Risk Assessment to Support the Review of the PM NAAQS – External Review Draft

Clean Air Scientific Advisory Committee Review Meeting

Office of Air Quality Planning and Standards

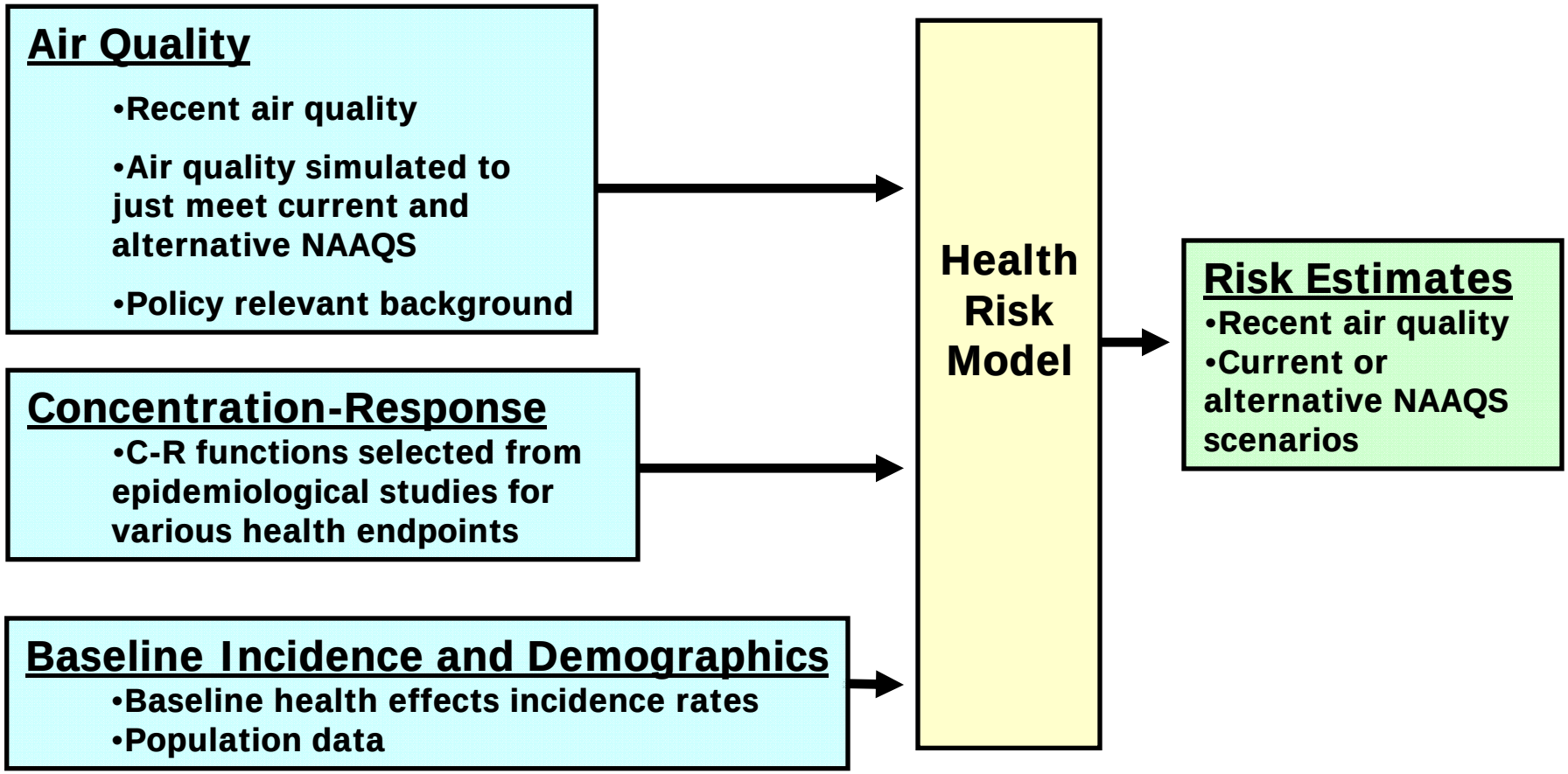
U.S. EPA

October 6th, 2009

Overview: Goals

- Estimate premature mortality and/or selected morbidity effects associated with short- and long-term $PM_{2.5}$ exposures in selected urban study areas
  - recent conditions
  - current NAAQS
  - alternative standard levels
- Focus on incremental differences in risk
- Gain better insights into distribution of risks and patterns of risk reduction
- Assess the influence of various inputs and assumptions and characterize uncertainty, to the extent possible
- Place risk estimates generated for set of urban study areas within a broader national context

Overview of Risk Assessment Model (including key design elements)



Overview of Quantitative Approach for Considering Uncertainty

Risk Assessment Modeling Elements

Air Quality:

Air Quality Adjustment (roll-back) Procedures

Concentration-Response:

Selection of Human Epidemiological Studies to Provide Concentration-Response Functions

Specification of Concentration - Response Relationships – consider:
- model form
- model risk down to PRB vs LML
- single- v.s. multi-chemical
- lag structure
- seasonally-differentiated
- slope of CR function

Primary Analysis Generating Core Set of Risk Estimates

Apply criteria for selecting subset of modeling element options for use in the core analysis

Generate **core set** of risk estimates for each combination of urban study area and air quality scenario

Apply single-factor sensitivity analysis to identify those modeling elements with a significant impact on risk results

Identify additional plausible modeling options (distinct from those used in the core analysis) for this set of key modeling elements

Conduct single- and multi-factor sensitivity analysis (for this subset of key modeling options) to generate **alternative sets of reasonable risk estimates** for a subset of urban study areas and air quality scenarios

Uncertainty Analysis Producing Additional Set of Reasonable Risk Estimates

Requested CASAC Feedback - 1 Scope of the analysis

- Decision to model risk only for $PM_{2.5}$
  - Excluded $PM_{10-2.5}$, ultrafines or specific PM components
- Focusing on health effect categories having a *causal* or *likely causal* association with short- or long-term $PM_{2.5}$ exposure
  - Excluded health effect categories classified as *suggestive* of a casual association, primarily due to data/evidence limitations
- Estimating risks associated with recent air quality, current standards, and 4 combinations of alternative standards
  - 13/35; 12/35; 13/30; 12/25

Requested CASAC Feedback-2 General approach

- Generating a set of core risk estimates
- Modeling long-term mortality risk down to lowest measured level (LML) and short-term mortality and morbidity risk down to policy relevant background (PRB)
- Specification of air quality inputs
  - Including a non-proportional (hybrid) rollback approach for simulating PM levels
- Selection of urban study areas
  - 15 urban study areas

Requested CASAC Feedback-3 General approach (cont.)

- Approach for selecting epidemiological studies and C-R functions
- Focusing on large multi-city studies for both long-term mortality and short-term mortality and morbidity
  - Zanobetti and Schwartz (2009)
  - Bell et al. (2008)
  - Krewski et al. (2009)
- Approach for addressing uncertainty and variability
  - Multi-tiered approach developed by WHO
    - Qualitative discussion of key sources of variability (any sources overlooked)?
    - Qualitative characterization of uncertainty (magnitude and direction of impact)
    - Single- and multi-factor sensitivity analyses

Requested CASAC Feedback- 4 Results

- Selection of risk metrics
  - Annual incidence associated with $PM_{2.5}$
  - Percent total annual incidence associated with $PM_{2.5}$
  - Percent reduction in $PM_{2.5}$–related incidence (for an alternative standard, relative to the current standard)
- Evaluating representativeness of the urban study areas in the national context
- Estimating long-term mortality related to $PM_{2.5}$ on a national scale
  - Overall technical approach used in the analysis
  - Assessing location of the 31 counties (associated with the 15 urban study areas) along the national distribution of county-level $PM_{2.5}$–related mortality

Additional Work

- Estimating risks for Pittsburgh
  - error identified in specification of design value monitor
  - rerun of risk estimates in process
- Analyzing impact of different approaches for characterizing annual-average $PM_{2.5}$ levels for the composite monitor at each urban study area
  - Weighting monitors by number of sample days vs.
  - Weighting monitors equally