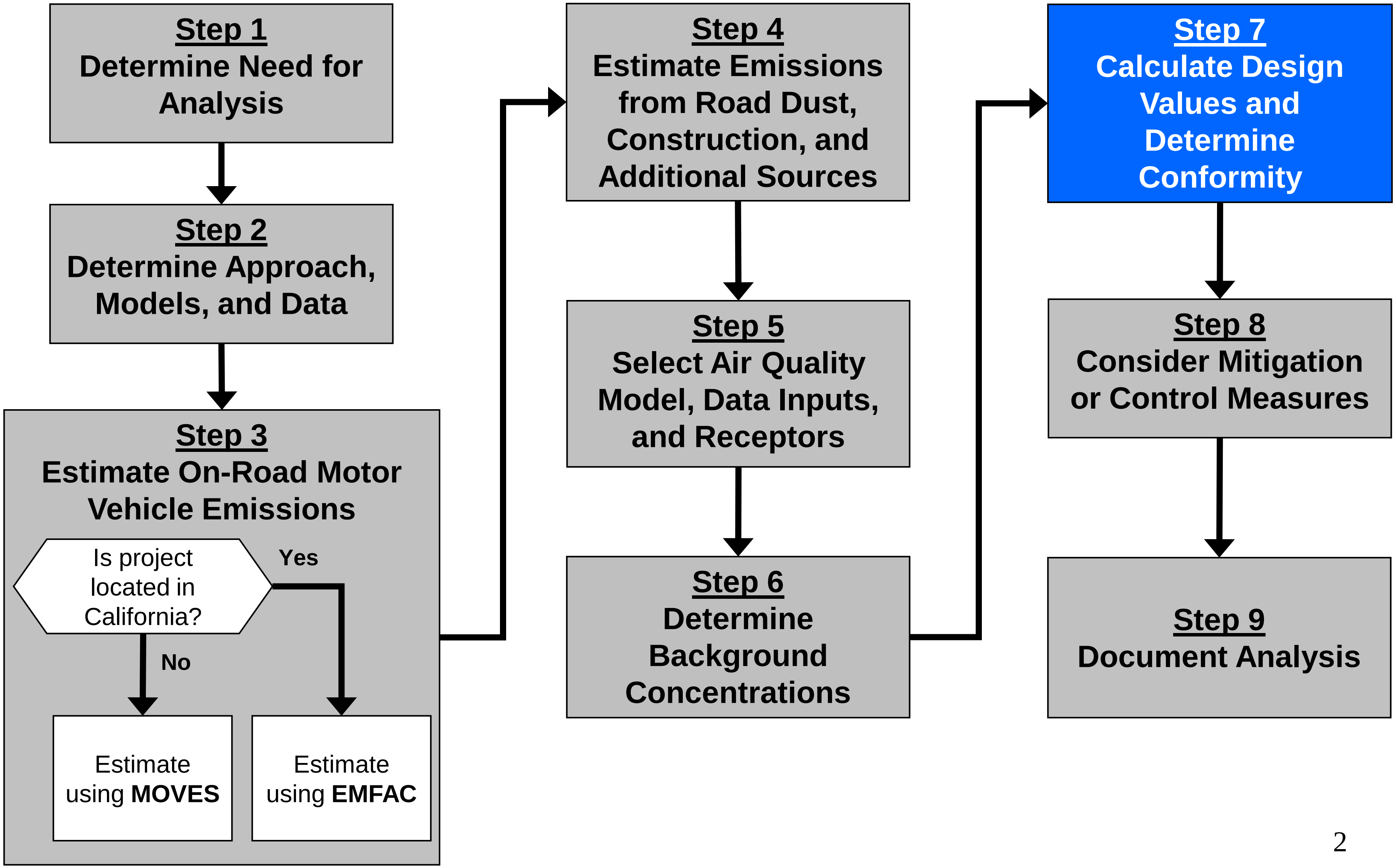
Module 7

Calculating Design Values and Determining Conformity

11/7/13

Completing a PM Hot-spot Analysis



Module Overview

- What is a design value?
- Design value procedures and data preparation tips for each PM NAAQS
- Determining appropriate receptors for the annual $PM_{2.5}$ NAAQS
- Calculating design values and determining conformity for our example analysis

Key References

- PM Hot-spot Guidance, Section 9 and Appendix K
- Design value regulations for monitoring data (40 CFR Part 50)
- Conformity rule sections 93.105(c)(1)(i) & 93.123(c)(1)
- Air quality monitoring regulations (40 CFR Part 58)

Visual Cues in this Module

- Different fonts used for different NAAQS
  - **Annual $PM_{2.5}$ NAAQS**
  - **24-hour $PM_{2.5}$ NAAQS**
  - *24-hour PM_{10} NAAQS*

- Different colors used to distinguish:
  - Data that results from modeling
  - Data that comes from monitoring

What is a Design Value?

- In PM hot-spot analyses, a design value (DV) is a statistic that describes a future air quality concentration in the project area that can be compared to a NAAQS

- Project design values are used to determine conformity

- In general, design values are calculated by combining:
  - » **Air quality modeling results**
    (project and nearby sources that are modeled)

    and
  - » **Air quality monitoring** data
    (background from other sources)

Guidance Reference:

Section 9.1

Using DVs to Determine Conformity

- Guidance describes how to calculate design values for each of the current PM NAAQS, consistent with:
  - How NAAQS are established, and
  - How design values are calculated for other purposes

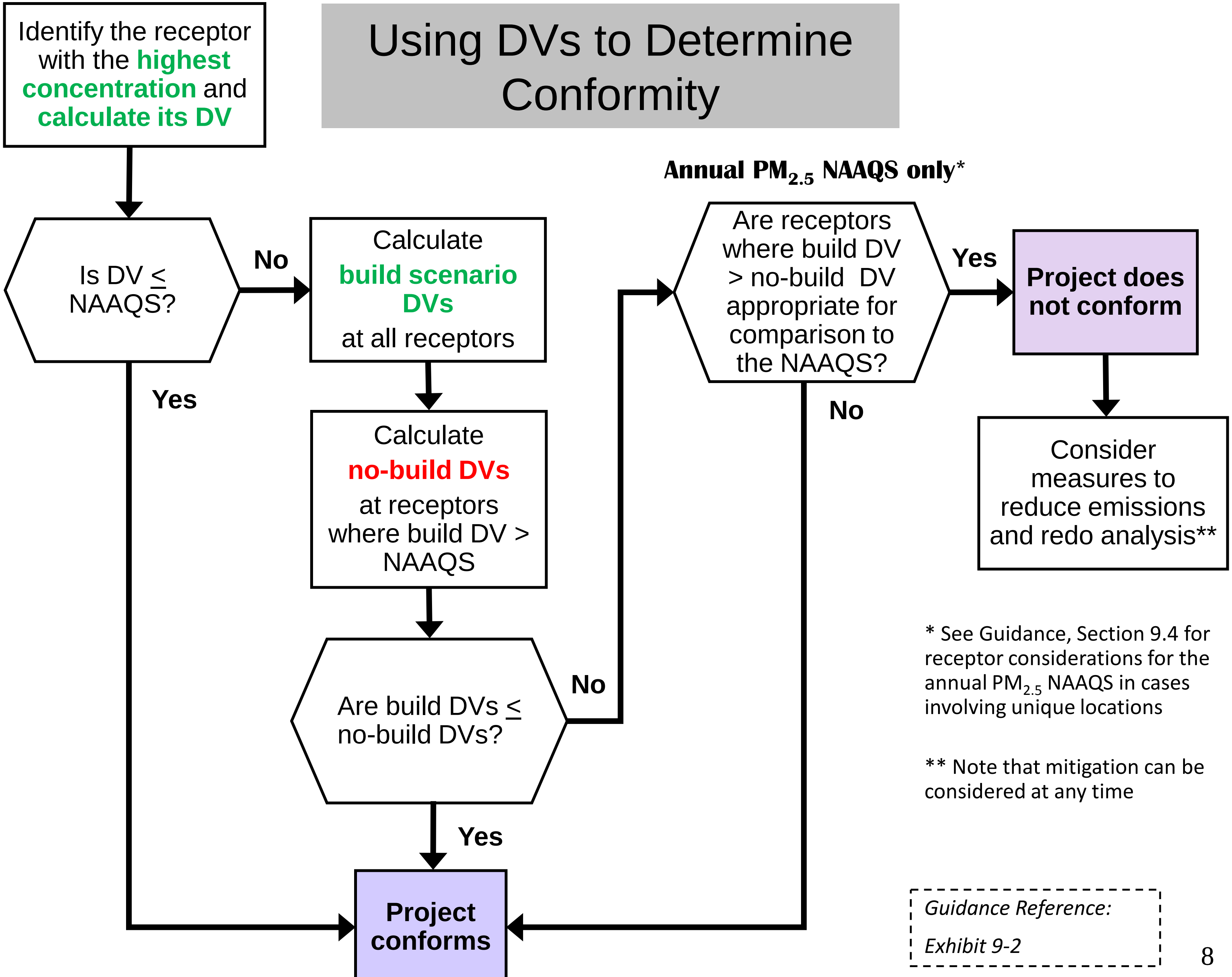
- Conformity is met if the design value for every appropriate receptor in the build scenario is <u>less than or equal</u> to
  - The NAAQS, or
  - The same receptor in the no-build scenario

- Exception: when a "new" violation in the build scenario can be considered a "relocated" violation in the no-build scenario
  - Limited cases – only where there is a clear relationship between such changes
  - Determined through interagency consultation

Guidance Reference:

Section 9.2

Using DVs to Determine Conformity



* See Guidance, Section 9.4 for receptor considerations for the annual $PM_{2.5}$ NAAQS in cases involving unique locations

** Note that mitigation can be considered at any time

Guidance Reference:

Exhibit 9-2

Calculating Design Values for the **Annual $PM_{2.5}$ NAAQS**

Annual $PM_{2.5}$ NAAQS

- 1997 Annual PM2.5 NAAQS = 15.0 µg/m^3
- Design value is the average of 3 years' annual averages
- Each year's annual average is estimated using equally-weighted quarterly averages

$$\text{Annual } PM_{2.5} \text{ DV} = ([Y1] \text{ avg} + [Y2] \text{ avg} + [Y3] \text{ avg}) \div 3$$

Avg annual $PM_{2.5}$ concentration for the *1st year* of AQ monitoring data

Avg annual $PM_{2.5}$ concentration for the *2nd year* of AQ monitoring data

Avg annual $PM_{2.5}$ concentration for the *3rd year* of AQ monitoring data

- DV is rounded to nearest *tenth* of a µg/m^3
  - » At the *end* of the DV calculation

Guidance Reference:
Section 9.3.2

Annual $PM_{2.5}$ NAAQS

To calculate the design value, you need:

- Air quality modeling results
  - » Average annual concentrations from the project and any nearby sources that are modeled
  - » For this class, assume that these are based on 5 years of off-site meteorology data
- Air quality monitoring data
  - » 12 quarters of background concentration measurements (4 quarters for 3 consecutive years)

Annual $PM_{2.5}$ NAAQS

- Step 1: For each receptor, calculate the average annual concentrations with air quality modeling results for each quarter and year of met data used
  - » If using AERMOD – model can produce these values:
    - – **CO** pathway: Set **AVERTIME** to either **PERIOD** or **ANNUAL**
    - – **OU** pathway: Specify either **RECTABLE** or **POSTFILE**
  - » If using CAL3QHCR – you will have to calculate averages:

Air Quality Modeling Results					
Met Data Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Average Annual Concentration:
Year 1	Q1Y1	Q2Y1	Q3Y1	Q4Y1	(Sum of row) ÷ 4
Year 2	Q1Y2	Q2Y2	Q3Y2	Q4Y2	(Sum of row) ÷ 4
Year 3	Q1Y3	Q2Y3	Q3Y3	Q4Y3	(Sum of row) ÷ 4
Year 4	Q1Y4	Q2Y4	Q3Y4	Q4Y4	(Sum of row) ÷ 4
Year 5	Q1Y5	Q2Y5	Q3Y5	Q4Y5	(Sum of row) ÷ 4
Average annual concentration:					(Sum of column) ÷ 5

Annual $PM_{2.5}$ NAAQS

- Step 2: ID receptor with the highest modeled average concentration
- Step 3: Calculate average annual background concentration (average 4 quarters of monitoring data in each year, then average the 3 years):

Background Data					
Monitor Data Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Avg annual Concentration:
Year 1	Q1Y1	Q2Y1	Q3Y1	Q4Y1	(Sum of row) ÷ 4
Year 2	Q1Y2	Q2Y2	Q3Y2	Q4Y2	(Sum of row) ÷ 4
Year 3	Q1Y3	Q2Y3	Q3Y3	Q4Y3	(Sum of row) ÷ 4
Average annual background concentration:					(Sum of column) ÷ 3

Annual $PM_{2.5}$ NAAQS

- Step 4: Add:

  Step 2 result ← (Average annual modeled concentration at highest receptor)

  + Step 3 result ← (Average annual background concentration)

  [Step 4 result]

- Step 5: Round to the nearest 0.1 μg/m^3
  - » This is the **build scenario DV** at the highest receptor
  - » If build DV $\leq$ annual $PM_{2.5}$ NAAQS (15.0 μg/m^3): project conforms

    You're done!

If not, a build/no-build comparison is needed

Annual $PM_{2.5}$ NAAQS

Build Scenario:

- Step 6: Repeat calculations in Step 1 for all receptors

- Step 7: For each receptor, add:

  Step 6 results ← (Average annual modeled concentration)

  + Step 3 result ← (Average annual background concentration)

  [Step 7 results]

- Step 8: Round to nearest 0.1 µg/m^3
  - These are the **build scenario DVs**
  - Identify all receptors where build scenario DV > 15.0 µg/m^3

Annual $PM_{2.5}$ NAAQS

No-Build Scenario:

- Step 9: For receptors ID'ed in Step 8, repeat calculations in Step 1 with *no-build AQ modeling results*

- Step 10: For each of these receptors, add:

  Step 9 results ← (Average annual modeled concentration for no-build)

  \+ Step 3 results ← (Average annual background concentration)

  [Step 10 results]

- Step 11: Round to nearest 0.1 µg/m³
  - » These are the **no-build scenario DVs**

Annual $PM_{2.5}$ NAAQS

- At all receptors identified in Step 8:
  - » If build DV $\leq$ no-build DV at each receptor: project conforms. You're done!

  - » If build DV > no-build DV at any appropriate receptor, project does not conform
    - – Consider additional mitigation/control measures
  - » In limited cases, receptors at unique locations (e.g., near a tunnel entrance) will not be appropriate for comparison to the annual PM2.5 NAAQS
    - – See Section 9.4 of PM hot-spot guidance for more info

Preparing Data, Calculating Design Values, and Determining Conformity for the **Annual $PM_{2.5}$ NAAQS**

Using the Example Analysis as Examples:

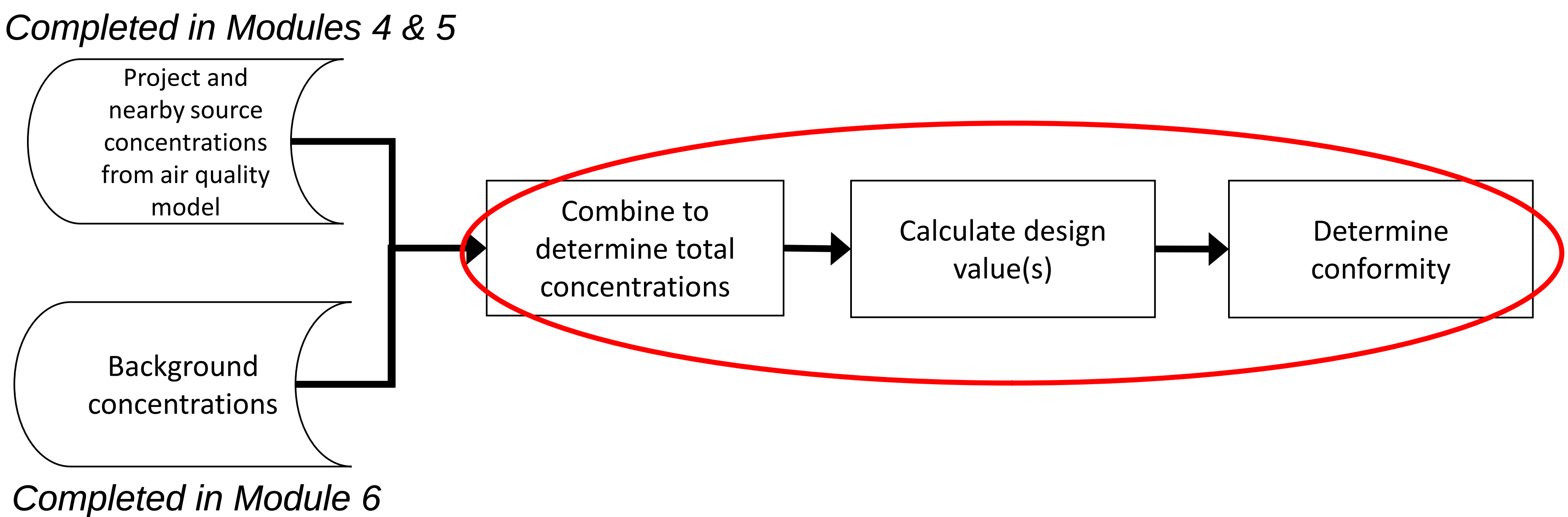
Highway/transit project = AERMOD output

Highway-only project = CAL3QHCR output

Determining DVs for the Example Analysis

- We have outputs from AERMOD and CAL3QHCR from **Modules 4 and 5** and representative background data from **Module 6**

- We will combine these inputs to determine design values and conformity for the project



Tips for preparing modeled data - AERMOD output

Annual $PM_{2.5}$ NAAQS

ALL_ANNUAL.pst - Notepad

File Edit Format View Help

```
* AERMOD ( 12345):  Hotspot Training Exercise                                                    07/26/13
* MODELING OPTIONS USED:                                                                         15:42:09
* NonDFAULT CONC                                        FLAT                 FLGPOL

*         POST/PLOT FILE OF ANNUAL VALUES FOR SOURCE GROUP: ALL
*         FOR A TOTAL OF    311 RECEPTORS.
*         FORMAT: (3(1X,F13.5),7(1X,F8.2),2X,A6,2X,A8,2X,I8.8,2X,A8)

*        X             Y       AVERAGE CONC    ZELEV    ZHILL    ZFLAG    AVE     GRP       NUM YRS   NET ID
*  ____________  ____________  ____________  ______  ______  ______  ______  ________  ________  ________
       9.00000     212.80000       0.14878     0.00     0.00     1.80  ANNUAL  ALL       00000005
      59.00000     212.80000       0.19716     0.00     0.00     1.80  ANNUAL  ALL       00000005
     109.00000     212.80000       0.24701     0.00     0.00     1.80  ANNUAL  ALL       00000005
     159.00000     212.80000       0.31782     0.00     0.00     1.80  ANNUAL  ALL       00000005
     209.00000     212.80000       0.40556     0.00     0.00     1.80  ANNUAL  ALL       00000005
     259.00000     212.80000       0.53328     0.00     0.00     1.80  ANNUAL  ALL       00000005
       9.00000     262.80000       0.12277     0.00     0.00     1.80  ANNUAL  ALL       00000005
      59.00000     262.80000       0.16471     0.00     0.00     1.80  ANNUAL  ALL       00000005
     109.00000     262.80000       0.21805     0.00     0.00     1.80  ANNUAL  ALL       00000005
     159.00000     262.80000       0.30416     0.00     0.00     1.80  ANNUAL  ALL       00000005
       9.00000     312.80000       0.11537     0.00     0.00     1.80  ANNUAL  ALL       00000005
      59.00000     312.80000       0.15569     0.00     0.00     1.80  ANNUAL  ALL       00000005
     109.00000     312.80000       0.21238     0.00     0.00     1.80  ANNUAL  ALL       00000005
     159.00000     312.80000       0.31074     0.00     0.00     1.80  ANNUAL  ALL       00000005
       9.00000     362.80000       0.11196     0.00     0.00     1.80  ANNUAL  ALL       00000005
      59.00000     362.80000       0.15425     0.00     0.00     1.80  ANNUAL  ALL       00000005
     109.00000     362.80000       0.21634     0.00     0.00     1.80  ANNUAL  ALL       00000005
     159.00000     362.80000       0.32557     0.00     0.00     1.80  ANNUAL  ALL       00000005
       9.00000     412.80000       0.10969     0.00     0.00     1.80  ANNUAL  ALL       00000005
      59.00000     412.80000       0.15537     0.00     0.00     1.80  ANNUAL  ALL       00000005
     109.00000     412.80000       0.22486     0.00     0.00     1.80  ANNUAL  ALL       00000005
     159.00000     412.80000       0.35044     0.00     0.00     1.80  ANNUAL  ALL       00000005
       9.00000     462.80000       0.10751     0.00     0.00     1.80  ANNUAL  ALL       00000005
      59.00000     462.80000       0.15695     0.00     0.00     1.80  ANNUAL  ALL       00000005
     109.00000     462.80000       0.23630     0.00     0.00     1.80  ANNUAL  ALL       00000005
     159.00000     462.80000       0.39357     0.00     0.00     1.80  ANNUAL  ALL       00000005
       9.00000     512.80000       0.10484     0.00     0.00     1.80  ANNUAL  ALL       00000005
      59.00000     512.80000       0.15790     0.00     0.00     1.80  ANNUAL  ALL       00000005
     109.00000     512.80000       0.25069     0.00     0.00     1.80  ANNUAL  ALL       00000005
     159.00000     512.80000       0.47558     0.00     0.00     1.80  ANNUAL  ALL       00000005
```

AERMOD "ALL_ANNUAL.pst" postfile will give annual average concentrations values for each receptor across all 5 years modeled

Tips for preparing modeled data - AERMOD output

Annual $PM_{2.5}$ NAAQS

Book1 - Microsoft Excel

Home | Insert | Page Layout | Formulas | Data | Review | View | Acrobat

A1 | *

	A	B	C	D	E	F	G	H	I	J
1	*	AERMOD (1234	5): Hotspot T	raining Exercise						7/26/2013
2	*	MODELING OPTI	ONS USED:							15:42:09
3	*	NonDFAULT CON	C			FLAT		FLGPOL		
4	*	POST/	PLOT FILE OF A	NNUAL VALUES FOR	SOURC	E GROUP:	ALL			
5	*	FOR A	TOTAL OF 31	1 RECEPTORS.						
6	*	FORMA	T: (3(1X,F13.5	),3(1X,F8.2),2X,	A6,2X,	A8,2X,I8.	8,2X,A8)			
7	*	X	Y	AVERAGE CONC	ZELEV	ZHILL	ZFLAG	AVE	GRP	NUM YRS NET ID
8	*									
9		9	212.8	0.14878	0	0	1.8	ANNUAL	ALL	5
10		59	212.8	0.19716	0	0	1.8	ANNUAL	ALL	5
11		109	212.8	0.24701	0	0	1.8	ANNUAL	ALL	5
12		159	212.8	0.31782	0	0	1.8	ANNUAL	ALL	5
13		209	212.8	0.40556	0	0	1.8	ANNUAL	ALL	5
14		259	212.8	0.53328	0	0	1.8	ANNUAL	ALL	5
15		9	262.8	0.12277	0	0	1.8	ANNUAL	ALL	5
16		59	262.8	0.16471	0	0	1.8	ANNUAL	ALL	5
17		109	262.8	0.21805	0	0	1.8	ANNUAL	ALL	5
18		159	262.8	0.30416	0	0	1.8	ANNUAL	ALL	5
19		9	312.8	0.11537	0	0	1.8	ANNUAL	ALL	5
20		59	312.8	0.15569	0	0	1.8	ANNUAL	ALL	5
21		109	312.8	0.21238	0	0	1.8	ANNUAL	ALL	5
22		159	312.8	0.31074	0	0	1.8	ANNUAL	ALL	5
23		9	362.8	0.11196	0	0	1.8	ANNUAL	ALL	5
24		59	362.8	0.15425	0	0	1.8	ANNUAL	ALL	5
25		109	362.8	0.21634	0	0	1.8	ANNUAL	ALL	5
26		159	362.8	0.32557	0	0	1.8	ANNUAL	ALL	5
27		9	412.8	0.10969	0	0	1.8	ANNUAL	ALL	5
28		59	412.8	0.15537	0	0	1.8	ANNUAL	ALL	5
29		109	412.8	0.22486	0	0	1.8	ANNUAL	ALL	5
30		159	412.8	0.35044	0	0	1.8	ANNUAL	ALL	5
31		9	462.8	0.10751	0	0	1.8	ANNUAL	ALL	5
32		59	462.8	0.15695	0	0	1.8	ANNUAL	ALL	5

Sheet1 | Sheet2 | Sheet3

Ready | 100%

Import data into new spreadsheet and delete extraneous columns and rows (highlighted)

Set aside while preparing monitoring data

Annual $PM_{2.5}$ NAAQS

Tips for preparing monitoring data

C1 SAMPLE_DATE

	C	D	E	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	SAMPLE_DATE	DAILY_MEAN_CONCENTRATION	UNITS												
2	1/1/2008	3.1	ug/m3 LC												
3	1/4/2008	12.1	ug/m3 LC												
4	1/7/2008	7.5	ug/m3 LC												
5	1/10/2008	6.7	ug/m3 LC												
6	1/13/2008	11.2	ug/m3 LC												
7	1/16/2008	11.8	ug/m3 LC												
8	1/19/2008	6.7	ug/m3 LC												
9	1/22/2008	9	ug/m3 LC												
10	1/25/2008	10.5	ug/m3 LC												
11	1/28/2008	10.1	ug/m3 LC												
12	1/31/2008	6.9	ug/m3 LC												
13	2/3/2008	12.7	ug/m3 LC												
14	2/6/2008	5.5	ug/m3 LC												
15	2/9/2008	9.9	ug/m3 LC												
16	2/12/2008	8.7	ug/m3 LC												
17	2/15/2008	11.2	ug/m3 LC												
18	2/18/2008	3.7	ug/m3 LC												
19	2/21/2008	11.2	ug/m3 LC												
20	2/24/2008	10.9	ug/m3 LC												
21	2/27/2008	4.6	ug/m3 LC												
22	3/1/2008	11.8	ug/m3 LC												
23	3/4/2008	2.2	ug/m3 LC												
24	3/7/2008	13	ug/m3 LC												
25	3/10/2008	11.4	ug/m3 LC												
26	3/16/2008	7.7	ug/m3 LC												
27	3/19/2008	7.7	ug/m3 LC												
28	3/22/2008	19.6	ug/m3 LC												
29	3/25/2008	10.6	ug/m3 LC												
30	3/28/2008	17	ug/m3 LC												
31	3/31/2008	12.8	ug/m3 LC	AVG Q1	9.593333										
32	4/3/2008	11.9	ug/m3 LC												

data_PM25_2008 | data_PM25_2009 | data_PM25_2010 | Annual_PM25 | 24HR_PM25

Ready 100%

Obtain average for each quarter of each year (in this case, some quick Excel functions were used - Year 2008, Quarter 1 shown)

Tips for preparing monitoring data

Annual $PM_{2.5}$ NAAQS

	Q1	Q2	Q3	Q4	Average
2008	9.593333	12.01	15.929	10.85	12.0956
2009	9.23	12.4733	16.3933	9.55517	11.913
2010	8.97	10.8467	12.469	8.58065	10.2166
					11.4084

data_PM25_2008 | data_PM25_2009 | data_PM25_2010 | **Annual_PM25** | 24HR_PM25

Ready

Quarterly averages are placed in new spreadsheet and average for all years calculated

(see Step 3)

This result is then ready to be added to modeled results for the receptor(s)

Calculating the design value for the highway/transit project

Annual $PM_{2.5}$ NAAQS

Annual_PM25_DV.xlsx

	A	B	C	D	E
1	X	Y	AVERAGE CONC	Avg Background	DV
2	485	193	1.95364	11.4083735	13.3620135
3	527.1	111.5	1.76008	11.4083735	13.1684535
4	527.1	161.5	1.17122	11.4083735	12.5795935
5	577.1	61.5	1.07376	11.4083735	12.4821335
6	448.7	373.2	1.07292	11.4083735	12.4812935
7	513.2	13.1	1.03244	11.4083735	12.4408135
8	470	341.8	1.00181	11.4083735	12.4101835
9	527.1	211.5	0.97499	11.4083735	12.3833635
10	343.4	162.5	0.94644	11.4083735	12.3548135
11	439.4	436.7	0.93319	11.4083735	12.3415635
12	371.3	113	0.89761	11.4083735	12.3059835
13	320.2	206.8	0.87743	11.4083735	12.2858035
14	335.3	670.6	0.86483	11.4083735	12.2732035
15	413.2	113.1	0.84873	11.4083735	12.2571035
16	262.1	322.8	0.84839	11.4083735	12.2567635
17	627.1	-38.5	0.83411	11.4083735	12.2424835
18	519.6	312.4	0.8321	11.4083735	12.2404735
19	366.2	628.4	0.82665	11.4083735	12.2350235
20	577.1	111.5	0.81896	11.4083735	12.2273335
21	285.3	770.6	0.81115	11.4083735	12.2195235
22	427.7	543.3	0.80895	11.4083735	12.2173235
23	292.7	253.2	0.80707	11.4083735	12.2154435

Annual_PM25 | Sheet2 | Sheet3

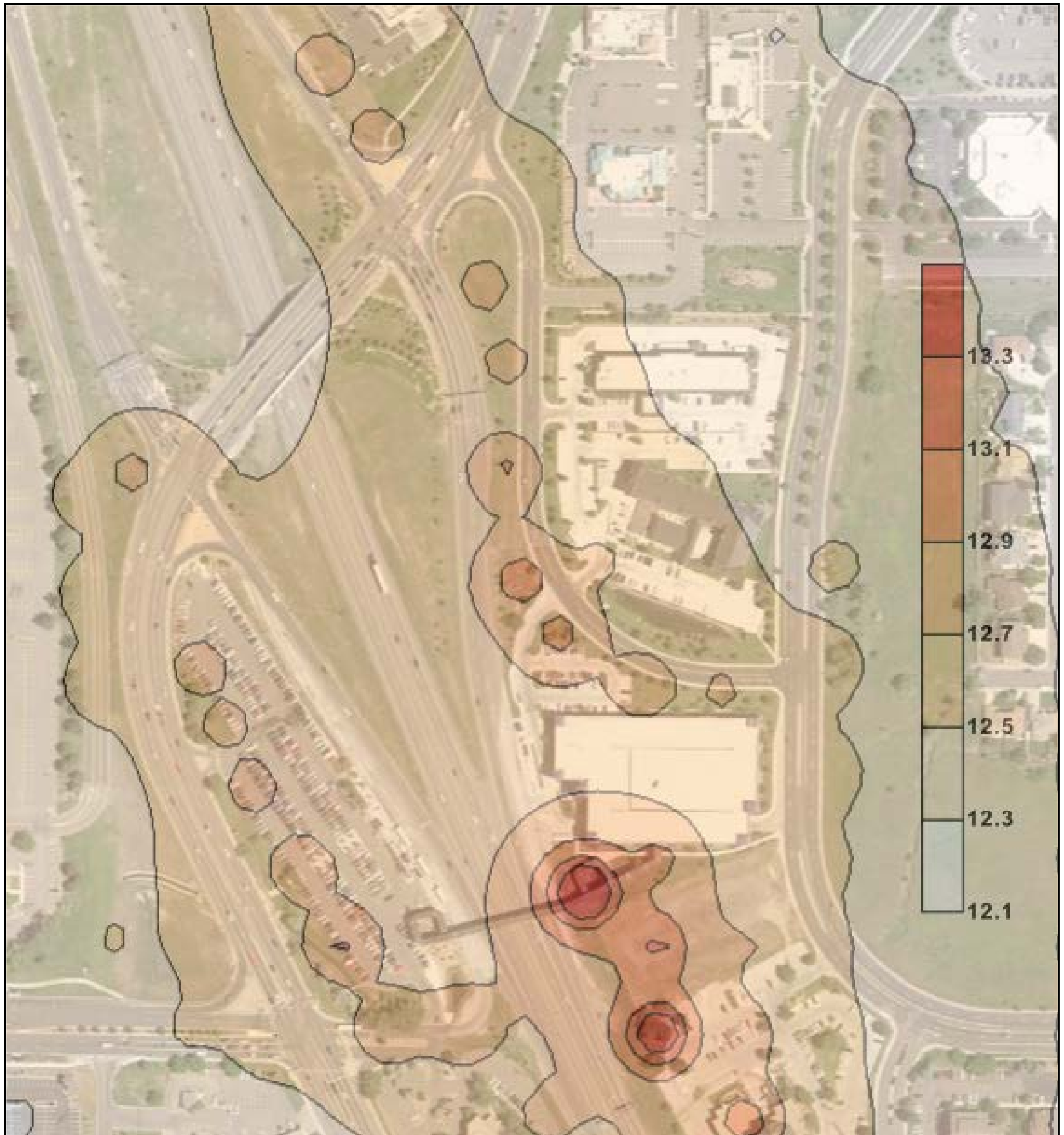
Add column for average monitoring (background) value previously calculated and insert value

Sum values (columns C and D) together to obtain DV for each receptor (see Step 4)

Sort DV column to obtain highest value

(13.3620… at receptor 485x193)

Contour Plot of **Annual PM$_{2.5}$** DVs



Determining Conformity to the **Annual $PM_{2.5}$ NAAQS** for Highway/Transit Project

- Highest concentration of 13.3620… μg/m^3 rounds to 13.4 μg/m^3 (nearest 0.1 μg/m^3) per the design value procedures for this NAAQS (see Step 5)

- 13.4 μg/m^3 $\leq$ 15.0 μg/m^3 (annual $PM_{2.5}$ NAAQS) → **project conforms** to the NAAQS

- Modeling no-build concentrations and comparing DVs to build scenario (Steps 6-11) are therefore unnecessary for this NAAQS

Tips for preparing modeled data - CAL3QHCR output

Annual $PM_{2.5}$ NAAQS

Annual_PM25_DV_CAL3.xlsx - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Acrobat

A1 | f_x | Receptor

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Receptor	2006Q1	2006Q2	2006Q3	2006Q4	2007Q1	2007Q2	2007Q3	2007Q4	2008Q1	2008Q2	2008Q3	2008Q4	2009Q1	2009Q2
2	1	0.078	0.0632	0.0695	0.0684	0.0752	0.0854	0.0886	0.0703	0.0864	0.0602	0.0955	0.0656	0.0988	0.0771
3	2	0.0904	0.074	0.0821	0.0783	0.0896	0.0991	0.1022	0.0809	0.0996	0.0705	0.1114	0.0749	0.116	0.0901
4	3	0.1043	0.0876	0.0938	0.0897	0.1054	0.1136	0.1164	0.0934	0.1154	0.0814	0.1292	0.0854	0.1365	0.1049
5	4	0.1229	0.106	0.1092	0.1056	0.1262	0.1332	0.1343	0.1105	0.1371	0.0956	0.1522	0.0996	0.1651	0.1249
6	5	0.1536	0.1349	0.1346	0.1324	0.162	0.1655	0.1619	0.1396	0.1735	0.1189	0.1916	0.124	0.2088	0.157
7	6	0.216	0.189	0.1807	0.1817	0.2273	0.2234	0.2148	0.1921	0.2433	0.1656	0.2552	0.1757	0.2907	0.2157
8	7	0.071	0.0564	0.0608	0.0584	0.0662	0.0768	0.0811	0.0625	0.0794	0.0535	0.0918	0.0589	0.0909	0.0706
9	8	0.0835	0.068	0.0733	0.0686	0.0807	0.0911	0.0958	0.0738	0.0937	0.0634	0.1091	0.0686	0.1097	0.0845
10	9	0.1002	0.0842	0.0879	0.0822	0.0991	0.1092	0.1146	0.089	0.1129	0.0764	0.132	0.0818	0.1351	0.103
11	10	0.1261	0.1096	0.1118	0.1039	0.1264	0.1385	0.1446	0.1134	0.1432	0.0968	0.1692	0.1025	0.175	0.1323
12	11	0.0713	0.0562	0.0605	0.0587	0.0665	0.0776	0.0817	0.062	0.0803	0.0537	0.0953	0.0599	0.091	0.0711
13	12	0.0854	0.0701	0.0737	0.0708	0.0821	0.0938	0.098	0.075	0.0968	0.0647	0.1149	0.0715	0.112	0.0865
14	13	0.1055	0.0891	0.0917	0.0885	0.1039	0.1173	0.1213	0.0941	0.1206	0.0807	0.1434	0.0887	0.1428	0.1089
15	14	0.1413	0.1243	0.1272	0.1226	0.142	0.1612	0.1634	0.129	0.163	0.1099	0.1954	0.1211	0.197	0.1489
16	15	0.0735	0.0583	0.0623	0.0621	0.0696	0.0812	0.0843	0.0641	0.0835	0.0561	0.0999	0.0635	0.0938	0.0737
17	16	0.0893	0.0737	0.0765	0.0765	0.0862	0.0996	0.1021	0.0789	0.1021	0.0684	0.1218	0.0772	0.1172	0.0907
18	17	0.1134	0.0963	0.0983	0.0989	0.1113	0.1277	0.1292	0.1018	0.1306	0.0871	0.1552	0.0984	0.1533	0.1165
19	18	0.1579	0.1391	0.1425	0.1428	0.1568	0.1817	0.1794	0.1457	0.1821	0.1226	0.2146	0.1392	0.2191	0.1641
20	19	0.0767	0.0613	0.0647	0.0669	0.0732	0.0855	0.0871	0.0671	0.0874	0.059	0.1044	0.0681	0.0977	0.0768
21	20	0.0942	0.078	0.0804	0.0833	0.0911	0.106	0.1064	0.0836	0.1079	0.0726	0.1282	0.0837	0.1236	0.0954
22	21	0.122	0.1047	0.1065	0.1099	0.1194	0.1385	0.1378	0.1101	0.1408	0.0941	0.1663	0.1085	0.1646	0.1245
23	22	0.1744	0.1545	0.1576	0.1635	0.1721	0.2012	0.1951	0.1628	0.2015	0.1358	0.2331	0.1576	0.2409	0.1796
24	23	0.0799	0.0644	0.0674	0.0723	0.0769	0.0901	0.0899	0.0706	0.0915	0.062	0.1084	0.073	0.1023	0.0799
25	24	0.0994	0.0831	0.0851	0.0909	0.0964	0.1129	0.1112	0.089	0.1142	0.0772	0.1342	0.0906	0.131	0.1003
26	25	0.1311	0.1142	0.1158	0.1224	0.1286	0.1515	0.1465	0.1195	0.1517	0.1018	0.1768	0.1194	0.1774	0.1332
27	26	0.1956	0.1748	0.1784	0.1895	0.1924	0.2271	0.2178	0.1851	0.2263	0.1539	0.2598	0.1813	0.269	0.2015
28	27	0.0836	0.0673	0.0702	0.078	0.0807	0.0952	0.0928	0.0746	0.0958	0.0652	0.1123	0.0781	0.1071	0.083
29	28	0.1053	0.0884	0.0908	0.0996	0.1021	0.1203	0.1171	0.0954	0.1213	0.0823	0.1413	0.0981	0.1395	0.1057
30	29	0.1416	0.1242	0.1265	0.1371	0.1386	0.1657	0.1575	0.1312	0.164	0.111	0.1886	0.1322	0.1932	0.1437
31	30	0.2288	0.2074	0.2119	0.2307	0.2236	0.267	0.2547	0.2228	0.2634	0.1828	0.3006	0.2181	0.3171	0.2373
32	31	0.0871	0.0698	0.0727	0.0838	0.0838	0.0995	0.0953	0.0784	0.0988	0.0681	0.1158	0.0831	0.1114	0.0857

Annual_PM25 | Sheet2 | Sheet3

Ready 100%

To obtain 5-year averages, place results from all 20 runs into spreadsheet

Annual $PM_{2.5}$ NAAQS

Tips for preparing modeled data - CAL3QHCR output

Annual_PM25_DV_CAL3.xlsx - Microsoft Excel

Home | Insert | Page Layout | Formulas | Data | Review | View | Acrobat

A1 | fx | Receptor

	O	P	Q	R	S	T	U	V	W	X
1	2009Q2	2009Q3	2009Q4	2010Q1	2010Q2	2010Q3	2010Q4	Five-Year Average	Avg Background	DV
2	0.0771	0.0992	0.0813	0.0989	0.0773	0.0797	0.065	0.07918	11.4083735	11.48755
3	0.0901	0.1136	0.0937	0.115	0.0892	0.092	0.0755	0.091905	11.4083735	11.50028
4	0.1049	0.1303	0.108	0.1357	0.1019	0.1056	0.0876	0.106305	11.4083735	11.51468
5	0.1249	0.1517	0.1274	0.1654	0.1185	0.1244	0.104	0.12569	11.4083735	11.53406
6	0.157	0.1848	0.1564	0.2146	0.1458	0.1543	0.1316	0.15729	11.4083735	11.56566
7	0.2157	0.2493	0.2142	0.305	0.2004	0.2101	0.1865	0.216835	11.4083735	11.62521
8	0.0706	0.0959	0.0738	0.0949	0.0689	0.0719	0.0582	0.072095	11.4083735	11.48047
9	0.0845	0.1127	0.0869	0.1127	0.0818	0.0853	0.0688	0.0856	11.4083735	11.49397
10	0.103	0.1354	0.1046	0.1379	0.0978	0.1026	0.0833	0.10346	11.4083735	11.51183
11	0.1323	0.1714	0.1328	0.1784	0.1228	0.1305	0.1064	0.13178	11.4083735	11.54015
12	0.0711	0.0984	0.0746	0.097	0.069	0.0725	0.0586	0.072795	11.4083735	11.48117
13	0.0865	0.1179	0.0897	0.1177	0.0835	0.088	0.0709	0.08815	11.4083735	11.49652
14	0.1089	0.1462	0.112	0.1484	0.1038	0.1101	0.0892	0.11031	11.4083735	11.51868
15	0.1489	0.1957	0.1536	0.2025	0.1399	0.1507	0.1233	0.1506	11.4083735	11.55897
16	0.0737	0.102	0.0781	0.1009	0.0716	0.0758	0.0614	0.075785	11.4083735	11.48416
17	0.0907	0.1237	0.0957	0.1242	0.0877	0.0934	0.0757	0.09303	11.4083735	11.5014
18	0.1165	0.1565	0.1228	0.1596	0.1118	0.1198	0.0978	0.119315	11.4083735	11.52769
19	0.1641	0.2159	0.1744	0.2231	0.1562	0.1689	0.1398	0.168295	11.4083735	11.57667
20	0.0768	0.1057	0.0829	0.1052	0.075	0.0799	0.0652	0.07949	11.4083735	11.48786
21	0.0954	0.1293	0.103	0.1306	0.0925	0.0994	0.0812	0.09852	11.4083735	11.50689
22	0.1245	0.1659	0.1346	0.1704	0.1199	0.1297	0.1068	0.12875	11.4083735	11.53712
23	0.1796	0.2334	0.1951	0.2439	0.1726	0.1877	0.157	0.18597	11.4083735	11.59434
24	0.0799	0.1094	0.088	0.1092	0.0786	0.084	0.0694	0.08336	11.4083735	11.49173
25	0.1003	0.1351	0.111	0.137	0.0978	0.1054	0.0874	0.10446	11.4083735	11.51283
26	0.1332	0.1759	0.1477	0.1819	0.129	0.1406	0.1167	0.139085	11.4083735	11.54746
27	0.2015	0.2584	0.2229	0.2721	0.1942	0.2134	0.1795	0.20965	11.4083735	11.61802
28	0.083	0.1132	0.0935	0.1131	0.0826	0.0883	0.0739	0.087425	11.4083735	11.4958
29	0.1057	0.1418	0.1196	0.1436	0.104	0.1123	0.0942	0.111135	11.4083735	11.51951
30	0.1437	0.1888	0.1628	0.1948	0.1401	0.1534	0.1288	0.15119	11.4083735	11.55956
31	0.2373	0.3007	0.2671	0.3149	0.2299	0.2546	0.2162	0.24748	11.4083735	11.65585
32	0.0857	0.1167	0.0986	0.116	0.0863	0.0922	0.078	0.091105	11.4083735	11.49048

Annual_PM25 | Sheet2 | Sheet3

Ready | 100%

Average across each year and add monitoring average to each receptor to get DVs

Tips for preparing modeled data - CAL3QHCR output

Annual $PM_{2.5}$ NAAQS

Annual_PM25_DV_CAL3.xlsx - Microsoft Excel

	O	P	Q	R	S	T	U	V	W	X
1	2009Q2	2009Q3	2009Q4	2010Q1	2010Q2	2010Q3	2010Q4	Five-Year Average	Avg Background	DV
2	0.8893	0.7222	0.8172	1.1045	0.9242	0.8061	0.9861	0.922495	11.4083735	12.33087
3	0.8698	0.6965	0.7788	1.1083	0.8991	0.7753	0.9639	0.896535	11.4083735	12.30491
4	0.498	0.403	0.4428	0.6495	0.5103	0.436	0.5546	0.5163	11.4083735	11.92467
5	0.5193	0.5741	0.4819	0.8184	0.471	0.4833	0.4491	0.51298	11.4083735	11.92135
6	0.4809	0.3943	0.4286	0.6054	0.4949	0.4302	0.5287	0.497085	11.4083735	11.90546
7	0.4704	0.3782	0.4028	0.6192	0.478	0.4069	0.5169	0.483295	11.4083735	11.89167
8	0.4403	0.3611	0.3947	0.5559	0.4529	0.3934	0.4841	0.456155	11.4083735	11.86453
9	0.4312	0.353	0.3858	0.5466	0.4425	0.3827	0.477	0.446615	11.4083735	11.85499
10	0.4334	0.5055	0.4143	0.6229	0.3927	0.415	0.3727	0.429105	11.4083735	11.83748
11	0.4075	0.4725	0.3978	0.5759	0.3757	0.3974	0.3577	0.407425	11.4083735	11.8158
12	0.3936	0.3249	0.3501	0.5002	0.4036	0.3499	0.4314	0.40731	11.4083735	11.81568
13	0.3853	0.3077	0.3694	0.4508	0.4125	0.3546	0.423	0.4067	11.4083735	11.81507
14	0.3886	0.3176	0.3493	0.4897	0.4003	0.3458	0.4257	0.403215	11.4083735	11.81159
15	0.3832	0.4185	0.3734	0.5425	0.359	0.3658	0.3545	0.387035	11.4083735	11.79541
16	0.3659	0.2948	0.3512	0.4307	0.3918	0.3369	0.3987	0.38609	11.4083735	11.79446
17	0.378	0.4292	0.3838	0.49	0.3692	0.3809	0.3568	0.38553	11.4083735	11.7939
18	0.3681	0.3006	0.3285	0.4702	0.3752	0.3221	0.4088	0.38147	11.4083735	11.78984
19	0.3539	0.2765	0.3575	0.3824	0.3913	0.3395	0.3839	0.379	11.4083735	11.78737
20	0.376	0.4266	0.3703	0.5346	0.3483	0.3673	0.3351	0.3776	11.4083735	11.78597
21	0.3646	0.3072	0.2871	0.5468	0.3471	0.2942	0.4076	0.369655	11.4083735	11.77803
22	0.3624	0.4139	0.3572	0.5158	0.3354	0.3499	0.3235	0.36414	11.4083735	11.77251
23	0.36	0.408	0.3563	0.5146	0.3348	0.3471	0.3259	0.363365	11.4083735	11.77174
24	0.3558	0.3711	0.3393	0.4986	0.3378	0.3324	0.3356	0.35967	11.4083735	11.76804
25	0.3606	0.4008	0.3314	0.5674	0.3221	0.3332	0.3145	0.35546	11.4083735	11.76383
26	0.3415	0.2765	0.2894	0.4575	0.3443	0.2918	0.3759	0.351255	11.4083735	11.75963
27	0.3341	0.275	0.296	0.4279	0.3401	0.2925	0.3685	0.345635	11.4083735	11.75401
28	0.3259	0.2631	0.2945	0.4167	0.3337	0.2851	0.3558	0.339795	11.4083735	11.74817
29	0.3332	0.3437	0.3105	0.4594	0.3168	0.3038	0.3084	0.33515	11.4083735	11.74352
30	0.3216	0.2625	0.2888	0.4107	0.3299	0.2824	0.3518	0.33458	11.4083735	11.74295
31	0.3195	0.3339	0.3049	0.4273	0.308	0.3012	0.2924	0.32243	11.4083735	11.7308
32	0.3163	0.3209	0.3029	0.4456	0.3031	0.2957	0.297	0.32106	11.4083735	11.72943

Sheet tabs: Annual_PM25, Sheet2, Sheet3

Select destination and press ENTER or choose Paste

Sort DV column to obtain highest value (12.33087 at receptor 294)

Determining Conformity to the **Annual $PM_{2.5}$ NAAQS** from Highway Project

- Highest concentration of 12.33087 µg/m^3 rounds to 12.3 µg/m^3 (nearest 0.1 µg/m^3) per the design value procedures for this NAAQS (see Step 5)

- 12.3 µg/m^3 $\leq$ 15.0 µg/m^3 (annual $PM_{2.5}$ NAAQS) $\longrightarrow$ **project conforms** to the NAAQS

- Modeling no-build concentrations and comparing DVs to build scenario (Steps 6-11) are therefore unnecessary for this NAAQS

Determining Appropriate Receptors for the **Annual $PM_{2.5}$ NAAQS**

Determining Appropriate Receptors for the **Annual $PM_{2.5}$ NAAQS**

- It may be necessary in certain cases to determine whether a receptor is appropriate to compare to the NAAQS
  - » Conformity rule section 93.123(c)(1) requires PM hot-spot analysis to be based on "appropriate receptor location[s]"
- Need to be consistent with how the annual $PM_{2.5}$ NAAQS is established and monitored for air quality planning purposes (40 CFR Part 58)
  - » Annual $PM_{2.5}$ NAAQS is to be monitored at "area-wide" locations
- If conformity is met at all receptors:
  - » Unnecessary to determine appropriateness
- However, if, at one or more receptors, DV > the annual $PM_{2.5}$ NAAQS (15.0 μg/m^3) or the no-build DV (if above the NAAQS):
  - » Consider whether receptors are not appropriate for comparison to this NAAQS because they are at unique locations (e.g., tunnel entrance, a nearby point source, or other relatively unique location)
  - » Important to make this determination through the interagency consultation process

Guidance Reference:

Section 9.4.1 & 9.4.2

Calculating Design Values for the **24-hour $PM_{2.5}$ NAAQS**

24-hour $PM_{2.5}$ NAAQS

- Design value is the average of three consecutive years' 98th percentile concentrations of 24-hour values

$$\text{24-hour } PM_{2.5} \text{ DV} = ([Y1]\ 98^{th} + [Y2]\ 98^{th} + [Y3]\ 98^{th}) \div 3$$

98th percentile 24-hour $PM_{2.5}$ concentration for the *1st year* of AQ monitoring data

98th percentile 24-hour $PM_{2.5}$ concentration for the *2nd year* of AQ monitoring data

98th percentile 24-hour $PM_{2.5}$ concentration for the *3rd year* of AQ monitoring data

- DV is rounded to nearest *whole* $\mu g/m^3$

Guidance Reference:

Section 9.3.3

24-hour $PM_{2.5}$ NAAQS

Start with either of two tiers:

1^{st} Tier

For each receptor, average the highest modeled concentrations in each year of met data

+ The average of 98^{th} percentile background concentrations

[DV for build scenario]

OR

2^{nd} Tier

For each receptor, average the highest modeled concentration from each quarter and year of met data

+ A set of the highest background concentrations

[Set of values] ← Of these, determine which value is 98^{th} percentile = [DV for build scenario]

24-hour $PM_{2.5}$ NAAQS

- We're going to skip over the first tier analysis
- First tier analysis is less refined than a second tier analysis and was designed to save effort
- Since guidance was issued, OTAQ has developed a design value conformity tool that uses a MySQL script to calculate the second tier design values
  - » Script makes second tier analysis easier than first
  - » Slides explaining steps for first tier analysis and tips for data preparation included for reference

→ **Go to slide 48**

24-hour $PM_{2.5}$ NAAQS

First Tier Analysis

To calculate the design value, you need:

- Air quality modeling results
  - » Average the highest 24-hour values from each year of met data

- Air quality monitoring data
  - » 12 quarters of background concentration measurements (4 quarters for 3 consecutive years)

24-hour $PM_{2.5}$ NAAQS

- Step 1: From air quality modeling for the build scenario, identify the receptor with the highest average 24-hour concentration:
  - If using AERMOD – model can produce highest average 24-hour concentration at each receptor:
    - CO pathway: Specify **AVERTIME 24**
    - OU pathway: Specify **RECTABLE 24 1ST** (to get the highest 24 hour concentration at each receptor)
  - If using CAL3QHCR – need to post-process results
    - Separate AQ model output into each year of met data
    - At each receptor, identify 24-hour period (midnight to midnight) with highest average concentration in each year of met data = **"HiYr"**
    - At each receptor, average the highest 24-hour concentrations from each year of met data: (**HiYr1 + HiYr2 + HiYr3 + HiYr4 + HiYr5)÷ 5**
  - With either model: choose receptor with highest average

24-hour $PM_{2.5}$ NAAQS

- Step 2: Calculate the average 98th percentile 24-hour background concentration from the 3 most recent years of AQ monitoring data:
  - » Count the 24-hour background measurements in each year
  - » For each year, rank the 8 highest measurements from highest to lowest
  - » Using table, determine which rank corresponds to the 98th percentile for each year
  - » Average these three 98th percentile values

98th Percentile Ranking Table	
Number of Background Concentration Values	Rank of Value Corresponding to 98th Percentile
1 – 50	1
51 – 100	2
101 – 150	3
151 – 200	4
201 – 250	5
251 – 300	6
301 – 350	7
351 – 366	8

24-hour $PM_{2.5}$ NAAQS

- Step 3: Add:

  Step 1 result (the highest average 24-hour modeled concentration)

  \+ Step 2 result (the average 98th percentile background concentration)

  [Step 3 result]

  » Round to the nearest whole µg/m^3

  » This is the **build scenario DV**

  » If build DV ≤ NAAQS, project conforms and You're done!

If not...

24-hour $PM_{2.5}$ NAAQS

If DV > NAAQS in 1st Tier Analysis, there are two options:

- Complete 1st Tier analysis for all receptors, and for all receptors where build DV > NAAQS, calculate no-build scenario DVs
  - If build DV $\leq$ no-build DV for all receptors, project conforms
- Or, conduct a 2nd Tier analysis

Tips for Preparing Data When Calculating **24-hour $PM_{2.5}$ NAAQS** Design Values

- First Tier Analysis -

Tips for preparing **monitoring** data – First tier

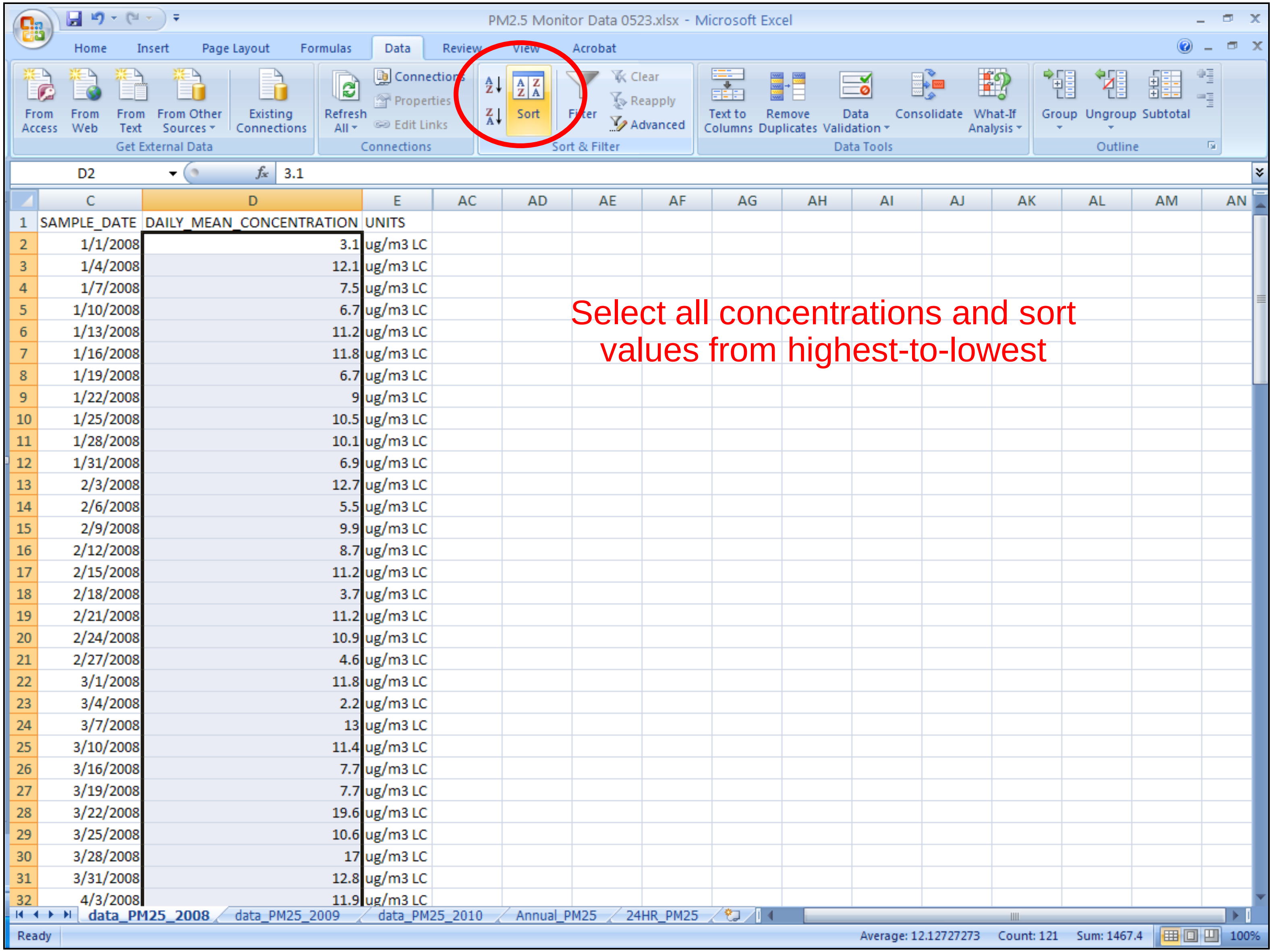
PM2.5 Monitor Data 0523.xlsx - Microsoft Excel

	C	D	E
1	SAMPLE_DATE	DAILY_MEAN_CONCENTRATION	UNITS
2	1/1/2008	3.1	ug/m3 LC
3	1/4/2008	12.1	ug/m3 LC
4	1/7/2008	7.5	ug/m3 LC
5	1/10/2008	6.7	ug/m3 LC
6	1/13/2008	11.2	ug/m3 LC
7	1/16/2008	11.8	ug/m3 LC
8	1/19/2008	6.7	ug/m3 LC
9	1/22/2008	9	ug/m3 LC
10	1/25/2008	10.5	ug/m3 LC
11	1/28/2008	10.1	ug/m3 LC
12	1/31/2008	6.9	ug/m3 LC
13	2/3/2008	12.7	ug/m3 LC
14	2/6/2008	5.5	ug/m3 LC
15	2/9/2008	9.9	ug/m3 LC
16	2/12/2008	8.7	ug/m3 LC
17	2/15/2008	11.2	ug/m3 LC
18	2/18/2008	3.7	ug/m3 LC
19	2/21/2008	11.2	ug/m3 LC
20	2/24/2008	10.9	ug/m3 LC
21	2/27/2008	4.6	ug/m3 LC
22	3/1/2008	11.8	ug/m3 LC
23	3/4/2008	2.2	ug/m3 LC
24	3/7/2008	13	ug/m3 LC
25	3/10/2008	11.4	ug/m3 LC
26	3/16/2008	7.7	ug/m3 LC
27	3/19/2008	7.7	ug/m3 LC
28	3/22/2008	19.6	ug/m3 LC
29	3/25/2008	10.6	ug/m3 LC
30	3/28/2008	17	ug/m3 LC
31	3/31/2008	12.8	ug/m3 LC
32	4/3/2008	11.9	ug/m3 LC

Sheets: data_PM25_2008 | data_PM25_2009 | data_PM25_2010 | Annual_PM25 | 24HR_PM25

Place one year of monitoring data in a spreadsheet

Tips for preparing monitoring data – First tier

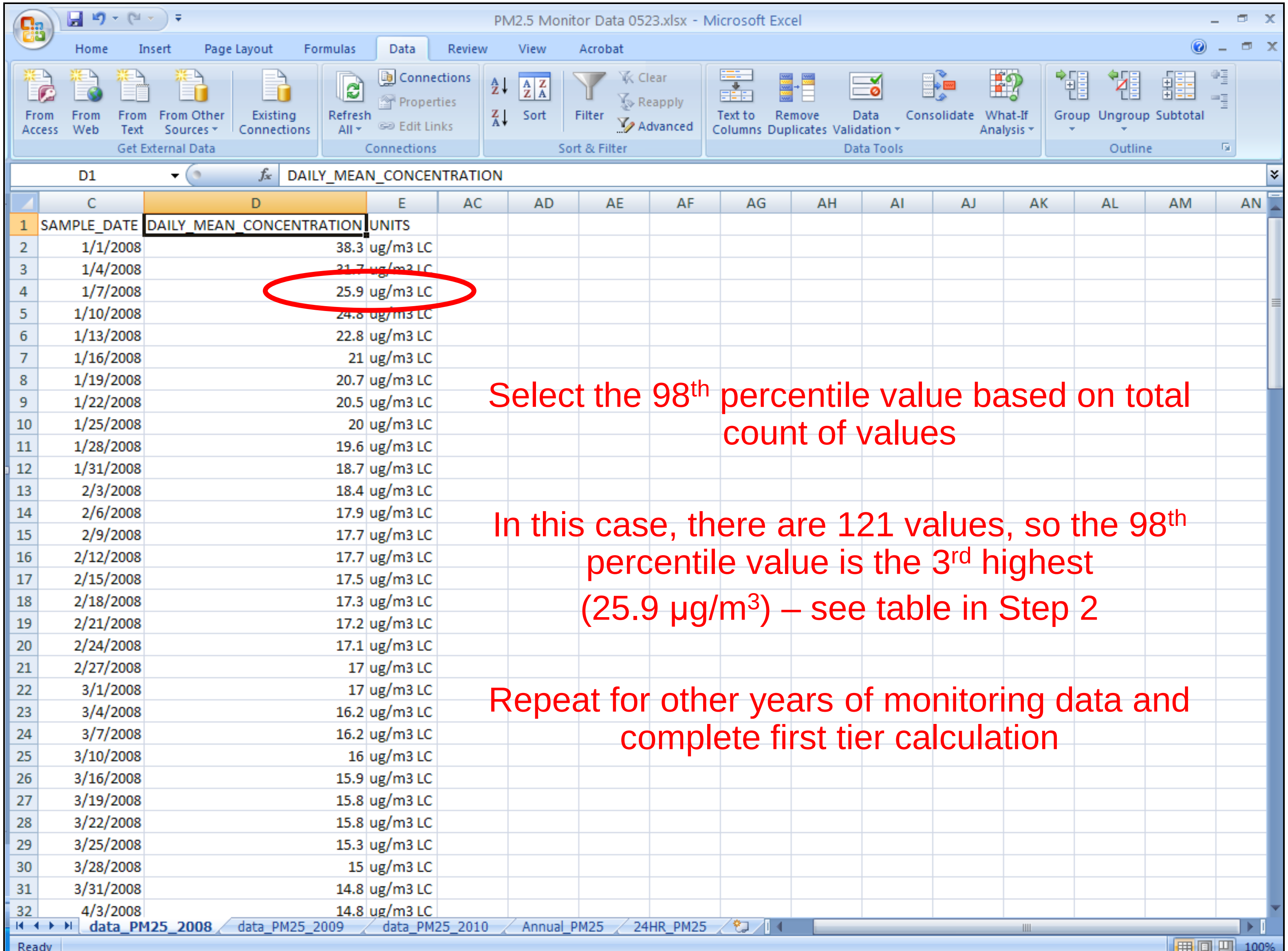


	C	D	E
1	SAMPLE_DATE	DAILY_MEAN_CONCENTRATION	UNITS
2	1/1/2008	3.1	ug/m3 LC
3	1/4/2008	12.1	ug/m3 LC
4	1/7/2008	7.5	ug/m3 LC
5	1/10/2008	6.7	ug/m3 LC
6	1/13/2008	11.2	ug/m3 LC
7	1/16/2008	11.8	ug/m3 LC
8	1/19/2008	6.7	ug/m3 LC
9	1/22/2008	9	ug/m3 LC
10	1/25/2008	10.5	ug/m3 LC
11	1/28/2008	10.1	ug/m3 LC
12	1/31/2008	6.9	ug/m3 LC
13	2/3/2008	12.7	ug/m3 LC
14	2/6/2008	5.5	ug/m3 LC
15	2/9/2008	9.9	ug/m3 LC
16	2/12/2008	8.7	ug/m3 LC
17	2/15/2008	11.2	ug/m3 LC
18	2/18/2008	3.7	ug/m3 LC
19	2/21/2008	11.2	ug/m3 LC
20	2/24/2008	10.9	ug/m3 LC
21	2/27/2008	4.6	ug/m3 LC
22	3/1/2008	11.8	ug/m3 LC
23	3/4/2008	2.2	ug/m3 LC
24	3/7/2008	13	ug/m3 LC
25	3/10/2008	11.4	ug/m3 LC
26	3/16/2008	7.7	ug/m3 LC
27	3/19/2008	7.7	ug/m3 LC
28	3/22/2008	19.6	ug/m3 LC
29	3/25/2008	10.6	ug/m3 LC
30	3/28/2008	17	ug/m3 LC
31	3/31/2008	12.8	ug/m3 LC
32	4/3/2008	11.9	ug/m3 LC

Select all concentrations and sort values from highest-to-lowest

Tips for preparing **monitoring** data – First tier

24-hour $PM_{2.5}$ NAAQS



	C	D	E
1	SAMPLE_DATE	DAILY_MEAN_CONCENTRATION	UNITS
2	1/1/2008	38.3	ug/m3 LC
3	1/4/2008	31.7	ug/m3 LC
4	1/7/2008	25.9	ug/m3 LC
5	1/10/2008	24.8	ug/m3 LC
6	1/13/2008	22.8	ug/m3 LC
7	1/16/2008	21	ug/m3 LC
8	1/19/2008	20.7	ug/m3 LC
9	1/22/2008	20.5	ug/m3 LC
10	1/25/2008	20	ug/m3 LC
11	1/28/2008	19.6	ug/m3 LC
12	1/31/2008	18.7	ug/m3 LC
13	2/3/2008	18.4	ug/m3 LC
14	2/6/2008	17.9	ug/m3 LC
15	2/9/2008	17.7	ug/m3 LC
16	2/12/2008	17.7	ug/m3 LC
17	2/15/2008	17.5	ug/m3 LC
18	2/18/2008	17.3	ug/m3 LC
19	2/21/2008	17.2	ug/m3 LC
20	2/24/2008	17.1	ug/m3 LC
21	2/27/2008	17	ug/m3 LC
22	3/1/2008	17	ug/m3 LC
23	3/4/2008	16.2	ug/m3 LC
24	3/7/2008	16.2	ug/m3 LC
25	3/10/2008	16	ug/m3 LC
26	3/16/2008	15.9	ug/m3 LC
27	3/19/2008	15.8	ug/m3 LC
28	3/22/2008	15.8	ug/m3 LC
29	3/25/2008	15.3	ug/m3 LC
30	3/28/2008	15	ug/m3 LC
31	3/31/2008	14.8	ug/m3 LC
32	4/3/2008	14.8	ug/m3 LC

Select the 98th percentile value based on total count of values

In this case, there are 121 values, so the 98th percentile value is the 3rd highest (25.9 μg/m³) – see table in Step 2

Repeat for other years of monitoring data and complete first tier calculation

Calculating Design Values for the **24-hour $PM_{2.5}$ NAAQS**

- Second Tier Analysis -

24-hour $PM_{2.5}$ NAAQS

To calculate the design value, you need:

- Air quality modeling results: Identify the highest 24-hour concentration in each quarter for each year of met data, then average the *quarters*

Air Quality Modeling Results				
Met Data Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Met Year 1	Hi Q1Y1	Hi Q2Y1	Hi Q3Y1	Hi Q4Y1
Met Year 2	Hi Q1Y2	Hi Q2Y2	Hi Q3Y2	Hi Q4Y2
Met Year 3	Hi Q1Y3	Hi Q2Y3	Hi Q3Y3	Hi Q4Y3
Met Year 4	Hi Q1Y4	Hi Q2Y4	Hi Q3Y4	Hi Q4Y4
Met Year 5	Hi Q1Y5	Hi Q2Y5	Hi Q3Y5	Hi Q4Y5
Average of highest quarterly concentrations:	Sum of column÷ 5	Sum of column÷ 5	Sum of column÷ 5	Sum of column÷ 5

24-hour $PM_{2.5}$ NAAQS

To calculate the design value, you need:

- Air quality modeling results: Identify the highest 24-hour concentration in each quarter for each year of met data, then average the *quarters*
- Air quality monitoring data
  - » 12 quarters of background concentration measurements (4 quarters for 3 consecutive years)

24-hour $PM_{2.5}$ NAAQS

- Step 1: Count the measurements for each year of monitoring data used for background

- Step 2: For each year of monitoring data used, determine the 8 highest 24-hour background concentrations from each quarter

  → 32 values for each year of monitoring data

- Note: Steps 1 & 2 are done just once, for all receptors

Example values from *one year* of monitoring data:

Rank	Q1	Q2	Q3	Q4
1	27.6	31.7	34.1	30.0
2	25.9	30.2	31.4	28.0
3	25.7	30.1	30.8	26.9
4	25.4	28.3	28.4	25.6
5	25.0	27.3	27.3	25.5
6	24.9	25.7	25.7	25.5
7	24.7	25.5	25.2	25.2
8	23.2	24.7	24.6	24.5

Guidance Reference:
Section 9.3.3 & App K

24-hour $PM_{2.5}$ NAAQS

- Step 3: At each receptor, identify the highest modeled 24-hour concentration in each quarter, and average across each year of met data:

Example high values for a receptor:

	Q1	Q2	Q3	Q4
Met Year 1	6.413	3.332	6.201	6.193
Met Year 2	3.229	3.481	5.846	4.521
Met Year 3	6.671	3.330	5.696	6.554
Met Year 4	7.095	3.584	7.722	7.951
Met Year 5	6.664	4.193	4.916	6.667
Average	6.014	3.584	6.076	6.377

24-hour $PM_{2.5}$ NAAQS

Notes on identifying the highest modeled 24-hour concentration in each quarter for Step 3:

- AERMOD does not give quarterly maximum concentrations averaged across 5 years of data
  - **OU** pathway: Specify **POSTFILE**
  - Produces 24-hour average concentrations for each receptor, for each of 365 days x 5 years of met data
  - Maximum concentrations per quarter can be identified through post-processing (using EPA's MySQL script tool, described later)
- CAL3QHCR should be run for each quarter of 5 years of data (20 runs)
  - Highest value at each receptor for each quarter (each run) can be obtained from output, then later averaged across each year of met data

- Step 4: At each receptor, add the results from Step 3:

	Q1	Q2	Q3	Q4
Avgs	6.014	3.584	6.076	6.377

+

and the results of Step 2 *by quarter…*

Rank	Q1	Q2	Q3	Q4
1	27.6	31.7	34.1	30.0
2	25.9	30.2	31.4	28.0
3	25.7	30.1	30.8	26.9
4	25.4	28.3	28.4	25.6
5	25.0	27.3	27.3	25.5
6	24.9	25.7	25.7	25.5
7	24.7	25.5	25.2	25.2
8	23.2	24.7	24.6	24.5

=

Rank	Q1	Q2	Q3	Q4
1	33.614	35.284	40.176	36.377
2	31.914	33.784	37.476	34.377
3	31.714	33.684	36.876	33.277
4	31.414	31.884	34.476	31.977
5	31.014	30.884	33.376	31.877
6	30.914	29.284	31.776	31.877
7	30.714	29.084	31.276	31.577
8	29.214	28.284	30.676	30.877

…to get 32 concentrations (8 per quarter) for each year of monitoring data

24-hour $PM_{2.5}$ NAAQS

- Step 5: Rank the 32 values from highest to lowest, regardless of quarter:

Rank	Q1	Q2	Q3	Q4
1	33.614	35.284	40.176	36.377
2	31.914	33.784	37.476	34.377
3	31.714	33.684	36.876	33.277
4	31.414	31.884	34.476	31.977
5	31.014	30.884	33.376	31.877
6	30.914	29.284	31.776	31.877
7	30.714	29.084	31.276	31.577
8	29.214	28.284	30.676	30.877

$\mu g/m^3$	Yearly Rank
40.176	1
37.476	2
36.876	3
36.377	4
35.284	5
34.476	6
34.377	7
33.784	8

8 highest in this table (circled)...

…are the first column of this table

- Step 6: Using ranking table, determine which value represents 98th percentile

98th Percentile Ranking Table	
Number of Background Concentration Values	Rank of Value Corresponding to 98th Percentile
1 – 50	1
51 – 100	2
101 – 150	3
151 – 200	4
201 – 250	5
251 – 300	6
301 – 350	7
351 – 366	8

Assuming 122 monitored values (from Step 1 where measurements were counted), the value at Rank 3 is 98th percentile

$\mu g/m^3$	Yearly Rank
40.176	1
37.476	2
36.876	3
36.377	4
35.284	5
34.476	6
34.377	7
33.784	8

24-hour $PM_{2.5}$ NAAQS

- Step 7: Repeat Step 6 for each of the three years of background monitoring data
  - » Result: three 24-hour 98th percentile concentrations for each receptor:

Year	98^{th} Percentile Concentration
Year 1	36.876
Year 2	36.895
Year 3	36.802
Average:	36.858

- Step 8: Calculate the average
- Step 9: Round to nearest whole number and compare to the NAAQS
- In this example: 37 > 35 (2006 $PM_{2.5}$ NAAQS), conformity is not met → no-build DVs are needed

Preparing Data, Calculating Design Values, and Determining Conformity for the

24-hour $PM_{2.5}$ NAAQS

Using a Second Tier Analysis and the Example Analysis as Examples

24-hour $PM_{2.5}$ NAAQS

- EPA has developed a MySQL script to calculate second tier design values for this NAAQS for PM hot-spot analyses
- Following is required for script to work properly:
  - » **Modeled** data saved as .csv file in folder **c:\design values** with file named: **`modeled_data.csv`**
  - » **Monitoring** data saved as .csv file in folder **c:\design values** with file named: **`monitor_data.csv`**
  - » Empty MySQL database named `design_values`
- Script can run from MOVES post-processing menu or from MySQL Query Browser directly

24-hour $PM_{2.5}$ NAAQS

- **Important note:** if multiple receptors have been placed at identical X,Y coordinates, but at different heights (Z), the script will treat them as the same receptor
  - » This is due to how script identifies receptors during calculations

- There are no issues if multiple receptors are placed at the same X,Y coordinates at <u>identical</u> heights.

- Keep in mind if laying down overlapping receptor grids, etc.

Required modeled data format and directory

A1 | X

	A	B	C	D
1	X	Y	AVERAGE CONC	DATE
2	-185.2	-68.5	0.27247	91010124
3	-180.2	-68.5	0.33636	91010124
4	-175.2	-68.5	0.37678	91010124
5	-170.2	-68.5	0.40854	91010124
6	-165.2	-68.5	0.47666	91010124
7	-160.2	-68.5	0.60092	91010124
8	-155.2	-68.5	0.74283	91010124
9	-150.2	-68.5	0.84381	91010124
10	-145.2	-68.5	0.89215	91010124
11	-140.2	-68.5	0.895	91010124
12	-135.2	-68.5	0.86546	91010124
13	-130.2	-68.5	0.81861	91010124
14	-125.2	-68.5	0.7653	91010124
15	-120.2	-68.5	0.71206	91010124
16	-115.2	-68.5	0.66646	91010124
17	-110.2	-68.5	0.61302	91010124
18	-105.2	-68.5	0.51677	91010124
19	-100.2	-68.5	0.36954	91010124
20	-95.2	-68.5	0.21332	91010124
21	-185.2	-63.5	0.19561	91010124
22	-180.2	-63.5	0.2611	91010124
23	-175.2	-63.5	0.31464	91010124
24	-170.2	-63.5	0.35049	91010124
25	-165.2	-63.5	0.4302	91010124
26	-160.2	-63.5	0.56822	91010124
27	-155.2	-63.5	0.69611	91010124
28	-150.2	-63.5	0.77748	91010124
29	-145.2	-63.5	0.81559	91010124
30	-140.2	-63.5	0.81415	91010124
31	-135.2	-63.5	0.78295	91010124
32	-130.2	-63.5	0.73646	91010124

Modeled_Data

Ready 100%

For the script to work, this template must be used for modeled data

(exact header row names are unimportant)

Saved as **c:\design values\modeled_data.csv**

24-hour $PM_{2.5}$ NAAQS

Tips for preparing modeled data – AERMOD output

ALL_24hr.pst - Notepad

File Edit Format View Help

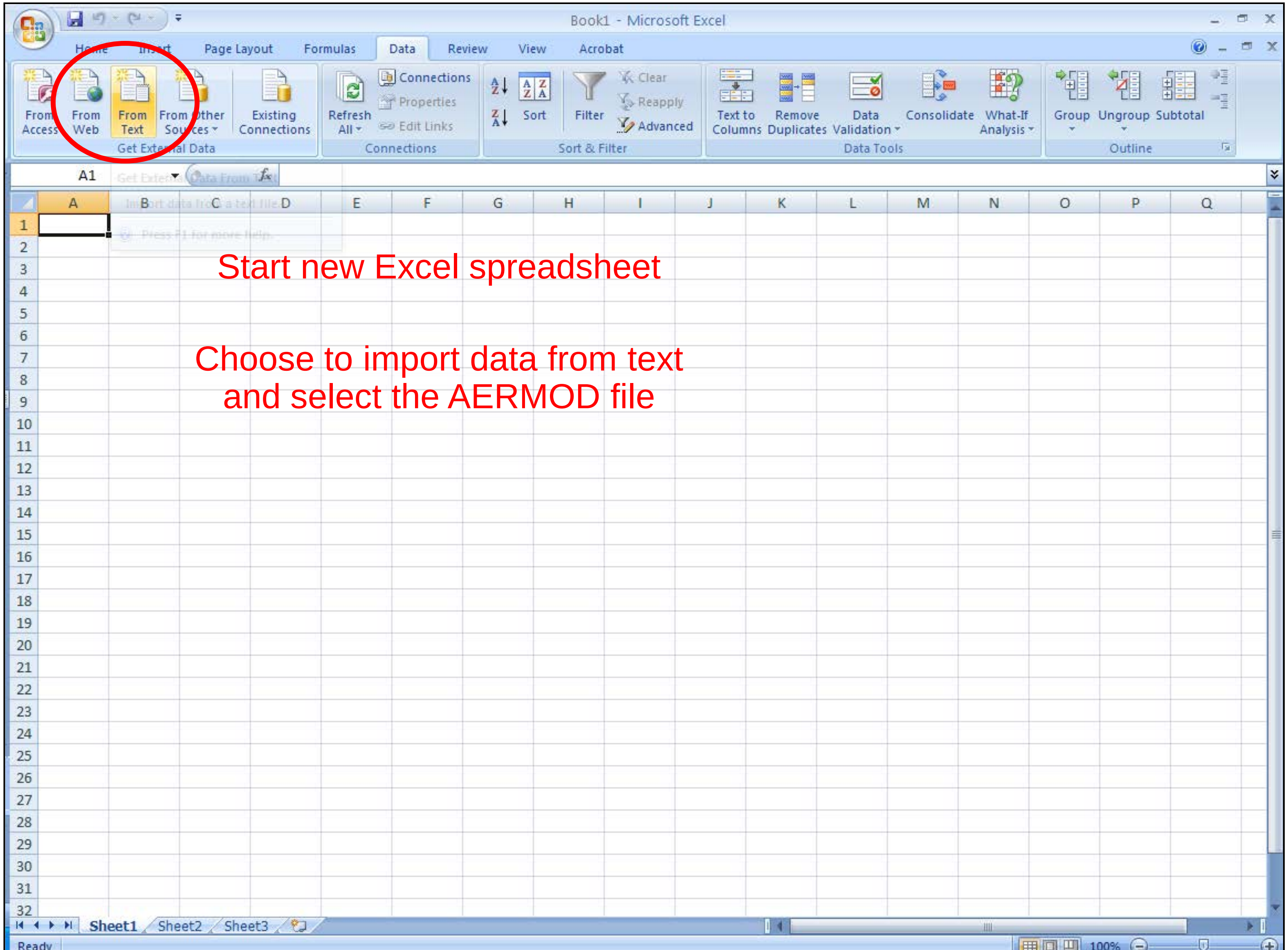
* AERMOD (12345): Hotspot Training Exercise 07/26/13
* MODELING OPTIONS USED: 15:42:09
* NonDFAULT CONC FLAT FLGPOL

* POST/PLOT FILE OF CONCURRENT 24-HR VALUES FOR SOURCE GROUP: ALL
* FOR A TOTAL OF 311 RECEPTORS.
* FORMAT: (3(1X,F13.5),3(1X,F8.2),2X,A6,2X,A8,2X,I8.8,2X,A8)

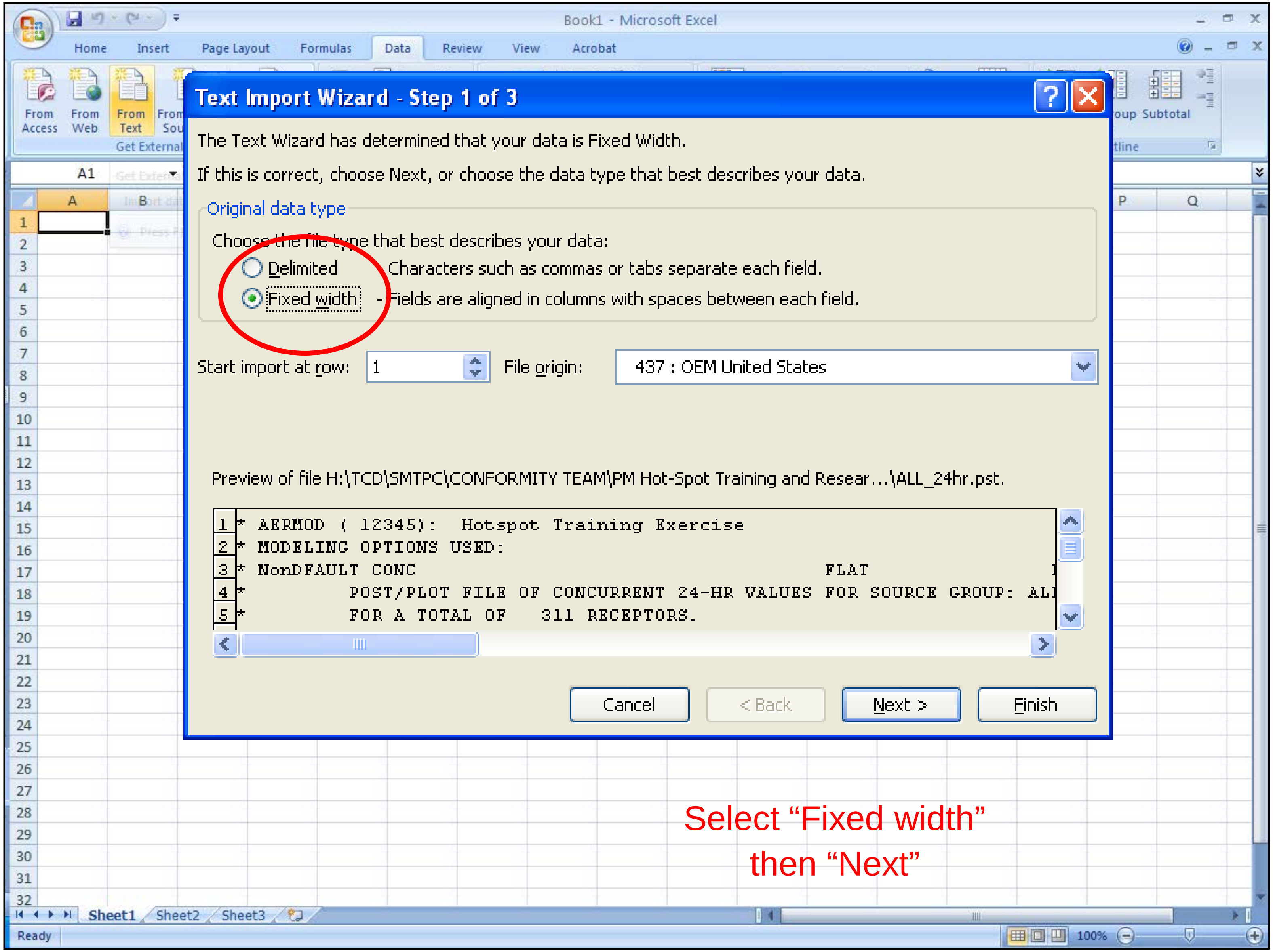
X	Y	AVERAGE CONC	ZELEV	ZHILL	ZFLAG	AVE	GRP	DATE	NET ID
9.00000	212.80000	0.33118	0.00	0.00	1.80	24-HR	ALL	91010124	
59.00000	212.80000	0.37218	0.00	0.00	1.80	24-HR	ALL	91010124	
109.00000	212.80000	0.40974	0.00	0.00	1.80	24-HR	ALL	91010124	
159.00000	212.80000	0.45024	0.00	0.00	1.80	24-HR	ALL	91010124	
209.00000	212.80000	0.57544	0.00	0.00	1.80	24-HR	ALL	91010124	
259.00000	212.80000	1.24916	0.00	0.00	1.80	24-HR	ALL	91010124	
9.00000	262.80000	0.24455	0.00	0.00	1.80	24-HR	ALL	91010124	
59.00000	262.80000	0.28587	0.00	0.00	1.80	24-HR	ALL	91010124	
109.00000	262.80000	0.33546	0.00	0.00	1.80	24-HR	ALL	91010124	
159.00000	262.80000	0.40887	0.00	0.00	1.80	24-HR	ALL	91010124	
9.00000	312.80000	0.21234	0.00	0.00	1.80	24-HR	ALL	91010124	
59.00000	312.80000	0.25560	0.00	0.00	1.80	24-HR	ALL	91010124	
109.00000	312.80000	0.31796	0.00	0.00	1.80	24-HR	ALL	91010124	
159.00000	312.80000	0.44713	0.00	0.00	1.80	24-HR	ALL	91010124	
9.00000	362.80000	0.20457	0.00	0.00	1.80	24-HR	ALL	91010124	
59.00000	362.80000	0.25196	0.00	0.00	1.80	24-HR	ALL	91010124	
109.00000	362.80000	0.32590	0.00	0.00	1.80	24-HR	ALL	91010124	
159.00000	362.80000	0.51075	0.00	0.00	1.80	24-HR	ALL	91010124	
9.00000	412.80000	0.21141	0.00	0.00	1.80	24-HR	ALL	91010124	
59.00000	412.80000	0.26761	0.00	0.00	1.80	24-HR	ALL	91010124	
109.00000	412.80000	0.35641	0.00	0.00	1.80	24-HR	ALL	91010124	
159.00000	412.80000	0.58416	0.00	0.00	1.80	24-HR	ALL	91010124	
9.00000	462.80000	0.22657	0.00	0.00	1.80	24-HR	ALL	91010124	
59.00000	462.80000	0.29489	0.00	0.00	1.80	24-HR	ALL	91010124	
109.00000	462.80000	0.40299	0.00	0.00	1.80	24-HR	ALL	91010124	
159.00000	462.80000	0.69907	0.00	0.00	1.80	24-HR	ALL	91010124	
9.00000	512.80000	0.24489	0.00	0.00	1.80	24-HR	ALL	91010124	
59.00000	512.80000	0.32857	0.00	0.00	1.80	24-HR	ALL	91010124	
109.00000	512.80000	0.46301	0.00	0.00	1.80	24-HR	ALL	91010124	
159.00000	512.80000	0.94011	0.00	0.00	1.80	24-HR	ALL	91010124	

AERMOD "ALL_24hr.pst" postfile from class highway and transit project

Tips for preparing modeled data – AERMOD output

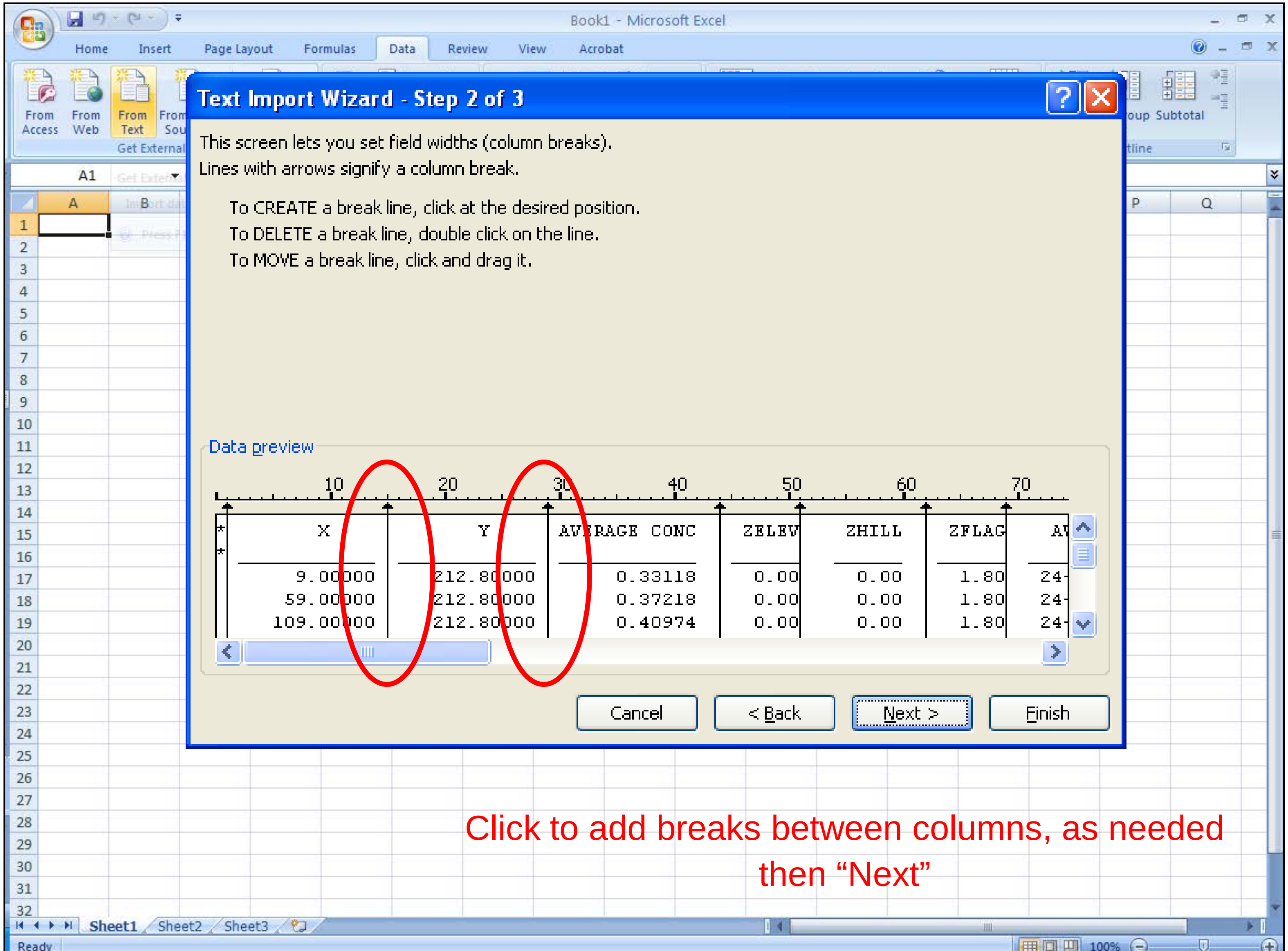


Tips for preparing modeled data – AERMOD output



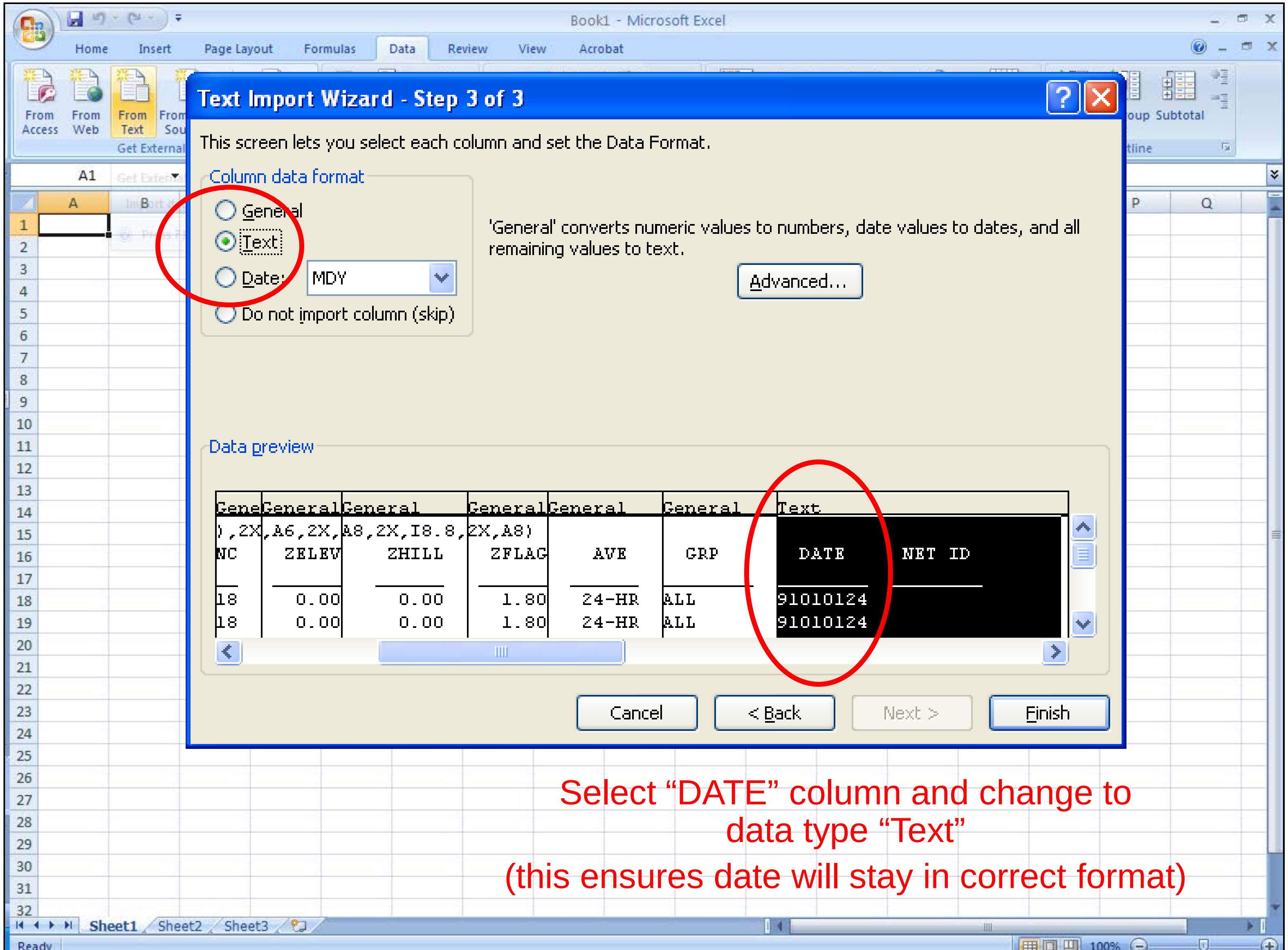
Select "Fixed width" then "Next"

Tips for preparing modeled data – AERMOD output



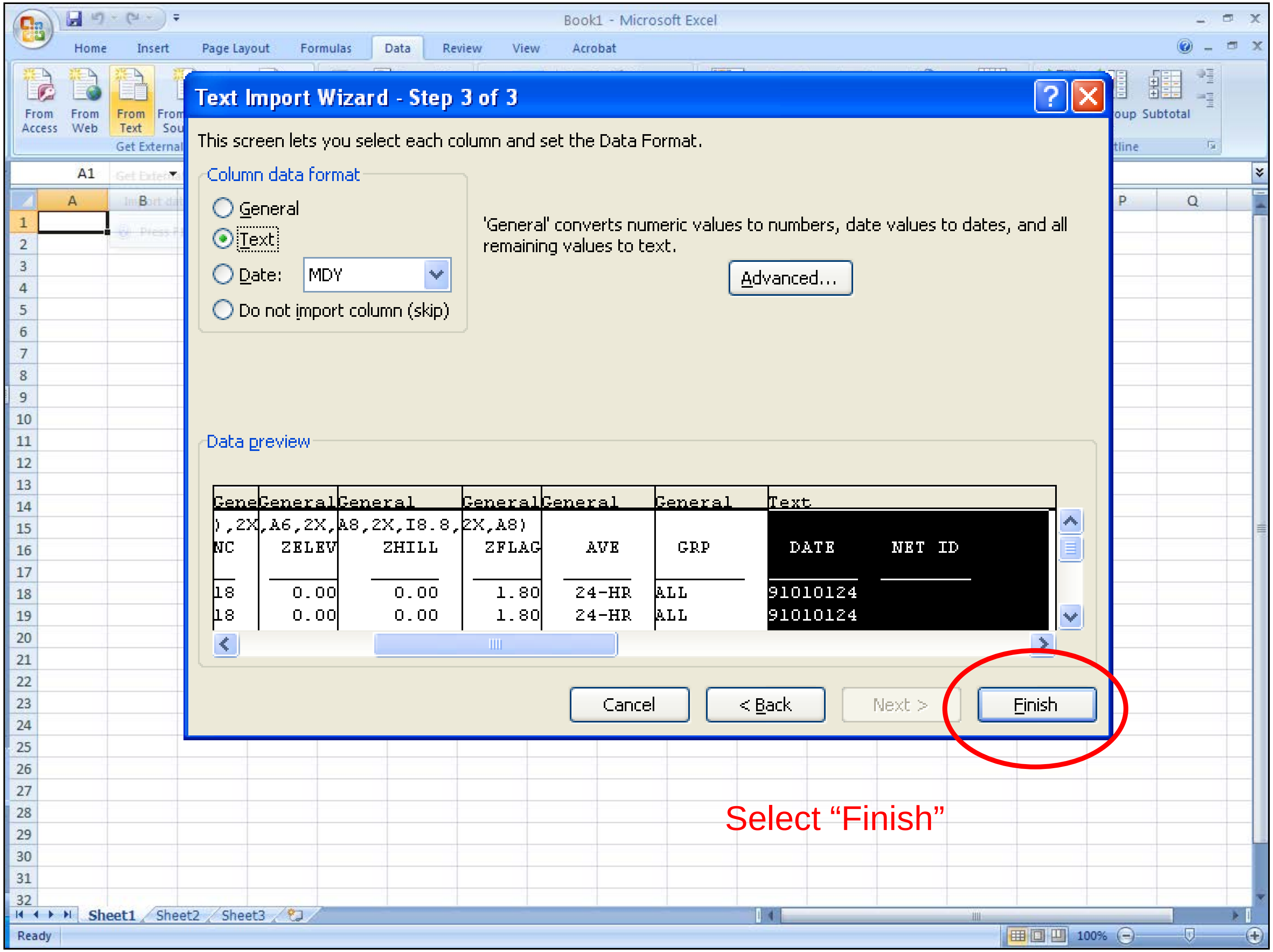
Click to add breaks between columns, as needed then “Next”

Tips for preparing modeled data – AERMOD output



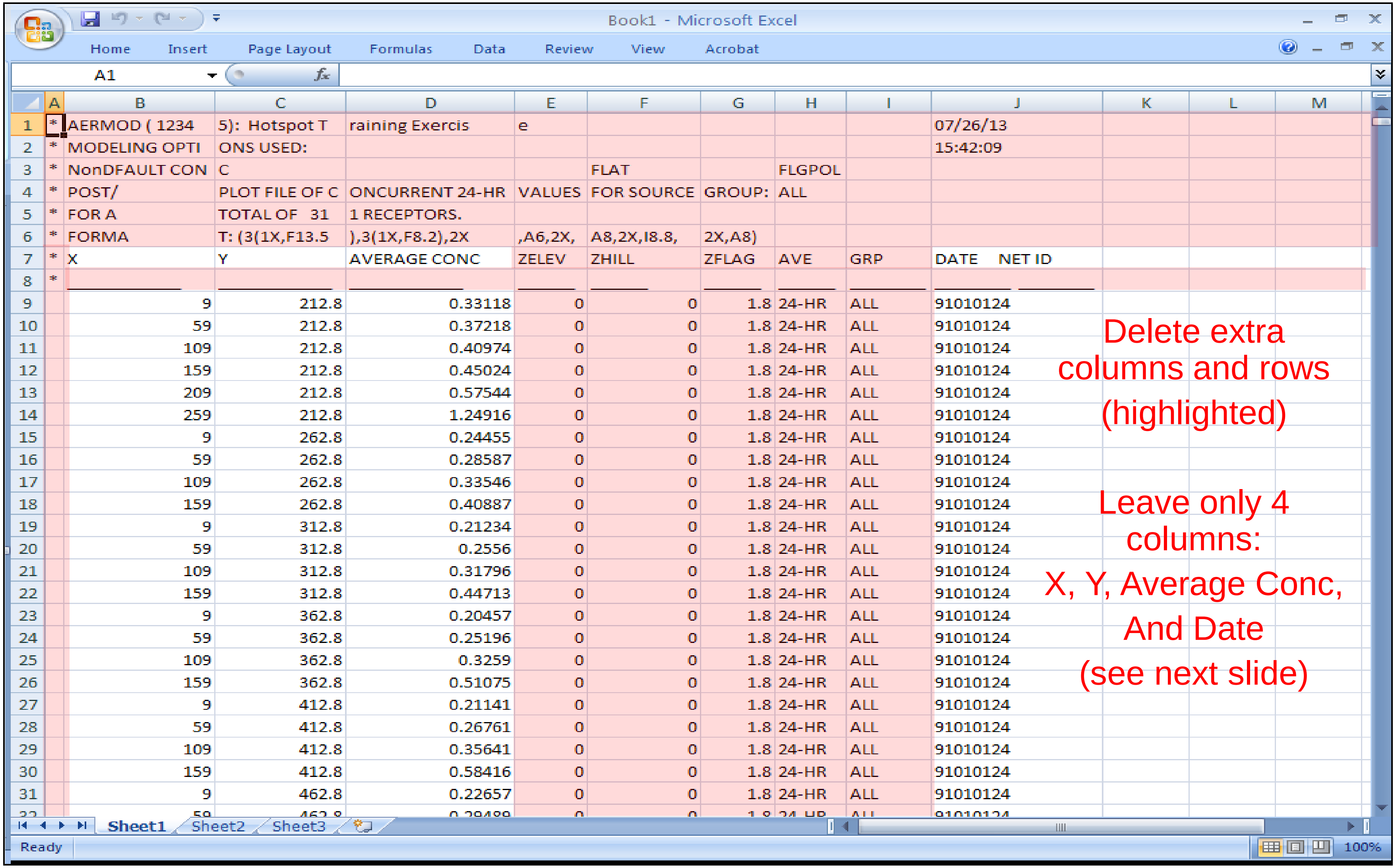
Select “DATE” column and change to data type “Text”
(this ensures date will stay in correct format)

Tips for preparing modeled data – AERMOD output



Select “Finish”

Tips for preparing modeled data – AERMOD output



	A	B	C	D	E	F	G	H	I	J
1	*	AERMOD (1234	5): Hotspot T	raining Exercis	e					07/26/13
2	*	MODELING OPTI	ONS USED:							15:42:09
3	*	NonDFAULT CON	C			FLAT		FLGPOL		
4	*	POST/	PLOT FILE OF C	ONCURRENT 24-HR	VALUES	FOR SOURCE	GROUP:	ALL		
5	*	FOR A	TOTAL OF 31	1 RECEPTORS.						
6	*	FORMA	T: (3(1X,F13.5	),3(1X,F8.2),2X	,A6,2X,	A8,2X,I8.8,	2X,A8)			
7	*	X	Y	AVERAGE CONC	ZELEV	ZHILL	ZFLAG	AVE	GRP	DATE NET ID
8	*									
9		9	212.8	0.33118	0	0	1.8	24-HR	ALL	91010124
10		59	212.8	0.37218	0	0	1.8	24-HR	ALL	91010124
11		109	212.8	0.40974	0	0	1.8	24-HR	ALL	91010124
12		159	212.8	0.45024	0	0	1.8	24-HR	ALL	91010124
13		209	212.8	0.57544	0	0	1.8	24-HR	ALL	91010124
14		259	212.8	1.24916	0	0	1.8	24-HR	ALL	91010124
15		9	262.8	0.24455	0	0	1.8	24-HR	ALL	91010124
16		59	262.8	0.28587	0	0	1.8	24-HR	ALL	91010124
17		109	262.8	0.33546	0	0	1.8	24-HR	ALL	91010124
18		159	262.8	0.40887	0	0	1.8	24-HR	ALL	91010124
19		9	312.8	0.21234	0	0	1.8	24-HR	ALL	91010124
20		59	312.8	0.2556	0	0	1.8	24-HR	ALL	91010124
21		109	312.8	0.31796	0	0	1.8	24-HR	ALL	91010124
22		159	312.8	0.44713	0	0	1.8	24-HR	ALL	91010124
23		9	362.8	0.20457	0	0	1.8	24-HR	ALL	91010124
24		59	362.8	0.25196	0	0	1.8	24-HR	ALL	91010124
25		109	362.8	0.3259	0	0	1.8	24-HR	ALL	91010124
26		159	362.8	0.51075	0	0	1.8	24-HR	ALL	91010124
27		9	412.8	0.21141	0	0	1.8	24-HR	ALL	91010124
28		59	412.8	0.26761	0	0	1.8	24-HR	ALL	91010124
29		109	412.8	0.35641	0	0	1.8	24-HR	ALL	91010124
30		159	412.8	0.58416	0	0	1.8	24-HR	ALL	91010124
31		9	462.8	0.22657	0	0	1.8	24-HR	ALL	91010124

Delete extra columns and rows (highlighted)

Leave only 4 columns:

X, Y, Average Conc, And Date

(see next slide)

Tips for preparing modeled data – AERMOD output

Book1 - Microsoft Excel

	A	B	C	D
1	X	Y	AVERAGE CONC	DATE NET ID
2	9	212.8	0.33118	91010124
3	59	212.8	0.37218	91010124
4	109	212.8	0.40974	91010124
5	159	212.8	0.45024	91010124
6	209	212.8	0.57544	91010124
7	259	212.8	1.24916	91010124
8	9	262.8	0.24455	91010124
9	59	262.8	0.28587	91010124
10	109	262.8	0.33546	91010124
11	159	262.8	0.40887	91010124
12	9	312.8	0.21234	91010124
13	59	312.8	0.2556	91010124
14	109	312.8	0.31796	91010124
15	159	312.8	0.44713	91010124
16	9	362.8	0.20457	91010124
17	59	362.8	0.25196	91010124
18	109	362.8	0.3259	91010124
19	159	362.8	0.51075	91010124
20	9	412.8	0.21141	91010124
21	59	412.8	0.26761	91010124
22	109	412.8	0.35641	91010124
23	159	412.8	0.58416	91010124
24	9	462.8	0.22657	91010124
25	59	462.8	0.29489	91010124
26	109	462.8	0.40299	91010124
27	159	462.8	0.69907	91010124
28	9	512.8	0.24489	91010124
29	59	512.8	0.32857	91010124
30	109	512.8	0.46301	91010124
31	159	512.8	0.94011	91010124
32	9	562.8	0.26237	91010124

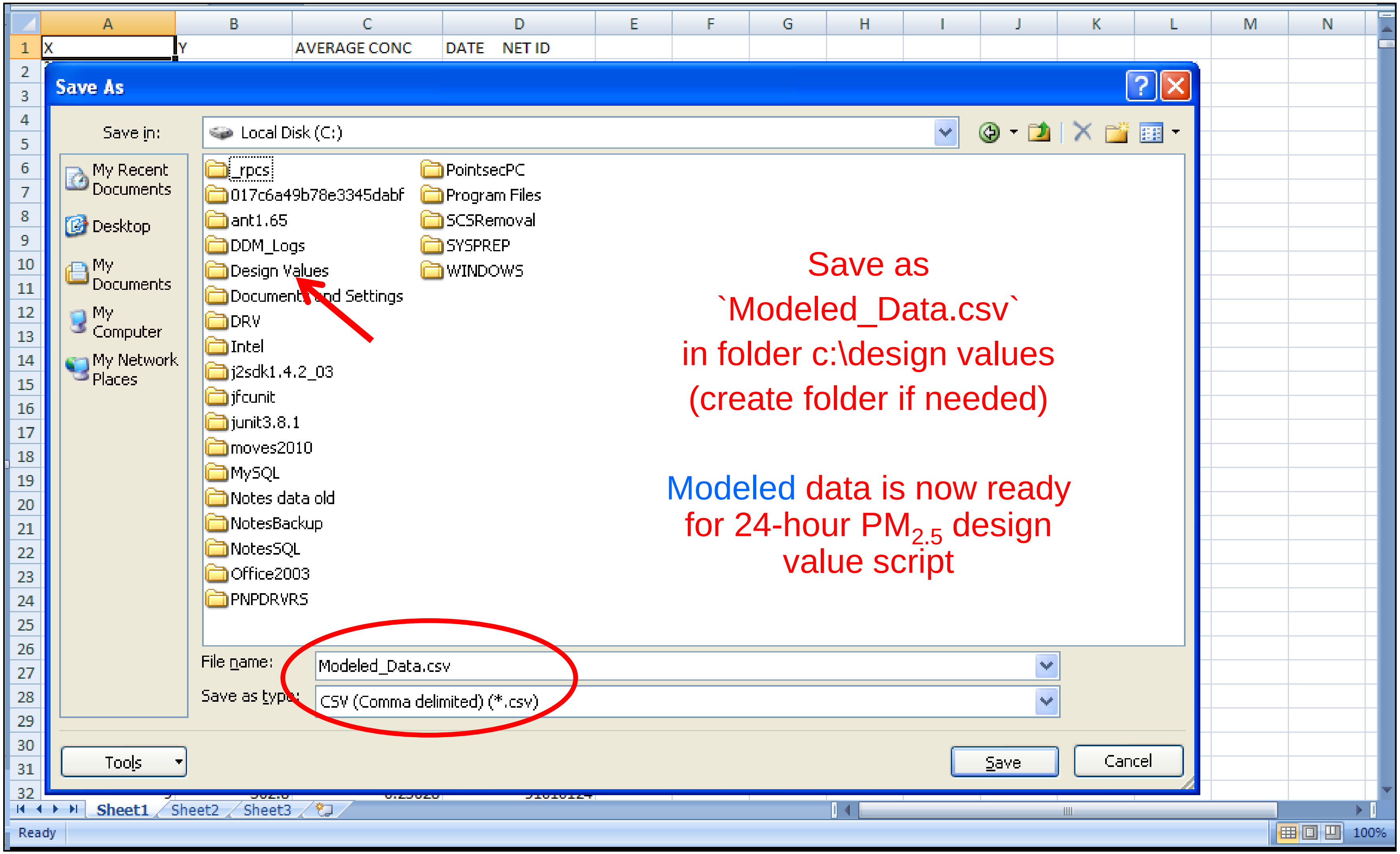
Sheet1 Sheet2 Sheet3

Ready 100%

Properly prepared modeled data:

One header row only and 4 columns of data in order/format shown

Tips for preparing modeled data – Saving as .csv file



Required monitoring data format and directory

Year	Quarter	Rank	Value	CountYear	Count
2008	1	1	19.6	2008	121
2008	1	2	17	2009	119
2008	1	3	13	2010	120
2008	1	4	12.8		
2008	1	5	12.7		
2008	1	6	12.1		
2008	1	7	11.8		
2008	1	8	11.8		
2008	2	1	22.8		
2008	2	2	17.7		
2008	2	3	17.2		
2008	2	4	17.1		
2008	2	5	15		
2008	2	6	14.8		
2008	2	7	14.1		
2008	2	8	13.5		
2008	3	1	38.3		
2008	3	2	31.7		
2008	3	3	25.9		
2008	3	4	24.8		
2008	3	5	21		
2008	3	6	20.7		
2008	3	7	18.4		
2008	3	8	17.9		
2008	4	1	20.5		
2008	4	2	20		
2008	4	3	18.7		
2008	4	4	17.7		
2008	4	5	17.5		
2008	4	6	16.2		
2008	4	7	15.9		

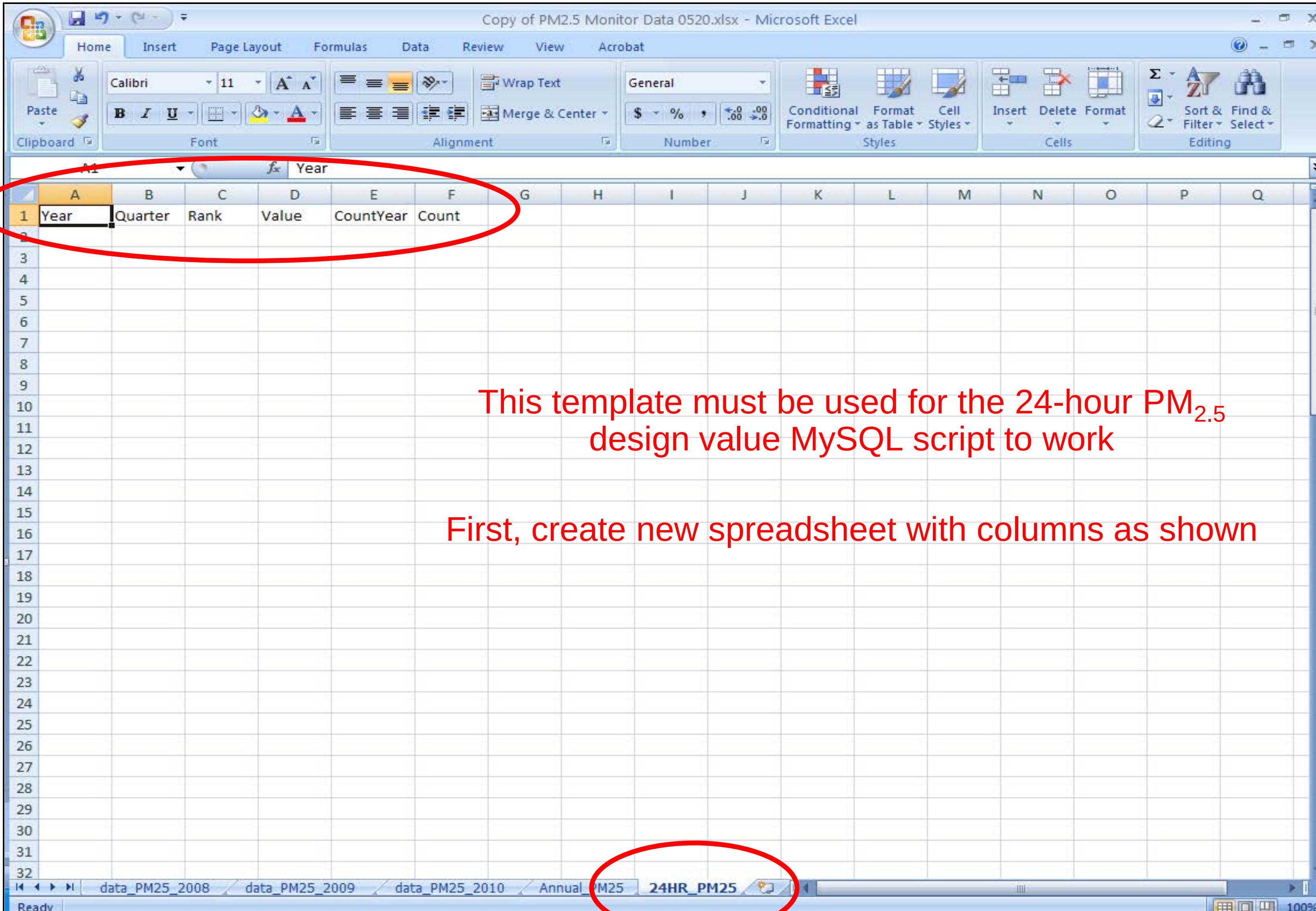
Monitor_Data

For the script to work, this template must be used for monitored data

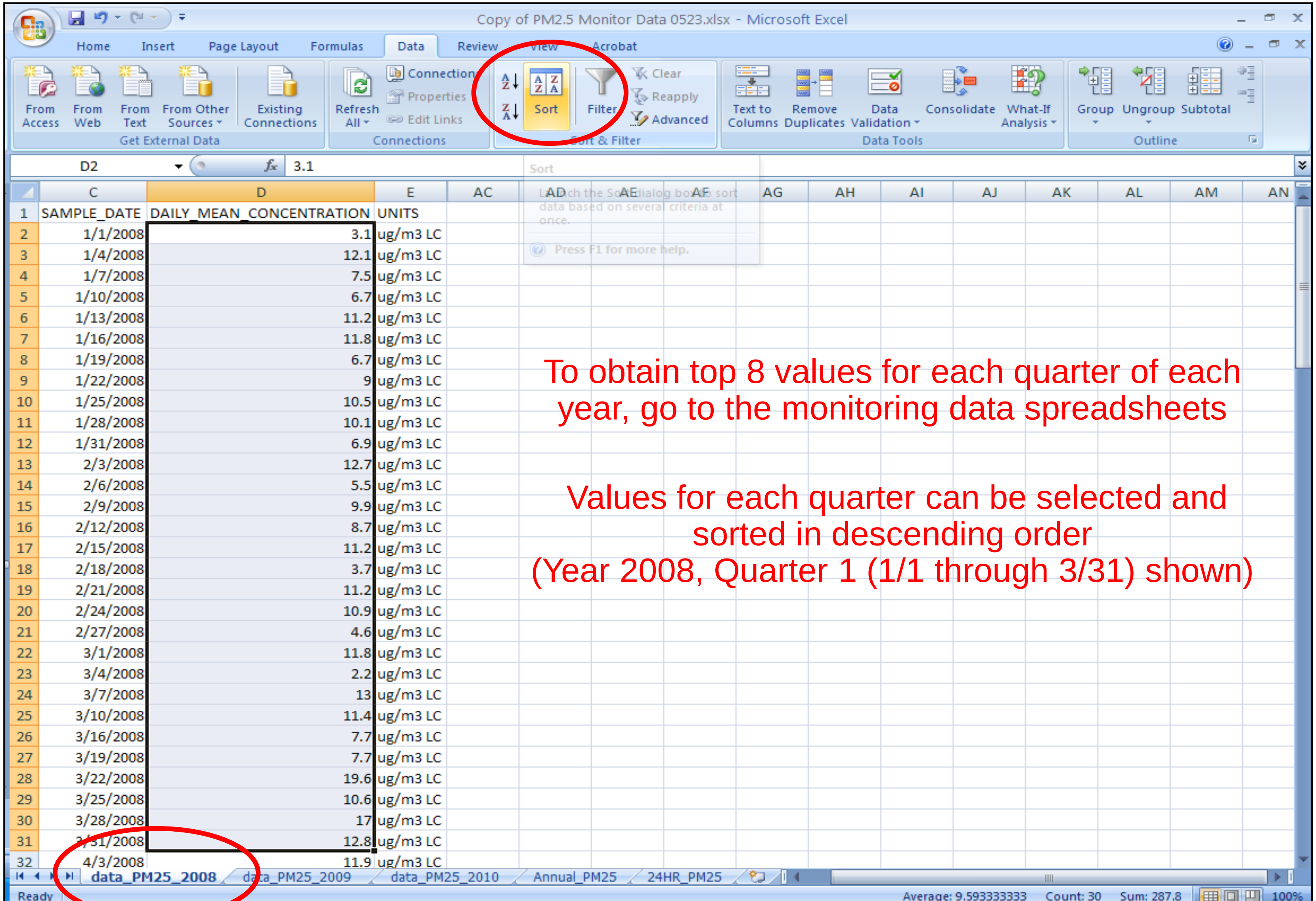
(exact header row names unimportant)

Saved as c:\design values\monitor_data.csv

Tips for preparing monitoring data



Tips for preparing monitoring data



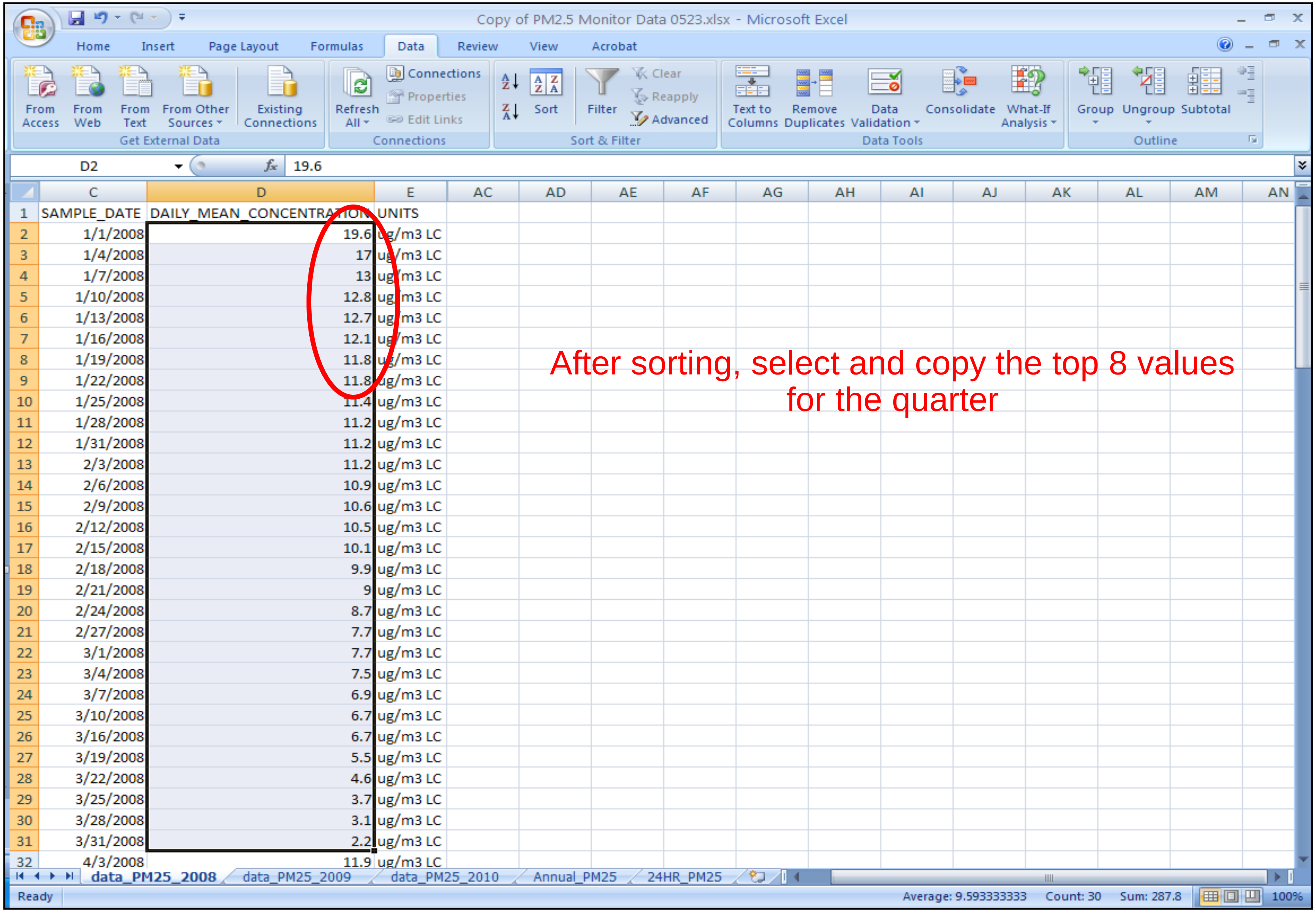
Copy of PM2.5 Monitor Data 0523.xlsx - Microsoft Excel

	C	D	E
1	SAMPLE_DATE	DAILY_MEAN_CONCENTRATION	UNITS
2	1/1/2008	3.1	ug/m3 LC
3	1/4/2008	12.1	ug/m3 LC
4	1/7/2008	7.5	ug/m3 LC
5	1/10/2008	6.7	ug/m3 LC
6	1/13/2008	11.2	ug/m3 LC
7	1/16/2008	11.8	ug/m3 LC
8	1/19/2008	6.7	ug/m3 LC
9	1/22/2008	9	ug/m3 LC
10	1/25/2008	10.5	ug/m3 LC
11	1/28/2008	10.1	ug/m3 LC
12	1/31/2008	6.9	ug/m3 LC
13	2/3/2008	12.7	ug/m3 LC
14	2/6/2008	5.5	ug/m3 LC
15	2/9/2008	9.9	ug/m3 LC
16	2/12/2008	8.7	ug/m3 LC
17	2/15/2008	11.2	ug/m3 LC
18	2/18/2008	3.7	ug/m3 LC
19	2/21/2008	11.2	ug/m3 LC
20	2/24/2008	10.9	ug/m3 LC
21	2/27/2008	4.6	ug/m3 LC
22	3/1/2008	11.8	ug/m3 LC
23	3/4/2008	2.2	ug/m3 LC
24	3/7/2008	13	ug/m3 LC
25	3/10/2008	11.4	ug/m3 LC
26	3/16/2008	7.7	ug/m3 LC
27	3/19/2008	7.7	ug/m3 LC
28	3/22/2008	19.6	ug/m3 LC
29	3/25/2008	10.6	ug/m3 LC
30	3/28/2008	17	ug/m3 LC
31	3/31/2008	12.8	ug/m3 LC
32	4/3/2008	11.9	ug/m3 LC

To obtain top 8 values for each quarter of each year, go to the monitoring data spreadsheets

Values for each quarter can be selected and sorted in descending order
(Year 2008, Quarter 1 (1/1 through 3/31) shown)

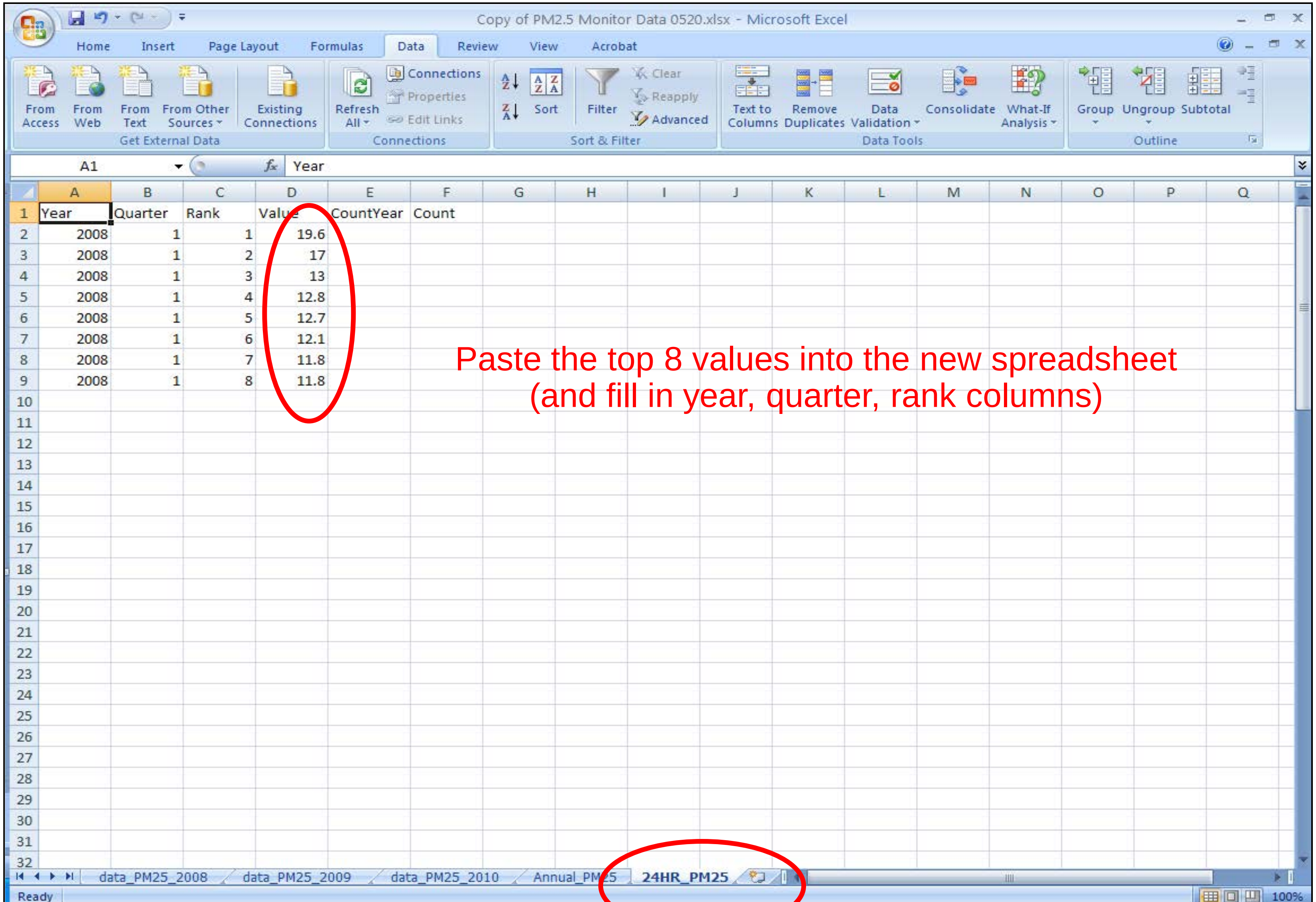
Tips for preparing monitoring data



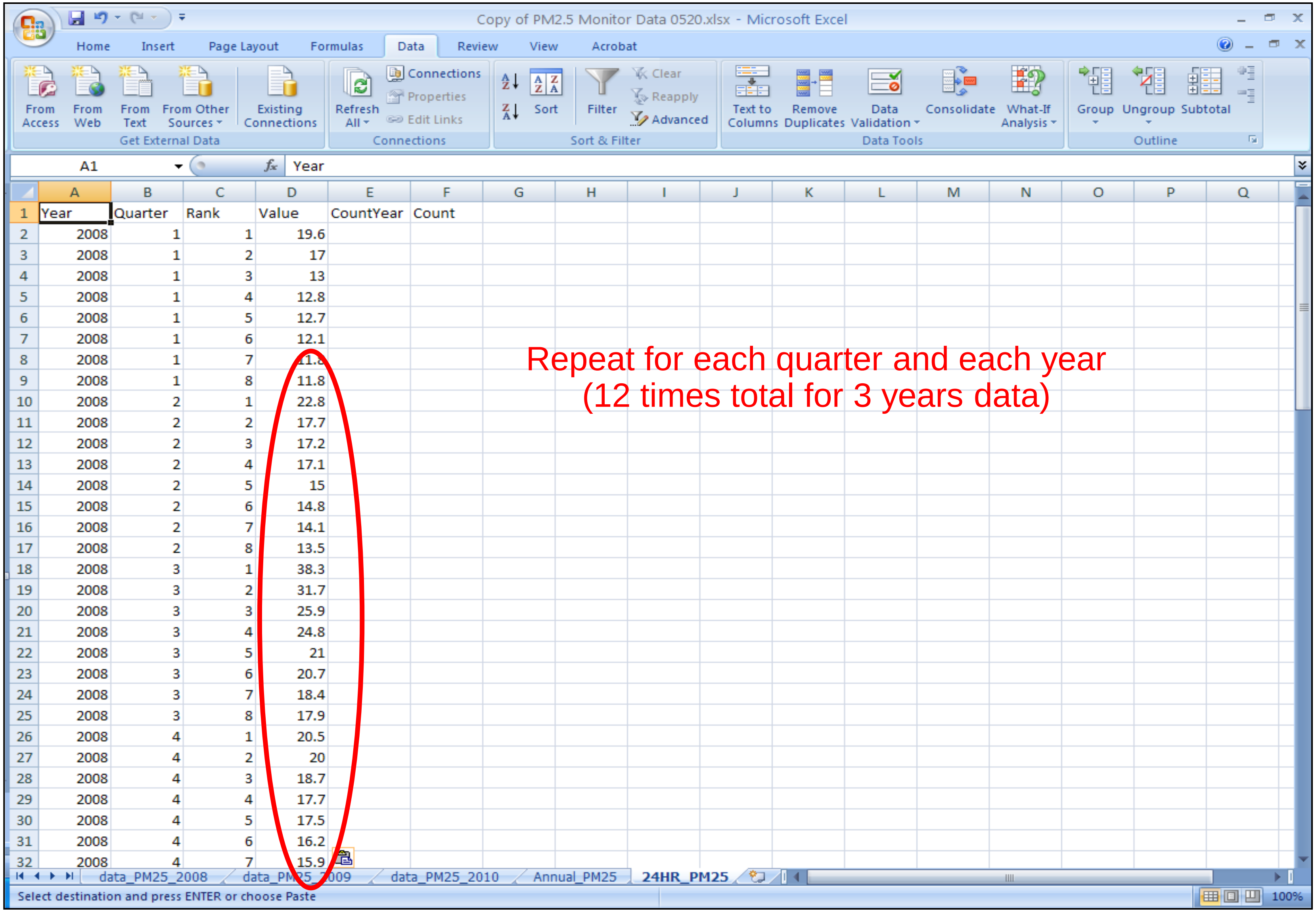
	C	D	E
1	SAMPLE_DATE	DAILY_MEAN_CONCENTRATION	UNITS
2	1/1/2008	19.6	ug/m3 LC
3	1/4/2008	17	ug/m3 LC
4	1/7/2008	13	ug/m3 LC
5	1/10/2008	12.8	ug/m3 LC
6	1/13/2008	12.7	ug/m3 LC
7	1/16/2008	12.1	ug/m3 LC
8	1/19/2008	11.8	ug/m3 LC
9	1/22/2008	11.8	ug/m3 LC
10	1/25/2008	11.4	ug/m3 LC
11	1/28/2008	11.2	ug/m3 LC
12	1/31/2008	11.2	ug/m3 LC
13	2/3/2008	11.2	ug/m3 LC
14	2/6/2008	10.9	ug/m3 LC
15	2/9/2008	10.6	ug/m3 LC
16	2/12/2008	10.5	ug/m3 LC
17	2/15/2008	10.1	ug/m3 LC
18	2/18/2008	9.9	ug/m3 LC
19	2/21/2008	9	ug/m3 LC
20	2/24/2008	8.7	ug/m3 LC
21	2/27/2008	7.7	ug/m3 LC
22	3/1/2008	7.7	ug/m3 LC
23	3/4/2008	7.5	ug/m3 LC
24	3/7/2008	6.9	ug/m3 LC
25	3/10/2008	6.7	ug/m3 LC
26	3/16/2008	6.7	ug/m3 LC
27	3/19/2008	5.5	ug/m3 LC
28	3/22/2008	4.6	ug/m3 LC
29	3/25/2008	3.7	ug/m3 LC
30	3/28/2008	3.1	ug/m3 LC
31	3/31/2008	2.2	ug/m3 LC
32	4/3/2008	11.9	ug/m3 LC

After sorting, select and copy the top 8 values for the quarter

Tips for preparing monitoring data



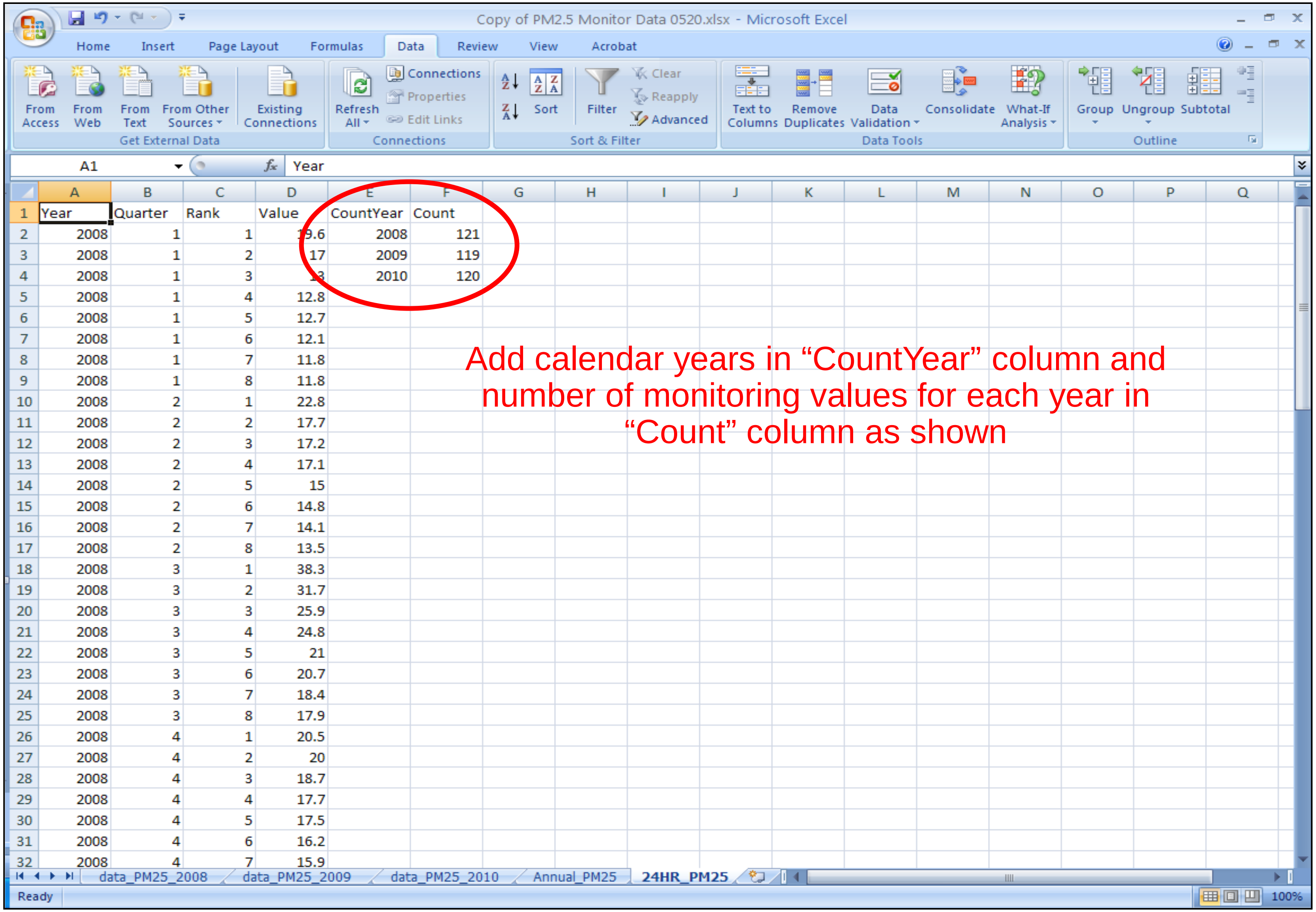
Tips for preparing monitoring data



Year	Quarter	Rank	Value	CountYear	Count
2008	1	1	19.6		
2008	1	2	17		
2008	1	3	13		
2008	1	4	12.8		
2008	1	5	12.7		
2008	1	6	12.1		
2008	1	7	11.8		
2008	1	8	11.8		
2008	2	1	22.8		
2008	2	2	17.7		
2008	2	3	17.2		
2008	2	4	17.1		
2008	2	5	15		
2008	2	6	14.8		
2008	2	7	14.1		
2008	2	8	13.5		
2008	3	1	38.3		
2008	3	2	31.7		
2008	3	3	25.9		
2008	3	4	24.8		
2008	3	5	21		
2008	3	6	20.7		
2008	3	7	18.4		
2008	3	8	17.9		
2008	4	1	20.5		
2008	4	2	20		
2008	4	3	18.7		
2008	4	4	17.7		
2008	4	5	17.5		
2008	4	6	16.2		
2008	4	7	15.9		

Repeat for each quarter and each year
(12 times total for 3 years data)

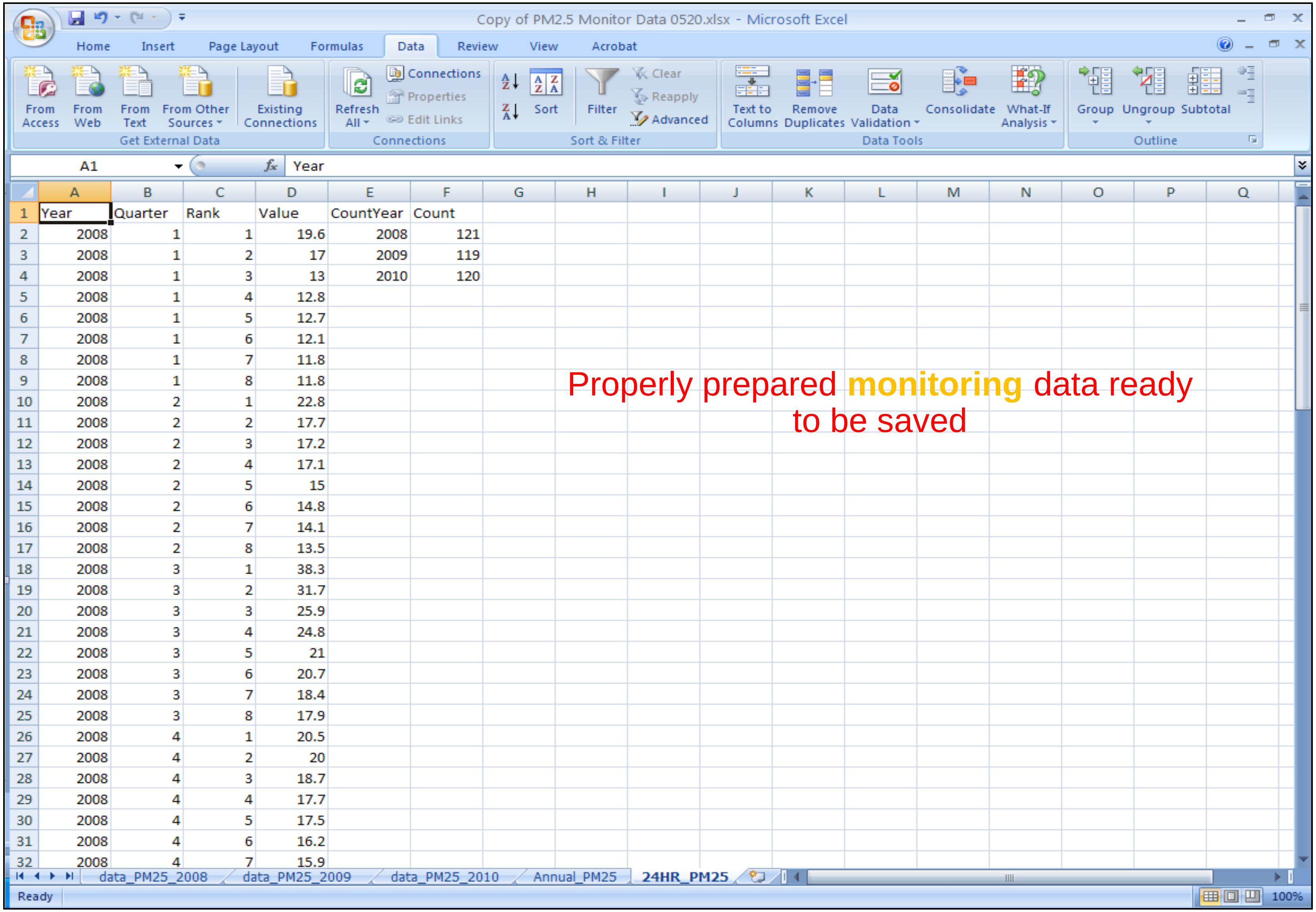
Tips for preparing monitoring data



Year	Quarter	Rank	Value	CountYear	Count
2008	1	1	19.6	2008	121
2008	1	2	17	2009	119
2008	1	3	13	2010	120
2008	1	4	12.8		
2008	1	5	12.7		
2008	1	6	12.1		
2008	1	7	11.8		
2008	1	8	11.8		
2008	2	1	22.8		
2008	2	2	17.7		
2008	2	3	17.2		
2008	2	4	17.1		
2008	2	5	15		
2008	2	6	14.8		
2008	2	7	14.1		
2008	2	8	13.5		
2008	3	1	38.3		
2008	3	2	31.7		
2008	3	3	25.9		
2008	3	4	24.8		
2008	3	5	21		
2008	3	6	20.7		
2008	3	7	18.4		
2008	3	8	17.9		
2008	4	1	20.5		
2008	4	2	20		
2008	4	3	18.7		
2008	4	4	17.7		
2008	4	5	17.5		
2008	4	6	16.2		
2008	4	7	15.9		

Add calendar years in “CountYear” column and number of monitoring values for each year in “Count” column as shown

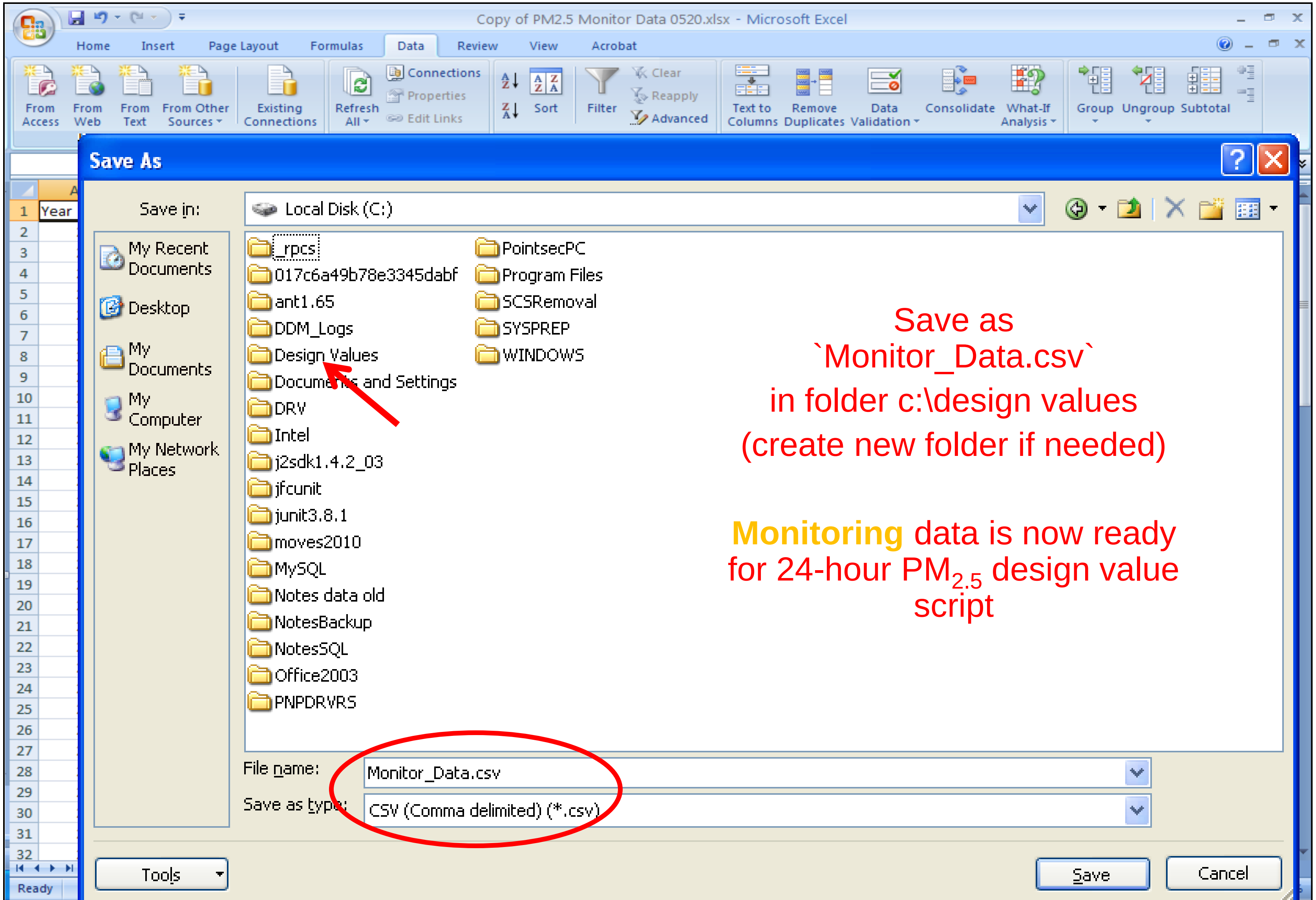
Tips for preparing monitoring data



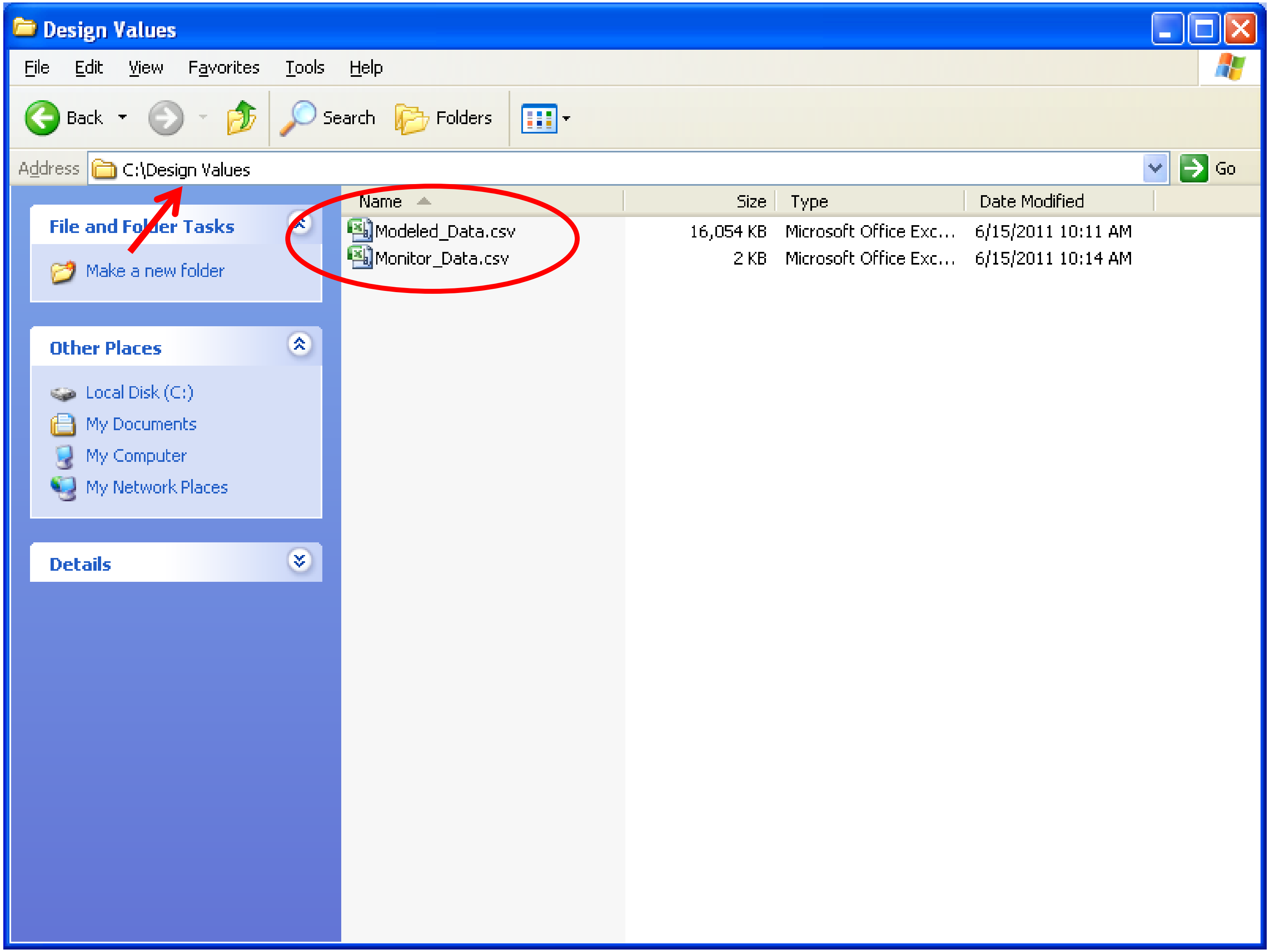
	A	B	C	D	E	F
1	Year	Quarter	Rank	Value	CountYear	Count
2	2008	1	1	19.6	2008	121
3	2008	1	2	17	2009	119
4	2008	1	3	13	2010	120
5	2008	1	4	12.8		
6	2008	1	5	12.7		
7	2008	1	6	12.1		
8	2008	1	7	11.8		
9	2008	1	8	11.8		
10	2008	2	1	22.8		
11	2008	2	2	17.7		
12	2008	2	3	17.2		
13	2008	2	4	17.1		
14	2008	2	5	15		
15	2008	2	6	14.8		
16	2008	2	7	14.1		
17	2008	2	8	13.5		
18	2008	3	1	38.3		
19	2008	3	2	31.7		
20	2008	3	3	25.9		
21	2008	3	4	24.8		
22	2008	3	5	21		
23	2008	3	6	20.7		
24	2008	3	7	18.4		
25	2008	3	8	17.9		
26	2008	4	1	20.5		
27	2008	4	2	20		
28	2008	4	3	18.7		
29	2008	4	4	17.7		
30	2008	4	5	17.5		
31	2008	4	6	16.2		
32	2008	4	7	15.9		

Properly prepared monitoring data ready to be saved

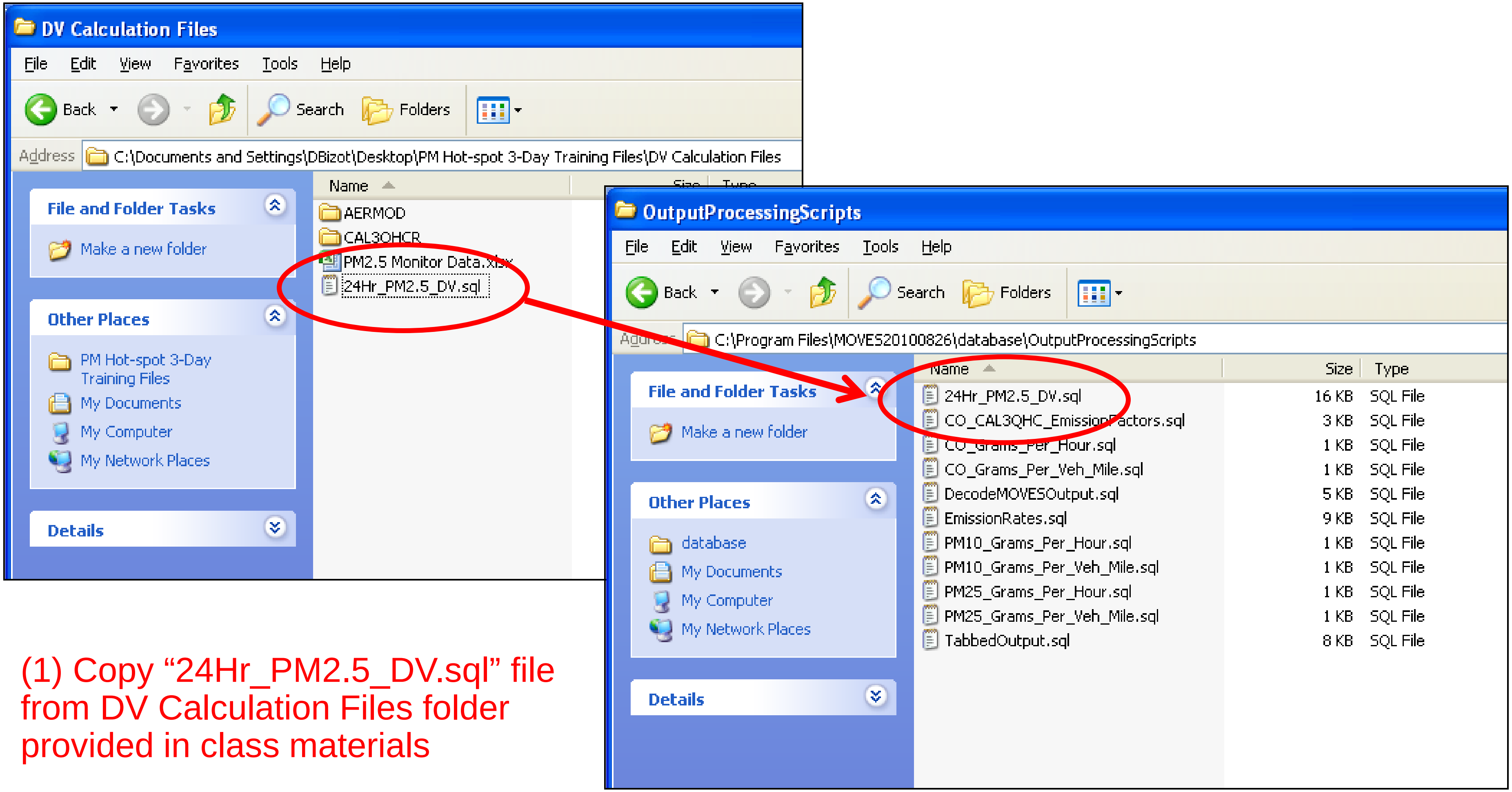
Tips for preparing monitoring data



Data files must be saved in folder c:\design values as shown below



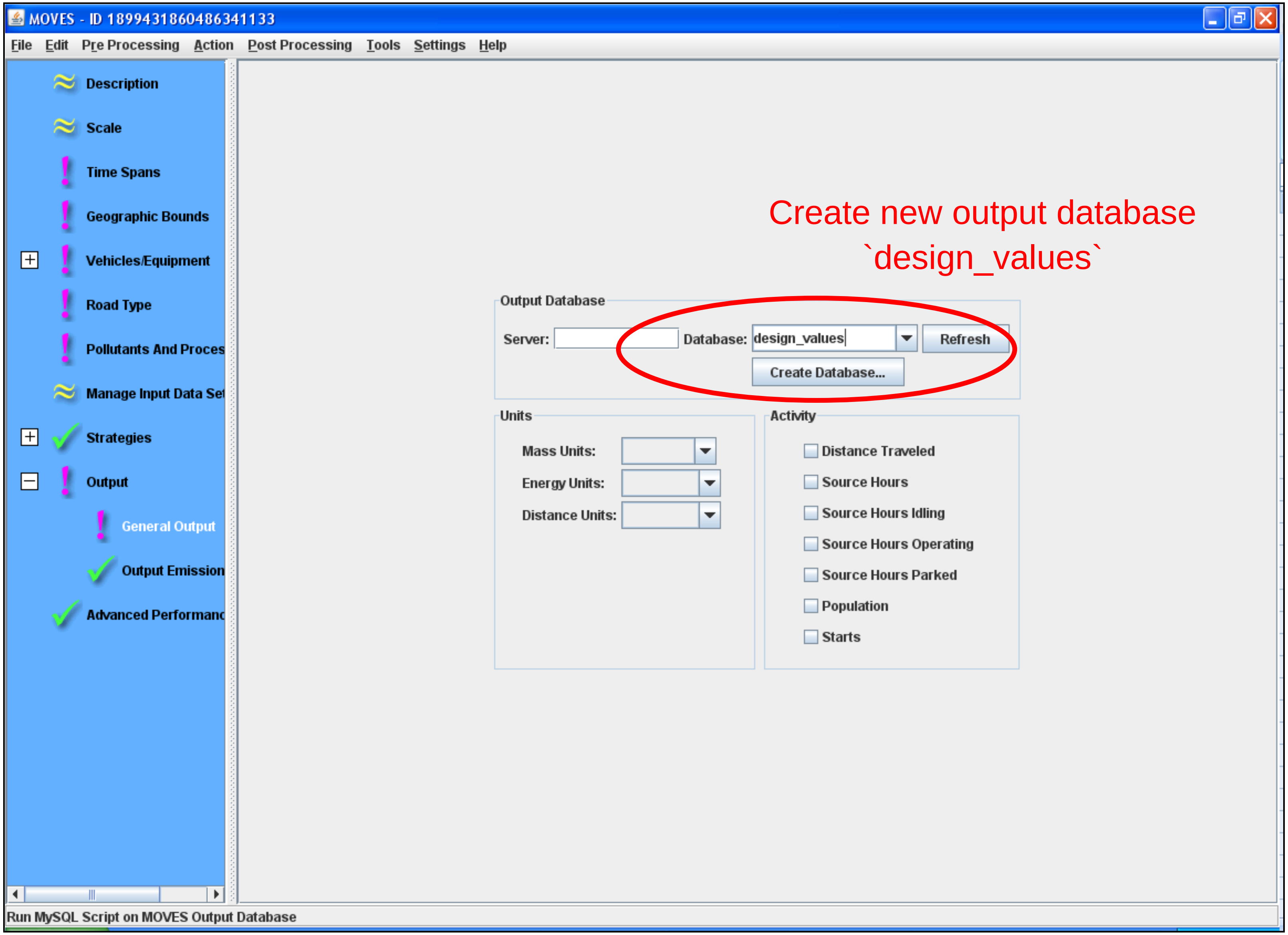
Adding MySQL script to MOVES



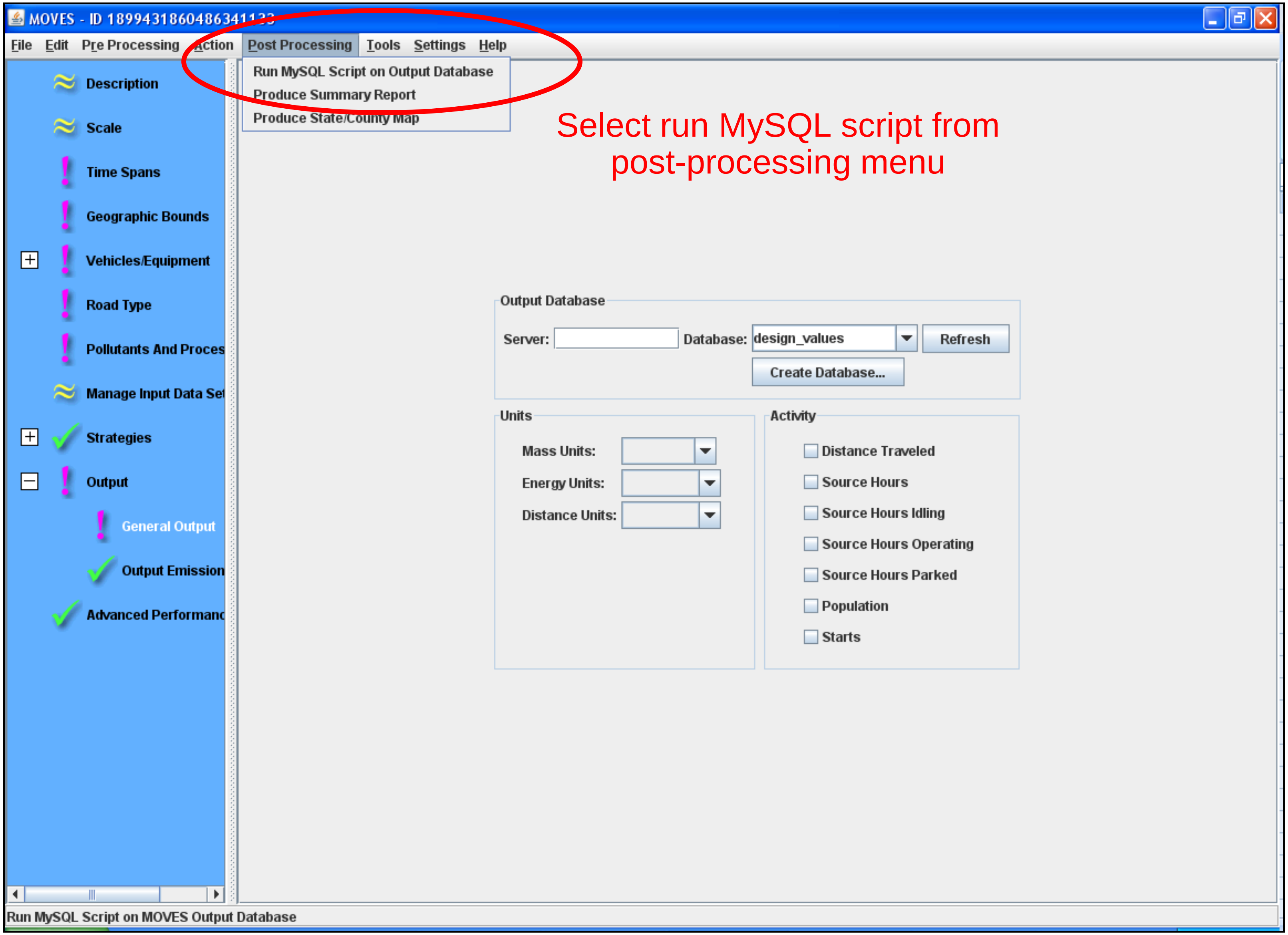
(1) Copy “24Hr_PM2.5_DV.sql” file from DV Calculation Files folder provided in class materials

(2) Paste into this folder on your computer:
C:\Program Files\MOVES20120410\database\OutputProcessingScripts

Running the script from MOVES

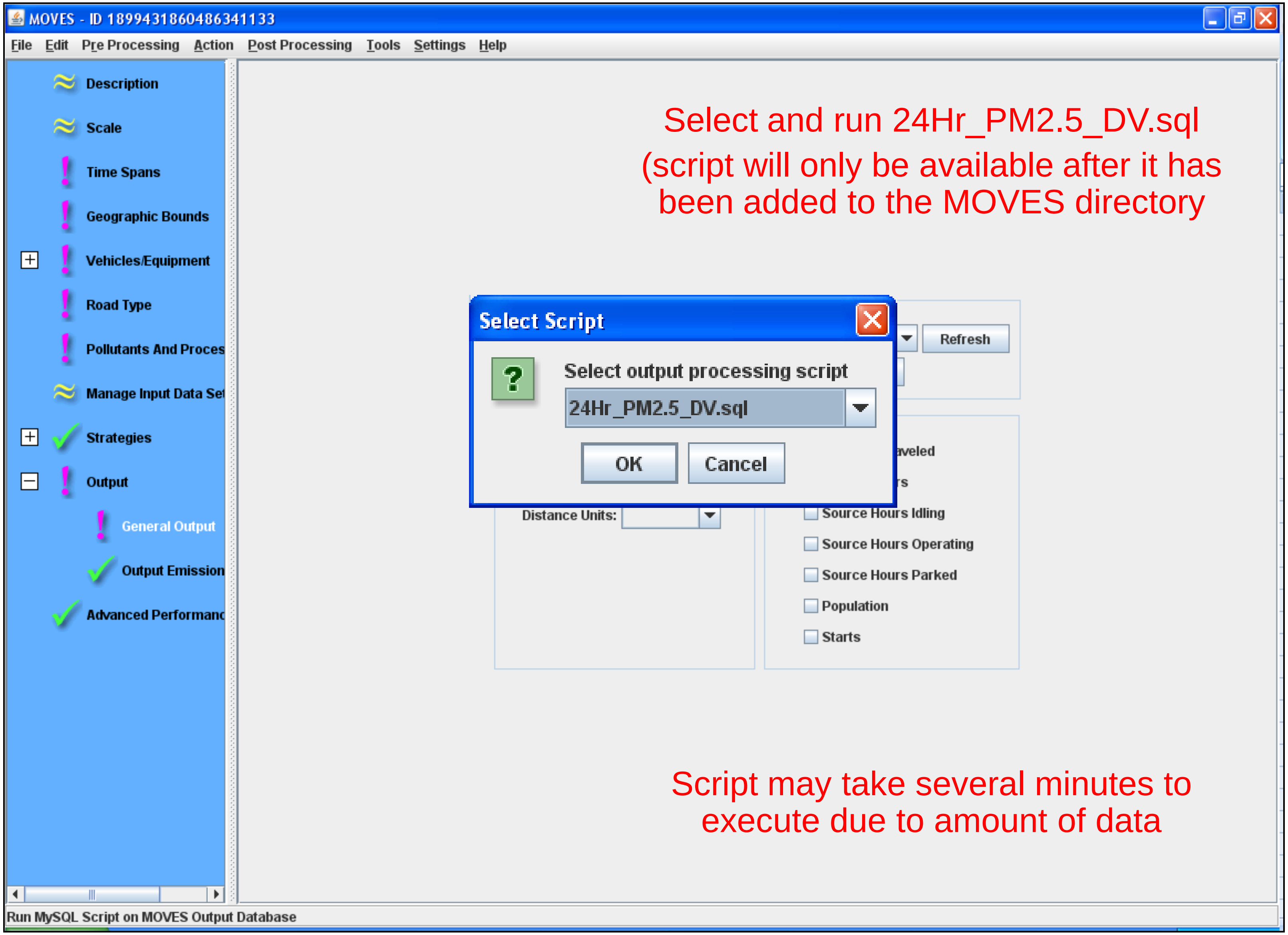


Running the script from MOVES



Select run MySQL script from post-processing menu

Running the script from MOVES

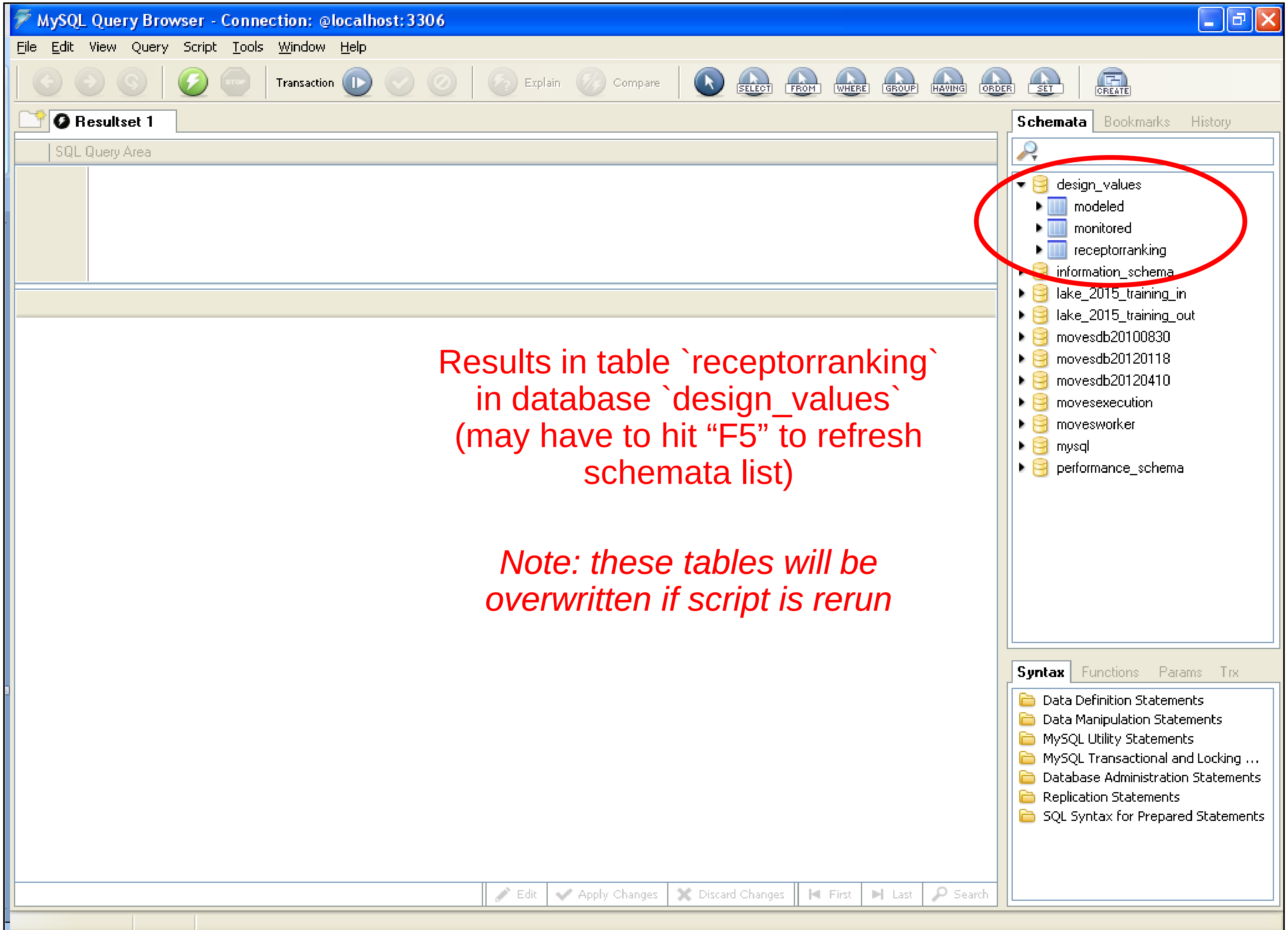


Select and run 24Hr_PM2.5_DV.sql

(script will only be available after it has been added to the MOVES directory

Script may take several minutes to execute due to amount of data

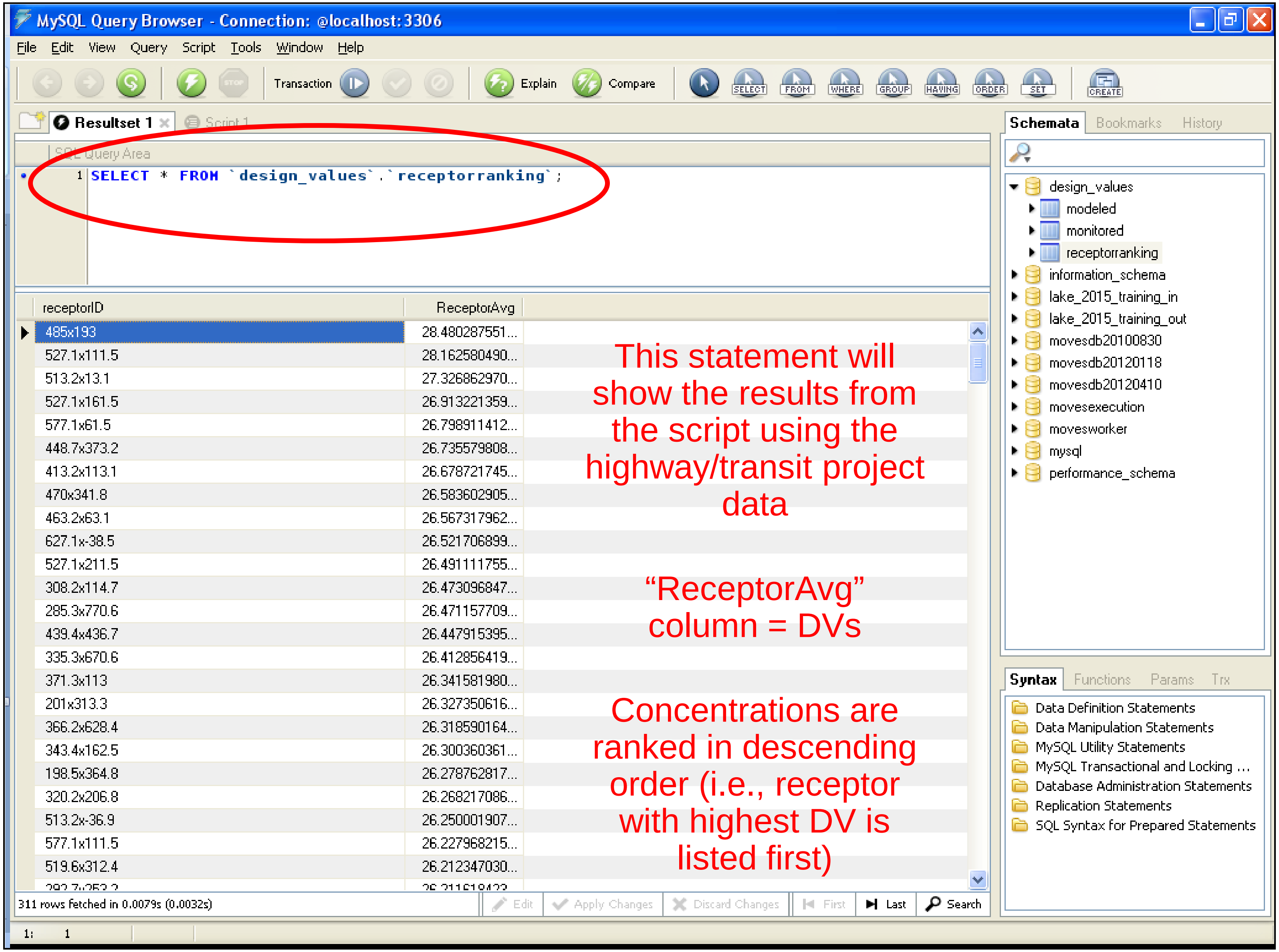
Viewing script results in MySQL Query Browser



Results in table \`receptorranking\` in database \`design_values\` (may have to hit "F5" to refresh schemata list)

Note: these tables will be overwritten if script is rerun

Viewing highway/transit project DV results in MySQL Query Browser

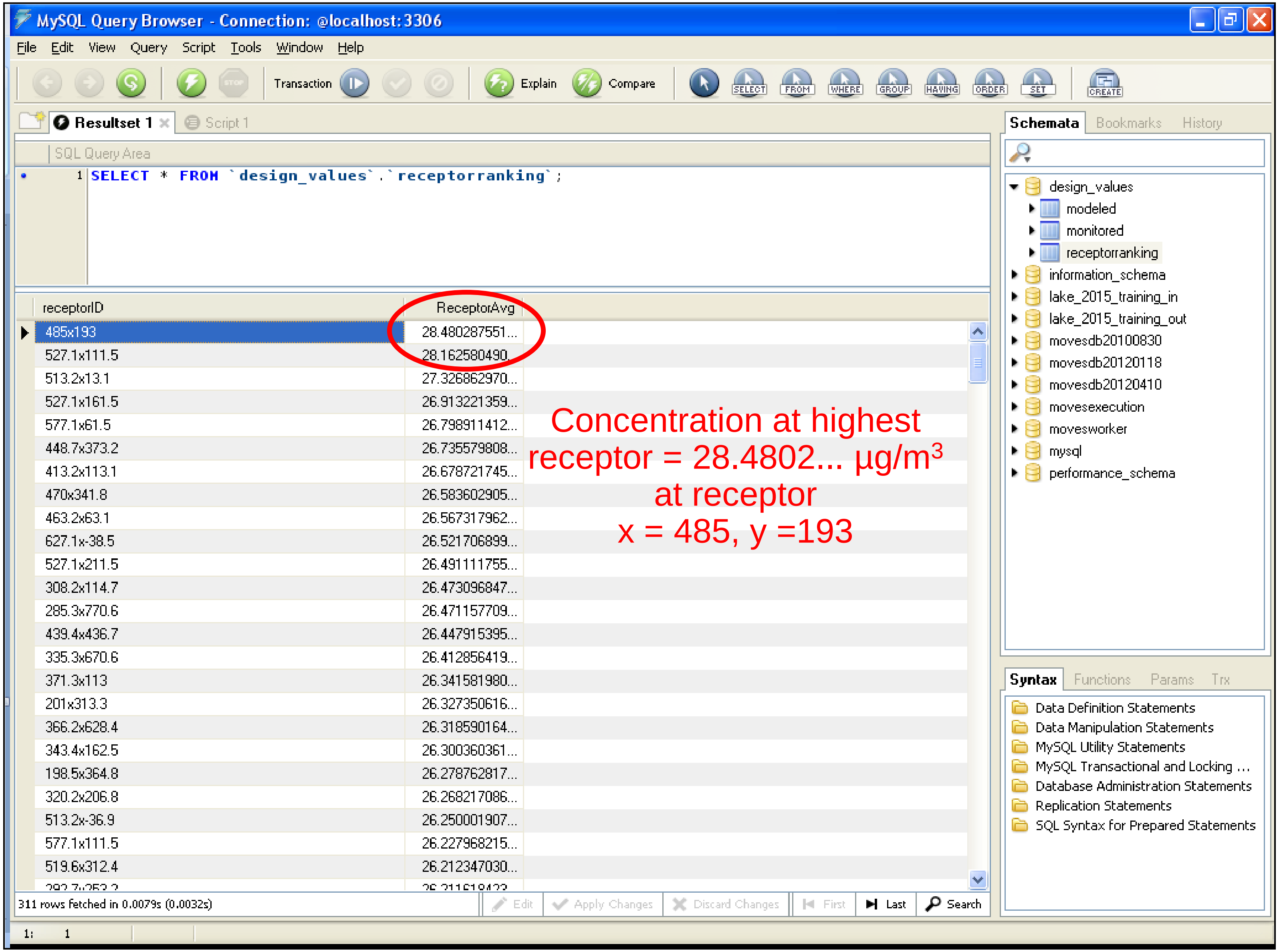


This statement will show the results from the script using the highway/transit project data

"ReceptorAvg" column = DVs

Concentrations are ranked in descending order (i.e., receptor with highest DV is listed first)

Viewing highway/transit project DV results in MySQL Query Browser



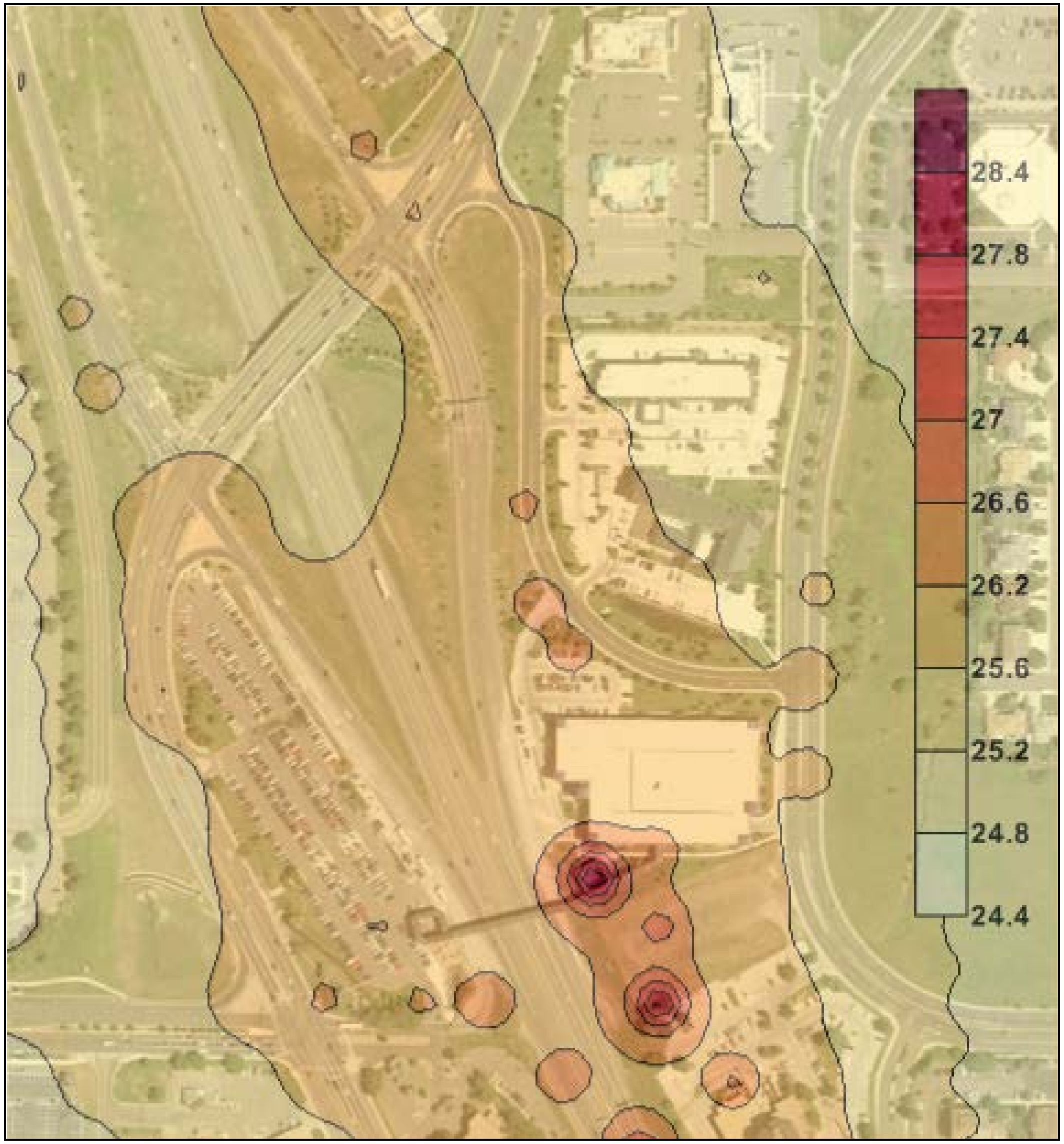
Determining Conformity to the **24-hour $PM_{2.5}$ NAAQS** for Highway/Transit Project

- Highest concentration of 28.4802… $\mu g/m^3$ rounds to 28 $\mu g/m^3$ (nearest whole number) per design value procedures for this NAAQS

- 28 $\mu g/m^3 \leq$ 35 $\mu g/m^3$ (24-hour $PM_{2.5}$ NAAQS)
  $\longrightarrow$ **project conforms** to the NAAQS

- Modeling no-build concentrations and comparing design values to build scenario is therefore unnecessary for this NAAQS

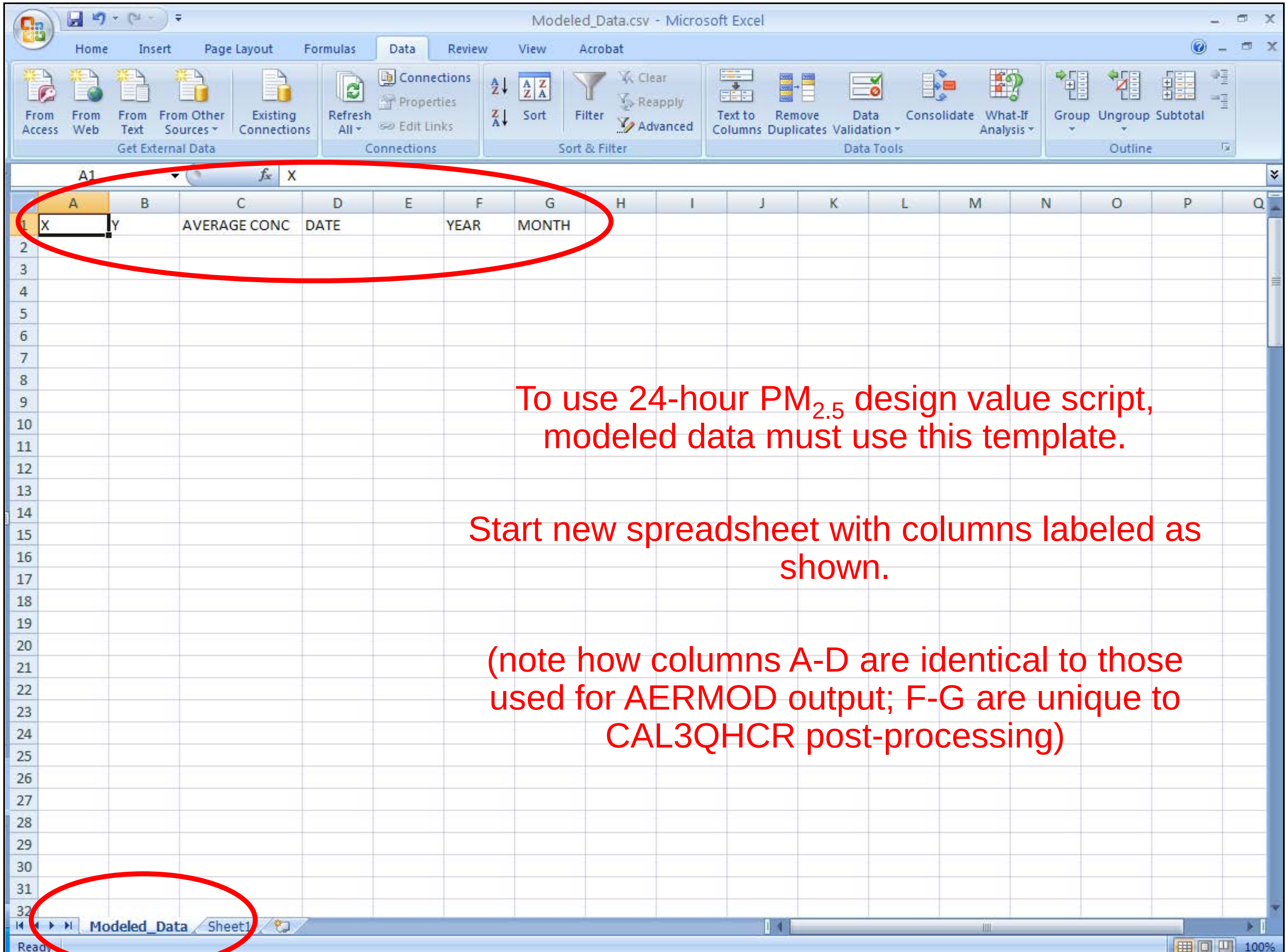
Contour Plot of **24-hour $PM_{2.5}$** DVs



Tips for preparing modeled data – CAL3QHCR output

- To use 24-hour $PM_{2.5}$ MySQL script, CAL3QHCR data must be post-processed to use same .csv template used for AERMOD output
- CAL3QHCR data will be moved into template one quarter at a time (20 quarters total for five years met data) using data from quarterly plot file (*.plt) output

Tips for preparing modeled data – CAL3QHCR output

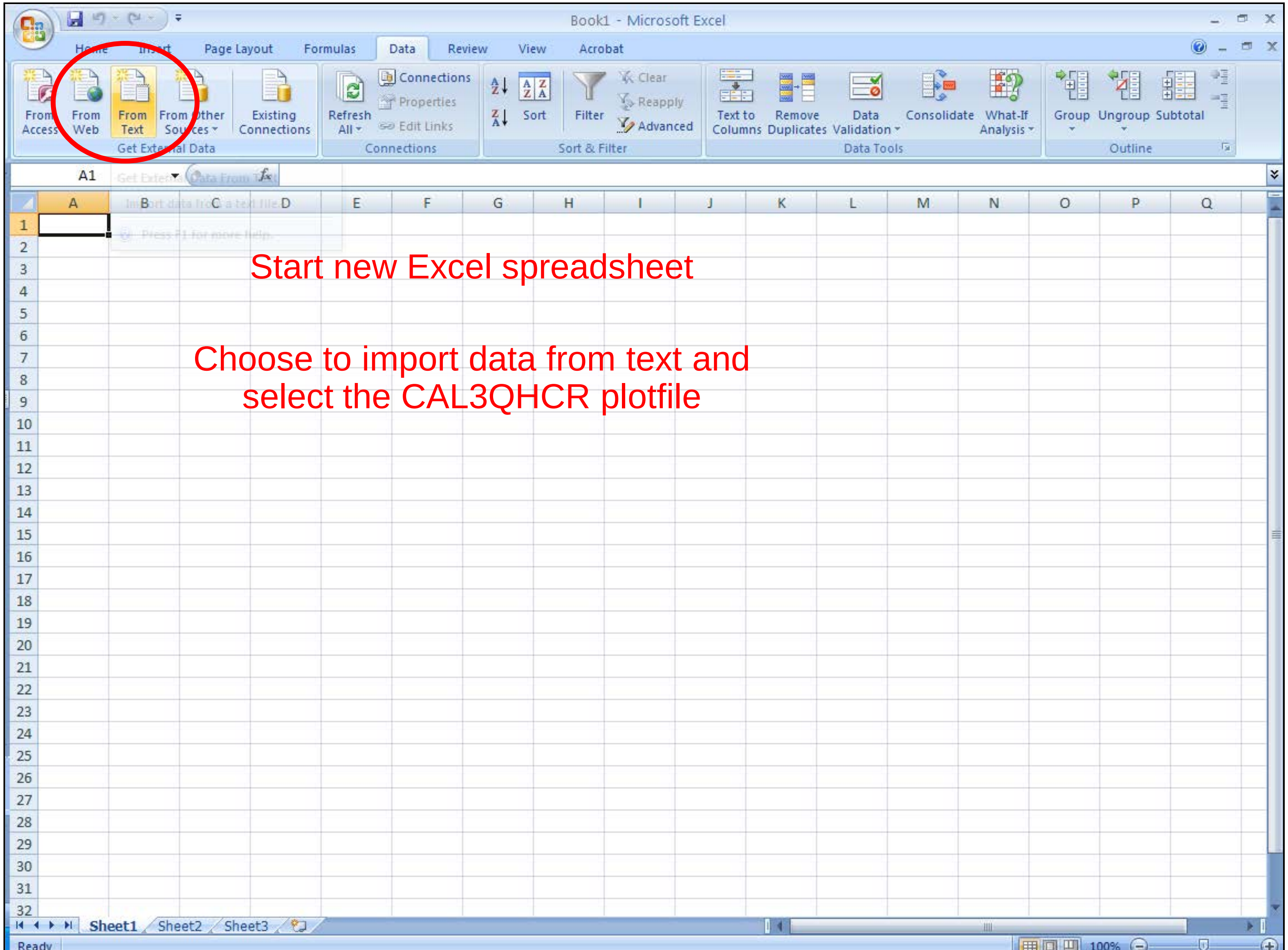


To use 24-hour $PM_{2.5}$ design value script, modeled data must use this template.

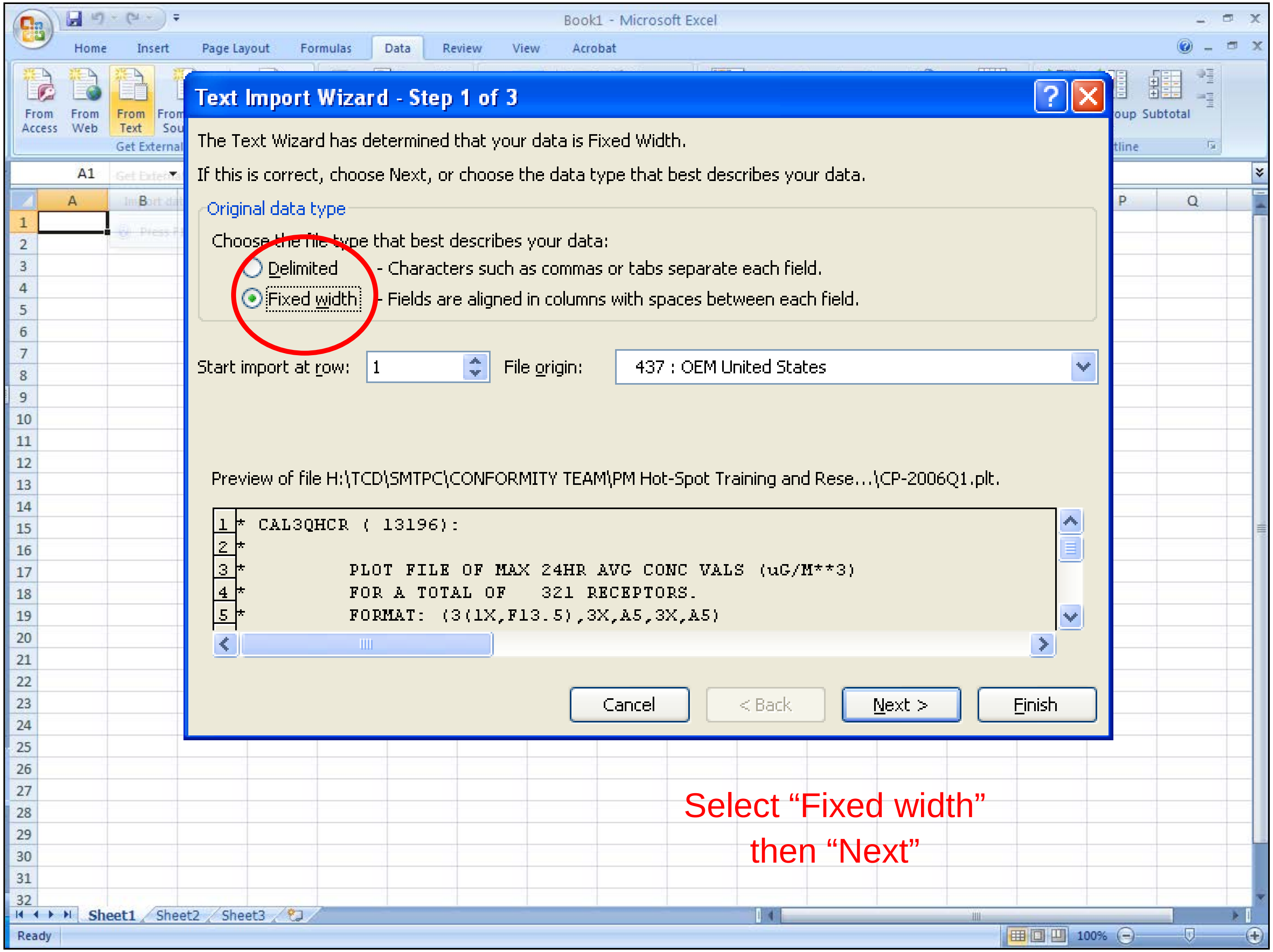
Start new spreadsheet with columns labeled as shown.

(note how columns A-D are identical to those used for AERMOD output; F-G are unique to CAL3QHCR post-processing)

Tips for preparing modeled data – CAL3QHCR output

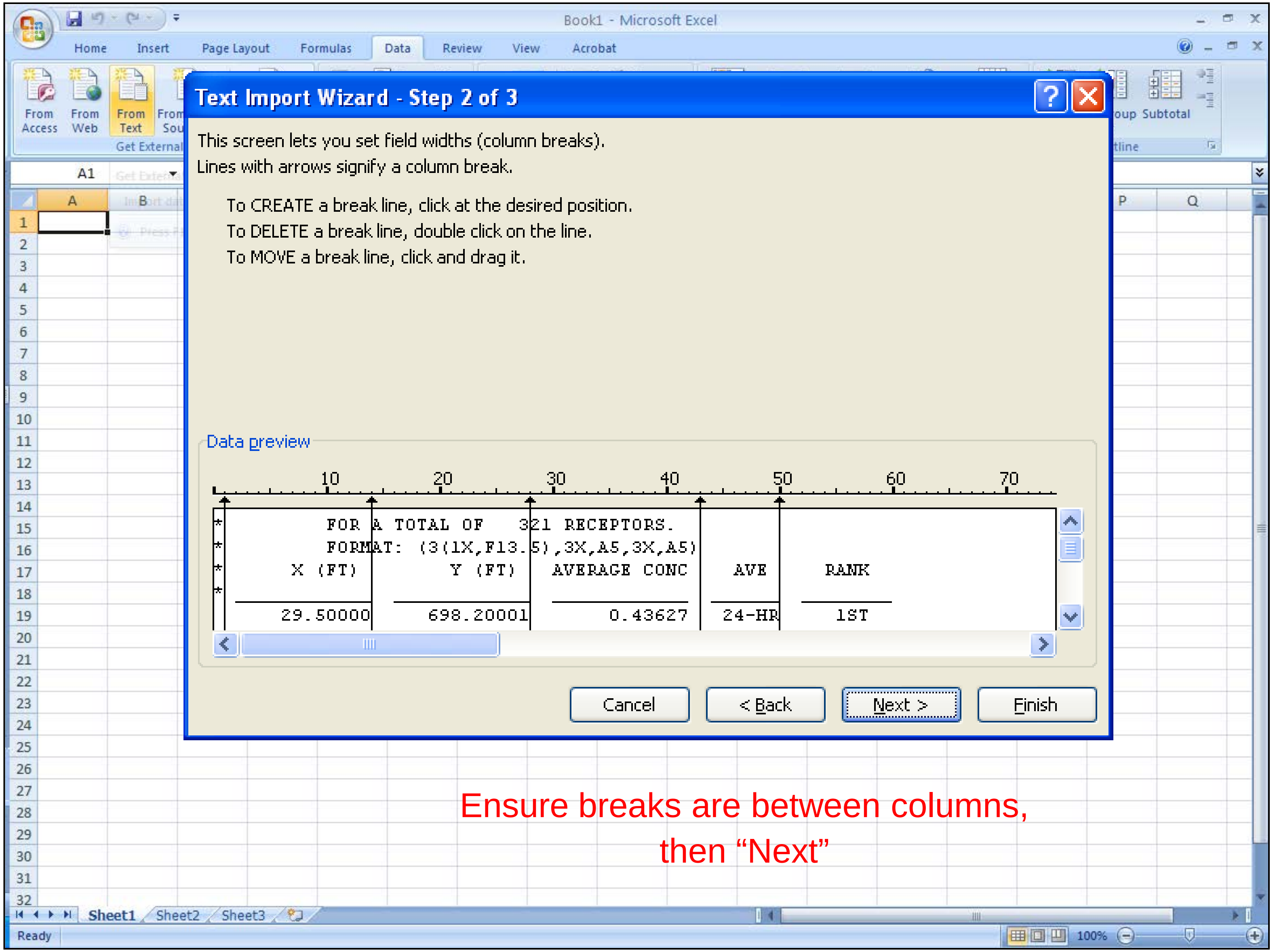


Tips for preparing modeled data – CAL3QHCR output



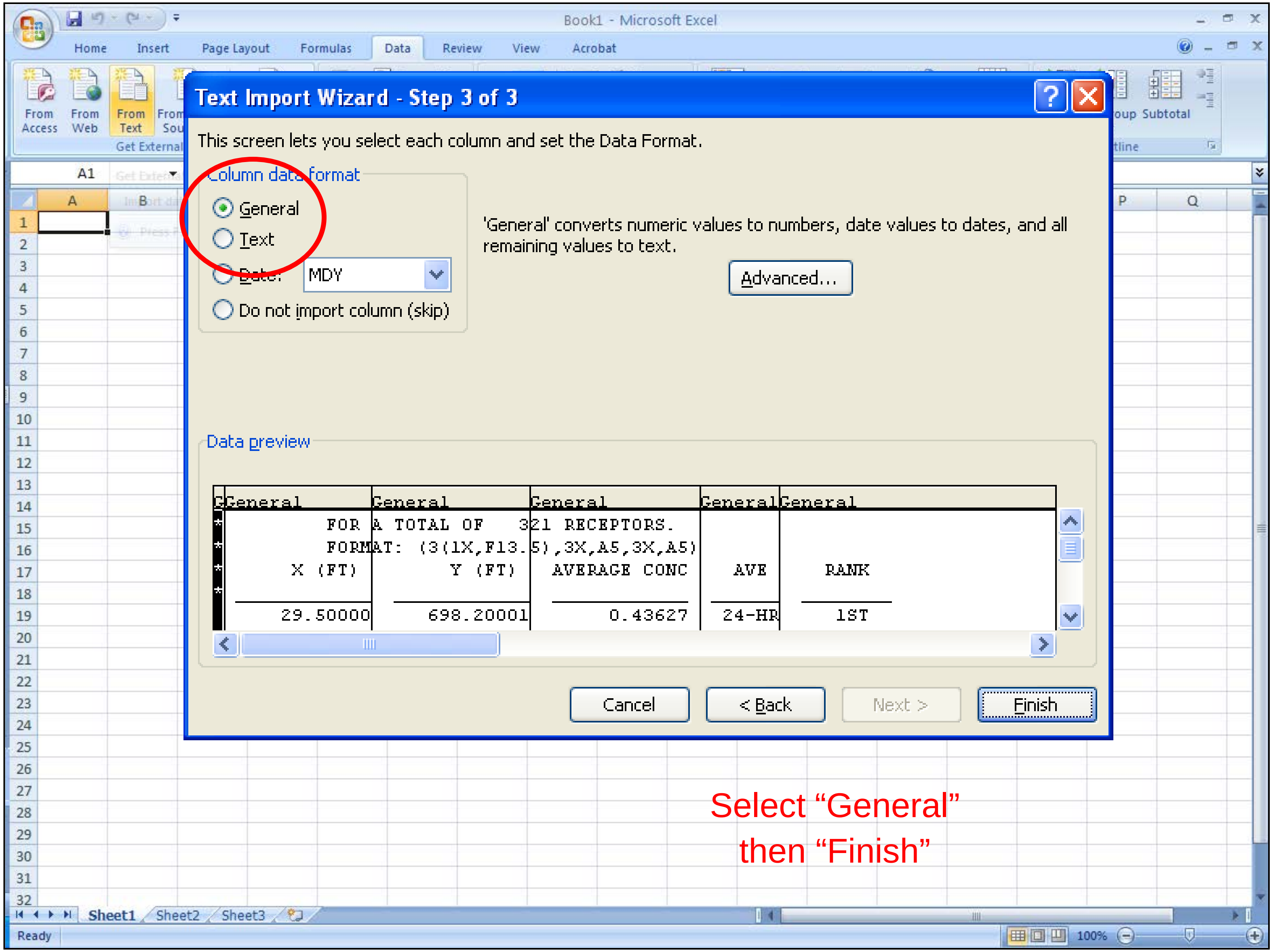
Select “Fixed width” then “Next”

Tips for preparing modeled data – CAL3QHCR output



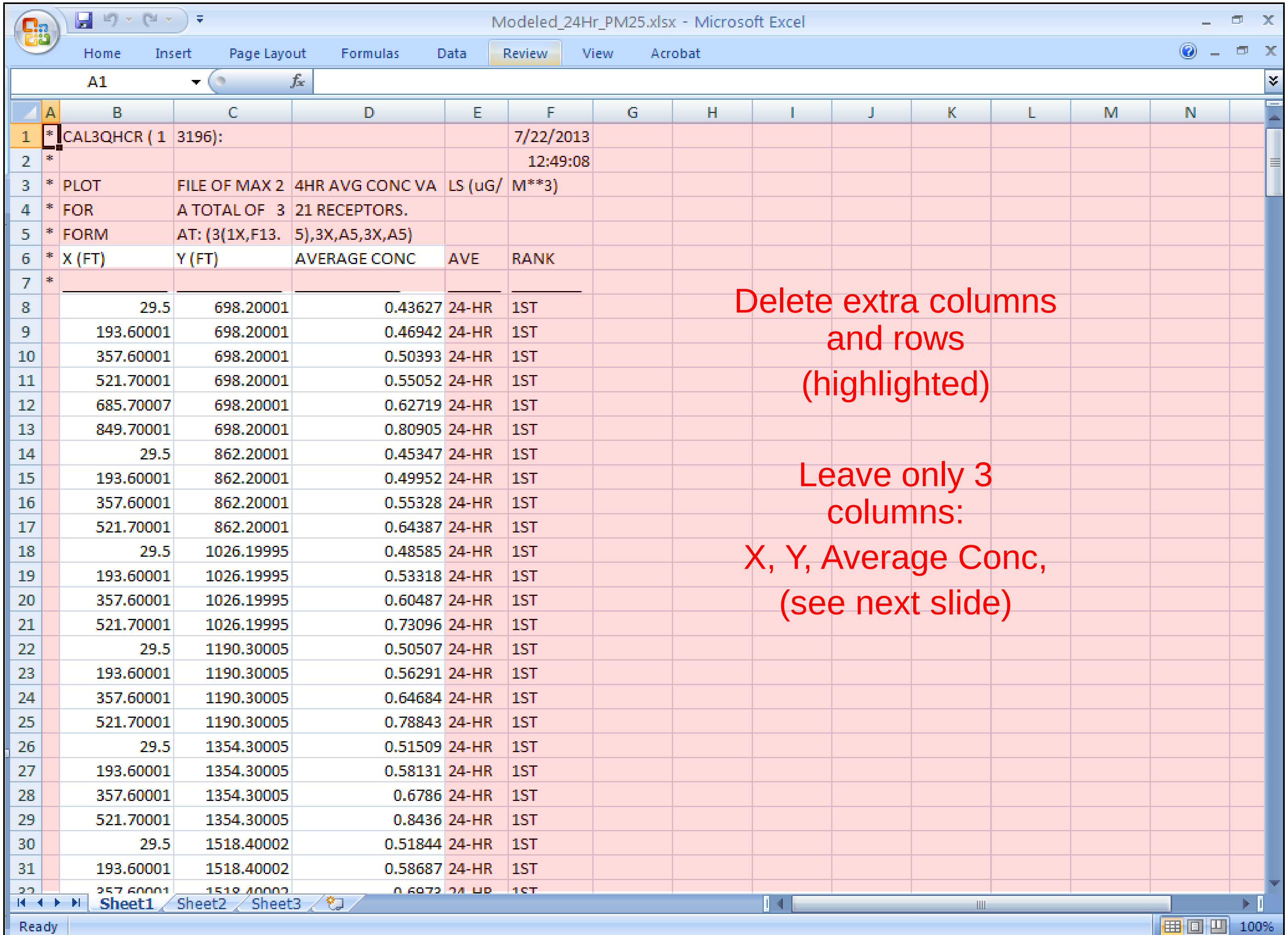
Ensure breaks are between columns, then “Next”

Tips for preparing modeled data – CAL3QHCR output



Select "General" then "Finish"

Tips for preparing modeled data – CAL3QHCR output



	A	B	C	D	E	F
1	*	CAL3QHCR (1	3196):			7/22/2013
2	*					12:49:08
3	*	PLOT	FILE OF MAX 2	4HR AVG CONC VA	LS (uG/	M**3)
4	*	FOR	A TOTAL OF 3	21 RECEPTORS.		
5	*	FORM	AT: (3(1X,F13.	5),3X,A5,3X,A5)		
6	*	X (FT)	Y (FT)	AVERAGE CONC	AVE	RANK
7	*	____________	____________	____________	______	________
8		29.5	698.20001	0.43627	24-HR	1ST
9		193.60001	698.20001	0.46942	24-HR	1ST
10		357.60001	698.20001	0.50393	24-HR	1ST
11		521.70001	698.20001	0.55052	24-HR	1ST
12		685.70007	698.20001	0.62719	24-HR	1ST
13		849.70001	698.20001	0.80905	24-HR	1ST
14		29.5	862.20001	0.45347	24-HR	1ST
15		193.60001	862.20001	0.49952	24-HR	1ST
16		357.60001	862.20001	0.55328	24-HR	1ST
17		521.70001	862.20001	0.64387	24-HR	1ST
18		29.5	1026.19995	0.48585	24-HR	1ST
19		193.60001	1026.19995	0.53318	24-HR	1ST
20		357.60001	1026.19995	0.60487	24-HR	1ST
21		521.70001	1026.19995	0.73096	24-HR	1ST
22		29.5	1190.30005	0.50507	24-HR	1ST
23		193.60001	1190.30005	0.56291	24-HR	1ST
24		357.60001	1190.30005	0.64684	24-HR	1ST
25		521.70001	1190.30005	0.78843	24-HR	1ST
26		29.5	1354.30005	0.51509	24-HR	1ST
27		193.60001	1354.30005	0.58131	24-HR	1ST
28		357.60001	1354.30005	0.6786	24-HR	1ST
29		521.70001	1354.30005	0.8436	24-HR	1ST
30		29.5	1518.40002	0.51844	24-HR	1ST
31		193.60001	1518.40002	0.58687	24-HR	1ST
32		357.60001	1518.40002	0.6973	24-HR	1ST

Delete extra columns and rows (highlighted)

Leave only 3 columns: X, Y, Average Conc, (see next slide)

Tips for preparing modeled data – CAL3QHCR output

Modeled_24Hr_PM25.xlsx - Microsoft Excel

X (FT)	Y (FT)	AVERAGE CONC	Date		Year	Month
29.5	698.20001	0.43627				
193.60001	698.20001	0.46942				
357.60001	698.20001	0.50393				
521.70001	698.20001	0.55052				
685.70007	698.20001	0.62719				
849.70001	698.20001	0.80905				
29.5	862.20001	0.45347				
193.60001	862.20001	0.49952				
357.60001	862.20001	0.55328				
521.70001	862.20001	0.64387				
29.5	1026.19995	0.48585				
193.60001	1026.19995	0.53318				
357.60001	1026.19995	0.60487				
521.70001	1026.19995	0.73096				
29.5	1190.30005	0.50507				
193.60001	1190.30005	0.56291				
357.60001	1190.30005	0.64684				
521.70001	1190.30005	0.78843				
29.5	1354.30005	0.51509				
193.60001	1354.30005	0.58131				
357.60001	1354.30005	0.6786				
521.70001	1354.30005	0.8436				
29.5	1518.40002	0.51844				
193.60001	1518.40002	0.58687				
357.60001	1518.40002	0.6973				
521.70001	1518.40002	0.91396				
29.5	1682.40002	0.51768				
193.60001	1682.40002	0.58856				
357.60001	1682.40002	0.70744				
521.70001	1682.40002	0.99466				
29.5	1846.50012	0.51685				

Add headings for date, year, and month columns

Tips for preparing modeled data – CAL3QHCR output

Modeled_24Hr_PM25.xlsx - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Acrobat

F2 | 06

	A	B	C	D	E	F	G
1	X (FT)	Y (FT)	AVERAGE CONC	Date		Year	Month
2	29.5	698.20001	0.43627			06	01
3	193.60001	698.20001	0.46942			06	01
4	357.60001	698.20001	0.50393			06	01
5	521.70001	698.20001	0.55052			06	01
6	685.70007	698.20001	0.62719			06	01
7	849.70001	698.20001	0.80905			06	01
8	29.5	862.20001	0.45347			06	01
9	193.60001	862.20001	0.49952			06	01
10	357.60001	862.20001	0.55328			06	01
11	521.70001	862.20001	0.64387			06	01
12	29.5	1026.19995	0.48585			06	01
13	193.60001	1026.19995	0.53318			06	01
14	357.60001	1026.19995	0.60487			06	01
15	521.70001	1026.19995	0.73096			06	01
16	29.5	1190.30005	0.50507			06	01
17	193.60001	1190.30005	0.56291			06	01
18	357.60001	1190.30005	0.64684			06	01
19	521.70001	1190.30005	0.78843			06	01
20	29.5	1354.30005	0.51509			06	01
21	193.60001	1354.30005	0.58131			06	01
22	357.60001	1354.30005	0.6786			06	01
23	521.70001	1354.30005	0.8436			06	01
24	29.5	1518.40002	0.51844			06	01
25	193.60001	1518.40002	0.58687			06	01
26	357.60001	1518.40002	0.6973			06	01
27	521.70001	1518.40002	0.91396			06	01
28	29.5	1682.40002	0.51768			06	01
29	193.60001	1682.40002	0.58856			06	01
30	357.60001	1682.40002	0.70744			06	01
31	521.70001	1682.40002	0.99466			06	01
32	29.5	1846.50012	0.51685			06	01

Sheet1 Sheet2 Sheet3

Select destination and press ENTER or choose Paste

100%

Fill in year and month

For "month", insert first month of quarter being modeled:

Jan-Mar: month = 01

Apr-Jun: month = 04

Jul-Sep: month = 07

Oct-Dec: month = 10

Year and month entries **MUST** show in 2 digits (e.g., "04" not "4")

Change cell type to "text"

Year 2006, Quarter 1 shown

Tips for preparing modeled data – CAL3QHCR output

Modeled_24Hr_PM25.xlsx - Microsoft Excel

G6421 | 10

	A	B	C	D	E	F	G
6392	1201.40002	2061.69995	0.81752			10	10
6393	284.39999	2558.1001	0.88081			10	10
6394	1591.19995	633.20001	2.03046			10	10
6395	2057.3999	1062.69995	0.55524			10	10
6396	2071.19995	1253	0.51076			10	10
6397	1403.19995	1782.50012	0.83031			10	10
6398	1444.90015	1637.09998	0.80756			10	10
6399	1441.6001	1432.69995	0.94486			10	10
6400	1126.59998	533.09998	0.69803			10	10
6401	1050.5	678.50006	0.7319			10	10
6402	960.29999	830.70007	0.72701			10	10
6403	908.5	948.50006	0.72978			10	10
6404	859.90002	1059.1001	0.76204			10	10
6405	1480.30005	1973.80005	0.64257			10	10
6406	898.30005	558.09998	0.70766			10	10
6407	1218.19995	370.70001	0.66833			10	10
6408	732	1426.5	0.97448			10	10
6409	659.40002	1027.90002	0.99676			10	10
6410	651.20001	1196.90002	1.07214			10	10
6411	627	1382.19995	0.97729			10	10
6412	885.80005	1207.30005	0.95125			10	10
6413	974.40002	1079.40002	1.02042			10	10
6414	1036.69995	984.30005	1.04122			10	10
6415	1131.90002	849.70001	1.08434			10	10
6416	1236.90002	692.30005	1.25677			10	10
6417	1328.70007	554.5	1.32807			10	10
6418	1627.30005	823.50006	1.06035			10	10
6419	1528.90002	1000.70001	1.1589			10	10
6420	1692.90002	859.59998	0.86037			10	10
6421	1843.80005	866.09998	0.64483			10	10
6422							

Sheet1 | Sheet2 | Sheet3

Repeat for remaining quarters

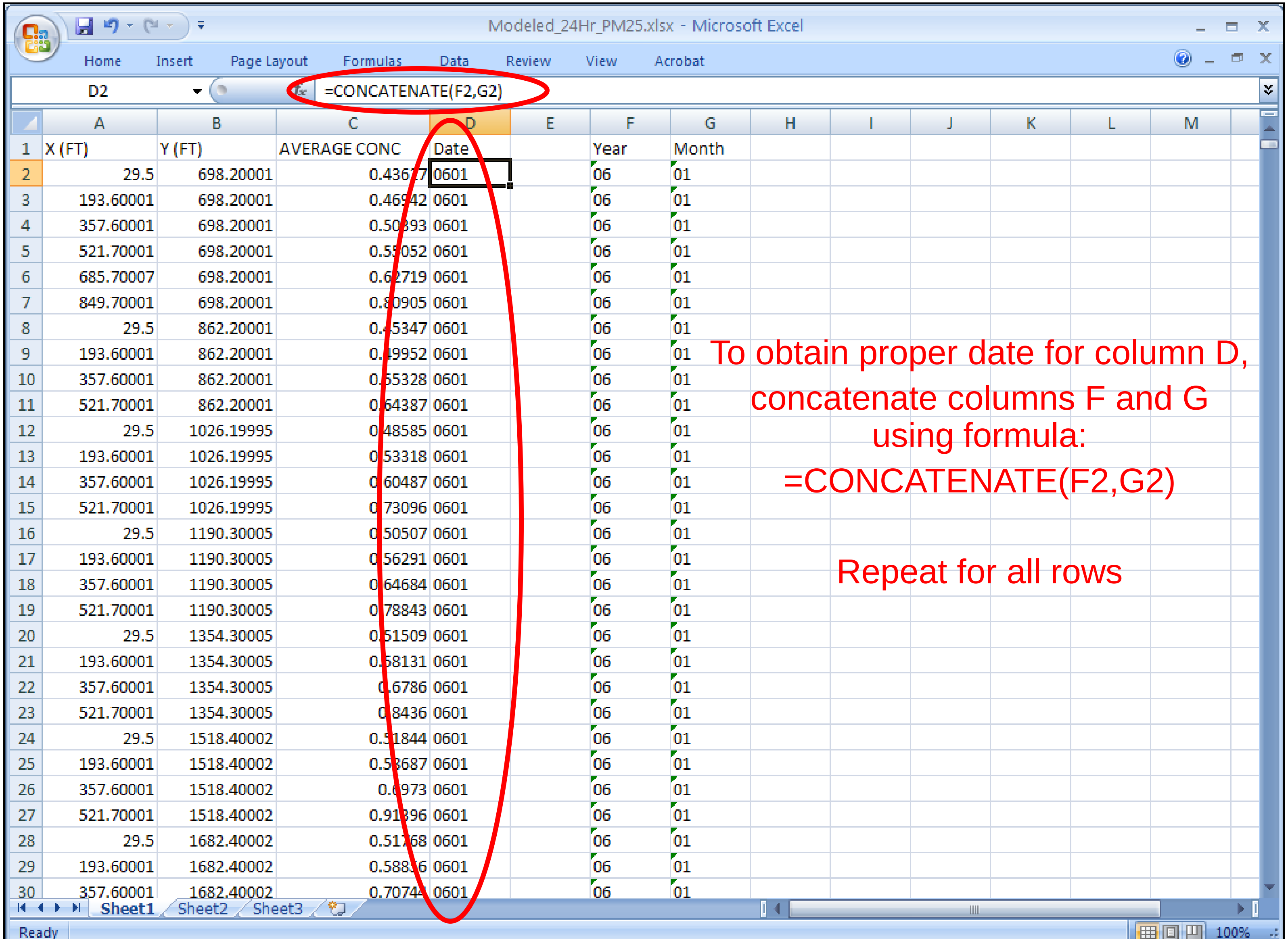
(20 quarters total for 5 years data)

Tip: Add the year/month after each quarter is imported to reduce possibility of error

For class highway project, will have 6420 lines of data

(321 receptors x 20 quarters)

Tips for preparing modeled data – CAL3QHCR output



	A	B	C	D	E	F	G
1	X (FT)	Y (FT)	AVERAGE CONC	Date		Year	Month
2	29.5	698.20001	0.43627	0601		06	01
3	193.60001	698.20001	0.46942	0601		06	01
4	357.60001	698.20001	0.50393	0601		06	01
5	521.70001	698.20001	0.55052	0601		06	01
6	685.70007	698.20001	0.62719	0601		06	01
7	849.70001	698.20001	0.80905	0601		06	01
8	29.5	862.20001	0.45347	0601		06	01
9	193.60001	862.20001	0.49952	0601		06	01
10	357.60001	862.20001	0.55328	0601		06	01
11	521.70001	862.20001	0.64387	0601		06	01
12	29.5	1026.19995	0.48585	0601		06	01
13	193.60001	1026.19995	0.53318	0601		06	01
14	357.60001	1026.19995	0.60487	0601		06	01
15	521.70001	1026.19995	0.73096	0601		06	01
16	29.5	1190.30005	0.50507	0601		06	01
17	193.60001	1190.30005	0.56291	0601		06	01
18	357.60001	1190.30005	0.64684	0601		06	01
19	521.70001	1190.30005	0.78843	0601		06	01
20	29.5	1354.30005	0.51509	0601		06	01
21	193.60001	1354.30005	0.58131	0601		06	01
22	357.60001	1354.30005	0.6786	0601		06	01
23	521.70001	1354.30005	0.8436	0601		06	01
24	29.5	1518.40002	0.51844	0601		06	01
25	193.60001	1518.40002	0.58687	0601		06	01
26	357.60001	1518.40002	0.6973	0601		06	01
27	521.70001	1518.40002	0.91396	0601		06	01
28	29.5	1682.40002	0.51768	0601		06	01
29	193.60001	1682.40002	0.58856	0601		06	01
30	357.60001	1682.40002	0.70744	0601		06	01

To obtain proper date for column D, concatenate columns F and G using formula:

=CONCATENATE(F2,G2)

Repeat for all rows

Tips for preparing modeled data – CAL3QHCR output

Modeled_24Hr_PM25.xlsx - Microsoft Excel

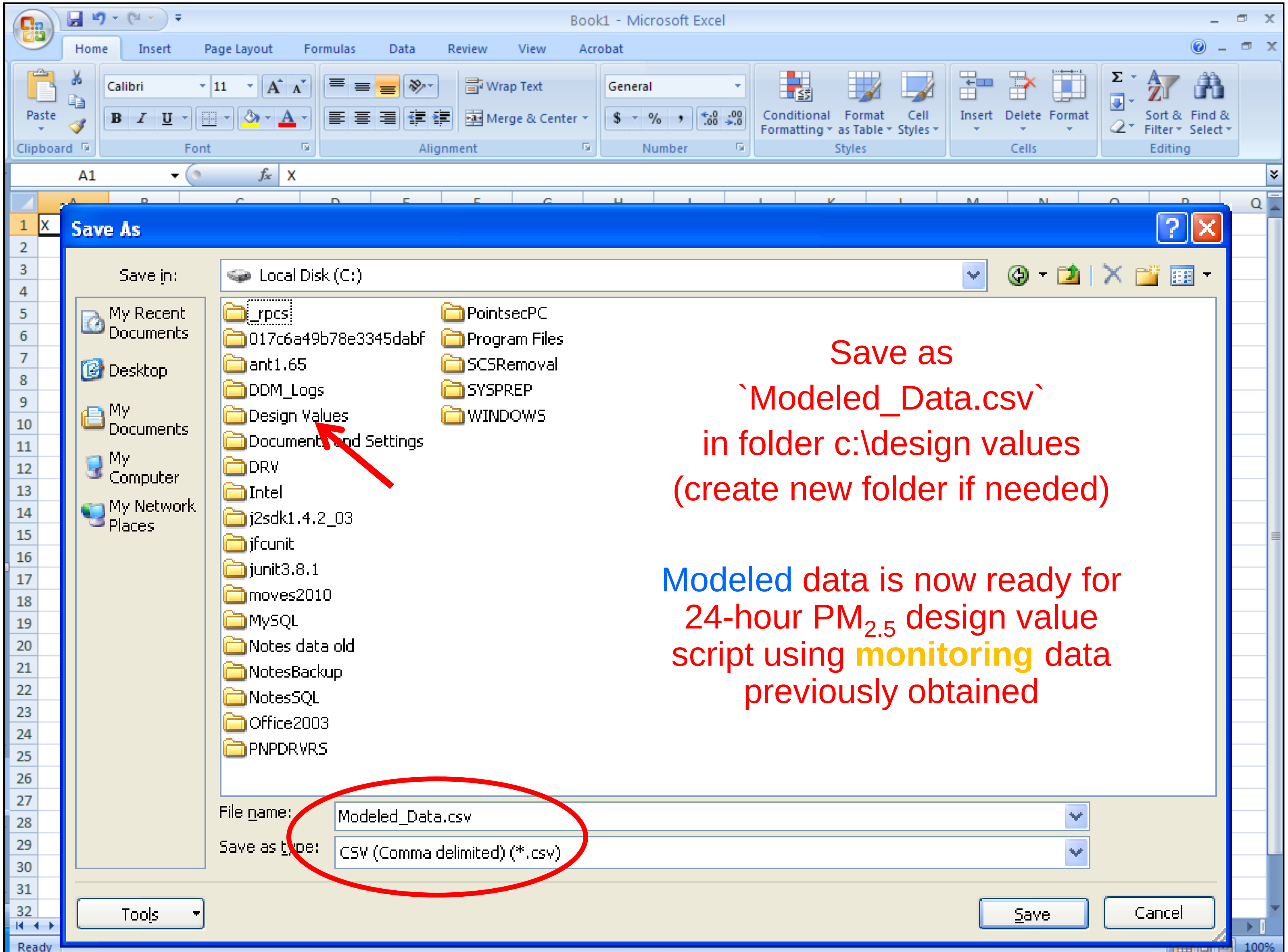
	A	B	C	D	E	F	G
1	X (FT)	Y (FT)	AVERAGE CONC	Date		Year	Month
2	29.5	698.20001	0.43627	0601		06	01
3	193.60001	698.20001	0.46942	0601		06	01
4	357.60001	698.20001	0.50393	0601		06	01
5	521.70001	698.20001	0.55052	0601		06	01
6	685.70007	698.20001	0.62719	0601		06	01
7	849.70001	698.20001	0.80905	0601		06	01
8	29.5	862.20001	0.45347	0601		06	01
9	193.60001	862.20001	0.49952	0601		06	01
10	357.60001	862.20001	0.55328	0601		06	01
11	521.70001	862.20001	0.64387	0601		06	01
12	29.5	1026.19995	0.48585	0601		06	01
13	193.60001	1026.19995	0.53318	0601		06	01
14	357.60001	1026.19995	0.60487	0601		06	01
15	521.70001	1026.19995	0.73096	0601		06	01
16	29.5	1190.30005	0.50507	0601		06	01
17	193.60001	1190.30005	0.56291	0601		06	01
18	357.60001	1190.30005	0.64684	0601		06	01
19	521.70001	1190.30005	0.78843	0601		06	01
20	29.5	1354.30005	0.51509	0601		06	01
21	193.60001	1354.30005	0.58131	0601		06	01
22	357.60001	1354.30005	0.6786	0601		06	01
23	521.70001	1354.30005	0.8436	0601		06	01
24	29.5	1518.40002	0.51844	0601		06	01
25	193.60001	1518.40002	0.58687	0601		06	01
26	357.60001	1518.40002	0.6973	0601		06	01
27	521.70001	1518.40002	0.91396	0601		06	01
28	29.5	1682.40002	0.51768	0601		06	01
29	193.60001	1682.40002	0.58856	0601		06	01
30	357.60001	1682.40002	0.70744	0601		06	01
31	521.70001	1682.40002	0.99466	0601		06	01
32	29.5	1846.50012	0.51685	0601		06	01

Sheet1 Sheet2 Sheet3

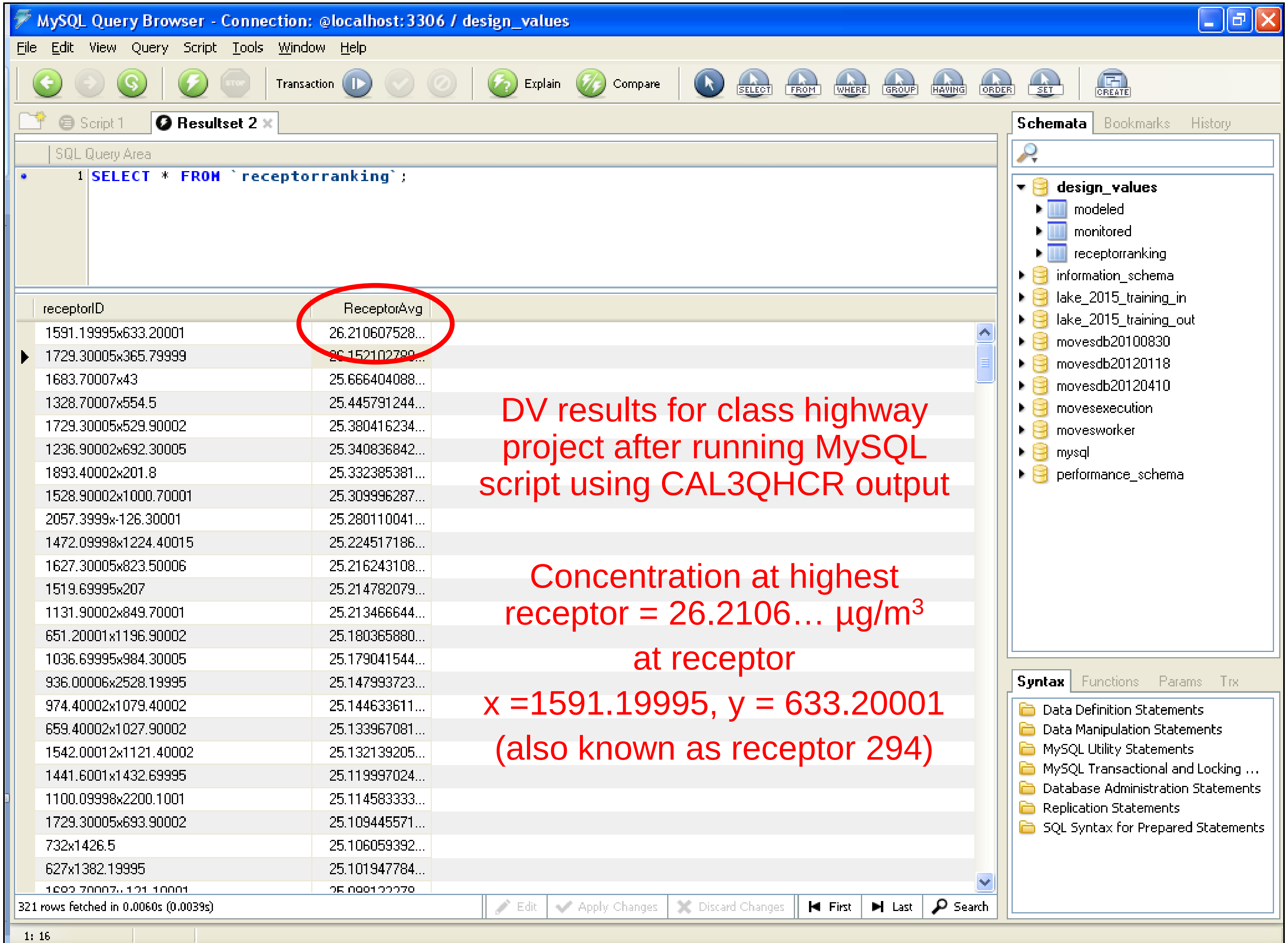
Properly prepared modeled data:
One header row only with columns of data in order/format shown

(columns other than A-D will be ignored by MySQL script)

Tips for preparing modeled data – Saving as .csv file



Viewing highway project results in MySQL Query Browser



DV results for class highway project after running MySQL script using CAL3QHCR output

Concentration at highest receptor = 26.2106… µg/m³

at receptor

x =1591.19995, y = 633.20001

(also known as receptor 294)

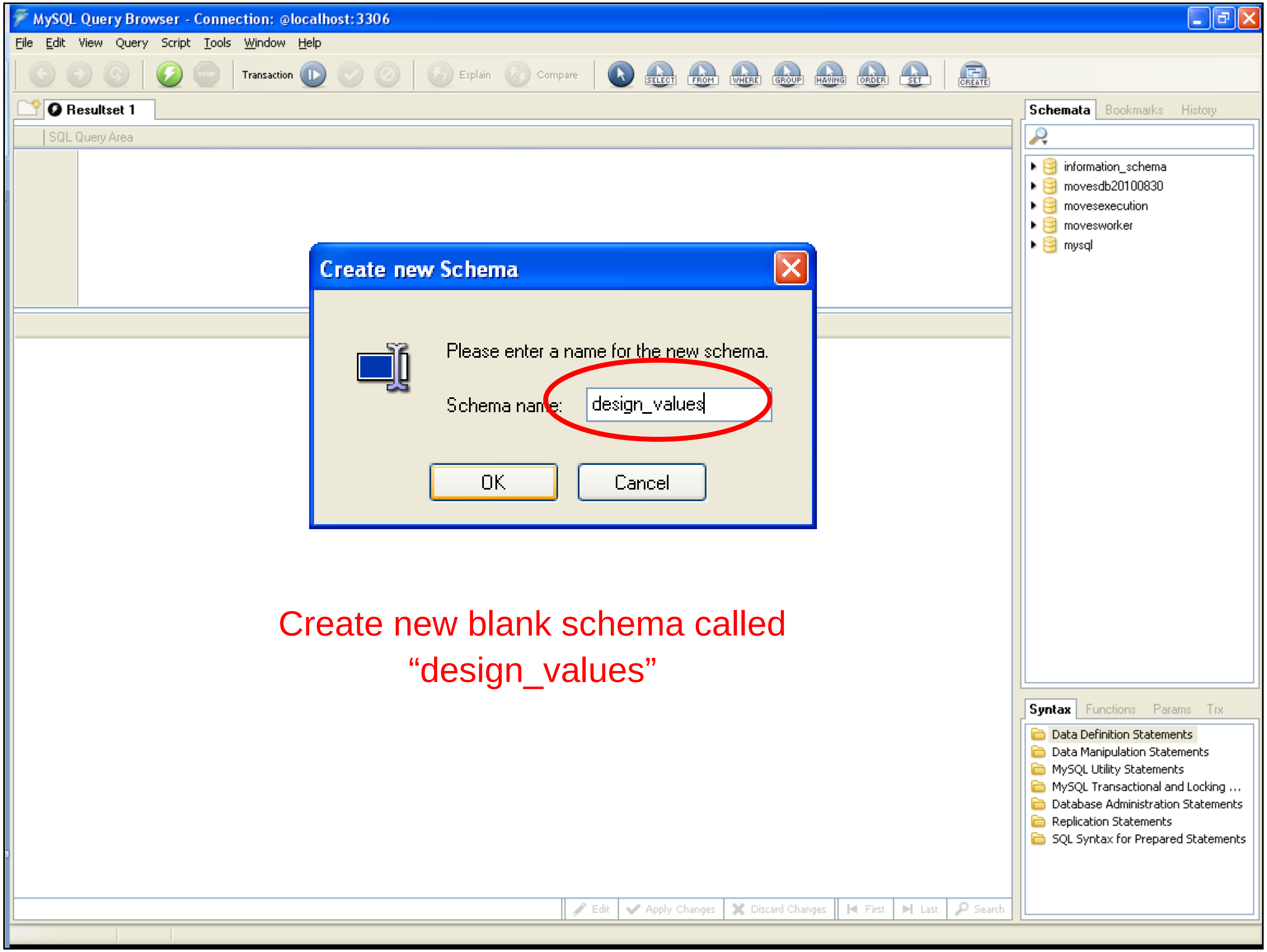
Determining Conformity to the **24-hour $PM_{2.5}$ NAAQS** for Highway Project

- Highest concentration of 26.2106… µg/m^3 rounds to 26 µg/m^3 (nearest whole number) per design value procedures for this NAAQS

- 26 µg/m^3 $\leq$ 35 µg/m^3 (24-hour $PM_{2.5}$ NAAQS) → **project conforms** to the NAAQS

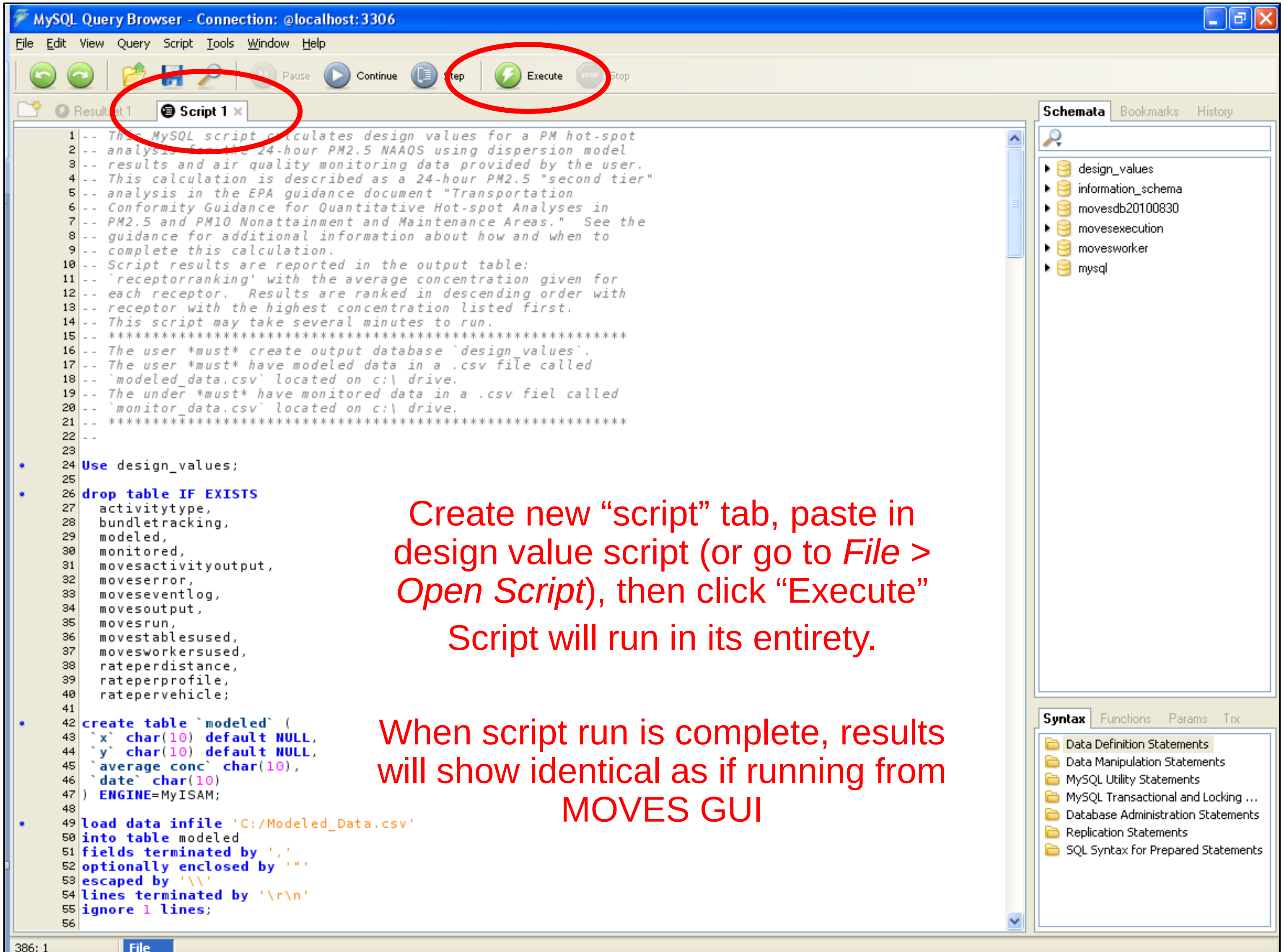
- Modeling no-build concentrations and comparing design values to build scenario is therefore unnecessary for this NAAQS

Running script directly using MySQL Query Browser



Create new blank schema called "design_values"

Running script directly using MySQL Query Browser



Create new "script" tab, paste in design value script (or go to *File > Open Script*), then click "Execute"

Script will run in its entirety.

When script run is complete, results will show identical as if running from MOVES GUI

Calculating Design Values for the *24-hour PM_{10} NAAQS*

24-hour PM_{10} NAAQS

- Compliance with the NAAQS is based on the expected number of exceedances of the level (currently 150 µg/m^3)

- NAAQS is met when expected number of exceedances, averaged over 3 consecutive years, is $\leq$ 1.0:

Expected exceedances = [total exceedances in 3 years] ÷ 3

- Design value is rounded to nearest 10 µg/m^3

Guidance Reference:

Section 9.3.4

24-hour PM_{10} NAAQS

To calculate the design value, you need:

- Air quality <u>modeling</u> results
  - » If you used 5 years of met data for air quality modeling, calculate the 6th highest 24-hour modeled concentration at each receptor
- Air quality <u>monitoring</u> data
  - » 12 quarters of background concentration measurements (4 quarters for 3 consecutive years)

24-hour PM_{10} NAAQS

- Step 1: For each receptor, identify the 6th highest 24-hour concentration across 5 years of met data
  - » If using AERMOD – model can produce these values:
    - – **CO** pathway: Specify **AVERTIME H6H**
    - – **OU** pathway: Specify **RECTABLE**
    - – These selections will generate a postfile with each receptor's sixth highest value across all years of met data
  - » If using CAL3QHCR – post-processing is needed. Look at same receptor in all 20 output files to find 6th highest value
- Step 2: Identify the highest of these values
  - » If using AERMOD, the highest 6th highest value will be identified
- Step 3: Identify the highest 24-hour background concentration from the 3 most recent years of monitoring data

24-hour PM_{10} NAAQS

- Step 4: Add:

  Step 2 result ← (highest 6th highest concentration)

  \+ Step 3 result ← (highest background concentration)

  [Step 4 result]

- Step 5: Round to nearest 10 µg/m³
  - » This is the **highest DV in the build scenario**
  - » If build DV ≤ 24-hour PM10 NAAQS (150 µg/m³): project conforms

    You're done!

If not, a build/no-build comparison is needed

24-hour PM_{10} NAAQS

Build Scenario

- Step 6: For each receptor, add

Step 1 result ← (6th highest modeled concentration)

\+ Step 3 result ← (highest background concentration)

[Step 6 result]

- Step 7: Round to nearest 10 µg/m^3
  - These are the **build scenario DVs**
  - Identify all receptors where build scenario DVs > 150 µg/m^3

24-hour PM_{10} NAAQS

No-Build Scenario

- Step 8: From **no-build** AQ modeling results, identify the 6th highest modeled concentration at each receptor identified

- Step 9: Add

  Step 8 result ← (6th highest modeled concentration)

  \+ Step 3 result ← (highest background concentration)

  [Step 9 result]

- Step 10: Round to nearest 10 μg/m^3
  - » These are the **no-build scenario DVs**
  - » Compare; if build DVs ≤ no-build DVs, conformity is met

24-hour PM_{10} NAAQS

- Next set of slides show tips for preparing data for the design value calculation

  » Provided for later reference

⟶ ***Go to Slide 122***

Tips for Preparing Data When Calculating *24-hour PM_{10} NAAQS* Design Values

Tips for preparing modeled data – AERMOD output

24-hour PM_{10} NAAQS

PM10H6H_output.txt - Notepad

File Edit Format View Help

```
              *** THE   6TH HIGHEST 24-HR AVERAGE CONCENTRATION   VALUES FOR SOURCE GROUP:  PROJECT   ***
                    INCLUDING SOURCE(S):      LINK1    , LINK2    , LINK3    , LINK5    , LINK4    , LINK7    , LINK8    ,
         LINK9    , LINK6    ,

                                  *** DISCRETE CARTESIAN RECEPTOR POINTS ***

                             ** CONC OF PM10     IN MICROGRAMS/M**3                          **

     X-COORD (M)  Y-COORD (M)        CONC     (YYMMDDHH)              X-COORD (M)  Y-COORD (M)        CONC     (YYMMDDHH)
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
         -185.20       -68.50        1.19763  (94041324)                -180.20       -68.50        1.38697  (94041324)
         -175.20       -68.50        1.65840c (95022824)                -170.20       -68.50        2.01870c (91072624)
         -165.20       -68.50        2.34931c (92012824)                -160.20       -68.50        2.48944c (91072624)
         -155.20       -68.50        2.49902c (91072624)                -150.20       -68.50        2.50236c (93101524)
         -145.20       -68.50        2.49965c (93101524)                -140.20       -68.50        2.46180c (93101524)
         -135.20       -68.50        2.41171c (93111024)                -130.20       -68.50        2.28000  (94032824)
         -125.20       -68.50        2.19417  (92020324)                -120.20       -68.50        2.11336  (91072724)
         -115.20       -68.50        2.01533  (94121824)                -110.20       -68.50        1.95299  (91081224)
         -105.20       -68.50        1.87890c (91010324)                -100.20       -68.50        1.76965  (91011324)
          -95.20       -68.50        1.70189  (95121224)                -185.20       -63.50        1.25688  (94041324)
         -180.20       -63.50        1.52154  (94041324)                -175.20       -63.50        1.80600  (94041324)
         -170.20       -63.50        2.29864c (95022824)                -165.20       -63.50        2.62804c (91072624)
         -160.20       -63.50        2.80098c (91021824)                -155.20       -63.50        2.83391c (91021824)
         -150.20       -63.50        2.80472c (93101524)                -145.20       -63.50        2.81320c (93101524)
         -140.20       -63.50        2.78635c (93101524)                -135.20       -63.50        2.75226c (93111024)
         -130.20       -63.50        2.63883  (91021924)                -125.20       -63.50        2.51908c (91010324)
         -120.20       -63.50        2.44829  (91072724)                -115.20       -63.50        2.32923  (94121824)
         -110.20       -63.50        2.32954  (93110724)                -105.20       -63.50        2.17072c (91010324)
         -100.20       -63.50        2.04829  (95121224)                 -95.20       -63.50        1.88252  (91101224)
         -185.20       -58.50        1.24533  (94041324)                -180.20       -58.50        1.58453  (94041324)
         -175.20       -58.50        2.02500  (94041324)                -170.20       -58.50        2.47549  (94041324)
         -165.20       -58.50        3.09437c (91102324)                -160.20       -58.50        3.28599c (91021824)
         -155.20       -58.50        3.30983  (95011224)                -150.20       -58.50        3.26450c (91021824)
         -145.20       -58.50        3.18707  (92122924)                -140.20       -58.50        3.19570  (92122924)
         -135.20       -58.50        3.13641  (95011224)                -130.20       -58.50        2.99487c (93101524)
         -125.20       -58.50        2.86225  (91021924)                -120.20       -58.50        2.75042  (91081224)
         -115.20       -58.50        2.78615c (91031624)                -110.20       -58.50        2.68703  (91092824)
         -105.20       -58.50        2.52422  (91092824)                -100.20       -58.50        2.38279  (91032524)
         -175.20       -38.50        1.70923  (93011424)                -170.20       -38.50        2.09168c (92022224)
         -100.20       -38.50        2.46729c (95112324)                 -95.20       -38.50        2.10214c (94012024)
         -185.20       -33.50        1.10191  (93041524)                -180.20       -33.50        1.34635  (93041524)
         -175.20       -33.50        1.64744  (95031624)                -170.20       -33.50        2.09788  (93050524)
         -100.20       -33.50        2.55401c (95112324)                 -95.20       -33.50        2.22003c (91120724)
         -185.20       -28.50        1.06986  (93041524)                -180.20       -28.50        1.31654  (92042124)
         -175.20       -28.50        1.65081  (92042124)                -170.20       -28.50        2.20333  (93050524)
         -100.20       -28.50        2.86019c (95112324)                 -95.20       -28.50        2.44142  (94020224)
         -185.20       -23.50        1.05040  (93050524)                -180.20       -23.50        1.26702  (92042124)
         -175.20       -23.50        1.53686  (92042124)                -170.20       -23.50        1.90265  (94061124)


                               *** THE SUMMARY OF HIGHEST 24-HR RESULTS ***

                             ** CONC OF PM10     IN MICROGRAMS/M**3                          **

                                                 DATE                                                         NETWORK
GROUP ID                         AVERAGE CONC    (YYMMDDHH)          RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

PROJECT   HIGH  6TH HIGH VALUE IS      3.65486c ON 91102224: AT (    -110.20,      -23.50,       0.00,       0.00,      1.80)  DC
```

Receptor with highest 6th high value is specifically noted – no further action needed

Tips for preparing modeled data – CAL3QHCR output

24-hour PM_{10} NAAQS

R1PT.OUT - Notepad

File Edit Format View Help

```
                                          CAL3QHCR (Dated: 13196)

   DATE : 07/16/13                                                                              PAGE:  3
   TIME : 08:26:11

   JOB: EXAMPLE OF PM-10 ROADWAY HOT SPOT                          RUN: MAIN ST. BETWEEN DISTANT INTERSECTIONS

     ==============
     Output Section
     ==============

     NOTES PERTAINING TO THE REPORT

       1.   THE HIGHEST AVERAGE IN EACH OF THE FIRST TWO COLUMNS OF EACH TABLE BELOW ARE SUFFIXED BY AN ASTERISK (*).
            FOR PM OUTPUT, THERE IS ONLY ONE COLUMN AND ASTERISK FOR THE ANNUAL AVERAGE/PERIOD OF CONCERN TABLE.

       2.   THE NUMBERS IN PARENTHESES ARE THE JULIAN DAY AND ENDING HOUR FOR THE PRECEDING AVERAGE.

       3.   THE NUMBER OF CALM HOURS USED IN PRODUCING EACH AVERAGE ARE PREFIXED BY A C.


     PRIMARY AND SECONDARY AVERAGES.

       SIX HIGHEST 24-HOUR END-TO-END AVERAGE CONCENTRATIONS IN MICROGRAMS/M**3
       INCLUDING AMBIENT BACKGROUND CONCENTRATIONS.

          Highest                Second Highest         Third Highest          Fourth Highest         Fifth Highest          Sixth Highest
  Rcptr          Ending                 Ending                 Ending                 Ending                 Ending                 Ending
  No      Conc   Day Hr  Calm    Conc   Day Hr  Calm    Conc   Day Hr  Calm    Conc   Day Hr  Calm    Conc   Day Hr  Calm    Conc   Day Hr  Calm


  1 196.3929 (177,24) C 0 178.5712 (232,24) C 3 177.5193 (182,24) C 3 177.3578 ( 53,24) C 5 176.6059 ( 34,24) C 1 175.3931 (297,24) C 1
  2 200.5638 (306,24) C 5 187.6656 (338,24) C 2 186.0542 (251,24) C 4 185.9499 (110,24) C 1 185.0858 (190,24) C 2 183.0828 (246,24) C 2
  3 227.7060*(329,24) C 7 209.9906*(338,24) C 2 199.8850 (306,24) C 5 198.0377 (345,24) C 0 193.2741 ( 31,24) C 2 192.2264 (266,24) C 1
  4 196.6450 (347,24) C 2 193.6965 (182,24) C 3 193.3652 (314,24) C 1 183.9364 (201,24) C 2 176.7032 (181,24) C 0 172.2290 (302,24) C 5
  5 169.3567 (177,24) C 0 162.2623 (182,24) C 3 158.5169 (347,24) C 2 156.3345 (314,24) C 1 155.4557 (232,24) C 3 154.4510 (297,24) C 1
  6 172.6905 (338,24) C 2 169.1879 (306,24) C 5 168.7845 (110,24) C 1 166.0201 (329,24) C 7 159.7351 (251,24) C 4 158.4597 (246,24) C 2
  7 156.5915 (329,24) C 7 142.6181 (338,24) C 2 138.9705 (266,24) C 1 138.3498 (345,24) C 0 137.2820 (306,24) C 5 136.4953 ( 31,24) C 2
  8 138.0207 (306,24) C 5 128.9047 (251,24) C 4 128.8732 (190,24) C 2 126.1906 (246,24) C 2 125.3878 ( 49,24) C 5 124.3924 (202,24) C 6

       THE HIGHEST ANNUAL AVERAGE CONCENTRATIONS
               IN MICROGRAMS/M**3
       INCLUDING AMBIENT BACKGROUND CONCENTRATIONS.

          Receptor        Maximum   Ending
           Number          Conc     Day Hr   Calm
             1           112.2207  (366,24) C 592
             2           104.3290  (366,24) C 592
             3           109.1065  (366,24) C 592
             4           116.9981* (366,24) C 592
             5           100.8026  (366,24) C 592
             6            92.9126  (366,24) C 592
             7            84.8696  (366,24) C 592
             8            80.0952  (366,24) C 592
                                          CAL3QHCR (Dated: 13196)

   DATE : 07/16/13                                                                              PAGE:  4
```

Output file gives 6 highest values for each receptor for the quarter modeled

Tips for preparing modeled data – CAL3QHCR output

24-hour PM_{10} NAAQS

Book1.xlsx - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Receptor	1	2	3	4	5	6	7	8	9	10	11	12	13	14
2		22.7	27.91	21.81	9.98	14.44	14.72	10.4	9	11.71	8.87	11.49	9.58	6.68	7.61
3		21.49	27.66	7.61	6.62	6.78	14.08	20.83	14.9	15.53	10.46	27.62	7.58	7.55	9.61
4		21.78	27.62	6.99	23.65	5.9	15.22	20.01	5.8	6.02	13.62	12.46	7.75	19.94	7.58
5		20.64	24.97	19.6	9.07	5.8	6.02	13.62	12.46	7.75	24.97	6.65	6.38	5.51	6.96
6		19.6	23.26	23.76	27.91	11.69	17.38	24.19	6.65	6.38	5.51	8.59	21.81	9.98	24.19
7		14.85	14.49	10.4	9	11.71	14.32	10.4	9	11.71	8.73	11.49	9.58	6.68	7.61

To obtain highest 6th highest value, start a new spreadsheet

Paste in the 6 highest values for each receptor from the output file for the first quarter modeled

Sheet1 Sheet2 Sheet3

Tips for preparing modeled data – CAL3QHCR output

24-hour PM_{10} NAAQS

Book1.xlsx - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Acrobat

A1 Receptor

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Receptor	1	2	3	4	5	6	7	8	9	10	11	12	13	
2		22.7	27.91	21.81	9.98	14.44	14.72	10.4	9	11.71	8.87	11.49	9.58	6.68	7.61
3		21.49	27.66	7.61	6.62	6.78	14.08	20.83	14.9	15.53	10.46	27.62	7.58	7.55	9.61
4		21.78	27.62	6.99	23.65	5.9	15.22	20.01	5.8	6.02	13.62	12.46	7.75	19.94	7.58
5		20.64	24.97	19.6	9.07	5.8	6.02	13.62	12.46	7.75	22.44	6.65	6.38	5.51	6.96
6		19.6	23.26	23.76	27.91	11.69	17.38	20.09	6.65	6.38	5.51	8.59	21.81	9.98	24.19
7		14.85	14.49	10.4	9	11.71	14.32	10.4	9	11.71	8.73	11.49	9.58	18.7	7.61
8		6.78	14.08	13.2	14.9	15.53	11.8	19.43	14.9	15.53	10.46	27.62	7.58	7.55	9.61
9		21.81	9.98	13.5	14.77	6.02	19.4	16.89	18.02	6.02	13.62	12.46	7.75	22.1	7.58
10		7.61	6.62	6.78	14.08	17.38	12.71	10.03	19.4	17.38	21.7	6.65	6.38	14.74	6.96
11		12.71	10.03	11.69	14.91	14.61	11.5	12.71	10.03	11.69	17.38	25.01	6.65	6.38	24.05
12		11.69	17.38	10.35	12.71	11.71	16.2	11.69	17.38	10.35	14.61	5.3	8.59	21.21	7.61
13		14.28	10.4	9	11.69	15.53	14.08	13.82	10.4	9	11.71	16	11.49	9.58	9.61
14		14.08	20.83	14.9	15.2	5.9	14.2	14.08	21.1	14.9	15.53	15.2	22.54	7.58	7.58
15		10.03	11.69	17.38	14.08	12.71	12.71	10.03	11.69	17.38	25.9	6.65	6.38	5.51	6.96
16		19.6	24.19	21.09	22.1	15.1	11.69	17.38	10.35	14.61	8.96	8.59	21.8	9.98	20.9
17		23.76	27.91	19.8	9.98	14.44	16.2	10.4	9	11.71	8.87	11.49	9.58	15.07	7.61
18		21.81	27.66	7.61	6.62	6.78	14.68	20.83	14.9	15.53	10.46	22.3	7.58	7.55	9.61
19		15.1	11.69	12.71	10.03	11.69	16.4	5.8	6.02	14.44	10.4	9	7.75	17.8	7.58
20		14.44	14.9	11.69	17.38	10.35	12.71	5.51	6.78	13.82	19.98	14.9	6.38	5.51	6.96
21		6.78	12.83	14.44	10.4	9	11.69	9.98	5.9	14.72	17.4	5.8	13.6	9.98	19.98
22		5.9	14.08	14.08	20.72	14.9	14.2	6.68	12.71	12.71	10.03	11.69	9.58	6.68	7.61
23		14.5	12.71	10.03	11.69	17.38	14.05	7.55	15.1	11.69	17.38	19.8	7.58	7.55	9.61
24		21.81	11.69	17.38	10.35	14.61	14.77	23.17	14.44	14.27	10.4	9	7.75	14.5	7.58
25		20.64	14.8	10.4	9	11.71	12.71	10.03	11.69	18.2	21.2	6.65	6.38	5.51	6.96
26		19.6	14.1	18.73	14.9	15.53	11.69	17.38	10.35	14.61	8.96	8.59	17.53	11.45	19.54
27		23.76	14.08	19.56	5.8	6.02	14.78	10.4	9	11.71	8.87	11.49	12	6.68	7.61
28		21.81	6.65	6.38	5.51	6.78	14.1	20.83	14.9	15.53	10.46	12.6	7.58	7.55	9.61
29		21.81	8.59	17.4	9.98	5.9	19.4	19.99	5.8	6.02	13.62	12.46	7.75	19.5	7.58
30		20.64	11.49	9.58	6.68	12.71	12.71	10.03	11.69	17.38	14.2	17.77	6.38	12.79	6.96

Sheet1 Sheet2 Sheet3

Select destination and press ENTER or choose Paste

100%

Repeat for all 20 quarters (120 values total per receptor)

Tips for preparing modeled data – CAL3QHCR output

24-hour PM_{10} NAAQS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Receptor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2		23.76	27.91	23.76	27.91	20.83	14.44	20.83	24.19	20.83	24.19	27.62	21.81	27.62	27.62	24.97	27.62
3		21.81	27.66	21.81	27.66	17.38	14.08	20.83	24	18.22	24	27.62	19.6	27.62	24.97	20.83	24.97
4		21.81	27.62	20.64	27.62	16.66	14.08	18.22	23.65	17.82	23.65	27.62	19.1	27.62	24.97	20.31	24.19
5		20.64	24.97	19.6	24.97	15.84	12.71	18.22	14.9	17.7	21.81	24.97	19	24.97	24.19	19	24
6		19.6	24.19	19.56	24.19	15.79	11.69	17.7	14.9	17.7	19.6	24.97	19	24.97	24.19	18.9	20.31
7		19.6	24	19.49	24	15.24	11.69	17.5	14.08	17.5	19.1	24.97	18.9	24.97	24	18.22	18.9
8		19.56	23.65	19.1	23.65	15.24	11.49	17.38	13.62	17.38	19	24.97	18.9	24.19	24	18.08	14.9
9		19.49	23.59	19	23.59	15.1	11.1	17.38	13.62	17.26	19	24.19	18.9	24	15.53	17.82	13.62
10		19.1	22.91	18.9	22.91	14.44	10.82	17.26	13.62	16.66	18.9	24	15.53	23.65	14.44	17.7	13.5
11		19.1	22.91	18.83	22.91	12.96	10.59	16.66	13.5	15.84	18.9	23.65	14.44	19	12.71	17.7	13.06
12		19	22.91	15.1	14.44	12.75	10.59	16.66	13.06	15.79	18.9	18.22	13.62	18.9	12.46	17.52	10.46
13		19	20.83	14.44	14.08	12.71	10.35	15.84	13.05	15.53	18.9	17.82	12.71	12.46	12.38	17.5	9.61
14		18.9	19.6	14.44	12.71	12.5	9.98	15.84	11.69	15.53	18.9	15.53	12.46	10.46	12.34	15.91	8.8
15		18.9	19.1	12.96	12.71	11.91	9.98	15.79	10.59	15.24	18.22	15.53	12.46	10.4	11.49	15.53	8.59
16		18.83	19	12.75	11.69	11.49	9.9	15.79	10.35	14.61	17.7	13.62	12.38	10.03	11.1	12.46	8.49
17		18.83	18.22	12.71	11.49	11.1	9.76	15.24	9.98	12.46	17.5	13.5	12.38	9.98	10.82	12.38	8.25
18		15.53	17.82	12.71	11.49	10.82	9.76	15.24	9.9	12.46	14.9	13.06	12.34	9.58	10.82	10.46	8.07
19		14.44	17.7	12.5	11.1	10.4	9.72	14.61	9.76	12.46	14.9	12.46	12.34	9.07	9.61	10.4	8.02
20		14.08	17.52	11.91	11.1	10.03	9.72	12.12	9.72	12.38	13.62	12.46	11.49	8.87	8.8	10.03	7.9
21		12.71	17.5	11.91	10.82	10.03	9.61	12.04	9.61	12.34	13.62	12.38	11.1	8.8	8.49	9.58	7.75
22		12.71	17.26	11.49	10.59	9.58	9.5	11.72	9.61	12.12	13.5	12.34	10.82	8.79	8.02	8.79	7.61
23		12.46	14.08	11.49	10.4	9.58	9.41	11.71	9.5	12.04	13.06	11.78	10.82	8.79	7.9	8.79	7.34
24		12.38	10.82	11.49	10.03	8.79	9.41	11.71	9.41	11.78	13.05	11.49	10.82	8.77	7.75	8.77	6.96
25		12.34	10.46	11.1	9.98	8.79	9.4	11.71	9.4	11.72	10.46	9.98	10.46	8.77	7.61	8.77	6.78
26		11.71	10.4	11.1	9.98	8.77	9.4	10.4	9.4	11.71	10.46	9.07	10.46	8.77	7.58	7.75	6.68
27		11.49	10.03	10.82	9.76	7.61	9.29	10.03	9.29	11.71	9.58	8.87	9.58	8.49	7.58	7.61	6.62
28		11.1	10.03	10.82	9.58	7.58	9	9.58	9	11.49	8.96	8.8	8.07	8.49	7	7.55	6.61
29		10.82	9.98	10.46	9.58	7.55	9	8.79	9	9.72	8.87	8.59	8.02	8.49	7	7.55	6.61
30		10.46	9.72	9.07	9.41	7	9	8.77	8.96	9.61	8.2	8.49	7.9	7.75	6.96	7.34	6.38
31		9.72	9.61	8.87	9.41	6.96	7.58	7.55	8.87	9.5	8.14	8.49	7.75	7.75	6.68	7.12	6.36
32		9.61	9.58	8.8	9.07	6.78	7	6.78	8.2	8.59	8.09	8.49	7.75	7.55	6.65	6.96	6.36

Sheet1 Sheet2 Sheet3

Ready 100%

Sort each column and identify 6th highest value for each receptor (highlighted) (see Step 1)

Tips for preparing modeled data – CAL3QHCR output

24-hour PM_{10} NAAQS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Receptor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2		23.76	27.91	23.76	27.91	20.83	14.44	20.83	24.19	20.83	24.19	27.62	21.81	27.62	27.62	24.97	27.62
3		21.81	27.66	21.81	27.66	17.38	14.08	20.83	24	18.22	24	27.62	19.6	27.62	24.97	20.83	24.97
4		21.81	27.62	20.64	27.62	16.66	14.08	18.22	23.65	17.82	23.65	27.62	19.1	27.62	24.97	20.31	24.19
5		20.64	24.97	19.6	24.97	15.84	12.71	18.22	14.9	17.7	21.81	24.97	19	24.97	24.19	19	24
6		19.6	24.19	19.56	24.19	15.79	11.69	17.7	14.9	17.7	19.6	24.97	19	24.97	24.19	18.9	20.31
7		19.6	24	19.49	24	15.24	11.69	17.5	14.08	17.5	19.1	24.97	18.9	24.97	24	18.22	18.9
8		19.56	23.65	19.1	23.65	15.24	11.49	17.38	13.62	17.38	19	24.97	18.9	24.19	24	18.08	14.9
9		19.49	23.59	19	23.59	15.1	11.1	17.38	13.62	17.26	19	24.19	18.9	24	15.53	17.82	13.62
10		19.1	22.91	18.9	22.91	14.44	10.82	17.26	13.62	16.66	18.9	24	15.53	23.65	14.44	17.7	13.5
11		19.1	22.91	18.83	22.91	12.96	10.59	16.66	13.5	15.84	18.9	23.65	14.44	19	12.71	17.7	13.06
12		19	22.91	15.1	14.44	12.75	10.59	16.66	13.06	15.79	18.9	18.22	13.62	18.9	12.46	17.52	10.46
13		19	20.83	14.44	14.08	12.71	10.35	15.84	13.05	15.53	18.9	17.82	12.71	12.46	12.38	17.5	9.61
14		18.9	19.6	14.44	12.71	12.5	9.98	15.84	11.69	15.53	18.9	15.53	12.46	10.46	12.34	15.91	8.8
15		18.9	19.1	12.96	12.71	11.91	9.98	15.79	10.59	15.24	18.22	15.53	12.46	10.4	11.49	15.53	8.59
16		18.83	19	12.75	11.69	11.49	9.9	15.79	10.35	14.61	17.7	13.62	12.38	10.03	11.1	12.46	8.49
17		18.83	18.22	12.71	11.49	11.1	9.76	15.24	9.98	12.46	17.5	13.5	12.38	9.98	10.82	12.38	8.25
18		15.53	17.82	12.71	11.49	10.82	9.76	15.24	9.9	12.46	14.9	13.06	12.34	9.58	10.82	10.46	8.07
19		14.44	17.7	12.5	11.1	10.4	9.72	14.61	9.76	12.46	14.9	12.46	12.34	9.07	9.61	10.4	8.02
20		14.08	17.52	11.91	11.1	10.03	9.72	12.12	9.72	12.38	13.62	12.46	11.49	8.87	8.8	10.03	7.9
21		12.71	17.5	11.91	10.82	10.03	9.61	12.04	9.61	12.34	13.62	12.38	11.1	8.8	8.49	9.58	7.75
22		12.71	17.26	11.49	10.59	9.58	9.5	11.72	9.61	12.12	13.5	12.34	10.82	8.79	8.02	8.79	7.61
23		12.46	14.08	11.49	10.4	9.58	9.41	11.71	9.5	12.04	13.06	11.78	10.82	8.79	7.9	8.79	7.34
24		12.38	10.82	11.49	10.03	8.79	9.41	11.71	9.41	11.78	13.05	11.49	10.82	8.77	7.75	8.77	6.96
25		12.34	10.46	11.1	9.98	8.79	9.4	11.71	9.4	11.72	10.46	9.98	10.46	8.77	7.61	8.77	6.78
26		11.71	10.4	11.1	9.98	8.77	9.4	10.4	9.4	11.71	10.46	9.07	10.46	8.77	7.58	7.75	6.68
27		11.49	10.03	10.82	9.76	7.61	9.29	10.03	9.29	11.71	9.58	8.87	9.58	8.49	7.58	7.61	6.62
28		11.1	10.03	10.82	9.58	7.58	9	9.58	9	11.49	8.96	8.8	8.07	8.49	7	7.55	6.61
29		10.82	9.98	10.46	9.58	7.55	9	8.79	9	9.72	8.87	8.59	8.02	8.49	7	7.55	6.61
30		10.46	9.72	9.07	9.41	7	9	8.77	8.96	9.61	8.2	8.49	7.9	7.75	6.96	7.34	6.38
31		9.72	9.61	8.87	9.41	6.96	7.58	7.55	8.87	9.5	8.14	8.49	7.75	7.75	6.68	7.12	6.36
32		9.61	9.58	8.8	9.07	6.78	7	6.78	8.2	8.59	8.09	8.49	7.75	7.55	6.65	6.96	6.36

Sheet1 Sheet2 Sheet3

Ready 100%

Identify receptor with highest 6th high value (circled) and continue DV calculation (see Steps 2-10)

End of Module 7

Questions?

End of Course

- What did we cover?
  - » General requirements in accordance with EPA PM Hot-spot Guidance
  - » How to complete a PM hot-spot analyses using MOVES at the project level and AERMOD and CAL3QHCR to complete air quality modeling
  - » How to obtain and use background concentrations
  - » Calculating design values and determining conformity
- Any questions on any of the course material?