

# **Year 2005 and 2008 Gulfwide Emission Inventory Studies**

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# Introduction

- MMS is currently sponsoring the fourth air quality emissions inventory study effort for the Gulf of Mexico OCS
- The current study, *The Year 2008 Gulfwide Emission Inventory Study*, is an update to the 2000 and 2005 Gulfwide inventories
- Like the 2005 inventory, the 2008 inventory corresponds with the U.S. EPA's onshore periodic emissions inventory
- The inventories are used by states and RPO's for SIP demonstrations, and by MMS in the NEPA process and air quality assessments

# ■ Pollutants Addressed

- Criteria pollutants
  - Carbon monoxide (CO)
  - Nitrogen oxides (NO<sub>x</sub>)
  - Particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>)
  - Sulfur dioxide (SO<sub>2</sub>)
  - Volatile organic compounds (VOC)
- Greenhouse gases
  - Carbon dioxide (CO<sub>2</sub>)
  - Methane (CH<sub>4</sub>)
  - Nitrous oxide (N<sub>2</sub>O)

# Sources Addressed

- “Major” OCS Oil and Gas Production Platforms
- OCS Oil and Gas Production Non-platform Sources
  - Drilling rigs
  - Pipelaying vessels
  - Support helicopters
  - Support vessels
  - Survey vessels
- Non-OCS Oil and Gas Production Sources
  - Biogenic/geogenic sources
  - Commercial fishing vessels
  - CMVs
  - LOOP
  - Military vessels
  - Vessel lightering

# Year 2005 Results – Criteria Pollutants

<b>Equipment/Source Category</b>	<b>CO</b>	<b>NO<sub>x</sub></b>	<b>PM<sub>10</sub></b>	<b>SO<sub>2</sub></b>	<b>VOC</b>
<b>Total Platform Emissions</b>	<b>89,813</b>	<b>82,581</b>	<b>746</b>	<b>1,961</b>	<b>51,241</b>
<b>Drilling Rigs</b>	<b>3,372</b>	<b>36,787</b>	<b>613</b>	<b>4,902</b>	<b>613</b>
<b>Pipelaying Vessels</b>	<b>2,016</b>	<b>9,714</b>	<b>367</b>	<b>1,650</b>	<b>367</b>
<b>Support Helicopters</b>	<b>7,729</b>	<b>1,307</b>	<b>199</b>	<b>478</b>	<b>1,645</b>
<b>Support Vessels</b>	<b>14,379</b>	<b>150,958</b>	<b>2,614</b>	<b>20,341</b>	<b>2,614</b>
<b>Survey Vessels</b>	<b>101</b>	<b>1,214</b>	<b>18</b>	<b>147</b>	<b>18</b>
<b>Total OCS Oil/Gas Production Source Emissions</b>	<b>117,410</b>	<b>282,560</b>	<b>4,558</b>	<b>29,481</b>	<b>56,498</b>
<b>Total Non-OCS Oil/Gas Production Source Emissions</b>	<b>4,885</b>	<b>110,402</b>	<b>1,530</b>	<b>11,078</b>	<b>24,434</b>
<b>Total Emissions (tpy)</b>	<b>122,295</b>	<b>392,961</b>	<b>6,088</b>	<b>40,559</b>	<b>80,933</b>

# Year 2005 Results – Platform Sources

<b>Equipment</b>	<b>CO</b>	<b>NO<sub>x</sub></b>	<b>PM<sub>10</sub></b>	<b>SO<sub>2</sub></b>	<b>VOC</b>
<b>Amine Units</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>979</b>	<b>&lt;1</b>
<b>Boilers/Heaters/ Burners</b>	<b>456</b>	<b>780</b>	<b>10</b>	<b>3</b>	<b>30</b>
<b>Diesel Engines</b>	<b>1,908</b>	<b>6,915</b>	<b>309</b>	<b>378</b>	<b>361</b>
<b>Drilling Equipment</b>	<b>1,174</b>	<b>4,420</b>	<b>79</b>	<b>558</b>	<b>111</b>
<b>Combustion Flares</b>	<b>964</b>	<b>185</b>	<b>&lt;1</b>	<b>2</b>	<b>16</b>
<b>Fugitives</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>17,647</b>
<b>Glycol Dehydrators</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>997</b>
<b>Loading Losses</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>Losses From Flashing</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>870</b>
<b>Mud Degassing</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>61</b>
<b>Natural Gas Engines</b>	<b>82,073</b>	<b>57,647</b>	<b>272</b>	<b>18</b>	<b>1,638</b>
<b>Natural Gas Turbines</b>	<b>3,237</b>	<b>12,633</b>	<b>75</b>	<b>24</b>	<b>83</b>
<b>Pneumatic Pumps</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,189</b>
<b>Pressure/Level Controllers</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>908</b>
<b>Storage Tanks</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9,253</b>
<b>Cold Vents</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>18,073</b>
<b>Total Emissions (tpy)</b>	<b>89,813</b>	<b>82,581</b>	<b>746</b>	<b>1,961</b>	<b>51,241</b>

# Year 2005 Results – Non-Platform Sources

<b>Source Category</b>	<b>CO</b>	<b>NO<sub>x</sub></b>	<b>PM<sub>10</sub></b>	<b>SO<sub>2</sub></b>	<b>VOC</b>
<b>Drilling Rigs</b>	<b>3,372</b>	<b>36,787</b>	<b>613</b>	<b>4,902</b>	<b>613</b>
<b>Pipelaying Vessels</b>	<b>2,016</b>	<b>9,714</b>	<b>367</b>	<b>1,650</b>	<b>367</b>
<b>Support Helicopters</b>	<b>7,729</b>	<b>1,307</b>	<b>199</b>	<b>478</b>	<b>1,645</b>
<b>Support Vessels</b>	<b>14,379</b>	<b>150,958</b>	<b>2,614</b>	<b>20,341</b>	<b>2,614</b>
<b>Survey Vessels</b>	<b>101</b>	<b>1,214</b>	<b>18</b>	<b>147</b>	<b>18</b>
<b>Total OCS Oil/Gas Production Sources (tpy)</b>	<b>27,597</b>	<b>199,979</b>	<b>3,812</b>	<b>27,520</b>	<b>5,257</b>
<b>Biogenic/Geogenic Sources</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>14,358</b>
<b>Commercial Fishing Vessels</b>	<b>89</b>	<b>1,009</b>	<b>16</b>	<b>124</b>	<b>16</b>
<b>Commercial Marine Vessels</b>	<b>3,494</b>	<b>94,756</b>	<b>1,159</b>	<b>8,793</b>	<b>1,639</b>
<b>LOOP</b>	<b>169</b>	<b>3,339</b>	<b>46</b>	<b>345</b>	<b>633</b>
<b>Military Vessels</b>	<b>492</b>	<b>5,213</b>	<b>135</b>	<b>1,025</b>	<b>54</b>
<b>Vessel Lightering</b>	<b>641</b>	<b>6,084</b>	<b>174</b>	<b>791</b>	<b>7,734</b>
<b>Total Non-OCS Oil/Gas Production Sources (tpy)</b>	<b>4,885</b>	<b>110,402</b>	<b>1,530</b>	<b>11,078</b>	<b>24,434</b>
<b>Total Non-Platform Emissions (tpy)</b>	<b>32,482</b>	<b>310,380</b>	<b>5,342</b>	<b>38,598</b>	<b>29,692</b>

# Year 2005 Results – Greenhouse Gases

Equipment/Source Category	CH <sub>4</sub>	CO <sub>2</sub>	N <sub>2</sub> O
<b>Total Platform Emissions</b>	<b>214,499</b>	<b>8,848,779</b>	<b>130</b>
Drilling Rigs	12	1,998,734	95
Pipelaying Vessels	7	657,052	28
Support Helicopters	N/A	180,684	N/A
Support Vessels	52	<b>8,282,197</b>	<b>392</b>
Survey Vessels	<1	59,953	3
<b>Total OCS Oil/Gas Production Source Emissions</b>	<b>214,571</b>	<b>20,027,399</b>	<b>649</b>
<b>Total Non-OCS Oil/Gas Production Source Emissions</b>	<b>1,913</b>	<b>4,307,048</b>	<b>2,154</b>
<b>Total Emissions (tpy)</b>	<b>216,484</b>	<b>24,334,447</b>	<b>2,803</b>



# Year 2005 GHG Results – Platform Sources

Equipment Type	CH <sub>4</sub>	CO <sub>2</sub>	N <sub>2</sub> O
Amine Units	4	0	0
Boilers/heaters/burners	12	651,640	12
Diesel Engines	8	305,921	N/A
Drilling Equipment	0	227,917	N/A
Combustion Flares	326	10,786	<1
Fugitives	84,201	0	0
Glycol Dehydrators	6,811	0	0
Losses From Flashing	19,149	435	0
Mud Degassing	316	1	0
Natural Gas Engines	15,582	3,307,482	N/A
Natural Gas Turbines	340	4,342,651	118
Pneumatic Pumps	12,114	245	0
Pressure/level Controllers	6,141	136	0
Cold Vents	69,494	1,565	0
<b>Total Emissions (tpy)</b>	<b>214,499</b>	<b>8,848,779</b>	<b>130</b>

# **Comparison of 2000 and 2005 Emission Estimates (Platform and Non-Platform Sources)**

<b>Base Year</b>	<b>CO (tpy)</b>	<b>NO<sub>x</sub> (tpy)</b>	<b>PM<sub>10</sub> (tpy)</b>	<b>SO<sub>2</sub> (tpy)</b>	<b>VOC (tpy)</b>
<b>2000</b>	<b>113,303</b>	<b>203,349</b>	<b>4,016</b>	<b>26,760</b>	<b>85,008</b>
<b>2005</b>	<b>122,295</b>	<b>392,961</b>	<b>6,088</b>	<b>40,559</b>	<b>80,933</b>
<b>Percent Difference</b>	<b>+8%</b>	<b>+93%</b>	<b>+52%</b>	<b>+52%</b>	<b>-5%</b>

# Comparison of 2000 and 2005 Emission Estimates (Platform Sources)

<b>Base Year</b>	<b>CO (tpy)</b>	<b>NO<sub>x</sub> (tpy)</b>	<b>PM<sub>10</sub> (tpy)</b>	<b>SO<sub>2</sub> (tpy)</b>	<b>VOC (tpy)</b>
<b>2000</b>	<b>92,144</b>	<b>78,049</b>	<b>789</b>	<b>3,472</b>	<b>59,536</b>
<b>2005</b>	<b>89,813</b>	<b>82,581</b>	<b>746</b>	<b>1,961</b>	<b>51,241</b>
<b>Percent Difference</b>	<b>-3%</b>	<b>+6%</b>	<b>-5%</b>	<b>-44%</b>	<b>-14%</b>

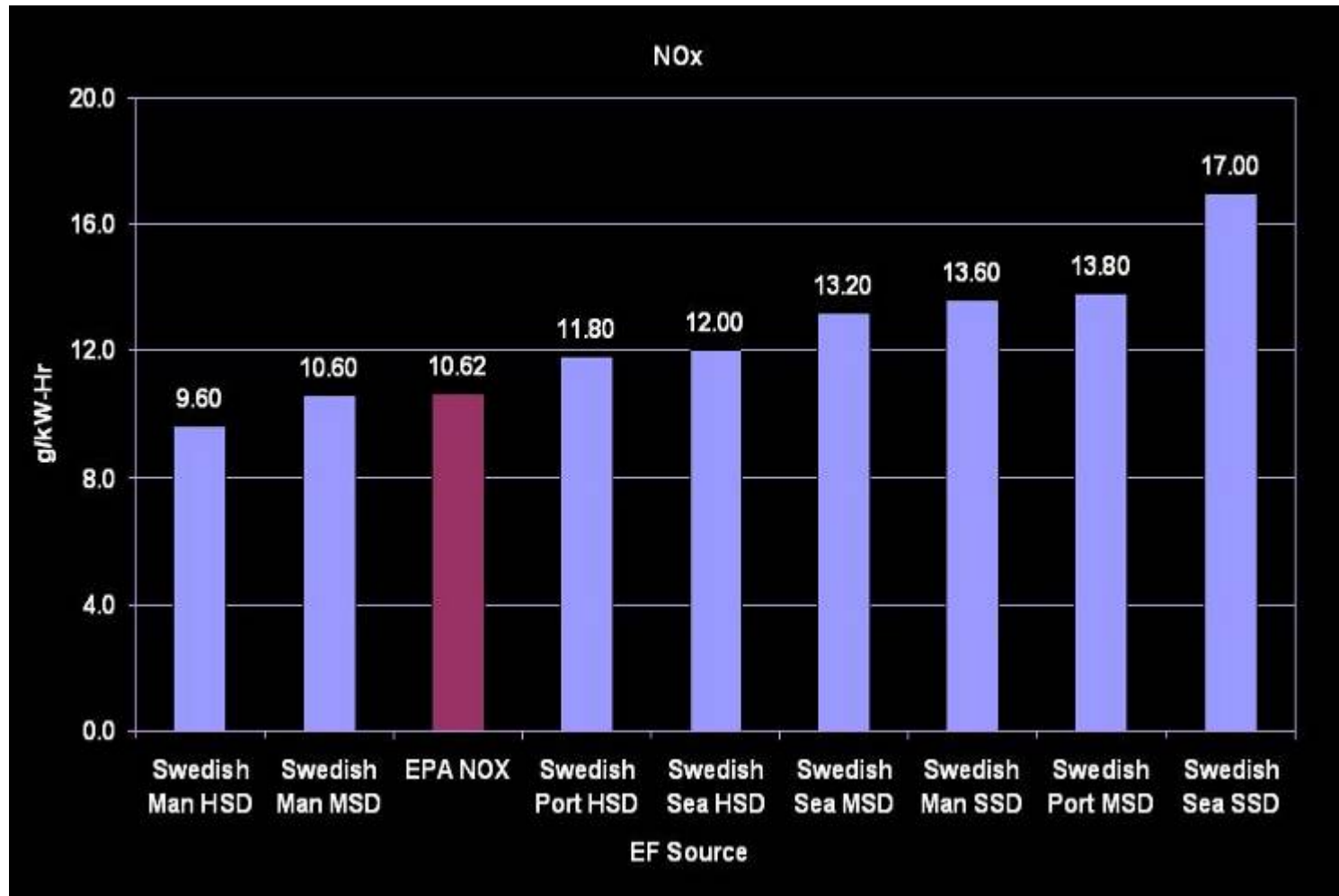
# Comparison of 2000 and 2005 Emission Estimates (Non-Platform Sources)

<b>Base Year</b>	<b>CO (tpy)</b>	<b>NO<sub>x</sub> (tpy)</b>	<b>PM<sub>10</sub> (tpy)</b>	<b>SO<sub>2</sub> (tpy)</b>	<b>VOC (tpy)</b>
<b>2000</b>	<b>21,159</b>	<b>125,300</b>	<b>3,227</b>	<b>23,288</b>	<b>25,472</b>
<b>2005</b>	<b>32,482</b>	<b>310,380</b>	<b>5,342</b>	<b>38,598</b>	<b>29,692</b>
<b>Percent Difference</b>	<b>+53%</b>	<b>+148%</b>	<b>+65%</b>	<b>+66%</b>	<b>+16%</b>

# Improved Activity Data

- Survey Vessels – 2000 estimates only for non-leased blocks. 2005 estimates were based on total hours of operation.
- Drilling Rigs – MMS documented a 24% decline in activity between 2000 and 2005.
- Support Vessels – Offshore Marine Service Vessels reported nearly twice the number vessels operating in the Gulf in 2005.
- LOOP – Activities were only slightly less in 2005 due to the 2005 Hurricanes.
- Helicopters – Better activity data from the FAA.
- Geogenic Sources – Added mud volcanoes.

# Comparison of 2000 and 2005 CMV Emission Factors



# Plans for the 2008 Inventory

- GOADS-2008
- Continue to improved data sources and methods for marine vessels
- Draft report: 30 November 2009
- Final report: 15 June 2010

# Data Collection – Platform Sources

- GOADS-2008 program used to collect monthly activity data from lessees and operators  
[www.gomr.mms.gov/homepg/regulate/environ/airquality/goads-2008.html](http://www.gomr.mms.gov/homepg/regulate/environ/airquality/goads-2008.html)
- NTL issued 24 September 2007
- Workshop held 24 October 2007
- FAQs
- Year 2005 import files provided for “static” platform data
- Deadline for files 17 April 2009



# Emission Estimation Procedures – Platform Sources

- Emission factors from EPA's AP-42, *Compilation of Air Pollutant Emission Factors*
- Emission estimation methods from the Emission Inventory Improvement Program (EIIP)
- AMINECalc and GLYCalc
- Monthly activity data QA'd; surrogates used as needed

# **Data Collection – Non-Platform Sources**

- Oil/gas production source activity data obtained from MMS, vessel operators, the Offshore Marine Service Association, and the FAA
- Non-oil/gas production source activity data obtained from NOAA, the Maritime Administration, the LOOP, and the U.S. Coast Guard

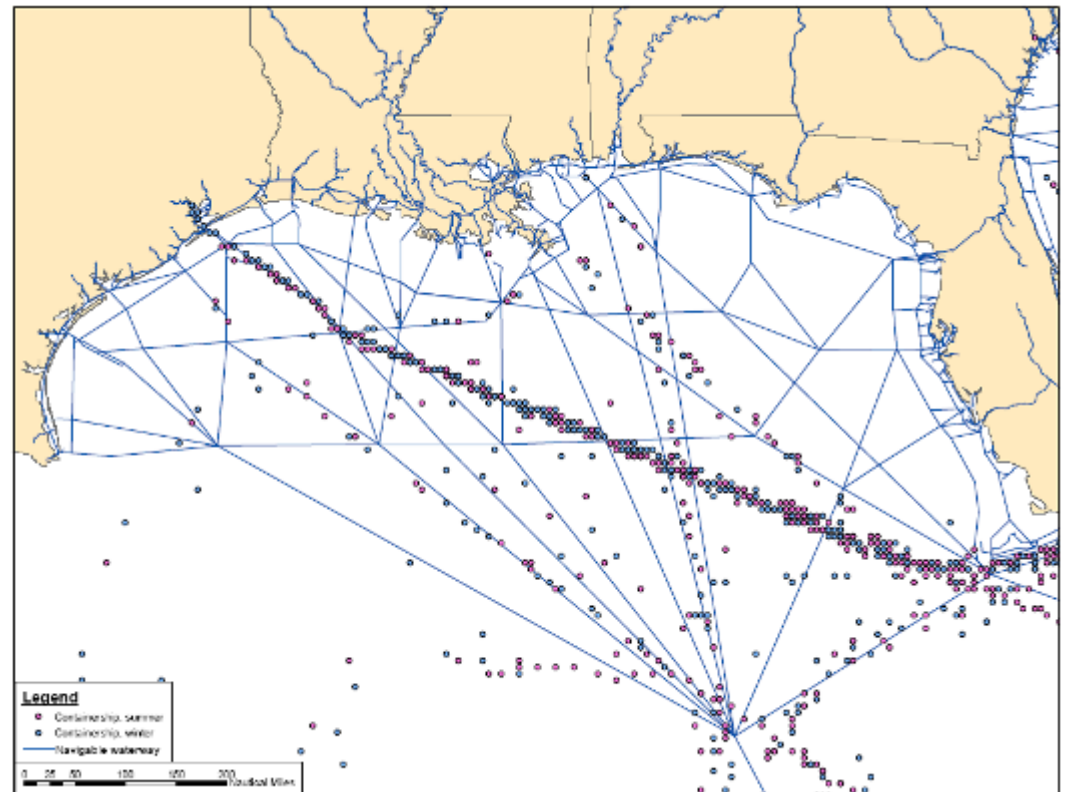
# Non-Platform Enhancements

- Incorporate state-of-the-art AIS vessel studies implemented by states such as Texas into the MMS inventory.



# Non-Platform Enhancements

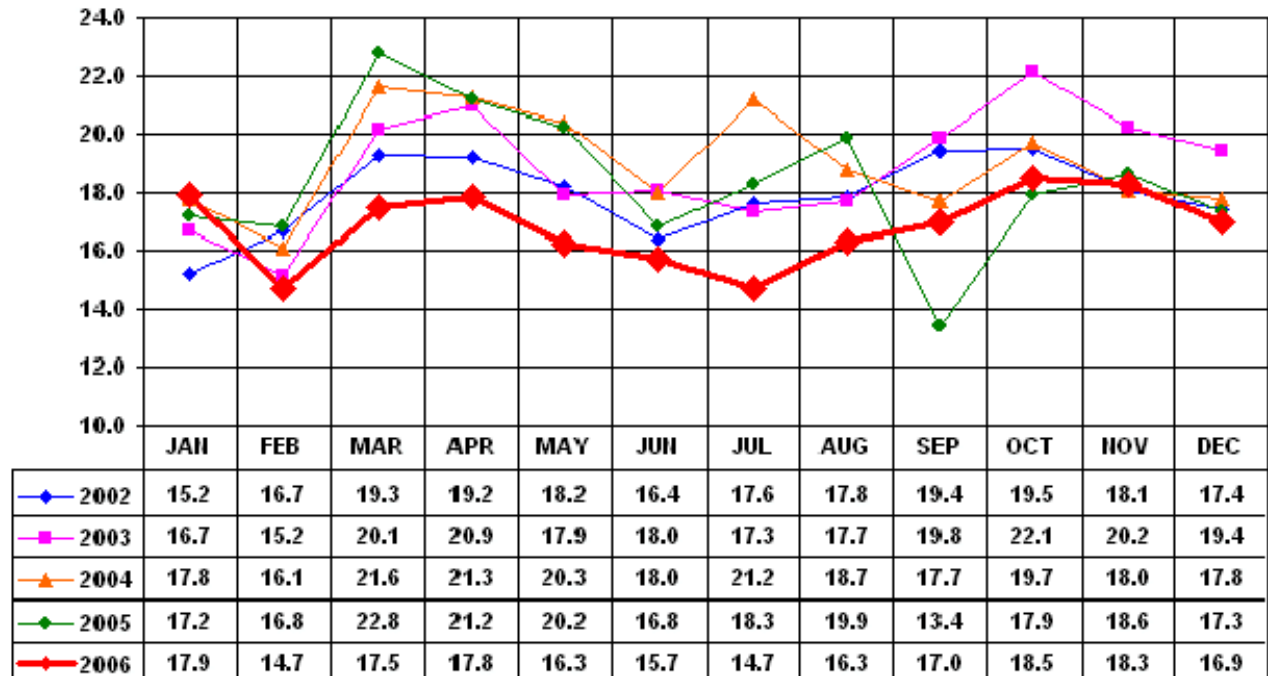
- Incorporate latest EPA vessel emission inventories (Category 2 & 3) into MMS data set using available GIS data.



# Non-Platform Enhancements

- Update temporal/seasonal adjustment factors to better represent monthly traffic variances.

**Petroleum and Chemicals**  
Monthly Tonnage Indicator for Internal U.S. Waterways



# Non-Platform Enhancements

- Military Vessels – evaluate base closures.

