Developing a Consistent Methodology to Calculate VOC and HAP Evaporative Emissions for Stage I and Stage II Operations at Gasoline Service Stations for the 1999 NEI (Draft v2.0)

G. Tracy Johnson
MACTEC Federal Programs, Inc. (f/k/a PES, Inc.)
5001 South Miami Boulevard, Ste. 300
RTP, NC 27709

MACTEC, Inc.

Acknowledgements

- **Funding for this project was provided by**
  - Emissions Inventory Improvement Program (EIIP)
- **US EPA Lead**
  - Ron Ryan, USEPA/OAQPS/EFIG
  - Tel. 919.541.4330
  - E-Mail: ryan.ron@epa.gov

Project Goals

- To evaluate 1999 NEI (version 2) data for Stage I and Stage II service station operations
- To develop an consistent approach for estimating evaporative emissions from Stage I and Stage II service station operations
  - Approach had to rely on publicly-available data sources
  - To develop a national emission inventory with county-level resolution
- Compare 1999 NEI emissions to EIIP emissions

Project Goals

- **To estimate VOC and HAP emissions from the following service station operations (gasoline only)**
  - Splash fill (Stage I),
  - Submerged fill (Stage I),
  - Balanced submerge fill (Stage I),
  - UST breathing & emptying (Stage I),
  - Vehicle refilling emissions (Stage II), and,
  - Spillage (Stage II)

Data Sources

- **Department of Energy**
  - 1999 State-level gasoline consumption
- **Census Bureau's 1997 Census of Retail Trade**
  - Service stations sales
- **US EPA**
  - AP-42 methodology (Section 5.2 and Section 7.1)
  - EPA publications or contractor reports
  - Reformulated Gasoline and Oxygenated Gasoline Program

Data Sources

- **State & Local Regulations**
  - Stage I and II requirements (control levels, throughput limits, phase-in periods)
- **American Petroleum Institute**
  - Fuel temperature data at service stations

Evaluation of Service Station Records in 1999 NEI

- **Gasoline Throughput**
  - Majority of throughput records were empty
  - Some throughput units were apparently erroneous (e.g., "thousand tons")
- **Emission Factors**
  - Majority of emission factor records were empty
  - Some emission factor units were apparently erroneous (e.g., "2,000 lbs/1000 gallons loaded)

Evaluation of Service Station Records in 1999 NEI

- VOC Emissions
  - 815,000 tons [Area (98.3%)and Point Source (1.7%)]
  - No emission records for over 300 counties
  - Some states/counties did not list both Stage I and Stage II emissions
  - Some states/counties did not list UST B&E emissions
  - Some states/counties listed emissions under generic SCCs (e.g., "Stage I Total") and were not allocated according to the state's control level

Methodology

- Gasoline throughput
  - Obtained 1999 State-level monthly data from DOE
  - 131 billion gallons
- County-level allocation
  - 1997 service station sales from the Census of Retail Trade
  - Also considered county population and vehicle miles traveled (VMT)
  - VMT used for 3 states (state-supplied)

Methodology

- Stage I Methodology
  - Used AP-42 methodology (Section 5.2) for Stage I VOC calculations
    - Used RVP values which were used to calculate 1999 onroad emission estimates
    - Used bulk liquid temperatures from a 1976 API/Radian study
    - Stage I control efficiencies based on regulatory requirements
    - Rule penetration based on throughput limits in regulations and Stage II Technical Guidance document

Methodology

- Stage II Methodology
  - Used MOBILE 6 for Stage II VOC evaporative calculations
    - MOBILE 6 input files previously developed for 1999 onroad calculations were modified (160)
    - Stage II control efficiencies based on review of regulations
    - Rule penetration based on throughput limits in regulations
    - Used spillage emission factor of 0.68 lbs VOC/1000 gallons

Methodology

- HAP emissions
  - Based on average HAP contents for normal, reformulated (year round/160 counties), and oxygenated gasoline (winter months/59 counties)
    - 2,2,4 Trimethylpentane
    - Benzene
    - Ethylbenzene
    - Hexane
    - MTBE (weight percentage of market share)
    - POM
    - Toluene
    - Xylene

Methodology

- **VOC Emissions Calculated with MS Excel Spreadsheets**
  - 13 county-level worksheets (one for each month and an annual summation)
- **HAP Emissions Calculated using MS Access Database**
  - Reports developed to calculate National, state, and county-level HAP emissions

NEI vs. EIIP Calculations

- VOC Emissions
  - NEI 815,000 tons (300 counties not reported)
  - EIIP 830,000 tons
  - County-level comparisons were significantly different
- HAP Emissions
  - 2,2,4 TMP - 6,530 tons
  - Benzene - 6,990 tons
  - Ethylbenzene - 830 tons
  - Hexane - 13,060 tons
  - MTBE - 5,830 tons
  - POM - 4,150 tons
  - Toluene - 10,570 tons
  - Xylene - 4,040 tons

Conclusions

- NEI v. 2 data (throughput, emission factors, and emissions) for service stations is incomplete
- Methodology developed for this project fills in those data gaps
  - County-level throughput, emission factors, and emissions were developed
  - Emissions are attributed to operation-specific SCCs which is consistent with regulatory requirements (e.g., splash vs. submerged vs. balanced fill)
- Consistent methodology applied to most states/counties
- Future emission updates will be easy to perform
  - Census data can be easily updated
  - DOE data can be easily updated

For More Information

- Contact

Glenn Tracy Johnson

Tel. 919.941.0333

E-mail: gtjohnson@mactec.com

MACTEC, Inc.