# How Does Your Model Stack Up?

## A Comparison of Monitoring Data to Model Estimates at a DRR source in Shelby County, Alabama

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JUNE 9, 2017

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# The Data Requirements Rule (DRR) in Alabama

On June 2, 2010, EPA tightened the primary $SO_2$ NAAQS and established a new 1-hr standard at a level of 75 ppb (196 $\mu g/m^3$).

The final Data Requirements Rule was published in the federal register on August 21, 2015.
◦ Final guidance documents published as late as August 2016.

The final Rule established a threshold of 2000 tpy actual $SO_2$ emissions (facility wide) during calendar year 2014 for inclusion.

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# The Data Requirements Rule (DRR) in Alabama

Approximately 15 sources in Alabama were affected by the DRR.

These sources had to make one of three choices:

- Propose to perform modeling to show compliance
  - 10 sources opted for this option, and turned in modeling analyses on Jan 13, 2017

- Propose to site and operate $SO_2$ monitor(s) to show compliance
  - **1 source chose this option, and began operating a monitor on Jan. 1, 2017**
  - **This means that this source's modeling predicted levels above the standard.**

- Take a federally enforceable limit to fall below 2000 tpy of $SO_2$, with a compliance date no later than January 13, 2017
  - The remaining 4 sources were exempt from modeling/monitoring.

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# Monitor Siting Modeling Analysis

- XYZ Facility submitted modeling to support monitor placement

- Five locations were evaluated
    - Accessibility
    - Safety
    - Power
    - Wind Direction
    - Terrain, etc.

- Final decision to locate just off the NW corner of the property
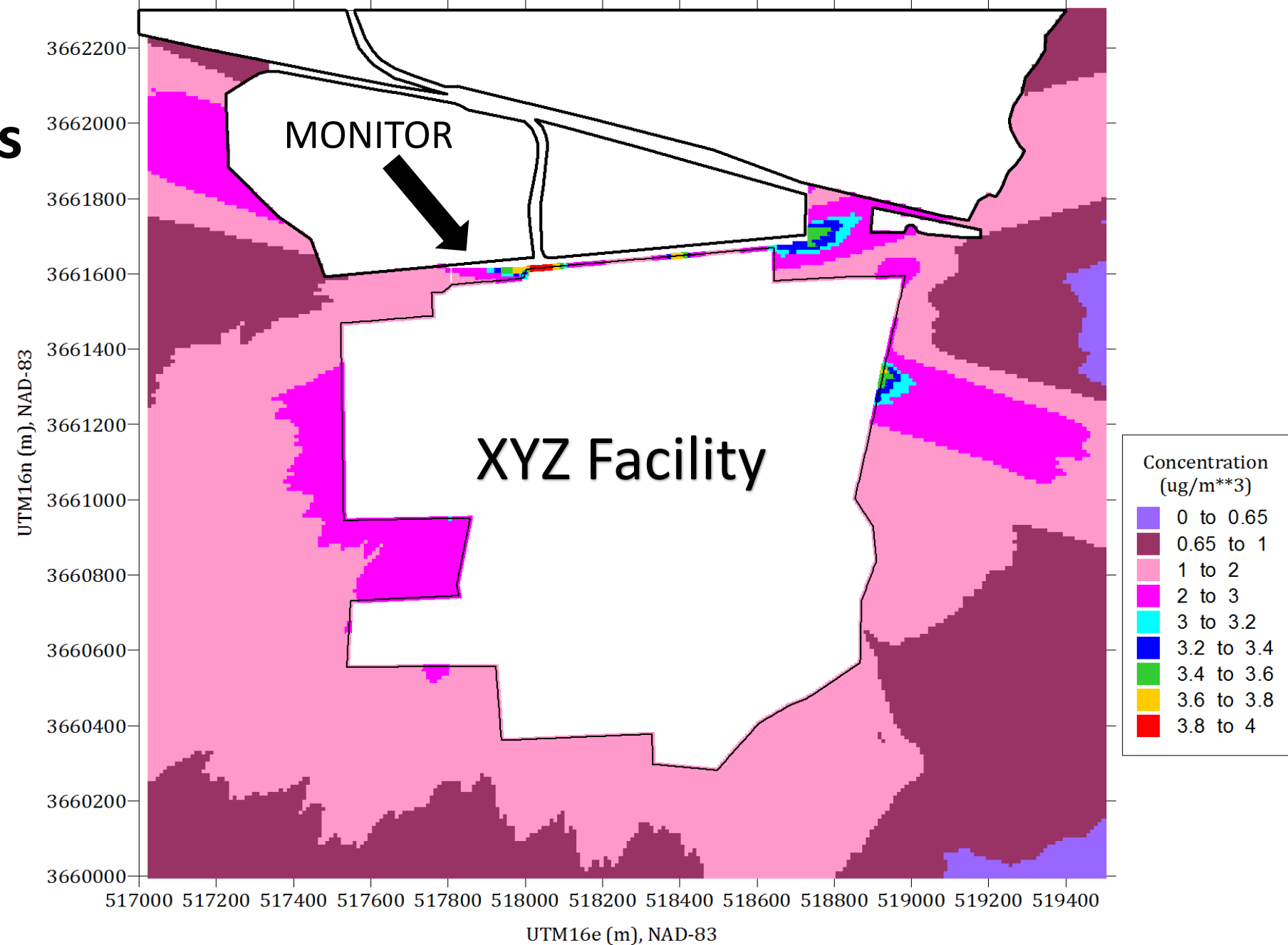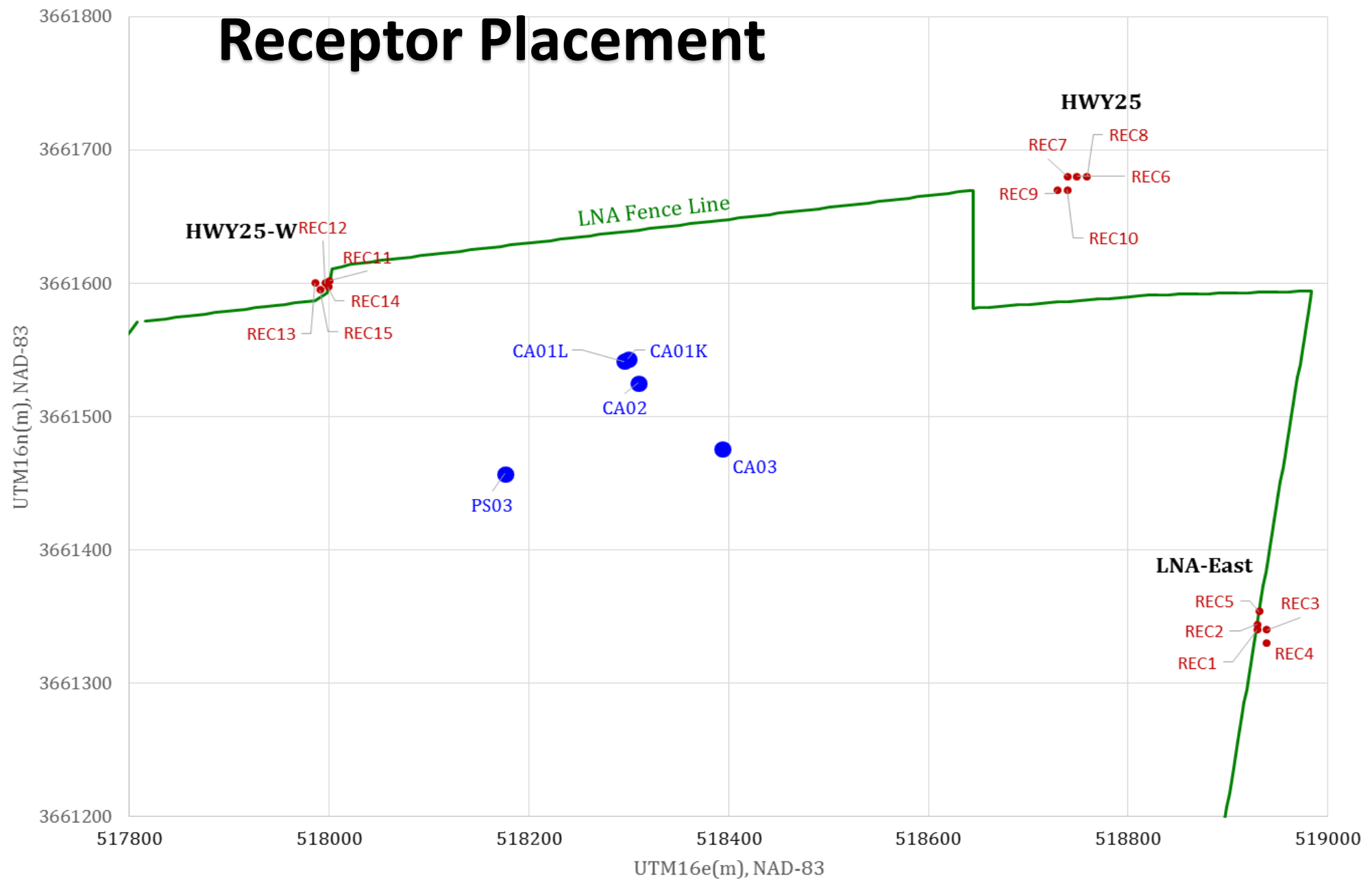


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**Final Location**

# Comparison of Monitoring Data to Model Estimates at a DRR source in Shelby County, Alabama

ADEM obtained the actual, quality-assured monitor data for the first 3 months of 2017

To compare the model against the observed data, a modeling file was developed

◦ Met data from a nearby NWS station (~6miles) was processed for the 3 month period.

◦ Maximum hourly actual emission rates were calculated for the facility units.

◦ The most recent version of the AERMOD model (v16216r) was run for comparison.

◦ No background concentrations were added to the model results, which means that the model data is underestimated by a few $\mu g/m^3$ for conservatism.

The  1-hr $SO_2$ NAAQS is 196 $\mu g/m^3$, 4th high, averaged over three years.

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## Comparison of Monitoring Data to Model Estimates at a DRR source in Shelby County, Alabama

Highest 1-hour concentration of the 1879 hours in the three months as predicted by the model: **1789** $\mu$g/m$^3$

Highest 1-hour concentration of these hours as measured: **121** $\mu$g/m$^3$

Difference:  Model over predicts by a factor of **14x**.

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# Comparison of Monitoring Data to Model Estimates at a DRR source in Shelby County, Alabama

Highest 4th highest concentration from modeling: **1153** µg/m³

Highest 4th highest concentration from monitor: **33.8** µg/m³

Difference: Model over predicts by a factor of **34x**.

1 hour $SO_2$ NAAQS: **196** µg/m³

Difference: Model over predicts by a factor of **6x**.

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# Comparison of Monitoring Data to Model Estimates at a DRR source in Shelby County, Alabama

Average of all 2160 hours in the 3 month period as predicted by model: **25.08** $\mu g/m^3$

Average of all hours monitored (1879): **0.89** $\mu g/m^3$
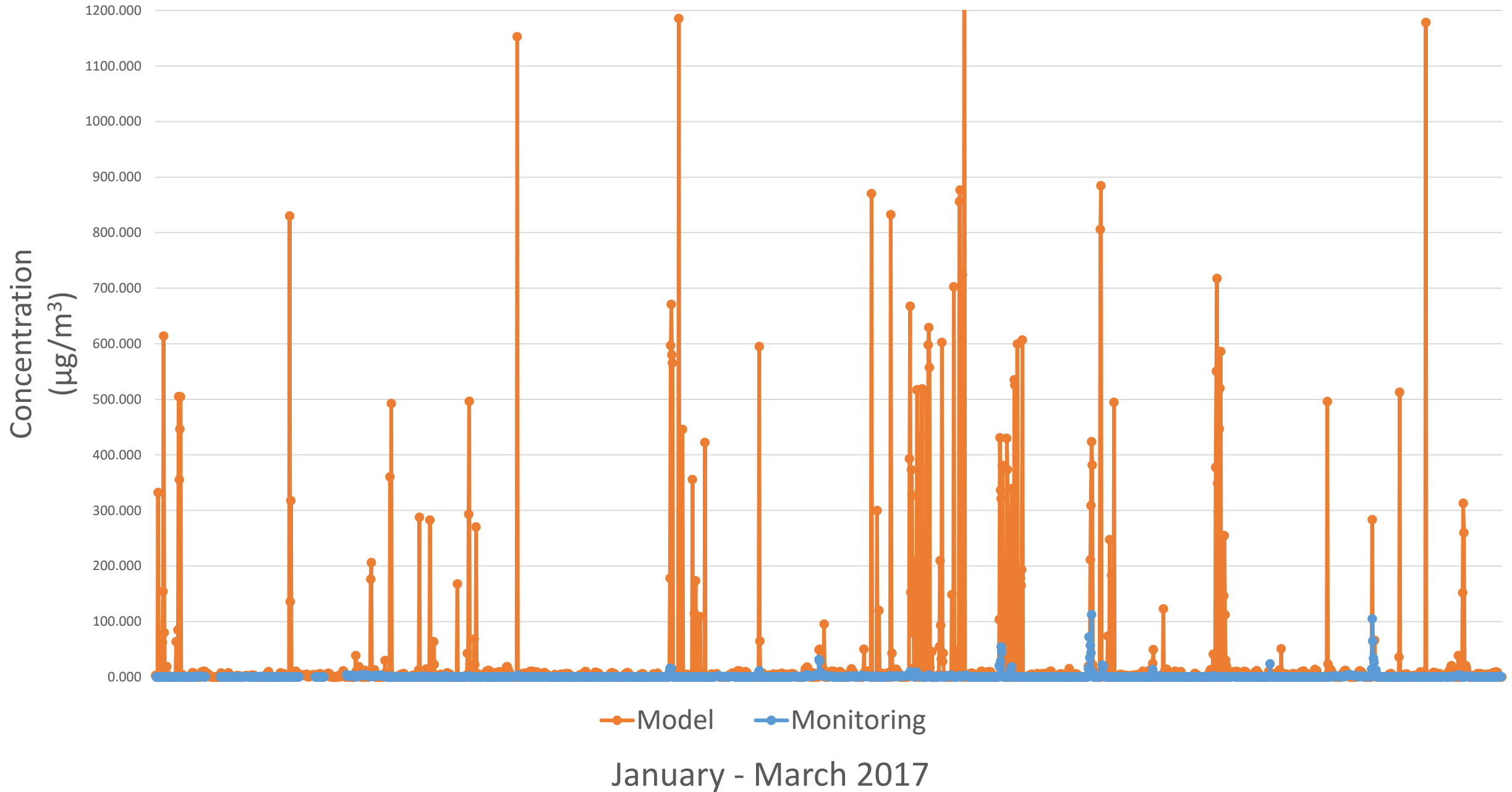
Model over predicts by a factor of **28x**.

# Comparison of Monitoring Data to Model Estimates at a DRR source in Shelby County, Alabama

Out of 1879 hours, the number of hours the model over predicts versus monitoring: **1250**, or **66.5%**

Out of 1879 hours, the number of hours the model under predicts versus monitoring: **286**, or **15.2%**

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Model vs Monitor Concentrations (μg/m³)

# Initial Thoughts

The analysis only looked at 1 quarter of data (1/12th)
  ◦ The signal, however, is concerning when attempting to validate model concentrations for short time periods (e.g., 1 hour $SO_2$/$NO_2$)

The model is predicting conservative impacts
  ◦ Good model performance is generally defined as 30-40%
  ◦ The results of this analysis indicates a much higher percentages

The placement of the receptors was based on a modeling study that identified the best location(s) for a monitor.

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# Initial Thoughts

Models are a very important tool for estimating impacts from emissions sources

- ◦ There needs to be some caution as to how strongly they are relied upon.
- ◦ Based on this analysis, if the facility being evaluated had had to rely on the modeling to show compliance, the expense to do so, directly or indirectly would be significant.

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## Conclusions and Next Steps

This analysis allowed the ADEM Air Division with a unique opportunity to evaluate model performance against measured data. The initial conclusions are that the data in the above slides shows that an actual violation is unlikely, and that the model tends to be extremely conservative.

**Next Steps:**

As data is received, reaccomplish the analysis to see if the initial conclusions continue to hold true.

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