

TECHNICAL SUPPORT DOCUMENT
2017 BASELINE WINTERTIME OZONE EMISSIONS INVENTORY:
NON-ROAD WELL PAD CONSTRUCTION EQUIPMENT
OPERATING WITHIN THE OIL AND GAS FIELDS
WITHIN THE UINTAH, UT NONATTAINMENT AREA

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Utah Division of Air Quality
Planning Branch/Mobile Sources

Abstract

This report discusses the non-road well pad construction equipment 2017 baseline wintertime ozone emissions inventory for equipment operating within the shale gas and conventional oil fields in the Uintah, UT Non-Attainment Area (NA).

Non-road equipment activity was provided by: March 2016 Ramboll Environ Colorado Air Resource Management Modeling Study (CARMMS) with updated Mancos Shale Modeling CARMMS 1.5 Final Report: appendix C-2 and C-4. Shale gas and conventional oil well pad construction activities include: pad, access road, and pipeline construction. Non-road equipment inventories were calculated using emission factors generated by the EPA MOVES2014b Non-Road Model (Motor Vehicle Emission Simulator) utilizing the movesdb20181022 default database. 2017 well counts were provided for by the DAQ Technical Analysis Section from the Utah Division of Oil, Gas, and Mining.

Summary Table for the 2017 Non-road well pad construction equipment inventory is located on page 9.

3.) NON-ROAD WELL PAD CONSTRUCTION EQUIPMENT INVENTORY

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ii. Overview

The purpose of this document is to explain the emissions modeling assumptions used to develop the 2017 baseline wintertime ozone emissions inventory for non-road well pad construction equipment operating within the oil and gas fields in the Uintah, UT Non-Attainment Area.

Agencies that developed the 2017 baseline for the Uintah Basin, UT Ozone NA:
Utah Division of Air Quality (UDAQ)

iii. Emissions Factors

The following procedures were used to develop emission factors:

1. Emission Factor Development

Non-road well pad construction equipment was identified within the March 2016 Ramboll Environ Colorado Air Resource Management Modeling Study (CARMMS) with updated Mancos Shale Modeling CARMMS 1.5 Final Report⁽¹⁾. Appendix C-2 and C-4 was used exclusively to identify well pad construction equipment, hours of operation, and days of operation for shale gas and conventional oil development. MOVES (Motor Vehicle Emission Simulator) Non-Road default emission factors were developed for these pieces of equipment using the EPA approved MOVES2014b Non-Road model. MySQL was used to select pieces of equipment by county and Source Classification Code (SCC) for equipment that equaled 300 Horse Power (HP). The emission factors developed from MOVES are in grams per operating hour by SCC by HP. This was accomplished by dividing the default daily emissions by the default daily hours of operation see Table 1 (p6).

2. The following local inputs were used within MOVES

Fuel:

An adjustment was made for 2017 to account for gasoline sulfur level in Utah since small volume refiners are not required to comply with federal Tier 3 gasoline (10 ppm sulfur) requirements until January 1, 2020. EPA Office of Transportation and Air Quality (OTAQ) provided 2017 local gasoline sulfur values of 20.9 ppm. MOVES 2014a default fuel parameters were used for diesel and CNG. Since the non-road equipment being modeled is primarily diesel equipment this change should have no impact on the modeling result but the input is consistent with the fuel parameters being used for on-road mobile emissions.

Meteorological Data:

The UDAQ Technical Analysis Section provided meteorological conditions from the airport in Vernal, Utah from the Meso West archives. Meso West (mesowest.utah.edu) is a database of current and archived meteorological data from weather stations in the United States maintained by the University of Utah. The meteorological data is an hourly average temperature and relative humidity from an ozone exceedance event that occurred in the Uintah, UT Non-attainment area from February 1-10, 2013.

iv. Emissions Inventory

The emissions inventory was derived by multiplying the grams per hour by SCC (Table 1 p6) by the total number hours of operation by SCC indicated by the activity identified in the CARMMS report. The activity for shale gas wells was used from CARMMS Report Appendix C-49 see Table 2 (p7). The activity for conventional oil wells was used from CARMMS Report Appendix C-49 see Table 3 (p8). This provides an inventory for a single shale gas or conventional oil well. This number is then multiplied by the total number of well types that have been developed for 2017 according to Utah Division of Oil, Gas, and Mining see Table 4 (p8). The emissions are combined by SCC by county to create a non-road mobile source well pad construction equipment inventory see Table 5 p(9)

Table 1: Emission Factors

2017 MOVES2014b Non-Road Emission Factors Gm/(Op*Hr) for Duchesne County							
Eq Description	SCC	HP Range	CO	NOx	NH3	VOC	PM2.5 Total Exh
Grader	2270-00-2048	300	52.932	163.900	0.594	9.491	9.043
Off-Highway Truck	2270-00-2051	300	36.540	109.640	0.627	6.280	6.491
Tractor/Loader/Backhoe	2270-00-2066	300	64.688	119.459	0.213	17.381	11.095
Crawler Tractor/Dozers	2270-00-2069	300	54.613	169.056	0.605	9.898	9.335
Other Const Eq	2270-00-2081	300	84.477	252.943	0.600	17.685	14.565

2017 MOVES2014b Non-Road Emission Factors Gm/(Op*Hr) for Uintah County							
Eq Description	SCC	HP Range	CO	NOx	NH3	VOC	PM2.5 Total Exh
Grader	2270-00-2048	300	52.932	163.899	0.594	9.491	9.043
Off-Highway Truck	2270-00-2051	300	36.540	109.640	0.627	6.280	6.491
Tractor/Loader/Backhoe	2270-00-2066	300	64.688	119.458	0.213	17.381	11.095
Crawler Tractor/Dozers	2270-00-2069	300	54.613	169.055	0.605	9.898	9.335
Other Const Eq	2270-00-2081	300	84.478	252.945	0.600	17.685	14.565

Table 2: 2016 Ramboll Environ CARMMS 1.5 Final Report Appendix C2 Shale Gas Calculator Inputs by Source Category: Well Pad, Access Road, Pipeline Construction (p C-49)

Construction
Equipment

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/Well Pad**	HP Range
Well Pad	Haul Truck	250	3	40	8	13	300
	Trackhoe	250	1	40	8	13	300
	Dozer	250	2	40	8	13	300
	Grader	250	1	40	8	13	300
	Compactor	250	1	40	8	13	300
	Water Truck	250	1	40	8	13	300
Well Pad Access Road	Dozer	250	2	40	8	10	300
	Grader	250	1	40	8	10	300
	Trackhoe	250	1	40	8	10	300
	Haul Truck	250	3	40	8	10	300
Pipeline	Dozer	250	1	40	10	10	300
	Grader	250	1	40	10	10	300
	Trackhoe	250	1	40	10	10	300
	Bending Mach	250	1	40	10	10	300
	Sideboom	250	1	40	10	10	300
	Utility Tractor	250	1	40	10	10	300

**Includes pad reclamation associated activity

Table 3: 2016 Ramboll Environ CARMMS 1.5 Final Report Appendix C4 Conventional Oil Well Calculator Inputs by Source Category : Well Pad, Access Road, Pipeline Construction (p C-73)

Construction Equipment

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/Well Pad	Equipment Category	HP Range
Well Pad	Construction Equipment	250	4	42	10	13	Other Construction Equipment	300
Well Pad Access Road	Construction Equipment	250	4	42	10	10	Other Construction Equipment	300
Pipeline	Construction Equipment	250	2	42	10	2	Other Construction Equipment	300

Table 4: Utah Division of Oil, Gas, and Mining 2017 Spud count

Utah Division of Oil, Gas, and Mining 2017 Spud count					
Cal Yr	County	FIPs	Gas	Oil	Sum
2017	DU	49013	0	60	60
2017	UI	49047	2	84	86

Table 5: 2017 MOVES2014b Non-Road Well Pad Construction Equipment Inventory Emissions Tons Per Year for Duchesne & Uintah County

2017 MOVES2014b Non-Road Well Pad Construction Equipment Inventory Emissions Tons Per Year for Duchesne County					
SCC	CO	NOx	NH3	VOC	PM2.5 Total Exh
2270-00-2048	0.0000	0.0000	0.0000	0.0000	0.0000
2270-00-2051	0.0000	0.0000	0.0000	0.0000	0.0000
2270-00-2066	0.0000	0.0000	0.0000	0.0000	0.0000
2270-00-2069	0.0000	0.0000	0.0000	0.0000	0.0000
2270-00-2081	5.3637	16.0601	0.0381	1.1229	0.9248
Tons Per Year	5.3637	16.0601	0.0381	1.1229	0.9248

2017 MOVES2014b Non-Road Well Pad Construction Equipment Inventory Emissions Tons Per Year for Uintah County					
SCC	CO	NOx	NH3	VOC	PM2.5 Total Exh
2270-00-2048	0.0331	0.1026	0.0004	0.0059	0.0057
2270-00-2051	0.0445	0.1334	0.0008	0.0076	0.0079
2270-00-2066	0.0548	0.1011	0.0002	0.0147	0.0094
2270-00-2069	0.0563	0.1744	0.0006	0.0102	0.0096
2270-00-2081	7.5659	22.6539	0.0538	1.5839	1.3045
Tons Per Year	7.7546	23.1655	0.0557	1.6224	1.3371

v. Appendix: Baseline Year Inventories

Input files will be furnished upon request:

vi. References

1. March 2016 Ramboll Environ Colorado Air Resource Management Modeling Study (CARMMS) with updated Mancos Shale Modeling CARMMS 1.5 Final Report