

# PROTOCOL FOR DETERMINING THE BEST PERFORMING AIR QUALITY MODEL

8<sup>TH</sup> MODELING CONFERENCE

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# MODEL PROTOCOL

- **THESE SLIDES ARE BASED ON AN EPA DOCUMENT – EPA-454/R-92-025 – ENTITLED:  
“PROTOCOL FOR DETERMINING THE BEST PERFORMING MODEL”  
DECEMBER 1992**
- **REFERENCED IN APPENDIX W**

# MODEL PROTOCOL

- **SCREENING TEST IS AVAILABLE**
  - **BASED ON FRACTIONAL BIAS (FB)**
    - $FB = 2 [PR - OB] / [OB + PR]$
  - **BASED ON THE HIGHEST 25 VALUES**
  - **IF ABSOLUTE FB EXCEEDS 0.67 (FACTOR OF 2), THE MODEL MAY BE EXCLUDED**

OB = OBSERVED DATA: PR =  
PREDICTED DATA

# MODEL PROTOCOL

- **THE MORE ADVANCED STATISTICAL TEST HAS 2 COMPONENTS**
  - **A REGULATORY COMPONENT**
  - **A SCIENTIFIC COMPONENT**

# MODEL PROTOCOL

- **THE REGULATORY COMPONENT**
  - **THE PRECISE TIME, LOCATION AND METEOROLOGICAL CONDITIONS ARE NOT OF CONCERN**
  - **THE MAGNITUDE OF THE HIGHEST CONCENTRATIONS IS OF PRIMARY CONCERN**

# MODEL PROTOCOL

- **THE REGULATORY COMPONENT**
  - **USES A TEST STATISTIC – THE ROBUST HIGHEST CONCENTRATION (RHC) - A SMOOTHED ESTIMATE OF THE HIGHEST CONCENTRATIONS**
  - **BASED ON A TAIL EXPONENTIAL FIT TO THE UPPER END OF THE DISTRIBUTION**
  - **GENERALLY BASED ON THE HIGHEST 25 CONCENTRATIONS**
  - **CONDUCTED FOR REGULATORY AVERAGING TIME (E.G. 3- AND 24-HOUR)**
  - **USES A PERFORMANCE MEASURE - THE FRACTIONAL BIAS OF THE RHCs**

# MODEL PROTOCOL

- **THE SCIENTIFIC COMPONENT**
  - **THE LOCATION AND METEOROLOGICAL CONDITIONS ARE OF CONCERN**
  - **THE MAGNITUDE OF THE HIGHEST CONCENTRATIONS UNDER EACH CONDITION IS OF CONCERN**

# MODEL PROTOCOL

- **THE SCIENTIFIC COMPONENT**
  - **USES A TEST STATISTIC – THE ROBUST HIGHEST CONCENTRATION (RHC) - A SMOOTHED ESTIMATE OF THE HIGHEST CONCENTRATIONS**
  - **BASED ON A TAIL EXPONENTIAL FIT TO THE UPPER END OF THE DISTRIBUTION**
  - **GENERALLY BASED ON THE HIGHEST 25 CONCENTRATIONS**
  - **USES A PERFORMANCE - THE FRACTIONAL BIAS OF THE RHCs**
  - **CONDUCTED FOR 1 HOUR CONCENTRATIONS**
  - **CONDUCTED FOR 2 WIND SPEED GROUPS AND 3 STABILITY CATEGORIES**



# MODEL PROTOCOL

- **COMBINE THE SCIENTIFIC AND REGULATORY COMPONENTS INTO ONE METRIC**

# MODEL PROTOCOL

- **USES A COMPOSITE PERFORMANCE METRIC (CPM)**

$$\text{CPM} = 1/3 [\text{AVERAGE AFB}_{i,j}] + 2/3 [\text{AFB}_3 + \text{AFB}_{24}] / 2$$

- $\text{AFB}_{i,j}$  = absolute fractional bias for met category  $i$  at station  $j$
- $\text{AFB}_3$  = absolute fractional bias for 3 hour averages
- $\text{AFB}_{24}$  = absolute fractional bias for 24 hour averages

# MODEL PROTOCOL

- **MODEL TO MODEL COMPARISON**

**USES THE MODEL COMPARISON MEASURE (MCM)**

$$\text{MCM}_{A,B} = \text{CPM}_A - \text{CPM}_B$$

**CPM<sub>A</sub> IS A COMPOSITE PERFORMANCE MEASURE FOR MODEL A**

**CPM<sub>B</sub> IS A COMPOSITE PERFORMANCE MEASURE FOR MODEL A**

# MODEL PROTOCOL

- **THE YARDSTICK**
  - THE RATIO OF THE 1) COMPOSITE DIFFERENCE TO THE 2) STANDARD ERROR
  - BLOCKED BOOTSTRAP METHOD IS USED TO GENERATE THE ESTIMATE OF THE STANDARD ERROR
  - RATIOS  $> 1.7$  INDICATE A SIGNIFICANT DIFFERENCE IN THE 2 MODELS AT ABOUT 90% CONFIDENCE LEVEL