

## **Appendix B**

### **WRAP Phase III O&G Surrogate Development**

## APPENDIX B – WRAP PHASE III O&G SURROGATE DEVELOPMENT

### WRAP PHASE III O&G SURROGATE DEVELOPMENT

A new set of spatial allocation surrogates were developed to allocate the county-level WRAP Phase III O&G area source emissions to the appropriate oil and gas fields. The locations of wells within Uinta, Piceance, and Denver-Julesburg basins, based on the 2006 IHS database for the WRAP Phase III basins, were used. The spatial allocation surrogate profiles developed are provided in Table B1. Each of the oil and gas emission source categories was assigned to one of the surrogate categories designed to represent the location of emissions (also shown in Table B1).

Surrogates were developed for the 4km, 12km and 36km modeling domains. Latitude and longitude coordinates for oil and gas wells and drilling events were obtained from the IHS database. The oil and gas production surrogates were based on production data at known well locations, while the drilling surrogate was based solely on the number and location of wells drilled.

**Table B1. Spatial Allocation Surrogates.**

SCC	SCC Description	Surrogate Code	Surrogate Description
2310000110	Drill Rigs	692	Spud count
2310000120	Workover Rigs	693	Well count - all wells
2310010100	Crude Petroleum, Truck Loading	694	Oil production at Oil wells
2310010200	Crude Petroleum, Tanks - Flashing & Standing/Working/Breathing	694	Oil production at Oil wells
2310010300	Crude Petroleum, Pneumatic devices	695	Well count - oil wells
2310010400	Crude Petroleum, Fugitives	695	Well count - oil wells
2310020100	Natural Gas, Dehydrators	696	Gas production at gas wells
2310020200	Natural Gas, Venting - Initial Completions	698	Well count - gas wells
2310020300	Natural Gas, Venting – Recompletions	698	Well count - gas wells
2310020400	Natural Gas, Venting - Blowdowns	696	Gas production at gas wells
2310020500	Natural Gas, Venting - Compressor Startup	696	Gas production at gas wells
2310020600	Natural Gas, Venting - Compressor Shutdown	696	Gas production at gas wells
2310020700	Natural Gas, Fugitives	698	Well count - gas wells
2310020800	Natural Gas, Pneumatic Devices	698	Well count - gas wells
2310020900	Natural Gas, Pneumatic Pumps	698	Well count - gas wells
2310020110	Natural Gas, Amine Units	696	Gas production at gas wells
2310023100	CBM, Dehydrators	699	Gas production at CBM wells
2310023200	Venting - Initial Completions	700	Well count - CBM wells
2310023300	Venting - Recompletions	700	Well count - CBM wells
2310023400	CBM, Venting - Blowdowns	699	Gas production at CBM wells
2310023500	CBM, Venting - Compressor Startup	699	Gas production at CBM wells
2310023600	CBM, Venting - Compressor Shutdown	699	Gas production at CBM wells
2310023700	CBM, Fugitives	700	Well count - CBM wells
2310023800	CBM, Pneumatic Devices	700	Well count - CBM wells
2310023900	CBM, Pneumatic Pumps	700	Well count - CBM wells
2310023110	CBM, Amine Units	699	Gas production at CBM wells
2310030100	Natural Gas Liquids, Gas Plant Truck Loading	697	Oil production at gas wells
2310030200	Natural Gas Liquids, Truck Loading	697	Oil production at gas wells
2310030300	Natural Gas Liquids, Tanks - Flashing & Standing/Working/Breathing	697	Oil production at gas wells
2310030400	Natural Gas Liquids, Water Tank Losses	697	Oil production at gas wells
2310024100	Natural Gas, Heaters	698	Well count - gas wells

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SCC	SCC Description	Surrogate Code	Surrogate Description
2310024200	Natural Gas, Initial Completion Flaring	692	Spud count
2310024300	Natural Gas, Condensate Tank Flaring	697	Oil production at gas wells
2310024400	Natural Gas, Dehydrator Flaring	689	Gas production at all wells
2310025100	Natural Gas, Compressor Engines	689	Gas production at all wells
2310025200	Natural Gas, Miscellaneous Engines	693	Well count - all wells
2310025300	Natural Gas, Artificial Lift	694	Oil production at Oil wells

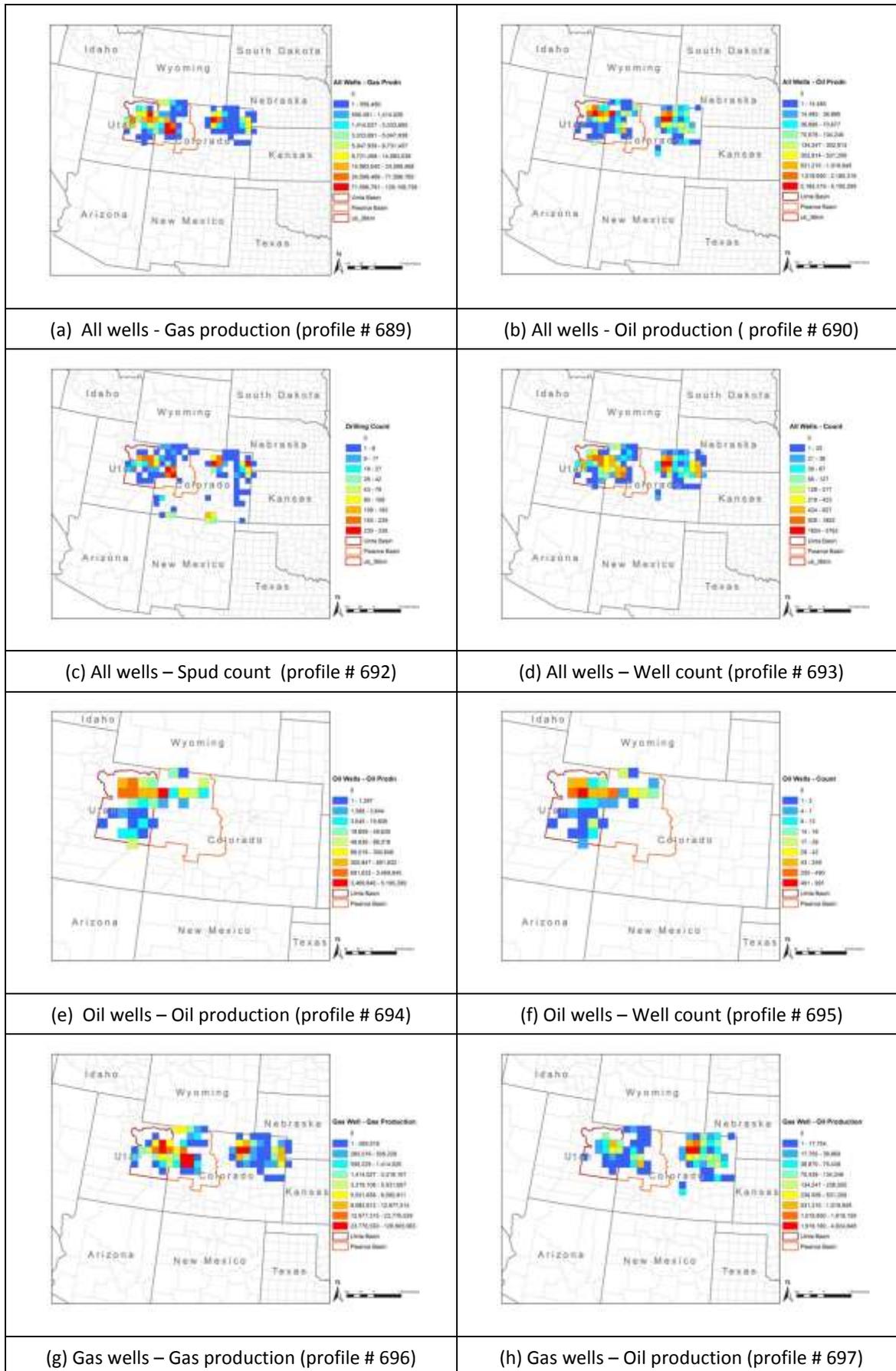
The creation of the surrogates took place in several steps, and relied on the use of ARC/GIS software.

1. All wells and drill rigs were spatially joined with the modeling grid cells using ARC/GIS.
2. For each individual well, the oil, gas and water production values were divided by the total oil, gas and water production values corresponding to the county in which the well was located. This division resulted in determination of the fraction of a county's total production taking place at each well. In the case of the drilling surrogate, the number of wells drilled, rather than the production values, was used.
3. For each grid cell (intersecting a county) and county combination, well production fraction were summed for wells inside the given grid cell to obtain the surrogate value.

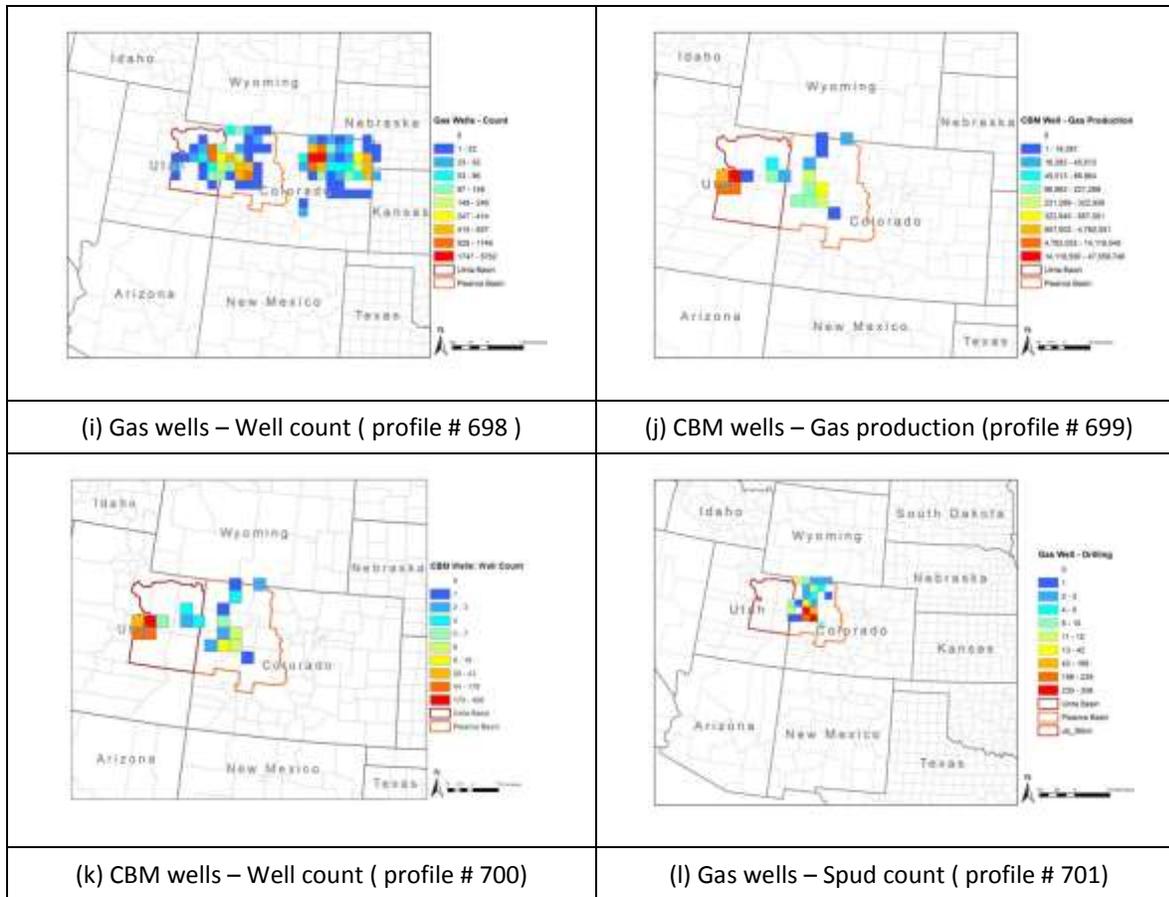
The surrogate values for each grid cell / county combination were reformatted to comply with the SMOKE emissions processor Area Gridding Profile (AGPRO) file format. A separate file for each modeling domain was created, and a single accompanying SMOKE Area Gridding Cross Reference (AGREF) file was created for use with either domain. The purpose of the AGREF file is to define the relationship between the 3-digit codes chosen to represent each of the four surrogate categories in the AGPRO file and the SCC codes for the twelve oil and gas emission categories to be allocated with these surrogates.

To display the surrogates, each grid cell / county surrogate value was multiplied by the county's total production, and then production was summed for each grid cell. Figure B1 depicts the 36 km domain surrogate values.

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**Figure B1. 36 km Domain Oil and Gas Spatial Surrogates.**