

# Emissions Modeling Quality Assurance Protocol

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# Outline

- Background
- Quality Assurance Framework
- QA Products



# Background

- Experience with large EPA and RPO emissions modeling projects
- Many different datasets from multiple sources
- Huge effort to model, QA, and interpret results
- Need a well-defined system for tracking, documenting, and archiving emissions data



# Quality Assurance Framework

- Goals for the QA protocol
  - Define systematic QA process
  - Ensure that the model works as expected
  - Model results are reproducible
  - Document and track all modeling input and output files
  - Build confidence in the emissions modeling



# Quality Assurance Framework

- Implementation: Multiple-modeler approach
- QA Classifications
- Required Information
- QA Procedures
- Templates and Worksheets
- QA Products



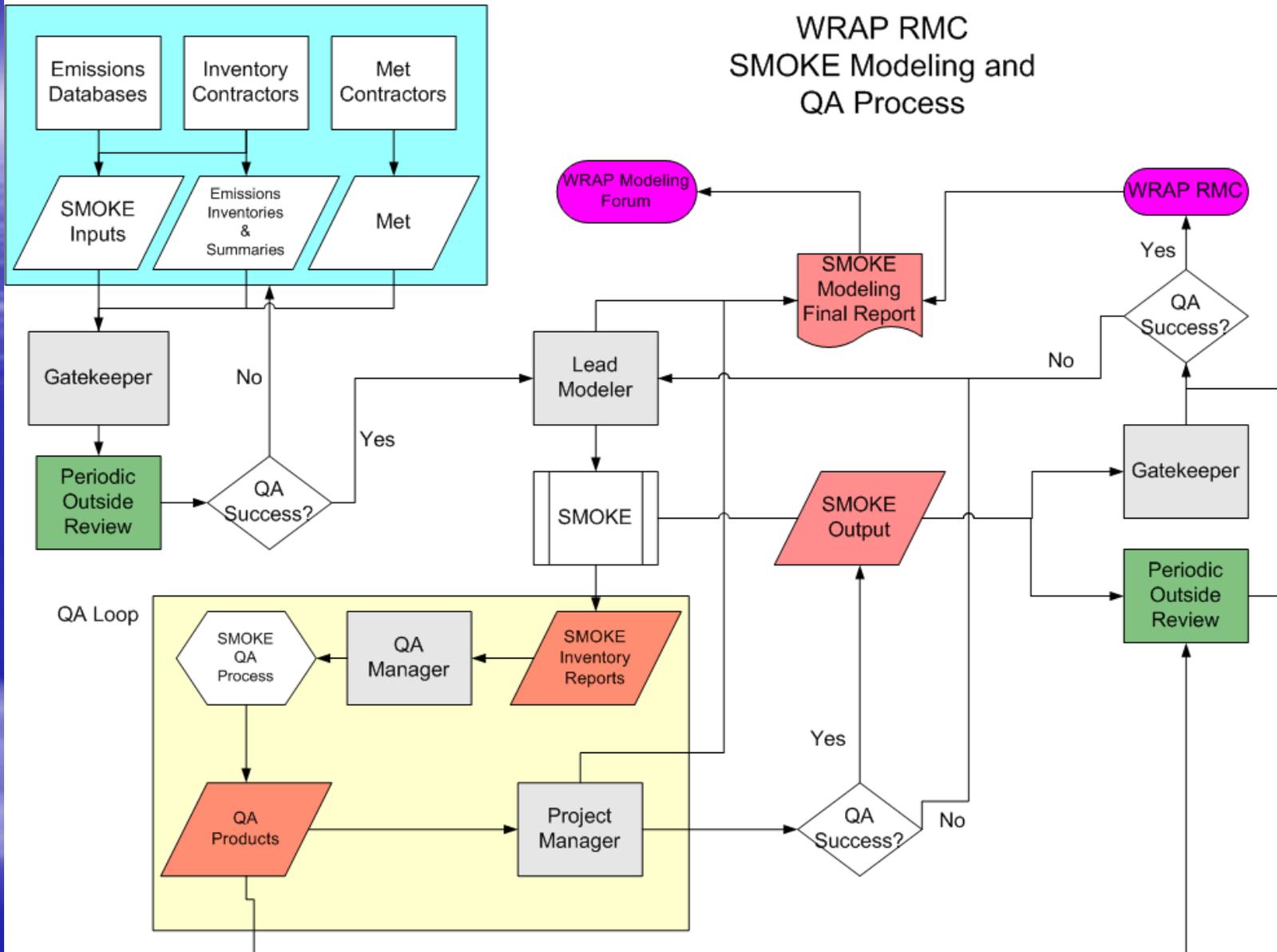
# Multiple-modeler approach

- **Project manager**
  - Primary technical advisor, maintains project schedule, final report writing
- **Production modeler**
  - Data collection, running the model, maintaining scripts, creating QA reports, archival, delivering model output, QA documentation
- **QA manager**
  - Enforcing adherence to QA protocol, leads QA documentation effort
- **Gate keeping and outside review**
  - Sanity checks on the I/O data streams, periodic audits of the QA process and products



Input Data

# WRAP RMC SMOKE Modeling and QA Process



# QA Classifications

- Modeling QA
  - Accuracy assurance and problem identification
- System QA
  - Software and data tracking
- Documentation
  - Tracking QA issues, recording the QA process, report writing



# Required Information

- Program logs
- Model QA reports
- Run scripts
- Configuration files
- Inventory summaries
- QA documents and worksheets



# Modeling QA

- Procedures for determining if the emissions model is working correctly and producing expected results
- Standardized approach for scrutinizing emissions model I/O establishes reference points for data quality



# Modeling QA Components

- Confirm model configuration
- Check inventories and ancillary input files
- Confirm model execution and check logs
- Confirm that the inventories processed correctly
- Confirm the information in the model QA reports
- Examine indicators for model performance



# System QA

- QA process for facilitating reproducibility
- Accounting system for models and data
- Begins with installation/benchmarking
- Tracks all updates/changes to software and data
- Completes with archival and recording of final model results



# System QA Components

- Archiving SMOKE source, scripts, and executables with CVS
- Installation freeze points
- Tracking SMOKE data with QA worksheets
- Email bug tracking system (Bugzilla) for logging and maintaining QA issues



# Documentation

- Record results, progress, and key features of Model and System QA
- Central to software and data tracking procedures
- Tangible record of emissions modeling process and how to reproduce the results
- Includes a final report summarizing all modeling and QA results



# Documentation Components

- Recording model configuration options
- Recording model input/output data files
- Documentation of the QA process
- Final report
- Automated project management tool



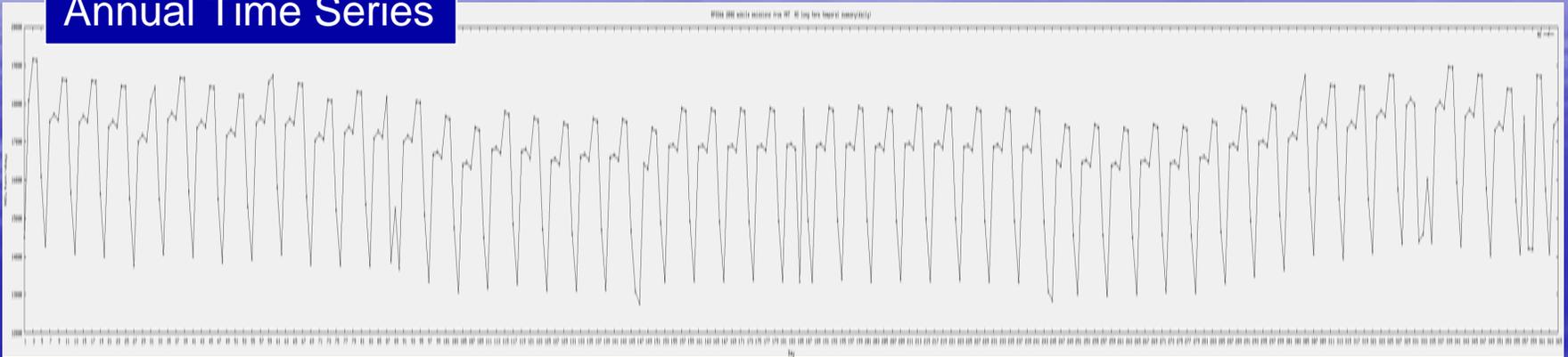
# QA Products

- Completed Emissions QA checklist
- Completed QA templates and worksheets
  - Model configuration settings
  - Inventory file log
  - Ancillary input file log
  - Model execution log (when, who, and what happened)
- Modeling QA reports and graphics
- Final report

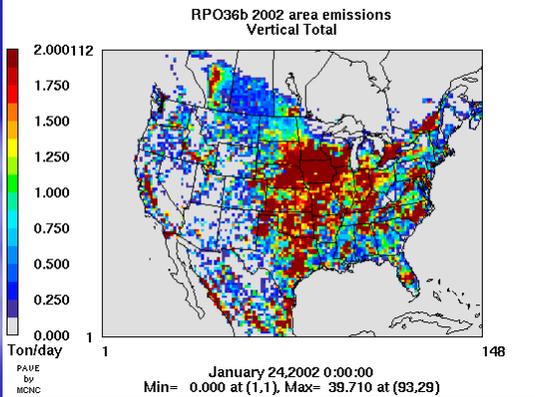


# QA Products

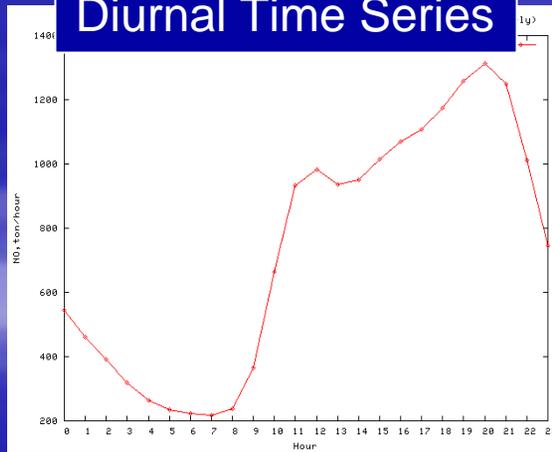
## Annual Time Series



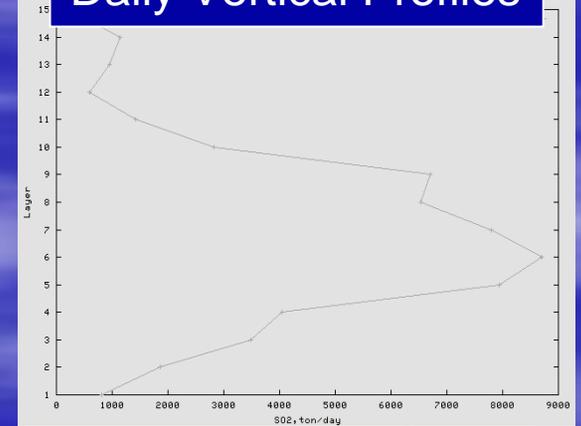
## Daily Tile Plots



## Diurnal Time Series



## Daily Vertical Profiles



# Download QA Protocol Document

- <ftp://ftp.unc.edu/pub/empd/wrap>
  - WRAP\_EmissionsQA\_Protocol\_v1.6.pdf
  - WRAP\_EmissionsQA\_Appendix\_v1.4.pdf
- Questions
  - zac@unc.edu

