AP42 Section:	4.12, draft 1997
Related:	4
Title:	RMA AP-42 emission factors January 12, 1999

RMA AP-42 Emission Factors

January 12, 1999

Goals

- Review status of finalizing RMA rubber processing emission factors in AP-42
- Review revisions to existing factors
- Answer EPA questions regarding factor development and application
- Discuss next steps

Program Overview

- Coordinated by RMA
  - over 120 member companies
  - operating in 46 states
- Project lasting over 5 years
- Expended $2,000,000
- Generated over 23,000 pages of data
- 1,000's of hours of work to coordinate
- Factors are currently being used worldwide in all sectors of the tire and rubber manufacturing industry
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Importance of Factor Usage

- Estimate Rubber Processing Emissions
  - US/Canada and International Plants
  - Federal Programs (Title V, MACT, 112(c), ...)
  - State Programs (Emission Inventories, Construction permits, air toxics, ...)
  - Other EPA Programs (SARA, CAM, ...)
  - Canadian NPRI Data

Program Background

- Purpose for testing
  - MACT & Title V, new regulatory requirements, limited historical emissions data
- Organization
  - Concept Development (RMA member company experts, EPA and TRC)
  - Test & QA Protocols (TRC, EPA)
  - Test Implementation (TRC, Triangle Lab, RMA, Equipment Manufactures and Labs, EPA invited)
  - Emission Factor Development (TRC, RMA, EPA invited to training)

Program Status

- Met with USEPA Testing group 6/8/94
  - Developed agreed upon testing protocols
- Met with USEPA Emissions Factor Group 6/22/94 regarding AP-42 Factor inclusion & issuance
- Conducted testing Fall 1994
- Data conversion & QA/QC spring 1995
- TRC Project Volumes to RMA spring 1995
- June 12, 1995 RMA meeting with AP-42 Group
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Program Status (cont'd)

- Summer 1995 forwarded draft to EPA, States and project participants
- RMA review and modification Fall 1995 to Spring 1996
- RMA revised factors & application manual issued September 1996
- On going review, refinement and update as questions arise (mixing-pm 11/96, calender , curing, etc...)
- 12/97 posted on Web by EPA
- 3/98 RMA commented on draft factors

Manufacturing Process Overview

Key Manufacturing Processes

- Mixing
- Milling
- Extruding
- Calendering
- Curing (4)
- Grinding (4)

Testing Program Overview

- Evaluated key rubber processing operations
- 23 Compounds (Tires and Engineered Products)
- Followed EPA approved protocols
- Generated over 15,000 test data points
- Field data (time, flow rates, process rates, temperature, ...)

INDEX OF RUBBER COMPOUNDS

Compound #1: Tire Inner Liner (BrIIR/NR)

Compound #2: Tire Ply Coat (Natural Rubber/Synthetic Rubber)

Compound #3: Tire Belt Coat (Natural Rubber)

Compound #4: Tire Base/Sidewall (Natural/Polybutadiene Rubber)

Compound #5: Tire Apex (Natural Rubber)

Compound #6: Tire Tread (SBR/Polybutadiene Rubber)

Compound #7: Tire Bladder (Butyl Rubber)

INDEX OF RUBBER COMPOUNDS

INDEX OF RUBBER COMPOUNDS

Emission Factor Development

- Field & Lab Data Conversion
- Pilot Scale Verification
- Multiple Replicates
- Detection Limits & Averaging
- Development of Emission Factors
- Interpolation

Field & Lab Data Collection

- Obtained the following data from testing:
  - Sample Volumes
  - Air flow rates from enclosures
  - Sample Times
  - Rubber Mass
  - Analyte Mass or Concentration
  - Rubber Temperature
  - Related test data as required by Method

Field Data Conversion

- Lab and Field Data were then converted into emission factors found in AP-42
- Analyte Mass and Sample Volume ⇒ Concentration (ug/m^3)
- Concentration converted to lb/scf

  ug/m^3 x (grams/1E06 ug)x(lbs/453.593g)x(1 m^3/35.3145 ft^3) = lb/scf
- Use sample flow rate to convert lb/scf to lb/hr emission rate

  lb/scf x (sample flow, scf/min) x 60 min/hr = lb/hr
- Divide emission rate by process rate to obtain final factor

  (lb/hr) / (process rate, lb rubber/hr) = lb emissions/lb rubber

Pilot Scale Verification

- Checks were run for the following cases
  - Small Mixer 1 & 2 and Large Mixer 1
  - Tire Curing - Tested whole tires and lab scale tire cuts
  -
- Established that emission rates were not a function of test equipment size
  -
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Multiple Replicates

Mixing / milling curves were not replicates???

- Calendering - Compounds 2 & 12 tested - 3 sample runs
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- Extrusion - Compounds 4, 6, 9 & 22 tested - 3 sample runs
- Grinding - 3 sample runs for each operation tested

Detection Limits & Averaging

- For single runs with results below detection limit - represented as "<" in AP-42
- For multiple replicates L/2 averaging method was used when non-detect result obtained
  - L/2 method more statistically correct
  - L/2 method used in other EPA work (i.e., Superfund)
  - Original TRC method averaged non-detect values using detection limit
  - Revised RMA method used L/2 method to better compensate for non-detects
  - If all values above detection limit then straight arithmetic average used

L/2 Example

Interpolation

- Not all compounds tested for each process
- For unknowns an algebraic interpolation method was used to estimate emission factors
- Mixing was used as reference point
- Following example illustrates methodology used:

Interpolation Example

EPA Questions

- Random comparison of current AP-42 factors to previous TRC volumes
- Reasons for discrepancies:
  - Calculation errors
  - L/2 averaging
  - Miss reading of values from the tables
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1/12/99

Status of TRC Volumes

- Volume 1: Emission Factor Program Results
  - Narrative Text and Background Correct
  - Emission Factor Calculations obsolete
- Volume 2: Project Data (2/96)
  - Raw data correct
  - Emission Factor Calculations obsolete

Status of TRC Volumes

- Volume 3: Test Program Protocol
  - Correct
- Volume 4: Emission Factor Application Manual
  - Some Narrative Correct, Emission Factor Calculations obsolete
  - Replaced by September '96 RMA Manual & Database

Continuing Development/Refinement

< extrusion & mixing covered earlier

- Calender Update
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- Curing Update (conversion of whole tire mass rates to pounds of rubber mass rates)
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- On Going AP-42 refinement, data calculation verification, and additional testing by RMA & Member companies, etc.

AP-42 Next Steps

- Update Calender and Curing Sections
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- AP-42 Rating and Finalization
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