Tank Emission Tracking Tools: A Comparative Analysis

Gery Vegh, ERA Environmental Management Solutions
• Over two decades of environmental, H&S, compliance, and business leadership.
• Works closely with US EPA, Suppliers Partnership for the Environment (SP), Commission for Environmental Cooperation, and industry groups.
• Trained Toxicologist/Chemist and consultant.

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Chief Toxicologist & Cofounder
Tank Emission Tracking Software: A Comparative Analysis

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Things to consider when looking for a Tanks software:

• Facility type
• Process type
• Tank type
• Type of material stored in tank
• Recordkeeping
• Are all Tanks programs created equally??
Industry/Process Types

- **Oil Exploration** (Crude Oil, Water, Dehydrator, Gas Line)
- **Refinery** (Crude Oil, Distillation, Storage, Mix, Packaging, Loading)
- **Midstream** (Tank farm; Storage/Mix Tanks, Loading Racks; Tank truck, Rail car, and Barge loading)
- **Chemical plant** (Tank farm; Storage/Mix Tanks)
- **Industry/Manufacturing** (ex. Automotive plant: gasoline, methanol, engine oil, antifreeze storage tanks)
Tank Types

- Open top tank
- Horizontal tank
- Vertical fixed roof tank
- Internal floating roof tank
- External floating roof tank
- Domed external floating roof tank
- Mobile tank
Tanks Process Flow
Materials & Calculations

• Some methods/tools only calculate certain situations:
  – Organic mixtures (ex. 20% Toluene 80% Benzene)
  – Petroleum (diesel, jet A, gasoline)
  – Petroleum standards (EPA/API)
  – Crude oil
  – Asphalt
  – Pure substances (100% methanol)
• Different approaches to calculations:
  – AP-42 calculations (American Petroleum Institute; API equations)?
  – Lab tested data?
  – Industry assumptions?
Record keeping

• Fixed annual throughput
• Monthly throughput
• Daily throughput
• Special events? (Cleaning, landing, heating, etc.)
Tanks Data Flow

Product/Chemical Data:
- Tested TVP or Antoine/Riedel Coefficients used to calculate TVP
- Chemical composition and percent weights
- Vapor pressures either user defined or from MCL
- Product specification

Recordkeeping:
- Movements of product into and out of tanks
- Date & length of time of upset
- Tank emptying, purging, refilling, sludge removal etc
- Heated products
- Emission or throughput data from monitoring device

Emissions and throughput calculations

Reports:
- TRI
- Tier II
- Emission inventory
- Tank specific reports
- KPIs
- CEMS reports

Continuous Monitoring (CEMS)
General Tank Emission

- **Working Losses**

- **Standing Losses**

- Material in Tanks exists in two (2) phases; a) **Liquid** b) **gas** (vapor)

- The vapor pressure (VP) plays an important role in calculating Tank emissions
Calculation of True Vapor Pressure (TVP)

- True Vapor Pressure (TVP)
  - Distillation Slope
  - Molecular weight (liquid)
  - Molecular weight (vapor)
  - Reid Vapor Pressure (RVP)
  - Antoine Coefficients
  - Riedel Coefficients
  - Liquid compositions
  - Vapor compositions
  - Tested values
True Vapor Pressure (TVP)/Chemical Composition

- TVP can be one of the most challenging variables to calculate for materials stored in tanks
  - **Complete Speciation** - 100% known chemical composition
  - **Partial Speciation** - Chemical composition NOT 100% known
Complete Speciation

• ~100% chemical components of substance known (Antoine or Riedel coefficients per chemical)
  • This is not always the case for the Oil & Gas industry.

• Process:
  1. Use **Antoine** or **Riedel** coefficients to calculate the TVP per chemical
  2. Calculate TVP for mixture using the % by Weight data (from known chemical compositions)
Partial Speciation

• How do you calculate TVP if you don’t know the chemical composition of your substance?
  – Common example: **Crude Oil/Petroleum products**

• **TVP** of the product should be calculated using the 4 variables below:
  – The **Reid VP** of the mixture
  – **Distillation Slope**
  – **Molecular weight** of the liquid
  – **Molecular weight** of the vapor
Managing large amounts of data
(How do you keep up?? What about 200 Tanks??)
Some available Tanks software/tools

- **EPA Tanks 4.09** (US Environmental Protection Agency)
- **E&P Tanks** (American Petroleum Institute; API)
- **Tanks ESP** (TGB; Rob Ferry)
- **ERA Tanks Module** (ERA Environmental Management Solutions)

- *note: (there are other Tank software/tools not listed in this presentation)*
# Functionality Analysis (Tank Type)

<table>
<thead>
<tr>
<th>Tank type</th>
<th>Functionality/ supported dataset</th>
<th>TANKS 4.09</th>
<th>E&amp;P</th>
<th>ESP</th>
<th>ERA</th>
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<tbody>
<tr>
<td>Open top tank</td>
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<tr>
<td>Horizontal tank</td>
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<tr>
<td>Vertical fixed roof tank</td>
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<tr>
<td>Internal floating roof tank</td>
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<tr>
<td>External floating roof tank</td>
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<tr>
<td>Domed external floating roof tank</td>
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<tr>
<td>Mobile tank</td>
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# Functionality Analysis (Tank Emission Types)

<table>
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<tr>
<th>Emission Type</th>
<th>Functionality/ supported dataset</th>
<th>TANKS 4.09</th>
<th>E&amp;P</th>
<th>ESP</th>
<th>ERA</th>
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<td>Roof Landing</td>
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<td>Cleaning</td>
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<td>Evaporation (open top tanks)</td>
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<tr>
<td>Standing</td>
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<td>Working</td>
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<td>Loading (mobile tanks)</td>
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<td>Organic liquid mixtures</td>
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<td>Petroleum distillates</td>
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<tr>
<td>Crude oil</td>
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<td>restricted</td>
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<td>Petroleum distillates (EPA standards)</td>
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## Functionality Analysis (Tank Recordkeeping throughputs)

<table>
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<tr>
<th>Functionality/ supported dataset</th>
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<th>E&amp;P</th>
<th>ESP</th>
<th>ERA</th>
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<td><strong>Recordkeeping - Daily</strong></td>
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<td>manual entry</td>
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<td><strong>Recordkeeping - Weekly</strong></td>
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<td>●</td>
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<tr>
<td></td>
<td>manual entry</td>
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<tr>
<td><strong>Recordkeeping - Monthly</strong></td>
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<tr>
<td></td>
<td>manual entry</td>
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<tr>
<td><strong>Recordkeeping - Annual</strong></td>
<td>importing function</td>
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<td>&quot;Grouped&quot; records</td>
<td>&quot;Grouped&quot; tank - automated distribution</td>
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<tr>
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<td>&quot;Grouped&quot; tank - archiving functionality</td>
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<td><strong>Material Revisions</strong></td>
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<td>Full Speciation</td>
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<tr>
<td></td>
<td>Partial Speciation</td>
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<tr>
<td><strong>Input - Vapor Composition</strong></td>
<td>Vapor Weight Speciation</td>
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</tr>
</tbody>
</table>

*TANKS 4.09 and ESP confirmed the analysis performed by ERA. E&P results to the best of our knowledge and not confirmed.*
Questions??
Thank You for attending this presentation.

Gary.vegh@era-ehs.com
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