**Documentation on the SPECIATE5.1 Pennsylvania county-specific oil & gas related Speciation Profiles.**

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**SUMMARY/SYNOPSIS**

The Pennsylvania Department of Environmental Protection (PADEP) provided gas composition data at wells throughout the state (by county and by township).  We used selected data to develop 3 county-specific untreated gas composition composite profiles (Butler, Greene and Washington) by taking the arithmetic mean of samples we chose that we felt were valid for this purpose.  Some that we chose were clearly measured with extended gas analysis but others that we chose did not have any documentation that they were measured (we assumed they were measured based on the species provided).  Some had all compounds above C6  (e.g., heptane, BTEX etc.) lumped into C6+ and we used other data in that county that had the more detailed C6+ breakout to speciate the C6+.

**INTRODUCTION**

At the 7/14/2016 call of the National Oil and Gas Committee (collaboration with EPA, States, Regional organizations) Madeleine Strum of EPA’s Emissions Inventory and Analysis Group presented the SPECIATE Work group’s efforts to add Region-specific oil and gas speciation profiles to the SPECIATE database. Organizers noted that if states had data that could be used for speciation, they should send it to EPA (Madeleine Strum).

In an effort to improve the calculation of emissions from oil and gas production sites in Pennsylvania, the Pennsylvania Department of Environmental Protection (PADEP) has collected numerous hydrocarbon analyses from around the state.  Charles Boritz, PADEP, emailed Madeleine Strum EPA/Emissions Inventory and Analysis Group a folder containing county-specific workbooks showing well-specific gas composition data provided to PA in support of the compliance demonstration for PA Exemption Category 38 for sources located at a well pad. In addition to the workbooks, the underlying information provided by the operators of the well pads were provide as pdf files. These data varied in scope and level of detail, with compositions provided from sample gas analysis reports (some listing test methods, others not) with different levels of species provided, meter analyses (with one or 2 months of weight percents by carbon number provided) or as tabulated data with no documentation or as inputs to downstream models (such as GRY-GLYCALC).

Charles Boritz compiled this information, entered them into spreadsheets, and discussed the information in detail with EIAG staff. Discussions about the data helped EIAG staff understand the vast array of data, the sources of the data, the characteristics of typical gas wells in the state of Pennsylvania, the test procedures used to form the data, and to help EIAG decide how to best compile the data into profiles the SPECIATE database. The PADEP database and additional information provided by Charles Bortiz resulted in the development of 3 county-composite speciation profiles for total organic gas emissions from raw gas well operations. More data is available to establish profiles for other counties, which may be added to SPECIATE at a later date.

**SELECTION OF SAMPLES AND DATA PROCESSING**

SPECIATE Workgroup members Art Diem and Madeleine Strum, along with assistance from Ying Hsu, Abt Associates contractor selected the samples to use from the composite based on completeness of species and documentation. Metered analyses (e.g., where just the Carbon number was reported for one or 2 months) were not selected. In addition, no liquid samples were chosen. Where analyses showed GPA (Gas Processor’s Association) test method 2286, we selected the data, even if the “hexanes plus” (C6+) mole percent was provided rather than the individual species that comprise this lumped group. However, for creating the composite profile, we speciated the C6+ by computing an average speciation based on other extended data in the county.

Composite profiles were generated by averaging (arithmetic mean) the well-samples after applying the C6+ speciation and after averaging multiple tests for a specific well (which did not occur very often).

Each profile and the data that were used are shown in the below table. Zipped up folders containing documents showing the compositions or lab analysis reports (as provided by Charles Boritz) are provided along with the workbook showing the calculations. In the table below, Unknown Sample analysis means the test method wasn’t provided but there appeared to be a sample analysis performed.

| **Profile** | **PROFILE NAME** | **DATA USED** |
| --- | --- | --- |
| PAGAS01 | Oil and Gas-Produced Gas Composition from Gas Wells-Greene Co, PA | * \*GC extended, Sandrock 11 H Gilmore TWP * \*Unknown Sample Analysis, Consol MOR10 Wellpad, assumed BTEX, 0.001% for each, Morris TWP * \*Unknown Sample Analysis, Adams RHL-13 Wellpad, assumed BTEX, 0.001% for each, Richhill TWP * \*Unknown Sample Analysis,Bilski RHL-28 Wellpad, Richhill TWP * \*Unknown Sample Analysis, Braddock RHL-99 Wellpad, Richhill TWP * \*Unknown Sample Analysis, CNX RHL-4 Wellpad, Richhill TWP * \*Unknown Sample Analysis, Silver Fox Farms RHL-71 Wellpad, Richhill TWP * Average of 16 tests (Method 2261) for Liberty 1 H Well, apply speciation of C6+ using the average of the analyses with \*, Perry TWP * \*Finnegan RHL8 Pad, Richhill TWP |
| PAGAS02 | Oil and Gas-Produced Gas Composition from Gas Wells-Butler Co, PA | * \*SPL Gas Analysis for Cypher A5H, Clearfield Twp * \*SPL Gas Analysis for Cypher B 1 H, Clearfield Twp * \*SPL Gas Analysis for Hixon 6HB, Forward Twp * \*SPL Gas Analysis for Beilstein C 3H, Jefferson Twp * \*SPL Gas Analysis for Veselich B 5H, Jefferson Twp * \*SPL Gas Analysis for Dreher A 1H, Summit Twp * \*SPL Gas Analysis for Geibel 3H, Summit Twp * \*SPL Gas Analysis for Heasley Nurseries 4H, Summit Twp * Pad Average from Hinch Smith Pad for Hinch Smith 2H, Butler TWP * Gas Analytical Services C6+ Report for Hinch Smith 6H, Butler TWP * Gas Analytical Services C6+ Report for Hinch Smith 7H, Butler TWP * Gas Analytical Services C6+ Report for Hinch Smith 5H, Butler TWP * Gas Analytical Services C6+ Report for Hinch Smith 10H, Butler TWP * Gas Analytical Services C6+ Report for Cypher A 1H, Clearfield TWP * Gas Analytical Services C6+ Report for Cypher A 2H, Clearfield TWP * Gas Analytical Services C6+ Report for Cypher A 3H, Clearfield TWP * Gas Analytical Services C6+ Report for Cypher A 4H, Clearfield TWP * Gas Analytical Services C6+ Report for Cypher A 5H, Clearfield TWP * Gas Analytical Services C6+ Report for Cypher B 1H, Clearfield TWP * Gas Analytical Services C6+ Report for Cypher B 2H, Clearfield TWP * Gas Analytical Services C6+ Report for Cypher B 5H, Clearfield TWP * Gas Analytical Services C6+ Report for Cypher B 4H, Clearfield TWP * Gas Analytical Services C6+ Report for Cypher B 3H, Clearfield TWP * Gas Analytical Services C6+ Gas Analysis from Pad W73 for W73 1H, Clinton TWP * Gas Analytical Services C6+ Gas Analysis from Pad W74 for W74 1H, Clinton TWP * Gas Analytical Services C6+ Gas Analysis from Pad W75 for W75 1H, Clinton TWP * Gas Analytical Services C6+ Gas Analysis from Pad W77 for W77 1H, Clinton TWP * Gas Analytical Services C6+ Gas Analysis from Pad W78 for W78 1H, Clinton TWP * Gas Analytical Services C6+ Report for Clouse 1H, Oakland TWP * Gas Analytical Services C6+ Report for Clouse 6H, Oakland TWP * Gas Analytical Services C6+ Report for Clouse 2H, Oakland TWP * Gas Analytical Services C6+ Report for Clouse 3H, Oakland TWP * Gas Analytical Services C6+ Report for Clouse 4H, Oakland TWP * Gas Analytical Services C6+ Report for Clouse 5H, Oakland TWP * Gas Analytical Services C6+ Gas Analysis for Pad W23 1H, Winfield TWP |
| PAGAS03 | Oil and Gas-Produced Gas Composition from Gas Wells-Washington Co, PA | * GRI-GLYCalc v4.0 Input Values for Wet Gas Stream Based on Extended Gas Analysis for Huffys Family 4H, Somerset Twp * GRI-GLYCalc v4.0 Input Values for Wet Gas Stream Based on Extended Analysis for Eakin Sandra 7H, Somerset Twp * GRI-GLYCalc v4.0 Input Values for Wet Gas Stream Based on Sample for Baumel 3H, South Strabane Twp * \*Extended Gas Analytical Services GPA 2286-14 Report for CNX MOR31 NHS, East Finley Twp * \*Extended Gas Analytical Services GPA 2286 Report for Martin Edwards 5H, North Strabane Twp * \*Extended Gas Analytical Services GPA-2286 Report for Randolph Karen 5H, North Strabane Twp * \*Extended Gas Analysis for Consol NV60 FHS, East Finley Twp * \*Extended Gas Analysis for CNX Gas Company WFN1 FHS, West Finley Twp * \*Extended Gas Analysis for Consol WFN6 AHS, West Finley Twp * \*Extended Gas Analysis for Consol WFN4 BHS, West Finley Twp * \*Extended Gas Analysis for Consol WFN5 EHS, West Finley Twp * \*Extended Gas Analysis for Consol WFN10 EHS, West Finley Twp * Gas Analytical Services GPA 2261-13 Report for Consol MOR30 MHS, East Finley TWP * Gas Analytical Services GPA 2261-13 Report for Bedillion NV61 EHS, East Finley TWP * Gas Analytical Services GPA 2261-13 Report for Lamperski NV 58 FHS, Morris Twp * Gas Analytical Services GPA 2261-13 Report for Coffield-Gottschalk NV34 BHS, Morris Twp * Legacy Measurement Solutions GPA 2286 Report for Kresic 1H, Smith Twp * Unknown Gas Analysis for Hunter John 1H, Donegal Twp |
|  |  | Notes:  \*means this sample was used to develop speciation of C6\* (hexanes +) to be used for wells where hexanes plus was measured but not broken out into individual components |