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Section 14
Daily Air Quality Forecast Operations

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Daily Forecast Operations

Nine steps to produce an accurate air quality forecast - a suggested method

1. Review yesterday's forecast
2. Review the latest air quality data
3. Review the weather
4. Develop a phenomenological forecast
5. Run forecast tools
6. Produce a final forecast
7. Document the forecast
8. Distribute the forecast
9. Monitor air quality and meteorology

Daily Forecast Operations

Example Forecast: Sacramento, California, USA

- Day 0
  (August 22, 2005)
- Day 1
  (August 23, 2005)

Step 1: Review Yesterday's Forecast (1 of 3)

- Did the forecast for yesterday verify? If the forecast missed by more than 20-30%, a retrospective study is recommended.
- Did it verify for the right reasons? For example, you forecasted for low ozone because of predicted rain, but low ozone occurred with no rain.
- Did all monitors report data yesterday?
- Are there any bad data points?
- If the forecast didn't verify, does that affect the forecast you plan to issue today?

Step 1: Review Yesterday's Forecast (2 of 3)

- Verification for yesterday
  - Ozone forecast issued on August 22, 2005 (Day 0) for August 22, 2005 (Day 0): 80 ppb
  - Observed peak 8-hr average ozone on August 22, 2005 (Day 0)
    - Placerville: 79 ppb
    - Cool: 75 ppb
    - Elk Grove: 73 ppb
    - Folsom: 72 ppb
- Ozone forecast issued on August 22, 2005 (Day 0) for August 23, 2005 (Day 1): 75 ppb

Step 1: Review Yesterday's Forecast (3 of 3)

Discussion issued on August 22, 2005 (Day 0):

Today, skies will remain sunny and temperatures will be seasonably warm. These conditions, combined with a light to moderate afternoon delta breeze, will lead to Moderate ozone levels. In addition, an isolated site in the foothills may reach Unhealthy for Sensitive Groups. Tomorrow, an upper-level trough of low pressure will move into the Pacific Northwest, weakening the temperature inversion, strengthening the delta breeze, and cooling temperatures a few degrees. These conditions will result in **Good to Moderate AQI levels** across the Sacramento region.

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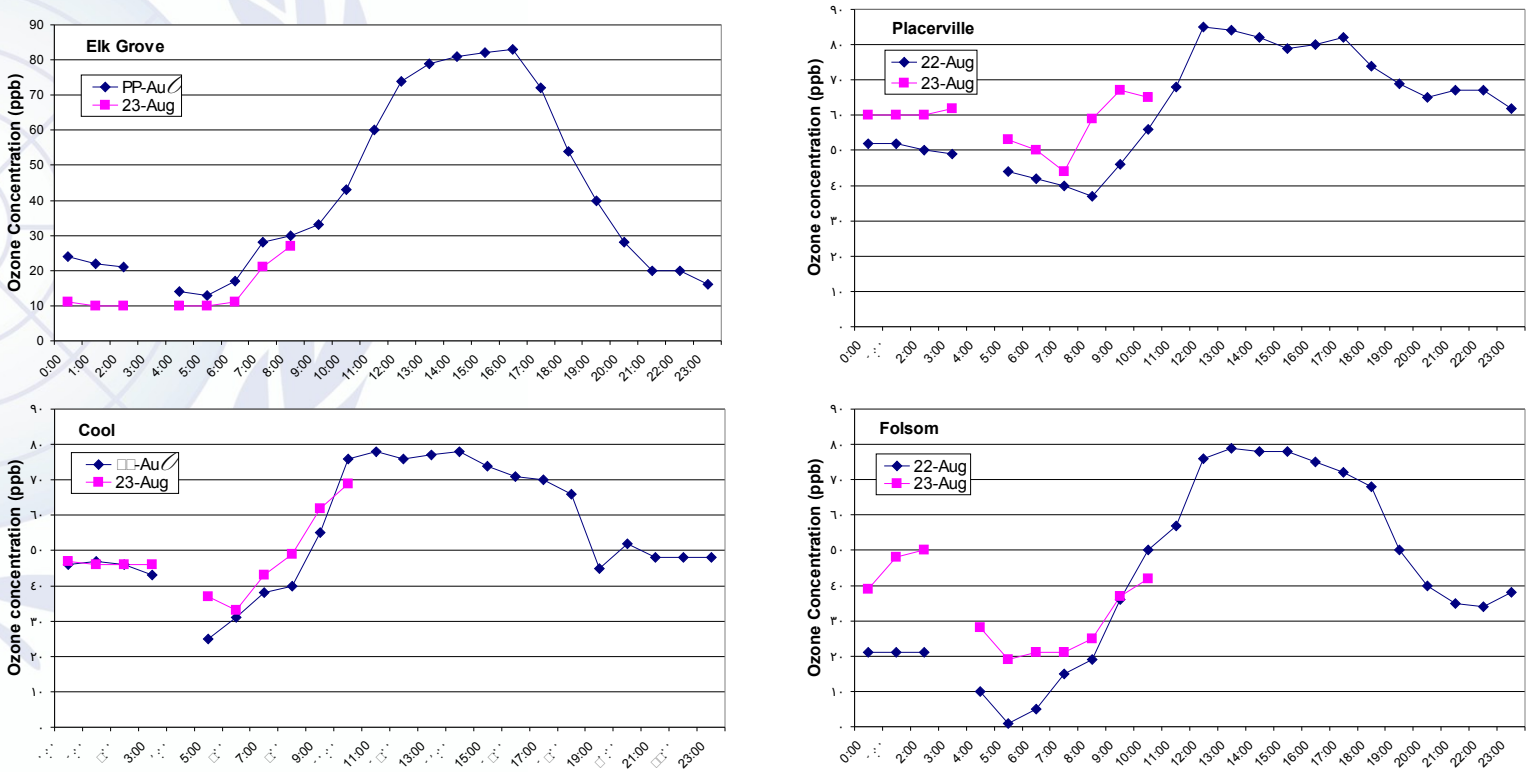
Step 2: Review the Latest Air Quality Data

- Are all sites reporting data today?
- How does yesterday's air quality compare with today's?
- Is today's meteorology (wind, temperature) similar to yesterday's?



Hourly ozone values from today and yesterday

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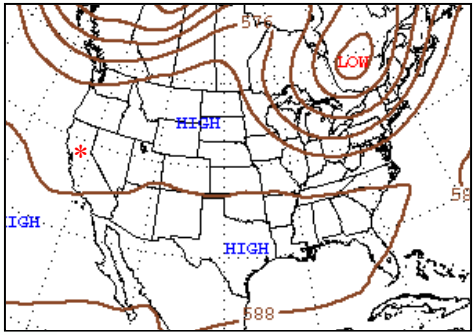
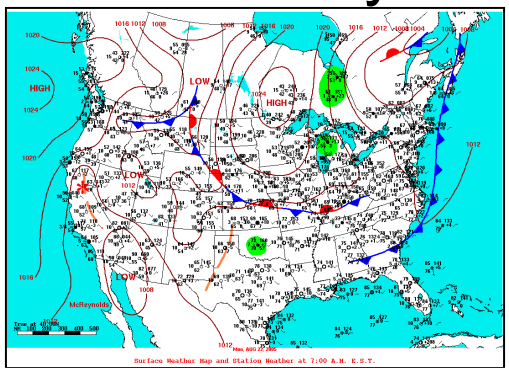
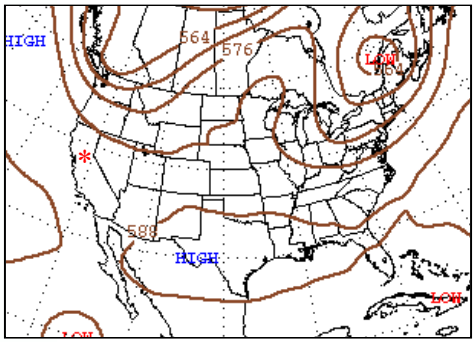
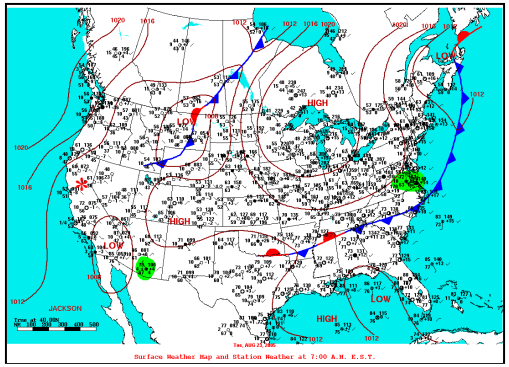
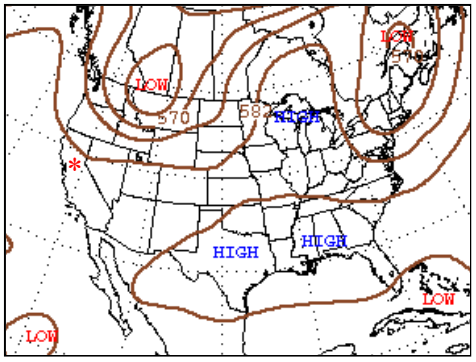
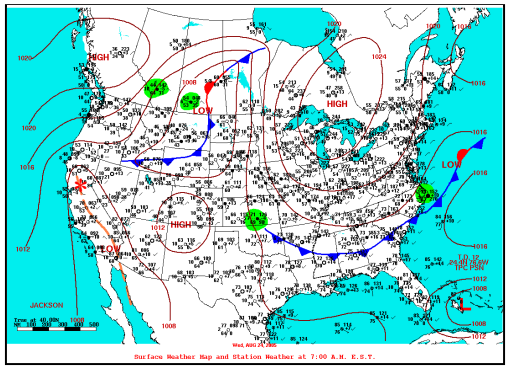
Step 3: Review the Weather (1 of 4)

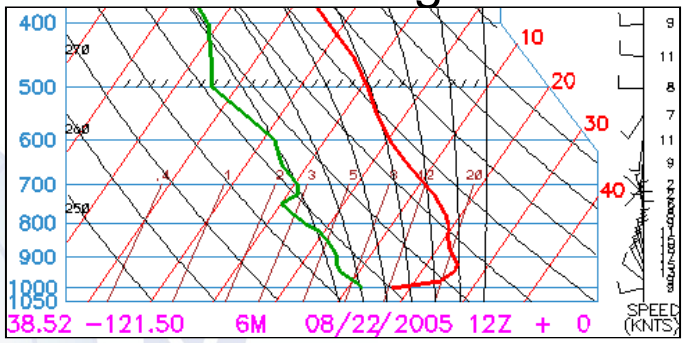
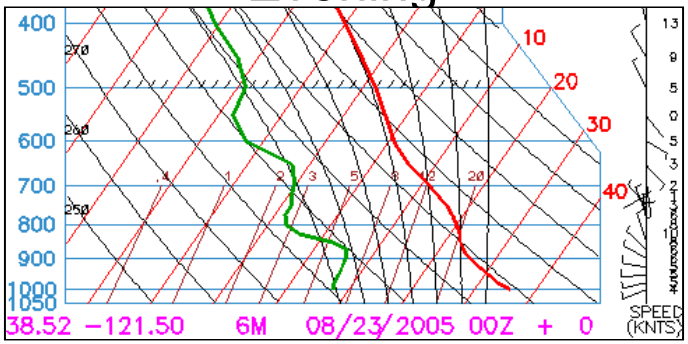
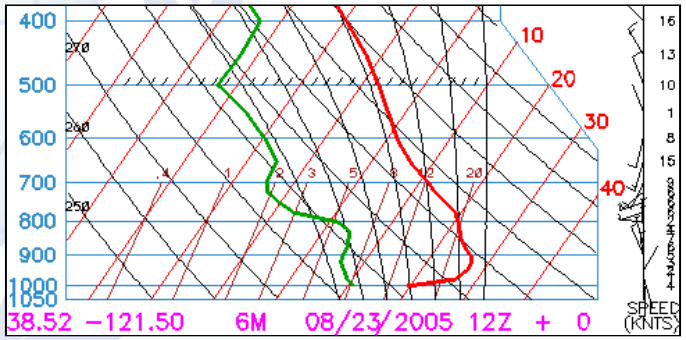
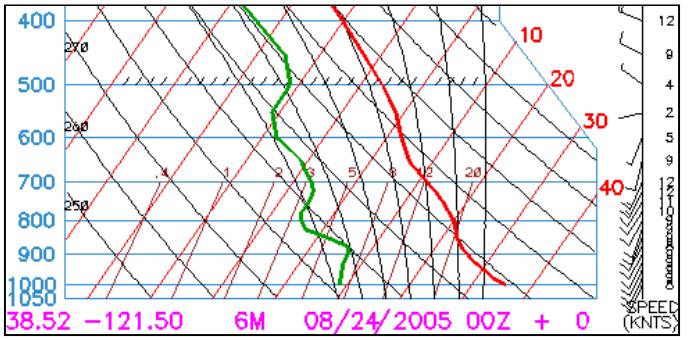
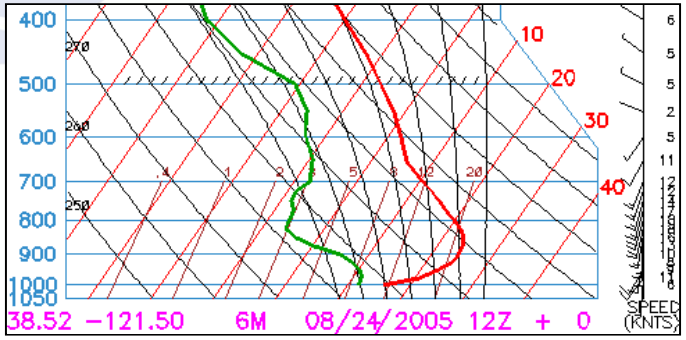
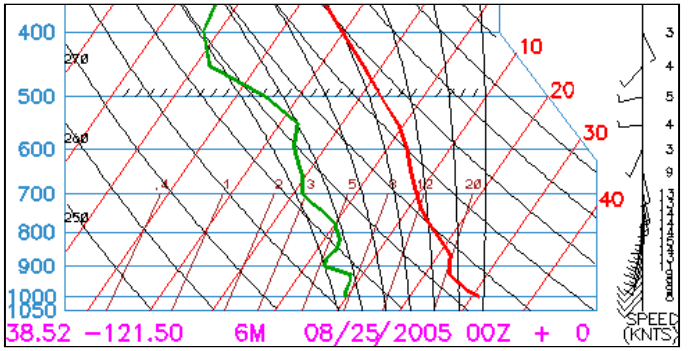
- What is the general synoptic pattern?
  - Ridges and troughs
  - Upper-level warming and cooling
  - Surface and aloft winds
- Is the large-scale pattern changing?
- Are these changes going to influence local weather and air quality?
- What are the local meteorological conditions?
- If weather forecasts are predicting conditions conducive to good air quality, consider skipping to Step 6, Produce a Final Forecast

Step 3: Review the Weather (2 of 4)

	500-mb heights	Surface analysis
Day 0: August 22, 2005 1200 GMT		
Day 1: August 23, 2005 1200 GMT		
Day 2: August 24, 2005 1200 GMT		

Step 3: Review the Weather (3 of 4)

Soundings in Sacramento, California, August 22-24, 2005.

	Morning	Evening
Day 0		
Day 1		
Day 2		

Step 3: Review the Weather (4 of 4)

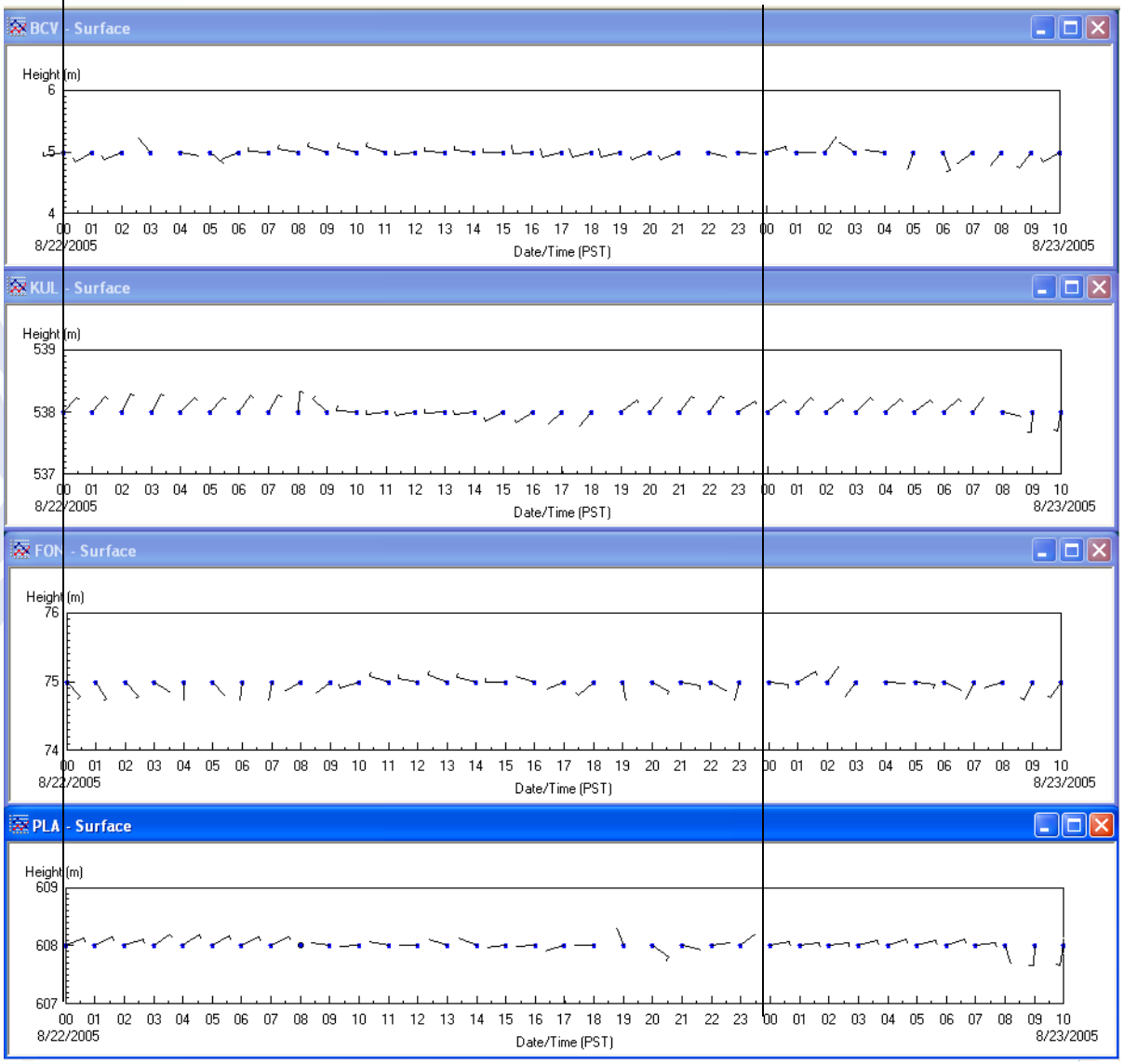
August 22 (Day 0) August 23 (Day 1)

Elk Grove winds

Cool winds

Folsom winds

Placerville winds



Step 4: Develop a Phenomenological Forecast (1 of 2)

- Use your conceptual understanding to fill in the following air quality forecast worksheet.
- The worksheet is designed to capture important processes that influence air quality.

	Ozone (ppb)	500-mb Pattern	Surface Pattern	Winds	Inversion/ Mixing	Carryover	Clouds/Fog	Transport/ Recirculation
Yesterday								
Today								
Tomorrow								

Step 4: Develop a Phenomenological Forecast (2 of 2)

Example forecast worksheet for ozone

	Ozone (ppb)	500-mb Pattern	Surface Pattern	Winds	Inversion/ Mixing	Carryover	Clouds/ Fog	Transport/ Recirculation
Day 0	79	Weak Trough	Weak onshore	Light delta breeze	Strong inversion, some mixing from trough	No	Sunny	None
Day 1	88	Weak Trough	No gradient	Light delta breeze	Strong inversion, some mixing from trough	Yes	Sunny	None
Day 2	87	Weak Trough	Weak offshore	Moderate delta breeze	Weak inversion, mixing from trough	Yes	Sunny	None

Step 5: Run Forecast Tools

- Gather and review forecast and observational data needed to run the forecast tool(s).
- Run the tool(s).
- Modify input values to estimate the impact of uncertainties in the weather forecasts.
- Save inputs and outputs for future verification.

Step 5: Run Forecast Tools – Example

Day 1

AQCast > Query Results AQCast Key

Region	City	Pollutant	Model	Method	8/23	8/24	8/25	8/26	8/27
Sacramento	El Dorado County	8hrO3 (ppb)	0 ETA	00Z Eta Log Regression	94.8	73.0	77.6		
Sacramento	El Dorado County	8hrO3 (ppb)	12 ETA	12Z Eta Log Regression		77.3	77.6	85.1	
Sacramento	Placer County	8hrO3 (ppb)	0 ETA	00Z Eta Log Regression	73.8	64.7			
Sacramento	Placer County	8hrO3 (ppb)	12 ETA	12Z Eta Log Regression	73.9	71.9			
Sacramento	Sacramento	8hrO3 (ppb)	0 ETA	00Z Eta Log Regression	67.9	63.5	70.9		
Sacramento	Sacramento	8hrO3 (ppb)	12 ETA	12Z Eta Log Regression		66.8	71.2	75.8	
Sacramento	Yolo-Solano County	8hrO3 (ppb)	0 ETA	00Z Eta Log Regression	54.5	48.8			
Sacramento	Yolo-Solano County	8hrO3 (ppb)	12 ETA	12Z Eta Log Regression		51.2			

Regression forecasting tool output for Sacramento, California

Step 6: Produce a Final Forecast

- Review output from forecast tools and the conceptual forecast.
- Do the forecasts from different tools agree?
  - If so, you may choose to use the average or the high or low values, or some value in between depending on your program objectives.
  - If not, check inputs for each tool.

Ozone Forecast (ppb)	Phenomeno-logical	Tool	Final
Day 1	Unhealthy for Sensitive Groups	70	88
Day 2	Unhealthy for Sensitive Groups	75	87

Step 7: Document the Forecast

Document forecast rationale

- What happened yesterday
- What's expected today and tomorrow and why

Sacramento Forecast Discussion issued August 23, 2005 (Day 1)

Today, despite an upper-level trough of low pressure moving into the Pacific Northwest, the temperature inversion remains strong, the delta breeze is weak, and temperatures are warm in the Sacramento area. These conditions will result in ***Unhealthy for Sensitive Groups AQI levels*** *across much of the region. Tomorrow, the temperature inversion will begin to weaken as the upper-level trough moves south into Northern California. In addition, cooler surface temperatures and a stronger delta breeze will lower ozone levels. However, high carryover from today will keep ozone levels low-end* ***Unhealthy for Sensitive Groups*** *in the foothills.*

Step 8: Distribute the Forecast

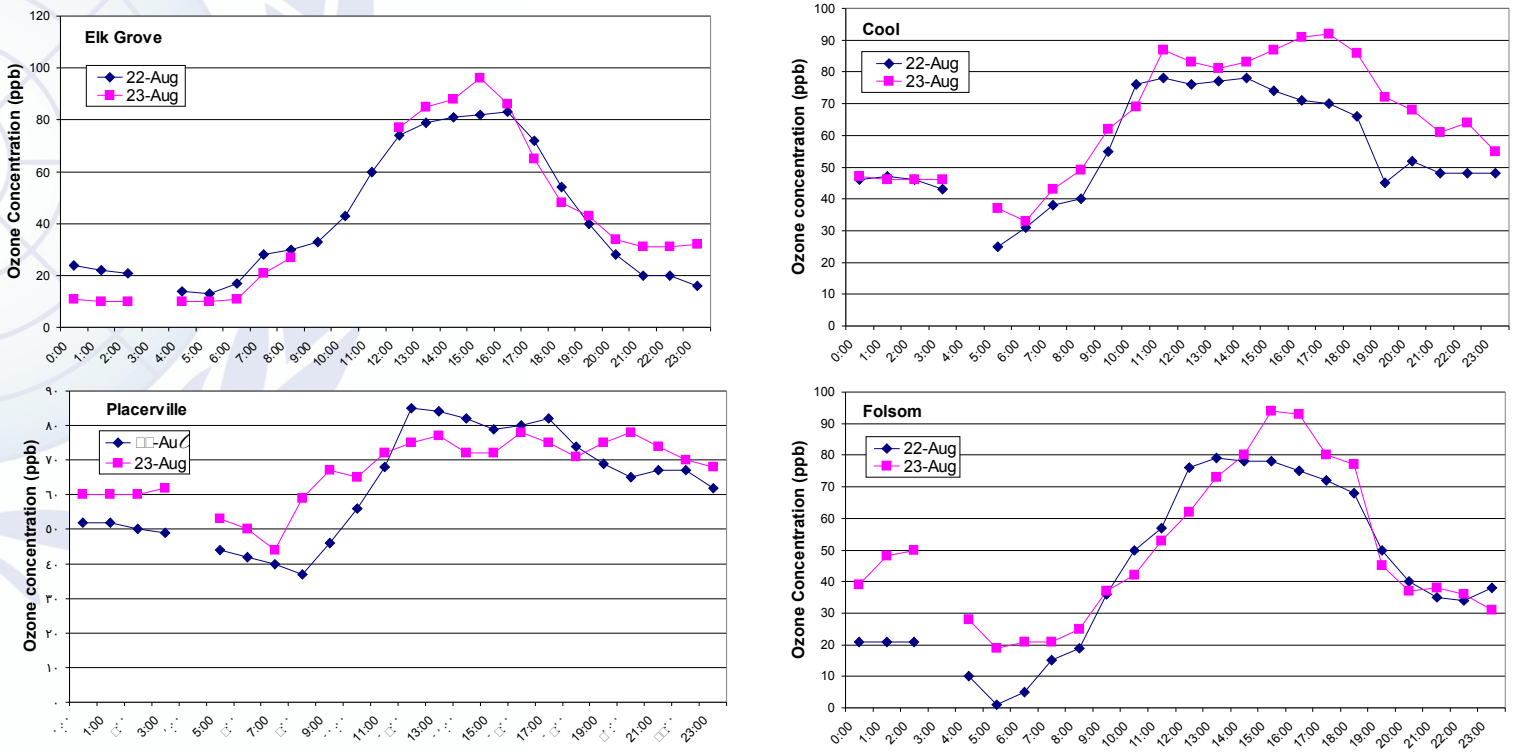
- Ensure forecast distribution occurs on time by planning a daily timeline.
- Distribution
  - Internal (technical details)
  - Public (generalized and health-oriented)
    - E-mail
    - Fax
    - Internet
    - Phone
    - Pager

Step 9: Monitor Air Quality and Meteorology (1 of 2)

- Monitor the air quality and meteorology throughout the day for unexpected changes.
- Update the forecast if meteorology or air quality is different than expected.
- Ensure that incoming data are reasonable given the meteorological and air quality conditions.

Step 9: Monitor Air Quality and Meteorology (2 of 2)

- Ozone concentrations at Cool, Folsom, and Elk Grove are higher than yesterday during the peak afternoon hours.
- Forecast for higher ozone concentrations today is on track.



Summary

Following a predetermined daily forecasting protocol helps produce a consistent, timely, and accurate forecast.