Proposed Amendments to the Tables of Maximum Incremental Reactivity (MIR) Values

Public Hearing

November 3, 2009

Sacramento, California

California Environmental Protection Agency

Air Resources Board

Agenda

- Background and Scientific Basis
- Development Process
- Proposed Amendments
- Impacts
- Summary and Recommendation

Background and Scientific Basis

Reactivity and MIR

- Reactivity definition
  - Rate that VOCs react to form ozone smog
- MIR concept
  - Developed by Dr. Carter (UCR) ~1990
  - Used in regulations: California & US EPA

Dr. Carter's Research Work

- 2003 "Highly Cited Researcher", ISI
- 2005 Haagen-Smit Award, ARB
- >1000 experiments → mechanism modifications
- Many additional distinct VOC mechanisms
- Additions/changes include:
  - Aromatic hydrocarbon mechanisms
  - Chlorine chemistry

Tables of MIR Values, as Approved by Board in 2000

- MIR values contained in two code sections
  - § 94700: 659 VOCs & mixtures
  - § 94701: 24 bins for hydrocarbon solvents
- Used in the Aerosol Coatings Regulation
  - Reactivity limits for 36 coating categories

Board Directive to Executive Officer

- Review MIR values periodically
  - Modify if warranted
- Amendments to Tables of MIR Values
  - Executive Officer public hearing

2003 Amendments

Section 94700:

- Added 102 new compounds with associated MIR values
- Updated MIR values for 14 existing compounds

Section 94701:

- No change to hydrocarbon solvent “Bin” MIRs

Why Amend MIR Values Again?

- Board resolution: periodic review of tables
  - Ensure regulations based on “best science”
- New SAPRC-07 mechanism
  - Substantial MIR changes for existing VOCs
  - Hundreds of new VOCs, with MIR values
- New method for hydrocarbon solvent bins
  - New MIR values for bins, based on
    - New compositional data, and
    - More MIR values for components

Summary of MIR Value Changes

- 383 New compounds with MIR values
- For existing compounds
  - Average change in MIR values: –14%
  - For ~70% of these compounds, MIR values changed by >10%
  - For 67 of these compounds, MIR values changed by >30%
- Bin MIR values:
  - Aromatic bins: +1% to -25%
  - Non-Aromatic bins: -7% to -40%

Development Process

Scientific Peer Review (1)

- Peer review required for the scientific portion of proposed rules
- Reactivity Scientific Advisory Committee (RSAC) created by ARB, 1996
  - John Seinfeld, Caltech (Chair)
  - Roger Atkinson, UC Riverside
  - Jack Calvert, NCAR (retired)
  - Harvey Jeffries, Univ. of North Carolina
  - Jana Milford, University of Colorado
  - Ted Russell, Georgia Tech

Scientific Peer Review (2)

- Peer reviews by four independent experts:
  - Merched Azzi, CSIRO (Australia)
  - Richard Derwent, rd scientific (England)
  - Robert Harley, UC Berkeley
  - John Stockwell, Howard University
- RSAC approved the scientific basis for this proposal (March 25, 2009)

Public Process

- Reactivity Research Advisory Committee (RRAC) meetings
  - August 28, 2007
  - March 25, 2009
- Public workshop
  - August 4, 2009
- Input from stakeholders led to
  - new compounds with MIR values listed
  - user-friendly re-organization of MIR Table

Proposed Amendments

Section 94700: MIR Values for Individual Compounds & Mixtures

- Add 383 new compounds/mixtures with MIR values (a total of 1166 VOCs and mixtures)
- Update MIR values for existing VOCs
- Amend columns of MIR values:
  - Replace “2004” column with “New MIR Value” column
- Modify presentation of VOCs:
  - Add number index for easy identification
  - Regrouped by class of VOCs

Section 94701: Bin MIR Values for Hydrocarbon Solvents

- Carter's alternative method to estimate MIR values for solvent bins
- Amend existing MIR values based on Carter's method
- Maintain 24-bin system
- Add a column: new MIR values

Proposed Modification

- Modify section 94700 to delete several hydrocarbon solvents and their respective MIR Values
  - Already covered in section 94701,

    MIR Values for Hydrocarbon Solvents

Impacts

Environmental & Economic Impacts

- Minimal impacts for aerosol coatings:
  - No requirements leading to changes in environment or economy
- Impacts on other regulations:
  - Low Emission Vehicle (LEV) & Reformulated Gasoline (RFG)
  - Future reactivity-based regulations for other source categories

Effect of Proposed Amendments on Aerosol Coating Manufacturers

- Existing limits: based on 2000 MIR values
- Manufacturers must continue to use these MIR values
- Newly added substances can be used, once amendments are legally effective

Summary and Recommendation

Summary and Recommendation

- Staff recommends adoption of the proposed amendments to the Tables of MIR Values
- Adopting this proposal will:
  - ensure ARB's reactivity-based regulations are based on up-to-date science
  - provide more flexibility to aerosol coating manufacturers

Comments or Questions?