# Summary of WRAP RMC BART Modeling for Alaska

**Draft#7**

**April 6, 2007**

**(Only difference from Draft#6 dated April 2, 2007 is addition of Table 6 ammonia sensitivity test for SRC03 Agrium Chem-Urea)**

More Information: http://pah.cert.ucr.edu/aqm/308/bart.shtml

This document summarizes the preliminary CALMET/CALPUFF BART modeling results performed by the WRAP RMC for Alaska. The procedures used are outlined in the WRAP RMC BART Modeling Protocol that is available at:

http://pah.cert.ucr.edu/aqm/308/bart/WRAP_RMC_BART_Protocol_Aug15_2006.pdf

WRAP used CAPUFF version 6.112. The basic assumptions in the WRAP BART CALMET/CALPUFF modeling for Alaska are as follows:

- Use of one year (2002) of CALMET/CALPUFF modeling supported by 2002 15 km MM5 data and surface meteorological observations.
- Visibility impacts due to emissions of SO2, NOx and primary PM emissions were calculated:
    - Unless States provided speciated PM emissions, all PM emissions were modeled as $PM_{2.5}$.
- A background ammonia value of 0.1 ppb was used
- The default background ozone value of 40 ppb was specified and used if ozone observations are missing from the one site in Alaska (Denali).
- POSTUTIL was not used to reprocess the CALPUFF output to account for background ammonia affects on overlapping puffs at receptors because it could not read the Alaska CALMET output:
    - When modeling a single source POSTUTIL typically has a very small effect and not using it would result in more conservative result.
- Visibility was calculated using the Old (Original) IMPROVE equation and Annual Average Natural Conditions.

The tables that follow contain for each Alaska BART source the following information:

- Emission summaries for each of the seven potential-BART-eligible sources in Alaska.
- For each source we include a source identifier (SRC01 through SCR07) and the following information on the CALPUFF modeling results:
    1. The four-letter Class I area identifier;
    2. The distance (km) between the source and the closest receptor in the Class I area;
    3. The maximum visibility impact in deciview;

4. The 99th percentile (i.e., 4th highest) visibility impact in 2002;
5. The 98th percentile (i.e., 8th highest) visibility impact in 2002; and
6. The number of days the visibility impact at the Class I area exceeded the 0.5 dv threshold.

The 99th and 98th percentile values are provided for informational purposes only. Per a May 10, 2006 verbal agreement with EPA and the FLMs, Alaska may only use the maximum impact since modeling was conducted with only one year of meteorological data. The 98th percentile may only be used when using three years of meteorological data.

Note that one deviation in this analysis from the Modeling Protocol was that the protocol discussed processing the CALPUFF output using both the Annual Average and Best 20% Days Natural Conditions. EPA's BART modeling guidance suggested using the Best 20% Days Natural conditions. However, under challenge EPA settled and allowed the use of Annual Average Natural Conditions. Most States and RPOs are now performing their BART analysis using Annual Average Natural Conditions so that was what was adopted by WRAP. Use of the Best 20% Days Natural Background would increase the modeled visibility impacts due to the BART sources.

The WRAP RMC also corrected a major coordinate error for the CPAI Kenai LNG plant, and very minor coordinate error for the Tesoro Refinery. The southern most source location shown in Figures 4-1 and 4-2 of the modeling protocol is wrong. The correct source locations are illustrated below in Figure 1.

Although not in the protocol, there were also discussions about including the ammonia emissions from the Agrium source (SRC03) in the analysis. No other source being modeled by the WRAP RMC for BART is having their ammonia emissions explicitly modeled. So instead we performed ammonia sensitivity tests for the SRC03 Agrium source where CALPUFF was run using background ammonia concentrations of 0.1 ppb (as in standard runs), 0.5, 1.0 and 10.0 ppb. The results of the Agrium ammonia sensitivity tests are presented in Table 6.

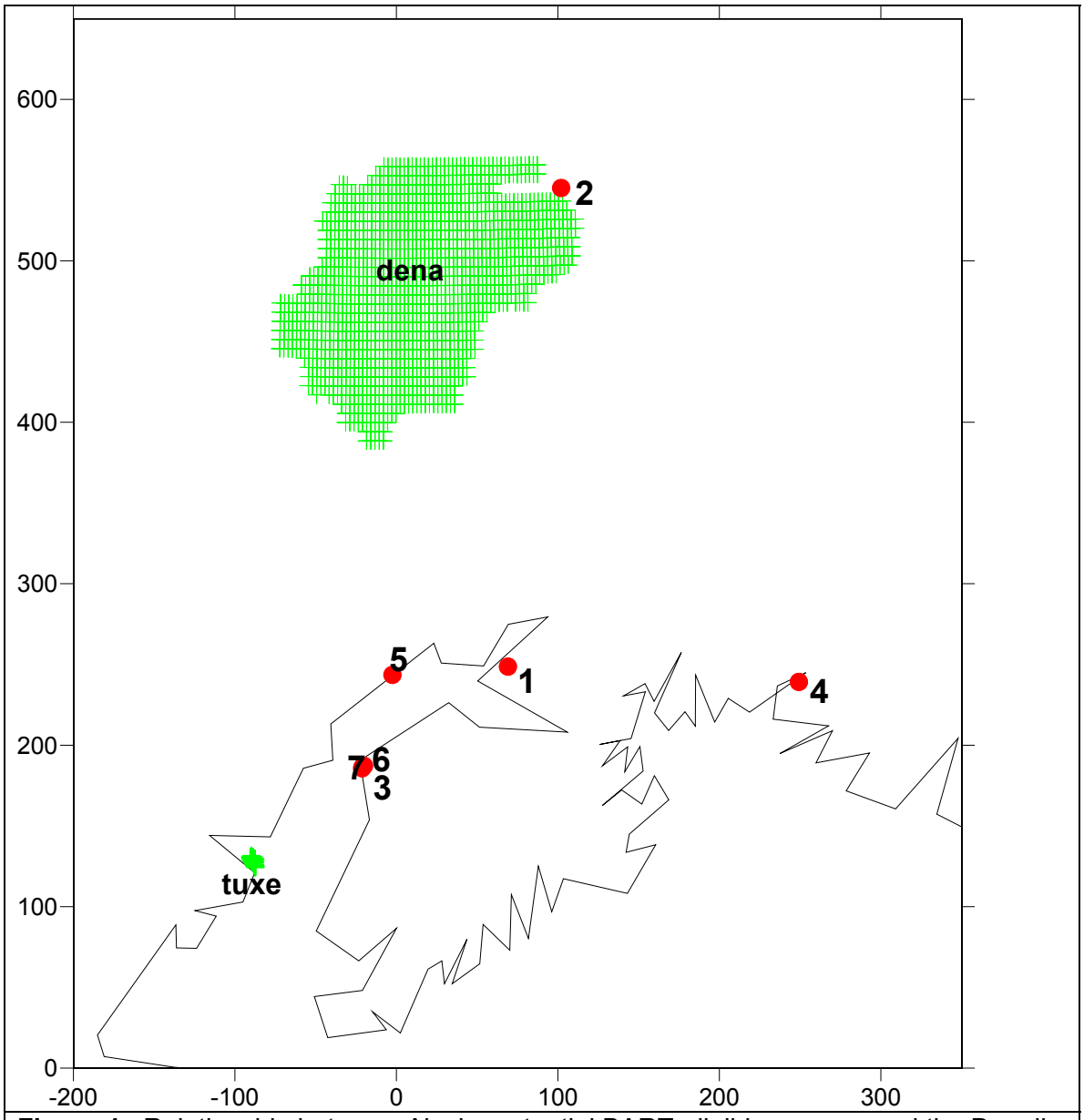


**Figure 1.** Relationship between Alaska potential BART-eligible sources and the Denali (dena) and Tuxedni (tuxe) Class I areas (distance in kilometers).

**Table 1.** Emissions used by source in the Alaska BART CALPUFF modeling.

| SRC01 | Unit Name | SO2 (g/s) | NOx (g/s) | PM25 (g/s) |
|---|---|---|---|---|
| AK01 | Anchorage MLP Sullivan | 0.6605 | 38.5875 | 0.1512 |
| AK02 | Anchorage MLP Sullivan | 2.3604 | 40.6193 | 3.9743 |
| **SRC02** | **Unit Name** | **SO2 (g/s)** | **NOx (g/s)** | **PM25 (g/s)** |
| AK03 | GVEA Healy Power Plant | 0.0163 | 14.4218 | 0.0023 |
| AK04 | GVEA Healy Power Plant | 0.0007 | 0.0002 | 0.1008 |
| **SRC03** | **Unit Name** | **SO2 (g/s)** | **NOx (g/s)** | **PM25 (g/s)** |
| AK05 | Agrium Chem-Urea (83) | 0.0378 | 17.9078 | 0.2499 |
| AK06 | Agrium Chem-Urea (83) | 0.0016 | 0.7823 | 0.0095 |
| AK07 | Agrium Chem-Urea (83) | 0.0378 | 17.9078 | 0.2499 |
| AK08 | Agrium Chem-Urea (83) | 0.0022 | 1.0395 | 0.0793 |
| AK09 | Agrium Chem-Urea (83) | 0.0002 | 2.0738 | 0.0247 |
| AK10 | Agrium Chem-Urea (83) | 0.0002 | 2.0738 | 0.0247 |
| AK11 | Agrium Chem-Urea (83) | 0.0000 | 10.8990 | 0.0000 |
| AK12 | Agrium Chem-Urea (83) | 0.0000 | 0.0000 | 0.2520 |
| AK13 | Agrium Chem-Urea (83) | 0.0000 | 0.0000 | 0.2520 |
| AK14 | Agrium Chem-Urea (83) | 0.0040 | 5.3918 | 0.1465 |
| AK15 | Agrium Chem-Urea (83) | 0.0040 | 5.3918 | 0.1465 |
| AK16 | Agrium Chem-Urea (83) | 0.0047 | 6.3263 | 0.1717 |
| AK17 | Agrium Chem-Urea (83) | 0.0058 | 7.9538 | 0.2158 |
| AK18 | Agrium Chem-Urea (83) | 0.0058 | 7.9538 | 0.2158 |
| AK19 | Agrium Chem-Urea (83) | 0.0009 | 1.5120 | 0.0312 |
| AK20 | Agrium Chem-Urea (83) | 0.0009 | 1.5120 | 0.0312 |
| AK21 | Agrium Chem-Urea (83) | 0.0009 | 1.5120 | 0.0312 |
| AK22 | Agrium Chem-Urea (83) | 0.0009 | 1.5120 | 0.0312 |
| AK23 | Agrium Chem-Urea (83) | 0.0009 | 1.5120 | 0.0312 |
| **SRC04** | **Unit Name** | **SO2 (g/s)** | **NOx (g/s)** | **PM25 (g/s)** |
| AK24 | Alyeska VMT (82) | 15.5768 | 7.9275 | 0.7623 |
| AK25 | Alyeska VMT (82) | 15.5768 | 7.9275 | 0.7623 |
| AK26 | Alyeska VMT (82) | 15.5768 | 7.9275 | 0.7623 |
| AK27 | Alyeska VMT (82) | 5.1156 | 20.1600 | 0.7817 |
| AK28 | Alyeska VMT (82) | 5.1156 | 20.1600 | 0.7817 |
| AK29 | Alyeska VMT (82) | 5.1156 | 20.1600 | 0.7817 |
| AK30 | Alyeska VMT (82) | 0.2284 | 0.0452 | 1.4459 |
| AK31 | Alyeska VMT (82) | 0.1239 | 0.7833 | 0.0247 |
| AK32 | Alyeska VMT (82) | 0.1239 | 0.7833 | 0.0247 |
| AK33 | Alyeska VMT (82) | 0.1402 | 0.8867 | 0.0278 |
| AK34 | Alyeska VMT (82) | 0.1402 | 0.8867 | 0.0278 |
| **SRC05** | **Unit Name** | **SO2 (g/s)** | **NOx (g/s)** | **PM25 (g/s)** |
| AK35 | Chugach Beluga (106) | 0.2594 | 69.9804 | 2.5043 |
| AK36 | Chugach Beluga (106) | 0.2594 | 69.9804 | 2.5043 |
| **SRC06** | **Unit Name** | **SO2 (g/s)** | **NOx (g/s)** | **PM25 (g/s)** |
| AK37 | CPAI Kenai LNG (90) | 0.0000 | 6.2738 | 0.6300 |
| AK38 | CPAI Kenai LNG (90) | 0.0000 | 6.2738 | 0.6300 |
| AK39 | CPAI Kenai LNG (90) | 0.0000 | 9.4306 | 0.6300 |

| | | | | |
|---|---|---|---|---|
| AK40 | CPAI Kenai LNG (90) | 0.0000 | 9.2211 | 0.6300 |
| AK41 | CPAI Kenai LNG (90) | 0.0000 | 6.3058 | 0.6300 |
| AK42 | CPAI Kenai LNG (90) | 0.0000 | 6.3058 | 0.6300 |
| AK43 | CPAI Kenai LNG (90) | 0.0000 | 3.3464 | 0.6300 |
| AK44 | CPAI Kenai LNG (90) | 0.0000 | 0.5807 | 0.0399 |
| AK45 | CPAI Kenai LNG (90) | 0.0000 | 0.5807 | 0.0399 |
| AK46 | CPAI Kenai LNG (90) | 0.0000 | 0.0940 | 0.0431 |
| AK47 | CPAI Kenai LNG (90) | 0.0767 | 1.8323 | 0.1302 |
| AK48 | CPAI Kenai LNG (90) | 0.0000 | 53.8913 | 0.2179 |
| **SRC07** | **Unit Name** | **SO2 (g/s)** | **NOx (g/s)** | **PM25 (g/s)** |
| AK49 | Tesoro Refinery (35) | 0.5292 | 4.4100 | 0.0882 |
| AK50 | Tesoro Refinery (35) | 0.6237 | 5.1975 | 0.1040 |
| AK51 | Tesoro Refinery (35) | 0.1202 | 1.0017 | 0.0200 |
| AK52 | Tesoro Refinery (35) | 0.1927 | 1.6065 | 0.0320 |
| AK53 | Tesoro Refinery (35) | 0.1055 | 0.8789 | 0.0173 |
| AK54 | Tesoro Refinery (35) | 0.2116 | 1.7640 | 0.0352 |
| AK55 | Tesoro Refinery (35) | 0.1381 | 0.6456 | 0.0231 |
| AK56 | Tesoro Refinery (35) | 0.1381 | 0.6456 | 0.0231 |
| AK57 | Tesoro Refinery (35) | 0.0116 | 2.2575 | 0.0035 |
| AK58 | Tesoro Refinery (35) | 0.0116 | 2.2575 | 0.0035 |
| AK59 | Tesoro Refinery (35) | 0.0074 | 0.7875 | 0.0646 |
| AK60 | Tesoro Refinery (35) | 0.0021 | 0.4436 | 0.0007 |

**Table 2.** Summary of CALPUFF estimated visibility impacts at Class I areas for Alaska potential BART-eligible sources.

| | Min Distance (km) | Max (dv) | 99th (dv) | 98th (dv) | Days > 0.5 dv |
|---|---|---|---|---|---|
| **SRC01 – Anchorage MLP Sullivan** | | | | | |
| dena | 159 | 1.12 | 0.62 | 0.44 | 4 |
| tuxe | 196 | 1.90 | 1.26 | 0.84 | 19 |
| | | | | | |
| **SRC02 – GVEA Healy Power Plant** | | | | | |
| dena | 8 | 1.21 | 0.75 | 0.68 | 13 |
| tuxe | 455 | 0.14 | 0.05 | 0.03 | 0 |
| | | | | | |
| **SRC03 – Agrium Chem-Urea** | | | | | |
| dena | 202 | 0.71 | 0.58 | 0.36 | 5 |
| tuxe | 86 | 5.57 | 3.02 | 2.36 | 79 |
| | | | | | |
| **SRC04 – Alyeska VMT** | | | | | |
| dena | 273 | 1.55 | 0.68 | 0.56 | 9 |
| tuxe | 353 | 1.24 | 0.66 | 0.55 | 8 |
| | | | | | |
| **SRC05 – Chugach Beluga** | | | | | |
| dena | 145 | 2.01 | 1.32 | 1.13 | 25 |
| tuxe | 141 | 3.42 | 3.11 | 2.59 | 68 |
| | | | | | |
| **SRC06 – CPAI Kenai LNG** | | | | | |
| dena | 201 | 0.82 | 0.56 | 0.42 | 5 |
| tuxe | 87 | 6.55 | 3.62 | 2.93 | 90 |
| | | | | | |
| **SRC07 – Tesoro Refinery** | | | | | |
| dena | 201 | 0.18 | 0.13 | 0.10 | 0 |
| tuxe | 88 | 2.00 | 0.92 | 0.78 | 21 |

**Table 3.** Summary of CALPUFF estimated visibility impacts at Class I areas for Alaska potential BART-eligible sources – NO3 only

| | Min Distance (km) | Max (dv) | 99th (dv) | 98th (dv) | Days > 0.5 dv |
|---|---|---|---|---|---|
| **SRC01 – Anchorage MLP Sullivan** | | | | | |
| dena | 159 | 1.10 | 0.58 | 0.42 | 4 |
| tuxe | 196 | 1.83 | 1.21 | 0.81 | 19 |
| | | | | | |
| **SRC02 – GVEA Healy Power Plant** | | | | | |
| dena | 8 | 1.21 | 0.74 | 0.68 | 13 |
| tuxe | 455 | 0.14 | 0.05 | 0.03 | 0 |
| | | | | | |
| **SRC03 – Agrium Chem-Urea** | | | | | |
| dena | 202 | 0.71 | 0.58 | 0.35 | 5 |
| tuxe | 86 | 5.55 | 3.00 | 2.34 | 79 |
| | | | | | |
| **SRC04 – Alyeska VMT** | | | | | |
| dena | 273 | 1.00 | 0.42 | 0.39 | 1 |
| tuxe | 353 | 0.91 | 0.46 | 0.34 | 2 |
| | | | | | |
| **SRC05 – Chugach Beluga** | | | | | |
| dena | 145 | 1.99 | 1.31 | 1.12 | 25 |
| tuxe | 141 | 3.39 | 3.07 | 2.57 | 67 |
| | | | | | |
| **SRC06 – CPAI Kenai LNG** | | | | | |
| dena | 201 | 0.80 | 0.55 | 0.41 | 5 |
| tuxe | 87 | 6.53 | 3.60 | 2.90 | 88 |
| | | | | | |
| **SRC07 – Tesoro Refinery** | | | | | |
| dena | 201 | 0.17 | 0.13 | 0.09 | 0 |
| tuxe | 88 | 1.93 | 0.89 | 0.69 | 18 |

**Table 4.** Summary of CALPUFF estimated visibility impacts at Class I areas for Alaska potential BART-eligible sources – SO4 only

| | Min Distance (km) | Max (dv) | 99th (dv) | 98th (dv) | Days > 0.5 dv |
|---|---|---|---|---|---|
| **SRC01 – Anchorage MLP Sullivan** | | | | | |
| dena | 159 | 0.03 | 0.02 | 0.02 | 0 |
| tuxe | 196 | 0.06 | 0.03 | 0.03 | 0 |
| | | | | | |
| **SRC02 – GVEA Healy Power Plant** | | | | | |
| dena | 8 | 0.00 | 0.00 | 0.00 | 0 |
| tuxe | 456 | 0.00 | 0.00 | 0.00 | 0 |
| | | | | | |
| **SRC03 – Agrium Chem-Urea** | | | | | |
| dena | 202 | 0.00 | 0.00 | 0.00 | 0 |
| tuxe | 86 | 0.01 | 0.00 | 0.00 | 0 |
| | | | | | |
| **SRC04 – Alyeska VMT** | | | | | |
| dena | 273 | 0.60 | 0.29 | 0.19 | 1 |
| tuxe | 353 | 0.35 | 0.28 | 0.20 | 0 |
| | | | | | |
| **SRC05 – Chugach Beluga** | | | | | |
| dena | 145 | 0.01 | 0.01 | 0.00 | 0 |
| tuxe | 141 | 0.02 | 0.01 | 0.01 | 0 |
| | | | | | |
| **SRC06 – CPAI Kenai LNG** | | | | | |
| dena | 201 | 0.00 | 0.00 | 0.00 | 0 |
| tuxe | 87 | 0.00 | 0.00 | 0.00 | 0 |
| | | | | | |
| **SRC07 – Tesoro Refinery** | | | | | |
| dena | 201 | 0.02 | 0.01 | 0.01 | 0 |
| tuxe | 88 | 0.09 | 0.08 | 0.07 | 0 |

**Table 5.** Summary of CALPUFF estimated visibility impacts at Class I areas for Alaska potential BART-eligible sources – PMF only

| | Min Distance (km) | Max (dv) | 99th (dv) | 98th (dv) | Days > 0.5 dv |
|---|---|---|---|---|---|
| **SRC01 – Anchorage MLP Sullivan** | | | | | |
| dena | 159 | 0.02 | 0.01 | 0.01 | 0 |
| tuxe | 196 | 0.03 | 0.01 | 0.01 | 0 |
| | | | | | |
| **SRC02 – GVEA Healy Power Plant** | | | | | |
| dena | 8 | 0.05 | 0.04 | 0.03 | 0 |
| tuxe | 456 | 0.00 | 0.00 | 0.00 | 0 |
| | | | | | |
| **SRC03 – Agrium Chem-Urea** | | | | | |
| dena | 202 | 0.01 | 0.00 | 0.00 | 0 |
| tuxe | 86 | 0.04 | 0.03 | 0.02 | 0 |
| | | | | | |
| **SRC04 – Alyeska VMT** | | | | | |
| dena | 273 | 0.01 | 0.01 | 0.00 | 0 |
| tuxe | 353 | 0.01 | 0.01 | 0.00 | 0 |
| | | | | | |
| **SRC05 – Chugach Beluga** | | | | | |
| dena | 145 | 0.02 | 0.02 | 0.02 | 0 |
| tuxe | 141 | 0.06 | 0.04 | 0.03 | 0 |
| | | | | | |
| **SRC06 – CPAI Kenai LNG** | | | | | |
| dena | 201 | 0.02 | 0.01 | 0.01 | 0 |
| tuxe | 87 | 0.07 | 0.06 | 0.05 | 0 |
| | | | | | |
| **SRC07 – Tesoro Refinery** | | | | | |
| dena | 201 | 0.00 | 0.00 | 0.00 | 0 |
| tuxe | 88 | 0.01 | 0.01 | 0.01 | 0 |

**Table 6.** Summary of CALPUFF estimated visibility impacts at Class I areas SRC03 Agrium Chem-Urea Ammonia (NH3) Sensitivity Tests.

| | Min Distance (km) | Max (dv) | 99th (dv) | 98th (dv) | Days > 0.5 dv |
|---|---|---|---|---|---|
| **SRC03 Agrium Chem-Urea – NH3 = 0.1 ppb (Base Case)** | | | | | |
| dena | 202 | 0.71 | 0.58 | 0.36 | 5 |
| tuxe | 86 | 5.57 | 3.02 | 2.36 | 79 |
| | | | | | |
| **SRC03 Agrium Chem-Urea – NH3 = 0.5 ppb** | | | | | |
| dena | 202 | 0.72 | 0.58 | 0.39 | 5 |
| tuxe | 86 | 5.60 | 3.06 | 2.64 | 85 |
| | | | | | |
| **SRC03 Agrium Chem-Urea – NH3 = 1.0 ppb** | | | | | |
| dena | 202 | 0.72 | 0.58 | 0.44 | 5 |
| tuxe | 86 | 5.61 | 3.06 | 2.68 | 86 |
| | | | | | |
| **SRC03 Agrium Chem-Urea – NH3 = 10.0 ppb** | | | | | |
| dena | 202 | 0.78 | 0.63 | 0.45 | 7 |
| tuxe | 86 | 5.61 | 3.38 | 2.81 | 87 |