

# Updating and Enhancing EPA's QA Handbook

## Volume IV: Meteorological Measurements

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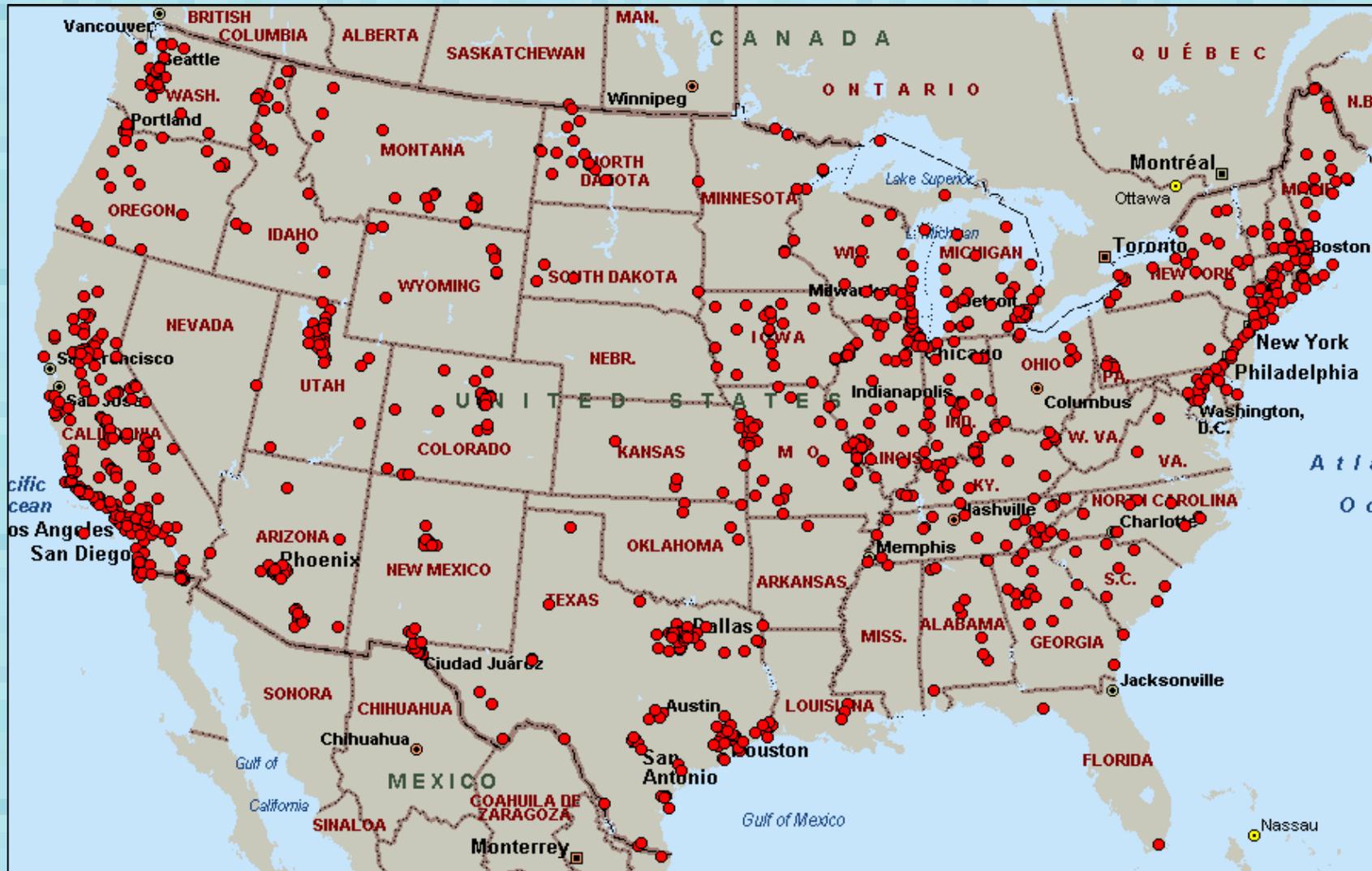
# Outline

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  - **Wind Systems**
  - **Upper Air Systems**
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- **Summary**



# Strategy

## Met Monitoring Across the Nation



# Strategy

- **Decision was made that rather than have a new met document, a revised Volume IV was the best answer**
- **Volume IV Re-write workgroup formed December 2005**
- **Finished 1<sup>st</sup> Draft October 2006**



# Work Group

## The Authors

### Participant

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# What's New!!

**This version would be:**

- **Targeted for State/Local and Tribal Agencies that may or may not have meteorologists on staff**
- **Be “user friendly”**
- **Have useful information – more of the “how to”**
- **Have less research information**
- **Have a number of “hot links” to documents that exist on the Internet**
- **Have clear Measurement Quality Objectives (MQOs) on different types of monitoring needs**
- **Have “hot links” to audio/video files on AMTIC**



# What's New: Content

## 4.0 Introduction

## 4.1 Tower Guidance and Siting

## 4.2 Wind Speed and Direction: Scalar and Vector

## 4.3 Temperature and Temperature Gradient

## 4.4 Rainfall and Precipitation

## 4.5 Relative Humidity and Dew Point Determination

## 4.6 Solar Radiation

## 4.7 Atmospheric Pressure

## 4.8 Upper Air Systems

## 4.9 Data Acquisition Systems and Meteorological Parameters

## 4.10 Data Validation and Verification



# What's New: MQOs

**Measurement Quality Objectives: The tolerances that monitoring staff need to meet the DQOs**

- **National Core Monitoring Stations**
- **Photochemical Assessment Monitoring Stations**
- **Prevention of Significant Deterioration Monitoring Stations**
- **Modeling Applications**
- **National Weather Service**



# What's New: MQOs

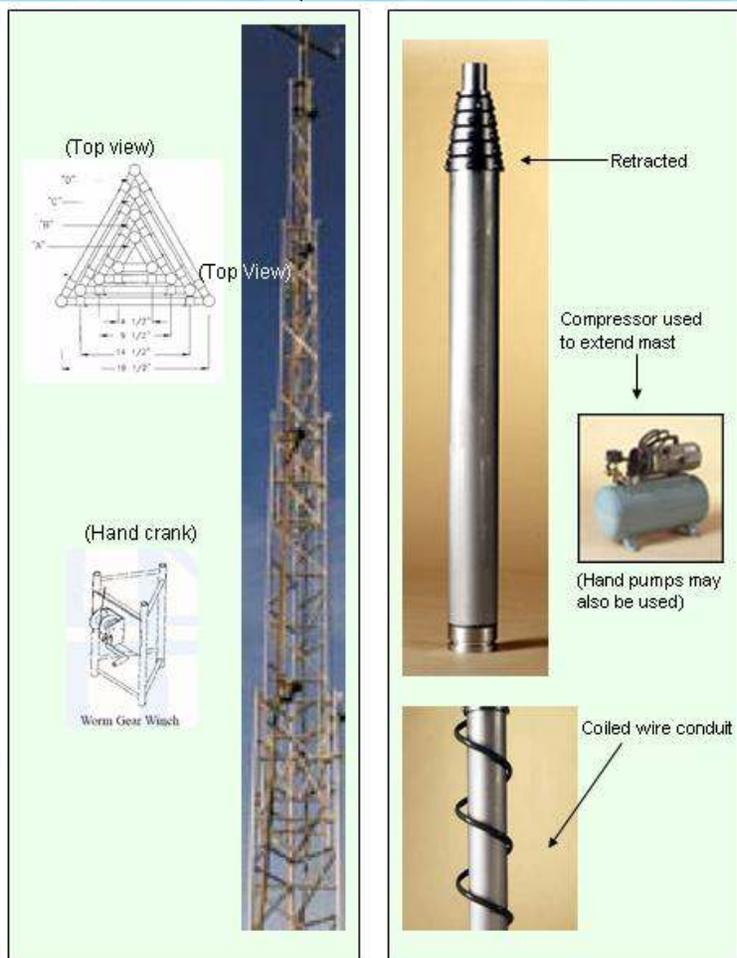
## NCore Measurement Quality Objectives

| Measurement  | Method                               | Reporting units            | Operating Range                  | Resolution         | Minimum Sample Frequency | Raw Data Collection Frequency | Completeness |
|--|--------------------------------------|----------------------------|----------------------------------|--------------------|--------------------------|-------------------------------|--------------|
| <b>(Required)</b>                                    |                                      |                            |                                  |                    |                          |                               |              |
| <b>Ambient Temperature</b>                           | <b>Thermistor</b>                    | <b>°C</b>                  | <b>-30 – 50</b>                  | <b>0.1</b>         | <b>Hourly</b>            | <b>1 minute</b>               | <b>75%</b>   |
| <b>Relative Humidity</b>                             | <b>Psychrometer/<br/>Hygrometer</b>  | <b>%</b>                   | <b>0 – 100</b>                   | <b>0.5</b>         | <b>Hourly</b>            | <b>1 minute</b>               | <b>75%</b>   |
| <b>Wind Speed</b>                                    | <b>Cup, prop or sonic anemometer</b> | <b>m/s</b>                 | <b>0.5 – 50.0</b>                | <b>0.1</b>         | <b>Hourly</b>            | <b>1 minute</b>               | <b>75%</b>   |
| <b>Wind Direction</b>                                | <b>Vane or sonic anemometer</b>      | <b>Degrees</b>             | <b>0 – 360 (540)<sup>3</sup></b> | <b>1.0</b>         | <b>Hourly</b>            | <b>1 minute</b>               | <b>75%</b>   |
| <b>Vector Data<br/>Wind Speed<br/>Wind Direction</b> | <b>DAS Calculations</b>              | <b>m/s<br/>degrees</b>     | <b>0 – 50.0<br/>0 – 360</b>      | <b>0.1<br/>1.0</b> | <b>Hourly</b>            | <b>1 minute<br/>1 minute</b>  | <b>75%</b>   |
| <b>(Optional)</b>                                    |                                      |                            |                                  |                    |                          |                               |              |
| <b>Solar Radiation</b>                               | <b>Pyranometer</b>                   | <b>Watts/m<sup>2</sup></b> | <b>0 – 1100</b>                  | <b>10</b>          | <b>Hourly</b>            | <b>1 minute</b>               | <b>75%</b>   |
| <b>Precipitation</b>                                 | <b>Tipping Bucket</b>                | <b>mm/hr</b>               | <b>0 – 25 mm/hr</b>              | <b>0.2 mm</b>      | <b>Hourly</b>            | <b>1 minute</b>               | <b>75%</b>   |
| <b>Barometric Pressure</b>                           | <b>Aneroid Barometer</b>             | <b>mb</b>                  | <b>600 – 1100</b>                | <b>0.5</b>         | <b>Hourly</b>            | <b>1 minute</b>               | <b>75%</b>   |



# What's New: Towers

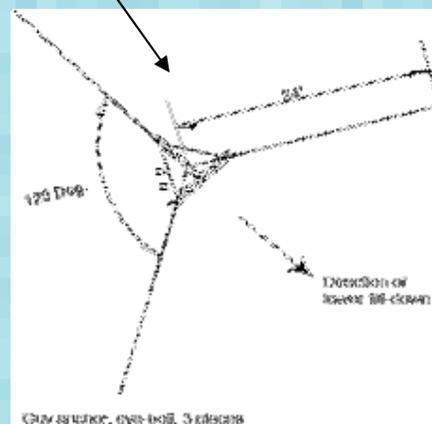
## Types of Towers Available



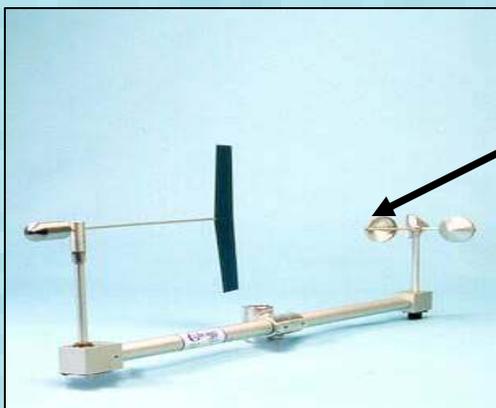
## Installations of Towers



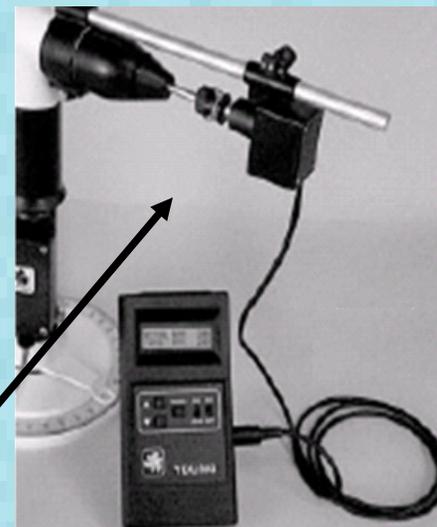
## Tower Support



# What's New: Wind Systems



Section 2 discusses  
Cup and Vane  
Systems



Calibrations, torque  
test and distance  
constants

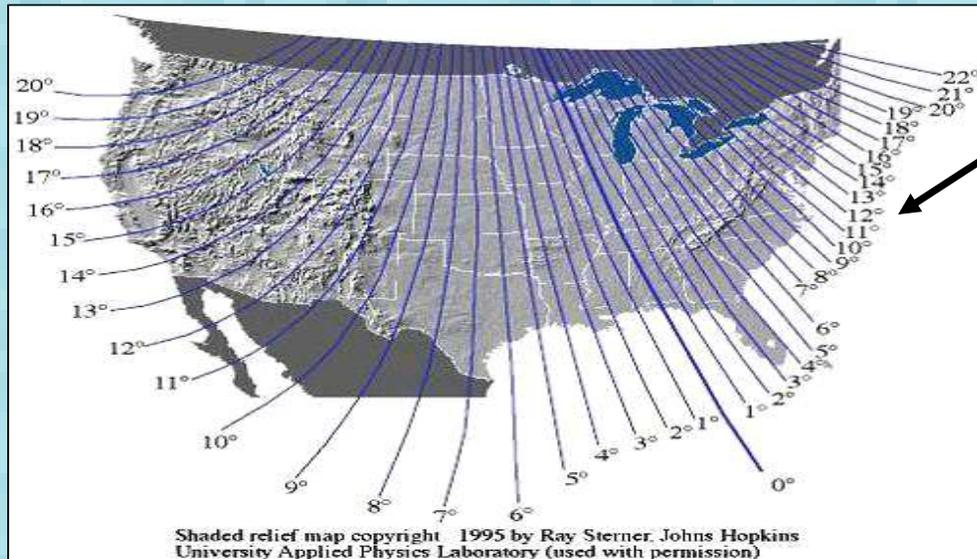


Section 2 discusses  
Propeller and Vane  
Systems

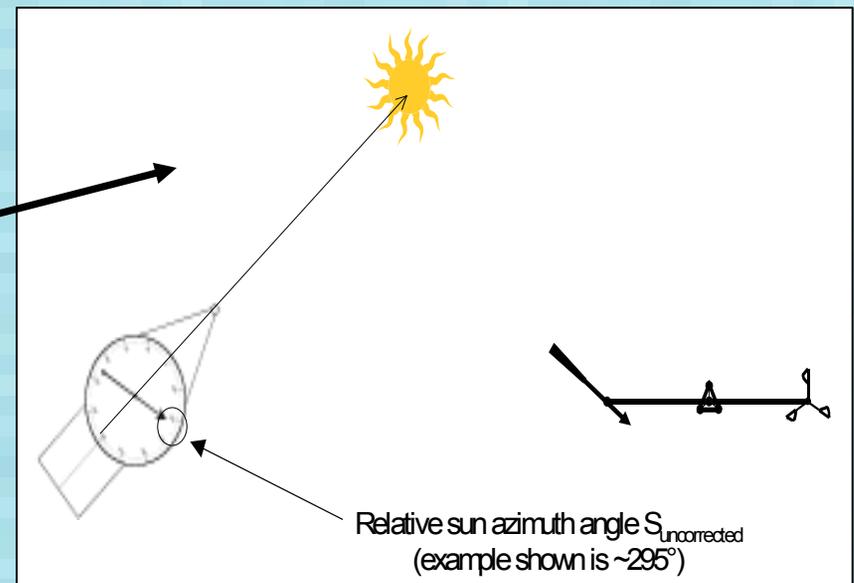


# What New: Wind Systems

There is a great discussion on Magnetic Declination for wind direction traceability



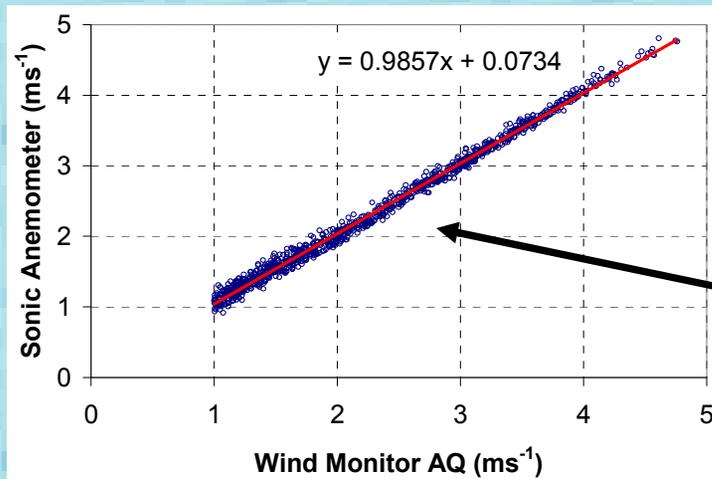
Detailed discussion on Solar Noon method for wind direction traceability



# What's New: Wind Systems



Section 2 has in-depth discussion of sonic anemometers



The Handbook illustrates some side by side comparisons of prop vs. sonic



# What's New: Upper Air Systems



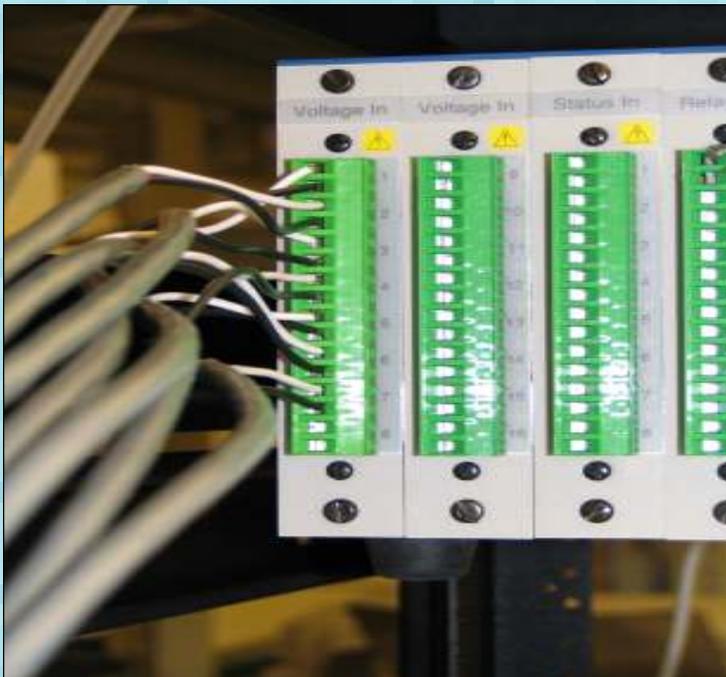
Section 8 discusses the three types of upper air systems with emphasis on:

- Types and applications
- Height
- Installation, setup and operation

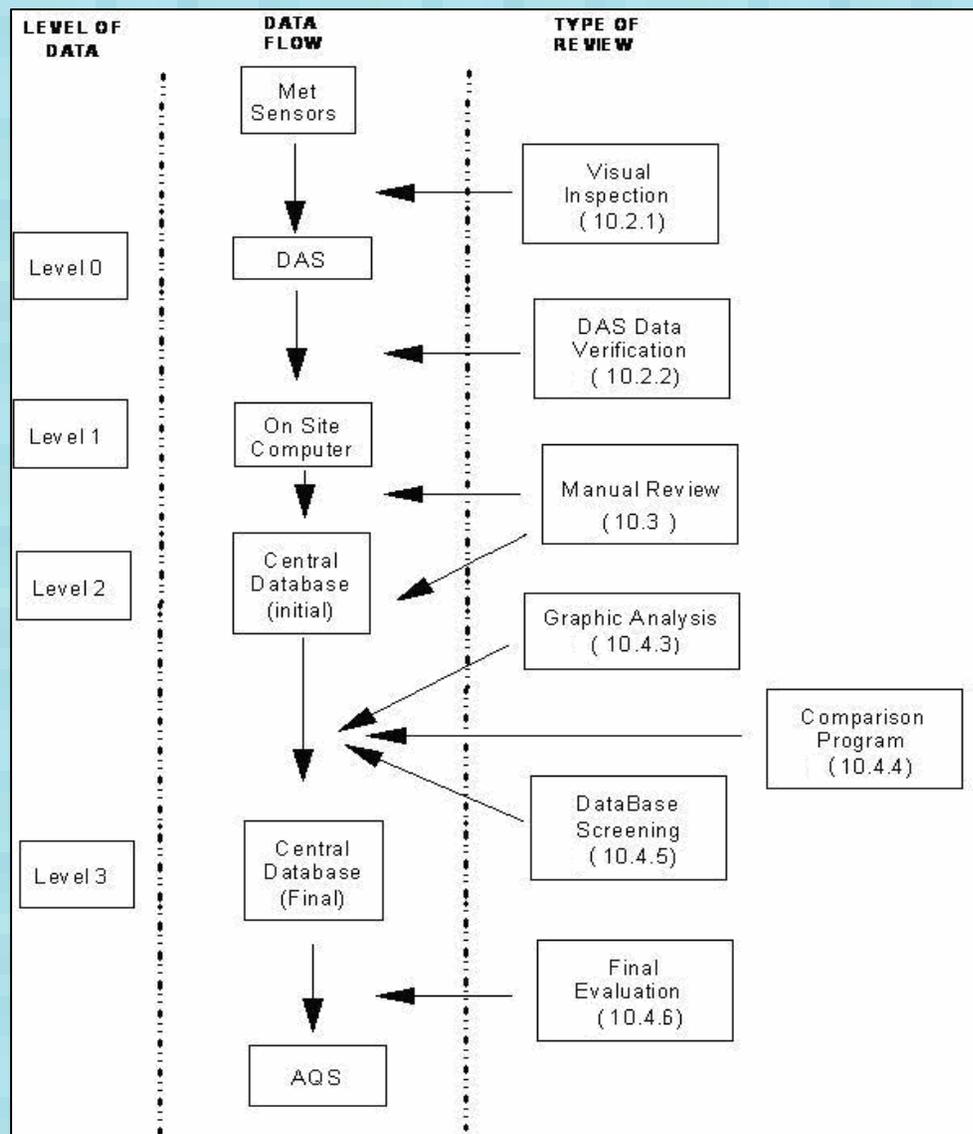


# What's New: Digital Data Discussion

- Why go “Digital?”
- Connectivity
- Discussion on Vector and Sigma Calculations



# What's New: Data Validation



In-depth discussion of data validation

Section discusses validation and verification

Discusses how to “link” met data to pollution data

Each “type of review” has a section number



# What's New: Calibration/Audit Tolerances

## NCore Calibration and Auditing Standards

| Measurement         | Calibration  |   |           | Accuracy   |  |               |
|---------------------|--|---|-----------|--|--|---------------|
|                     | Type   | Acceptance Criteria   | Frequency | Type   | Acceptance Criteria                                    | Frequency     |
| Ambient Temperature | 3 pt. Water Bath with NIST-traceable thermistor or thermometer | $\pm 0.5$ °C  | Quarterly | 3 pt. Water Bath With NIST-traceable thermistor or Thermometer | $\pm 0.5$ °C   | Semi-Annually |
| Relative Humidity   | NIST-traceable Psychrometer or standards solution              | $\pm 7\%$ RH  | Quarterly | NIST-traceable Psychrometer or standards solution              | $\pm 7\%$ RH   | Semi-Annually |
| Wind Speed          | NIST-traceable Synchronous Motor                               | $\pm 0.25\text{m/s} \leq 5\text{m/s}$ ;<br>5% > 2m/s not to exceed 2.5m/s | Quarterly | NIST-traceable Synchronous Motor                               | 0.25m/s $\leq$ 5m/s;<br>5% > 2m/s not to exceed 2.5m/s | Semi-Annually |
| Wind Direction      | Solar Noon, GPS Magnetic Compass                               | $\pm 5$ degrees;<br>includes orientation error                            | Quarterly | Solar Noon, GPS or Magnetic Compass                            | $\pm 5$ degrees;<br>includes orientation error         | Semi-Annually |
| Solar Radiation     | NIST-traceable Pyranometer                                     | $\pm 5\%$ of mean observed interval                                       | Quarterly | NIST-traceable Pyranometer                                     | $\pm 5\%$ of mean observed interval                    | Semi-Annually |
| Barometric Pressure | NIST-traceable Aneroid Barometer                               | $\pm 3$ mb  | Quarterly | NIST-traceable Aneroid Barometer                               | $\pm 3$ mb   | Semi-Annually |
| Precipitation       | Separatory funnel and graduated cylinder                       | $\pm 10\%$ of input volume  | Quarterly | Separatory funnel and graduated cylinder                       | $\pm 10\%$ of input volume                             | Semi-Annually |



# What's New: Some Cool Enhancements!

- Internet “hot links” throughout
- Audio/video (AV) files linked to Volume IV
- Download the files from AMTIC



In-depth AV file

- Met sensor calibrations
- Narration at each step
- Close-ups of technique
- Tips on “how to”



# Summary

- **New QA Handbook Volume IV is in 1<sup>st</sup> Draft. Lot's of new stuff!**
  - **MQOs**
  - **Towers**
  - **Wind systems**
  - **Data acquisition and validation**
  - **Upper Air Systems**
- **Audio Video Enhancements**



# Summary

