MATES V Regional Modeling Analysis: Emissions Inventory and Modeling

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South Coast Air Quality Management District
Toxic Air Contaminants (TAC) Inventories for MATES-IV

- MATES IV: 2012-2013

- Criteria Pollutant Inventories:
  - Based on 2012 AQMP Inventories
  - Projected from 2008 (base year) to 2012

- TAC Emissions from Speciation of TOG and PM Emissions Using CARB Profiles

- Hourly Emissions in 2x2Km Grids for Regional Modeling
Emissions Inventory for MATES V

• Point & Area sources
  – 2016 AQMP inventory
  – Annual Emissions Report for 2017 or 2018 upon availability

• On-Road
  – Emissions rates from EMFAC 2017
  – VMT and travel activity data for 2018
    • SCAG’S 2016 RTP/SCS Travel Demand Model estimates

• Off-Road
  – 2016 AQMP inventory projected for 2018
  – Port and OGV will be revised using the most recent available data
    • Discrepancy between projection from actual data
  – Incorporating Revisions Available by 2019
On-Road Emissions Inventory for the 2016 AQMP

- Based on real-time sensor data
- Light and Medium duty vehicles
  - California Department of Transportation Performance Measurement System (Caltrans PeMS)
  - > 9000 traffic monitoring stations
- Heavy duty vehicles
  - CalTrans PeMS Weight-In-Motion (WIM)
Possible Improvements

• Latest CARB Speciation Profiles upon availability
• Utilizing Permit Information to Allocate Minor Point Sources to Specific Locations
  – Minor Point sources are currently treated as area source
• Finer Scale spatial representations of
  – On-Road Emissions
  – Railroad Emissions
• Re-evaluating Ocean Going Vessels
  – Projection vs. Actual reported emissions
  – GPS based real-time ship location data, AIS (Automatic identification system)
• Improving aircraft taking-off and landing emissions
  – ACARS (Aircraft Communications Addressing and Reporting System)
  – “Aircraft Situation Display to Industry” (ASDI) data
  – Collaboration with CARB
AIS (Automatic identification system) Marine Traffic Data

• The automatic identification system (AIS) is an automatic tracking system used for collision avoidance on ships and by vessel traffic services (VTS).

• Provides vessel type, size, position, course, and speed.
## Example of AIS ship data near Port of LA

<table>
<thead>
<tr>
<th>Flag</th>
<th>Vessel Name</th>
<th>Photo</th>
<th>Type</th>
<th>Length x Breadth (m)</th>
<th>Deadweight</th>
<th>Area</th>
<th>Received</th>
<th>Destination / Reported ETA</th>
<th>My Fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANDO</td>
<td>Container Ship</td>
<td>153x25</td>
<td>17250</td>
<td>Aegian Sea</td>
<td>2017-06-30 00:14 LT (UTC +2)</td>
<td>TRISTE 2017-07-02 08:00 LT (UTC +2)</td>
<td>Add to Fleet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ULLEOY:14</td>
<td>Ro-Ro/Vehicles Carrier</td>
<td>238x26</td>
<td>15000</td>
<td>Aegian Sea</td>
<td>2017-06-30 00:14 LT (UTC +2)</td>
<td>ITTRAS-TROIS 2017-06-30 09:39 LT (UTC +3)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>TALOS</td>
<td>Ro-Ro/Vehicles Carrier</td>
<td>124x10</td>
<td>2888</td>
<td>Aegian Sea</td>
<td>2017-06-30 00:14 LT (UTC +2)</td>
<td>PEIRAIAS 2017-06-30 09:30 LT (UTC +3)</td>
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<td></td>
<td></td>
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<tr>
<td>AS FLORIANA</td>
<td>Container Ship</td>
<td>166x25</td>
<td>18445</td>
<td>Aegian Sea</td>
<td>2017-06-30 00:14 LT (UTC +2)</td>
<td>FOR ORDER 2017-06-04 22:00 (UTC)</td>
<td>Add to Fleet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LUCKY JOY</td>
<td>General Cargo</td>
<td>199x17</td>
<td>7158</td>
<td>East Mediterranean</td>
<td>2017-06-30 00:14 LT (UTC +2)</td>
<td>CASTELLON 2017-07-05 15:00 LT (UTC +2)</td>
<td>Add to Fleet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALLEGRA</td>
<td>Bulk Carrier</td>
<td>180x30</td>
<td>34146</td>
<td>Aegian Sea</td>
<td>2017-06-30 00:14 LT (UTC +2)</td>
<td>DERRYNANE 2017-07-07 12:00 LT (UTC +3)</td>
<td>Add to Fleet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEW GEMINI</td>
<td>General Cargo</td>
<td>98x15</td>
<td>5269</td>
<td>Aegian Sea</td>
<td>2017-06-30 00:14 LT (UTC +2)</td>
<td>MARGHERA 2017-07-03 14:09 LT (UTC +2)</td>
<td>Add to Fleet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Aloft Aircraft Emissions

(Source: www.flickr.com)
Chemical Transport Modeling

- Same as MATES IV
- 2 km by 2 km grid resolution
- Domain covers the Basin, major OGV corridors and the Coachella Valley
Modeling Platform: Dispersion Platform

- In-House Emissions Model

- Meteorological Model to provide dispersion platform
  - WRF mesoscale model
  - NAM and NARR as initial and boundary values
  - Considering urban parameterizations with high-resolution urban morphology, and high-resolution landuse data from SCAG
Modeling Platform: Chemical Transport Platform

• CAMx/rTRAC
  – Reactive Tracer probing algorithm
  – In MATES IV simulations, 20 toxic species were identified as a major risk contributors

• CMAQ
  – Primary modeling platform for the 2012 and 2016 AQMPs
  – Offers several options to account for chemical reactions and source apportionment probing tool for toxic species
  – Still needs customization to enable tracking of key toxic contaminants and source contributions to them.
## Toxics reported in MATES IV

<table>
<thead>
<tr>
<th>Species</th>
<th>Type</th>
<th>CB6MP_AE6_AQ (CMAQ 5.2)</th>
<th>SAPRC99tx3_ae5_aq (CMAQ 5.0.2)</th>
<th>saprc07tc_ae6_aq (CMAQ 5.2)</th>
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<tbody>
<tr>
<td>1,3 Butadiene</td>
<td>Gas</td>
<td>BUTADIENE13</td>
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<tr>
<td>Acetaldehyde</td>
<td>Gas</td>
<td>ALD2, ALD2_PRIMARY</td>
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<td>✓</td>
</tr>
<tr>
<td>As (2.5)</td>
<td>Aerosol</td>
<td>AAS (I)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>As (TSP)</td>
<td>Aerosol</td>
<td>AAS(I,J,K)</td>
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<tr>
<td>Benzene</td>
<td>Gas</td>
<td>BENZENE</td>
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<td>✓</td>
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<td>Cd (2.5)</td>
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<td>ACD (I)</td>
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<tr>
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<tr>
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<td>ACR_VI (I,J,K)</td>
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<tr>
<td>EC_{10}</td>
<td>Aerosol</td>
<td>DE_EC (I,J)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC_{2.5}</td>
<td>Aerosol</td>
<td>DE_EC (I)</td>
<td></td>
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</tr>
<tr>
<td>Formaldehyde</td>
<td>Gas</td>
<td>FORM, FORM_PRIMARY</td>
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<td>✓</td>
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<tr>
<td>Methylene Chloride</td>
<td>Non-reactive</td>
<td>CL2_ME</td>
<td></td>
<td>✓</td>
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<tr>
<td>Naphthalene</td>
<td>Non-reactive</td>
<td>NAPHTHALENE</td>
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<td>✓</td>
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<td>Ni (2.5)</td>
<td>Aerosol</td>
<td>ANI (I)</td>
<td></td>
<td>✓</td>
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<tr>
<td>Ni (TSP)</td>
<td>Aerosol</td>
<td>ANI (I,J,K)</td>
<td></td>
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<tr>
<td>Pb (2.5)</td>
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<td>APB (I)</td>
<td></td>
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<td>Pb (TSP)</td>
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<tr>
<td>P-Dichlorobenzene</td>
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</tbody>
</table>
Summary

• Emissions Inventory will be substantially updated from MATES IV methodology. This includes spatial and temporal allocation of on- and off-road mobile sources and point sources.

• Multiple Chemical transport modeling platforms and various chemical mechanisms will be evaluated to ensure the most updated methodology and consistent with AQMP/SIP approaches.