Estimating the Monthly Variation in California’s Nonroad Equipment Emissions For the 2002 Emissions and Air Quality Modeling Platform

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2002 Platform: From NEI to Model Ready Emissions
2002 Platform: From NEI to Model Ready Emissions

- **Point**
  - Ptnonipm
  - Ptimp (egus)

- **Nonpoint**
  - nonpt, nonptfire, afdust, ag

- **Point Fires**
  - ptfire

- **Onroad**
  - onroad

- **Nonroad**
  - alm
  - nonroad

**SMOKE**

Emission Inputs for AQ model (hourly, speciated emissions)
The Nonroad Sector of the 2002 Platform

• Consists of **monthly** estimates of equipment categories using National Mobile Inventory Model (NMIM) with NR2005 for 49 States
  – ~ 200 SCCs describe fuel/engine type, equipment category, specific equipment
  – Excludes aircraft, locomotive and commercial marine (alm)
  – “MODE”-specific emissions: Exhaust, Evaporative, Refueling
  – Accounts for impact of fuels/temperature/equipment activity
  – Uses state-submitted NMIM inputs where provided

• Uses California-submitted **annual** emission estimates only for California
  – ~40 SCCs provided by California
  – no modes
  – NH3 for California from NMIM (~200 SCCs)
Issue: How process California-submitted annual, non-MODE-specific nonroad sector emissions

Options:
1. Apply NMIM monthly variation for California to annual emissions to develop monthly emissions
2. Develop monthly temporal factors based on equipment variation (NMIM “season.dat” file)
Monthly Equipment Activity Variation for Nonroad Equipment In California

Most Categories show Large Monthly Variation In Activity
We chose NMIM approach

Just Kidding…..
Implementation of NMIM Approach

• Compute “allocation factors” that account for monthly and mode variation of emissions from NMIM results for California

• Mode variation for only one criteria air pollutant (VOC). All other criteria pollutants are exhaust mode.

• Apply allocation factors to California emissions by county /SCC*/pollutant

*Requires mapping NMIM SCCs to California SCCS
California Nonroad Inventory SCCs much broader than NEI SCCs, for example

<table>
<thead>
<tr>
<th>NEI SCC in CALIFORNIA</th>
<th>NMIM SCC used as a surrogate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2260002000 2-Stroke;Construction &amp; Mining</td>
<td>Diesel;Construction &amp; Mining Equip.; Off-highway Trucks</td>
</tr>
<tr>
<td>Equip.;Total</td>
<td></td>
</tr>
<tr>
<td>2260003000 2-Stroke;Industrial Equip.;Total</td>
<td>2-Stroke;Industrial Equip.; Other Genl Industrial Equip.</td>
</tr>
<tr>
<td>2260004000 2-Stroke;Lawn and Garden Equip.;All</td>
<td>2-Stroke;Lawn &amp; Garden Equip.; Turf Equip. (Comm)</td>
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<tr>
<td>2260006000 2-Stroke;Commercial Equip.;Total</td>
<td>2-Stroke;Commercial Equip.; Generator Sets</td>
</tr>
<tr>
<td>2260007000 2-Stroke;Logging Equip.;Total</td>
<td>2-Stroke;Logging Equip.; Chain Saws &gt; 6 HP</td>
</tr>
<tr>
<td>2265001020 4-Stroke;Rec. Equip.;Snowmobiles</td>
<td>2-Stroke;Rec. Equip.; Snowmobiles</td>
</tr>
<tr>
<td>2265002000 4-Stroke;Construction and Mining</td>
<td>Diesel; Construction and Mining Equip.; Off-hwy Trucks</td>
</tr>
<tr>
<td>Equip.;Total</td>
<td></td>
</tr>
<tr>
<td>2265003000 4-Stroke;Industrial Equip.;Total</td>
<td>4-Stroke;Industrial Equip.; Forklifts</td>
</tr>
<tr>
<td>2265004000 4-Stroke;Lawn and Garden Equip.;All</td>
<td>4-Stroke;Lawn and Garden Equip.; Lawn and Garden Tractors (Commercial)</td>
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<tr>
<td>2265005000 4-Stroke;Agricultural Equip.;Total</td>
<td>4-Stroke;Agricultural Equip.; Agricultural Tractors</td>
</tr>
<tr>
<td>2265006000 4-Stroke;Commercial Equip.;Total</td>
<td>4-Stroke; Comm. Equip.; Air Compressors</td>
</tr>
<tr>
<td>2265007000 4-Stroke;Logging Equip.;Total</td>
<td>4-Stroke; Logging Equip.; Shredders &gt; 6 HP</td>
</tr>
<tr>
<td>2282005000 Pleasure Craft; Gasoline 2-Stroke;</td>
<td>Pleasure Craft; Gasoline 2-Stroke; Outboard</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>2282010000 Pleasure Craft; Gasoline 4-Stroke;</td>
<td>Pleasure Craft; Gasoline 4-Stroke; Inboard/Sterndrive</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>
Specific Categories For Which We Examined NMIM-based Monthly Profiles

<table>
<thead>
<tr>
<th>SCC</th>
<th>Description</th>
<th>Calif. state total VOC from 2002 NEI, V3 (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2282005000</td>
<td>Pleasure Craft; Gasoline 2-Stroke; Total</td>
<td>37,256</td>
</tr>
<tr>
<td>2260004000</td>
<td>Off-highway Vehicle Gasoline, 2-Stroke; Lawn and Garden Equipment; All</td>
<td>29,234</td>
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<tr>
<td>2265004000</td>
<td>Off-highway Vehicle Gasoline, 4-Stroke; Lawn and Garden Equipment; All</td>
<td>19,146</td>
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<tr>
<td>2265001020</td>
<td>Off-highway Vehicle Gasoline, 4-Stroke; Recreational Equipment; Snowmobiles</td>
<td>15,186</td>
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<tr>
<td>2270002000</td>
<td>Off-highway Vehicle Diesel; Construction and Mining Equipment; Total</td>
<td>12,089</td>
</tr>
<tr>
<td>2282010000</td>
<td>Pleasure Craft; Gasoline 4-Stroke; Total</td>
<td>6,838</td>
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<tr>
<td>2270002000</td>
<td>Off-highway Vehicle Diesel; Construction and Mining Equipment; Total</td>
<td>117,031</td>
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<tr>
<td>2270005000</td>
<td>Off-highway Vehicle Diesel; Agricultural Equipment; Total</td>
<td>48,885</td>
</tr>
</tbody>
</table>
NMIM-based profiles:
Pleasure Craft 2 Stroke VOC
NMIM-based profiles: Pleasure Craft 4 Stroke VOC

Pleasure Craft 4-Stroke

Temporal Factor

Month of Year

Activity-based

EVP VOC
EXH VOC
RFL VOC
VOC
Activity-based
NMIM-based profiles: Pleasure Craft
NMIM-based profiles:
Lawn & Garden
NMIM-based profiles: Snowmobiles
NMIM-based profiles: Diesel Construction and Diesel Agricultural Equipment

![Graphs showing temporal factors for Diesel Construction Equipment and Diesel Agricultural Equipment]
Monthly VOC County Emissions Comparisons

- **January**
  - NMIM-temporalized Emissions (tons)
  - Activity-based Emissions (tons)

- **April**
  - NMIM-temporalized Emissions (tons)
  - Activity-based Emissions (tons)

- **July**
  - NMIM-temporalized Emissions (tons)
  - Activity-based Emissions (tons)

- **October**
  - NMIM-temporalized Emissions (tons)
  - Activity-based Emissions (tons)
LA County Nonroad Sector
Monthly VOC emissions

Nonroad Monthly VOC Emissions in Los Angeles

- NMIM results-based
- Equipment Activity-based

Emissions (tons)

Month
LA County Nonroad Sector Monthly NOX emissions

Nonroad Monthly NOX Emissions in Los Angeles

- NMIM results-based
- Equipment Activity-based
Conclusions

• Many nonroad categories show strong monthly variation in emissions, mainly due to equipment activity monthly profiles
• NMIM accounts for these profiles and other factors: temperature, fuel properties which can also impact monthly variation of emissions
• NMIM provides mode-specific emissions, which impact speciation of pollutants
• For 2002 platform, NMIM was used to provide mode and monthly emissions for California nonroad categories
• California monthly emissions very similar using equipment activity profiles vs NMIM, however, did not investigate differences in speciated VOC
• Application of NMIM variation to Calif. Emissions complicated because SCCs are different
Really!