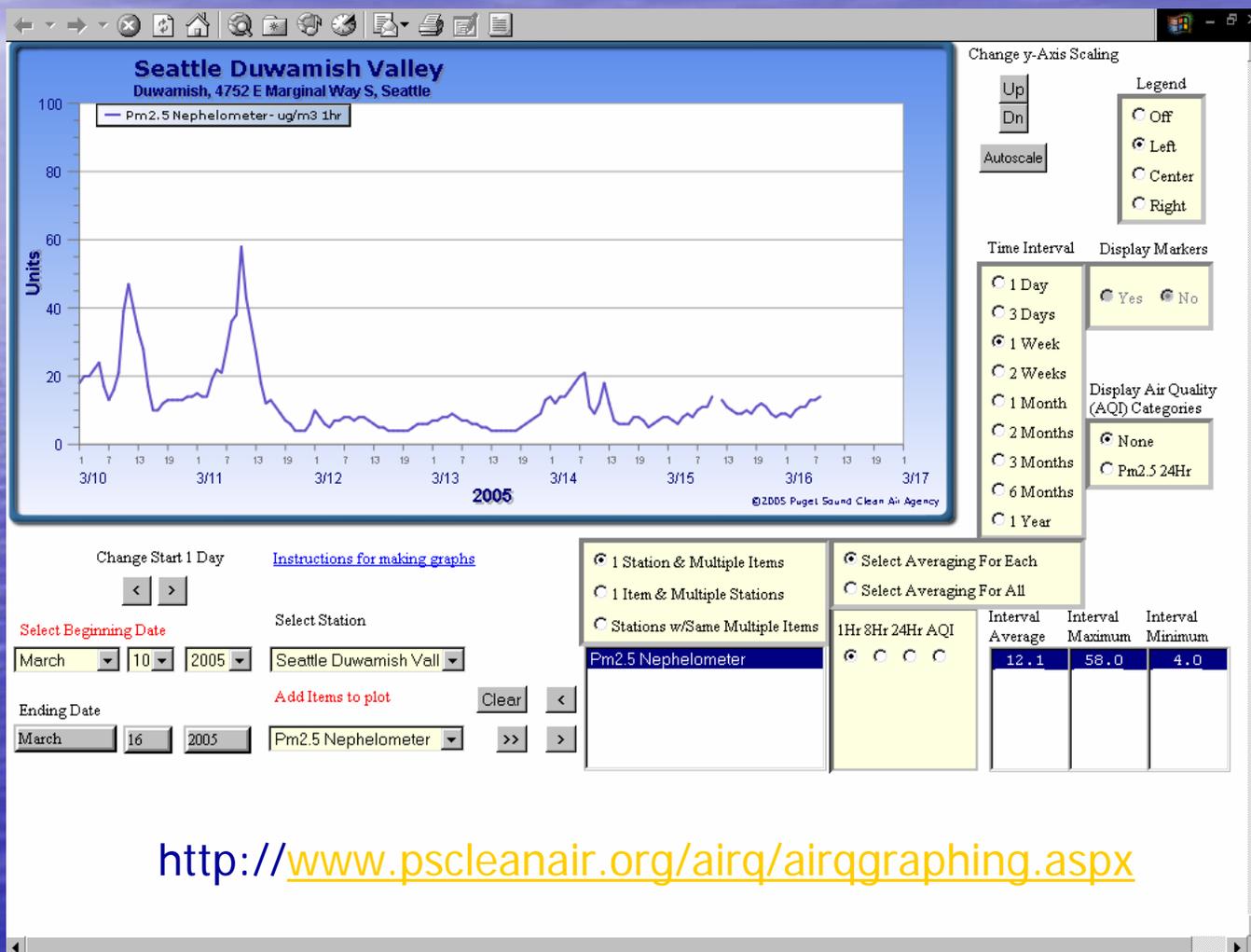


# Nope

- Shelter temperature must be maintained between 20 and 30 °C (68 – 86 °F)



# The graphical validation tool developed by Ken Knowle at PSCAA is another excellent resource



# Data Comparability

- At the end of the month, generate a 24 X 31 (Monthly Air Quality Data Report) from the site operator web page  
<https://fortress.wa.gov/ecy/aqp/Site/>
- Reduce several hours of data from the chart and compare it to the data on the 24 X 31
- Write the reduced value and the 24 X 31 value on the chart next to the hour in question
- If chart time is off by more than 10 minutes, stamp each 24 hr segment of chart with the Chart Time Error Stamp



# Missing and Invalidated Data

- Missing telemetry data should be reduced from the chart and filled in on the 24 X 31
- If more than three consecutive days are missing, use the Hourly Data Input form
- Strike through any invalid data and note the reason on the chart and 24 X 31
- If strip chart data is missing, indicate on the report that the data may be valid

# Properly edited 24 X 31

Monthly Running Average Report  
 Run Date: 03/16/05 09:20  
 ( 1 Hour Rolling Averages )

SITE NAME: SOMESITE : 53-111-1111  
 ADDRESS:  
 LAT/LONG:  
 ELEVATION:

PARAMETER NAME: OZONE  
 PARAMETER CODE: 44201  
 METHOD: 56 UNITS: PPM

MONTH: February  
 YEAR: 2005  
 DECIMAL POSITIONER: 3  
 PROJECT: 05

Hourly Averages  
 Beginning Hour (PST)

DA	C	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVG	MAX	FDS
01	TU	32	33	36C	38C	38	39	39	37	35	37	40	38	40	43	43	43	42	43	46	47	47	47	47	47	0.041	0.047	24
02	WE	47	47	47C	45C	47	48	47	47	48	46	48	45	42	41	42	43	43	42	42	44	45	44	46	49	0.045	0.049	24
03	TH	48	50	50C	50C	48	45	41	41	41	40	39	37	36	35	35	34	35	35	36	35	36	38	39	41	0.040	0.050	24
04	FR	41	41	40C	40C	41	40	40	39	38	32	30	40	41	42	43	43	42	43	41	42	43	42	42	41	0.040	0.043	24
05	SA	41	42	41C	42C	42	43	44	43	42	41	42	42	43	42	43	40	42	42	42	42	42	41	36	35	0.042	0.044	24
06	SU	36	42	41C	42C	38	34	34	33	35	36	32	33	34	31	31	32	31	30	28	28	29	30	30	0.033	0.042	24	
07	MO	31	31	32C	33C	32	32	32	32	34	35	34	30	<u>D</u>	<u>D</u>	<del>36</del>	<del>29</del>	<del>29</del>	<del>26</del>	<del>24</del>	<del>24</del>	<del>28</del>	<del>28</del>	<del>29</del>	0.030	0.035	22	
08	TU	<del>31</del>	<del>32</del>	<del>32C</del>	<del>33C</del>	<del>33</del>	<del>33</del>	<del>33</del>	<del>34</del>	<del>35</del>	<del>34</del>	<del>35</del>	<del>34</del>	<del>35</del>	<del>34</del>	<del>40</del>	<del>44</del>	<del>39</del>	<del>37</del>	<del>37</del>	<del>30</del>	<del>40</del>	<del>42</del>	<del>44</del>	<del>45</del>	0.036	0.045	24
09	WE	<del>45</del>	<del>40</del>	<del>49C</del>	<del>40C</del>	<del>50</del>	<del>40</del>	<del>40</del>	<del>42</del>	<del>45</del>	<del>46</del>	<del>45</del>	<del>43</del>	<del>40</del>	<del>41</del>	<del>39</del>	<del>36</del>	<del>30</del>	<del>34</del>	<del>37</del>	<del>30</del>	<del>40</del>	<del>43</del>	<del>44</del>	<del>45</del>	0.043	0.050	24
10	TH	<del>44</del>	<del>43</del>	<del>43C</del>	<del>40C</del>	<del>44</del>	<del>44</del>	<del>47</del>	<del>46</del>	<del>49</del>	<del>48</del>	<del>50</del>	<del>49</del>	<del>47</del>	<del>48</del>	<del>48</del>	<del>48</del>	<del>47</del>	<del>52</del>	<del>51</del>	<del>48</del>	<del>46</del>	<del>46</del>	<del>44</del>	<del>44</del>	0.046	0.052	24
11	FR	<del>40</del>	<del>49</del>	<del>47C</del>	<del>30C</del>	<del>42</del>	<del>44</del>	<del>44</del>	<del>43</del>	<del>43</del>	<del>40</del>	<del>30</del>	<del>30</del>	<del>39</del>	<del>41</del>	<del>42</del>	<del>43</del>	<del>43</del>	<del>45</del>	<del>50</del>	<del>52</del>	<del>52</del>	<del>40</del>	<del>47</del>	<del>50</del>	0.044	0.052	24
12	SA	<del>47</del>	<del>48</del>	<del>52C</del>	<del>51C</del>	<del>49</del>	<del>46</del>	<del>46</del>	<del>45</del>	<del>46</del>	<del>45</del>	<del>43</del>	<del>43</del>	<del>43</del>	<del>40</del>	<del>34</del>	<del>29</del>	<del>32</del>	<del>40</del>	<del>41</del>	<del>38</del>	<del>36</del>	<del>37</del>	<del>39</del>	<del>42</del>	0.042	0.052	24
13	SU	<del>44</del>	<del>44</del>	<del>44C</del>	<del>42C</del>	<del>45</del>	<del>44</del>	<del>44</del>	<del>43</del>	<del>43</del>	<del>43</del>	<del>42</del>	<del>42</del>	<del>40</del>	<del>41</del>	<del>41</del>	<del>41</del>	<del>40</del>	<del>42</del>	<del>43</del>	<del>45</del>	<del>46</del>	<del>44</del>	<del>44</del>	<del>43</del>	0.043	0.046	24
14	MO	<del>44</del>	<del>43</del>	<del>43C</del>	<del>43C</del>	<del>42</del>	<del>42</del>	<del>42</del>	<del>42</del>	<del>41</del>	<del>36</del>	<del>39</del>	<del>41</del>	<del>40</del>	<del>39</del>	<del>39</del>	<del>38</del>	<del>39</del>	<del>38</del>	<del>36</del>	<del>36</del>	<del>36</del>	<del>36</del>	<del>36</del>	<del>37</del>	0.040	0.044	24
15	TU	<del>37</del>	<del>38</del>	<del>38C</del>	<del>38C</del>	<del>39</del>	<del>40</del>	<del>39</del>	<del>37</del>	<del>39</del>	<del>39</del>	<del>38</del>	<del>37</del>	<del>38</del>	<del>37</del>	<del>36</del>	<del>35</del>	<del>35</del>	<del>35</del>	<del>35</del>	<del>36</del>	<del>37</del>	<del>37</del>	<del>38</del>	<del>37</del>	0.037	0.040	24
16	WE	<del>36</del>	<del>37</del>	<del>37C</del>	<del>40C</del>	<del>41</del>	<del>40</del>	<del>42</del>	<del>41</del>	<del>43</del>	<del>42</del>	<u>D</u>	<u>D</u>	39	40	40	40	40	40	40	41	42	43	44	0.040	0.044	22	
17	TH	44	44	45C	41C	43	42	42	33	36	42	43	42	43	43	42	41	40	39	38	38	39	41	43	45	0.041	0.045	24
18	FR	44	44	44C	43C	44	44	43	43	44	45	45	45	45	46	45	43	43	43	36	39	39	38	41	41	0.043	0.046	24
19	SA	40	40	42C	40C	39	37	35	34	34	36	37	39	41	42	41	41	39	30	30	36	35	30	29	29	0.037	0.042	24
20	SU	32	33	34C	34C	34	34	34	34	34	34	35	35	35	35	35	39	40	33	32	33	35	36	36	36	0.035	0.040	24
21	MO	37	37	37C	37C	37	38	38	37	37	38	37	38	39	37	38	38	38	37	38	38	40	43	43	42	0.038	0.043	24
22	TU	42	42	41C	39C	40	41	40	40	40	40	39	41	41	41	41	41	40	40	41	41	41	42	41	41	0.041	0.042	24
23	WE	40	40	41C	37C	41	41	40	41	41	40	40	40	39	38	39	39	39	37	38	39	37	39	38	38	0.039	0.041	24
24	TH	38	42	43C	40C	41	39	37	37	38	38	38	40	42	44	43	43	39	34	34	35	33	33	35	35	0.038	0.044	24
25	FR	33	32	34C	33C	33	34	33	33	34	37	40	42	43	43	41	36	32	26	31	31	32	32	32	32	0.035	0.043	24
26	SA	33	34	33C	33C	34	35	34	35	36	37	37	38	38	38	38	38	39	37	37	37	36	36	37	36	0.036	0.039	24
27	SU	37	36	35C	35C	35	35	35	35	36	36	36	35	36	36	37	37	38	36	36	36	37	36	36	36	0.036	0.038	24
28	MO	36	36	35C	35C	34	34	34	37	43	41	43	42	43	44	42	44	43	42	39	38	39	42	41	43	0.040	0.044	24
AVG		40	40	41	40	40	40	39	40	39	40	40	40	40	40	39	39	38	38	38	38	39	39	39	40	0.039		
MAX		48	50	52	51	50	48	48	47	49	48	50	49	47	48	48	48	47	52	51	52	52	48	47	50	0.052		
DAYS		28	28	28	28	28	28	28	28	28	28	27	27	27	27	28	28	28	28	28	28	28	28	28	28			668

STANDARD DEVIATION 0.052

NOTES: QC check failure; data is invalid from 1400 2/7/05 through 0900 2/16/05

NOTES: \*\*\* INDICATE INVALID DATA OR LESS THAN 75 PERCENT VALID DATA INCLUDED.

STATUS CODES 'P' - POWER DOWN, 'D' - DISABLED, 'B' - BAD STATUS, 'C' - CALIBRATION, '-' - MINIMUM, '+' - MAXIMUM,  
 'R' - RATE OF CHANGE, 'E' - FIELD EXCEEDED, 'N' - DATA NOT FOUND, 'A' - CALIBRATION OUT OF TOLERANCE, ' ' - NO ERROR



# Submitting Data

- Binder clip the Precision Check, 24 X 31, and Hourly Data Input forms to the strip charts. Please don't use staples
- Send to Quality Assurance no later than the 10<sup>th</sup> of the month

Department of Ecology  
Air Quality Program  
Attn: Quality Assurance  
PO Box 47600  
Olympia, WA 98504-7600

For complete procedures on data documentation and validation, please refer to:

Section III of the Quality Assurance Plan and Procedures Document: Automated Method Data Documentation and Validation Procedures

or on the web @

<http://www.ecy.wa.gov/pubs/95201c.pdf>

# Sean Lundblad

- Quality Assurance
- Phone: (360) 407-6843