

March 27, 2015

MEMORANDUM

To: Jeffrey Adams, BP; Matthew Todd, API; Tom Moore, WRAP
From: John Grant, Amnon Bar-Ilan
Subject: WRAP Regional O&G Emission Inventory Pneumatic Pump Data

Two regional oil and gas (O&G) emission inventory studies, the Montana-Dakota study¹ and the Western Regional Air Partnership (WRAP) Phase III study², co-sponsored by the WRAP, included the procurement of operator survey data for well-site sources upon which emission estimates were based. At the request of the WRAP, BP, and the American Petroleum Institute (API), ENVIRON has compiled representative inputs from the operator surveys for pneumatic pumps from these two studies. Information on survey data received for chemical injection and heat-trace pneumatic pumps is provided below.

Pneumatic Chemical Injection Pumps

A summary of the chemical injection pump data available by basin is provided below; representative survey data for each basin for which data from operator surveys is available is provided in Table 1a and Table 1b. It was not always possible to distinguish between chemical injection and heat-trace pumps, so the data provided in Table 1a and Table 1b may include some heat-trace pumps. To protect company confidentiality, averages, minimum and maximum pump characteristics and operational data were reported only in the case that information was provided by more than one company; in the case that this data was provided by only one company or not provided at all, the value is listed as “n/a” in Table 1a and Table 1b.

- **Denver Julesburg (DJ) Basin:** Limited operator data for pump characteristics and operational data fields did not allow for reporting of these values.
- **Piceance Basin:** Limited operator data did not allow reporting of pump make/model, piston size, or injection pressure.
- **South San Juan Basin:** Limited operator data for piston size did not allow for reporting of associated values.
- **North San Juan Basin:** Operator survey data for pneumatic pumps was not collected for this basin. Emissions for pneumatic pumps were estimated from the Southern Ute Indian Tribe Programmatic Environmental Assessment³. Pneumatic pump data for the North San Juan Basin are not summarized in Table 1a or Table 1b.

¹ <http://www.wrapair2.org/ND-SD-MT.aspx>

² <http://www.wrapair2.org/PhaseIII.aspx>

³ SUIT, 2009. “Draft Programmatic Environmental Assessment for 80 Acre Infill Oil and Gas Development on the Southern Ute Indian Reservation”; Prepared by Southern Ute Indian Tribe.

Table 1a. Chemical injection pump data for the DJ, Piceance, South San Juan, and Uinta Basins.

Parameter	DJ Basin (CY 2006 data)			Piceance Basin (CY 2006 data)			South San Juan Basin (CY 2006 data)			Uinta Basin (CY 2006 data)			
	average	min	max	average	min	max	average	min	max	average	min	max	
Pneumatic pump make/models:	Linc Methanol Pump, Texsteam (Series 5100 and 5103), Flomor (Series 5200)			n/a			Texsteam 3705, Texsteam 3700, Wilden PX200, Cemco			Leon, Western, Texstream 5000			
Number of chemical injection pumps (total basinwide)	1,335			783			7,787			4,682			
Pump Characteristic/Operational Data	average	min	max	average	min	max	average	min	max	average	min	max	
Piston Size (inches)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.38	0.38	0.38	
Injection Pressure (psi)	n/a	n/a	n/a	n/a	n/a	n/a	58	25	300	103	20	150	
Gas Usage (scf/gallons pumped)	n/a	n/a	n/a	111	118	108	57	1	100	410	141	1080	
Total volume of chemical pumped per year per pump:	n/a	n/a	n/a	273	180	365	803	3	1,800	870	274	3,667	
Fraction of annual usage by season:	Spring	23%	10%	50%	20%	10%	25%	24%	0%	25%	0.16	0.15	0.25
	Summer	1%	0%	25%	8%	0%	25%	22%	0%	25%	0.01	0.00	0.25
	Autumn	7%	0%	25%	27%	10%	30%	23%	10%	50%	0.15	0.00	0.25
	Winter	69%	25%	80%	45%	25%	75%	31%	25%	75%	0.68	0.25	0.75

Table 1b. Chemical injection pump data for the Wind River, Powder River, Southwest Wyoming, and Great Plains Basins.

Parameter	Wind River Basin (CY 2006 data)			Powder River Basin (CY 2006 data)			Southwest Wyoming Basin (CY 2006 data)			Great Plains Basin (CY 2011 data)			
	average	min	max	average	min	max	average ¹	min	max	average	min	max	
Pneumatic pump make/models:	Texsteam 5000, Wilden T-1, Sidewinder, Telstra			Wilden Pump, Wilden M -4, Arrow-Model 13			Arrow Model 13, ITT, Price, Texsteam 5103, Wilden M -4, Wilden Pump			n/a			
Number of chemical injection pumps (total basinwide)	105			1,106			5,280			3,301			
Pump Characteristic/Operational Data	average	min	max	average	min	max	average ¹	min	max	average	min	max	
Piston Size (inches)	n/a	n/a	n/a	0.25	0.25	0.25	0.37	0.25	0.38	n/a	n/a	n/a	
Injection Pressure (psi)	n/a	n/a	n/a	25	25	25	96	25	100	n/a	n/a	n/a	
Gas Usage (scf/gallons pumped)	n/a	n/a	n/a	0.60	0.002	0.8	114	0.002	120	42	30	47	
Total volume of chemical pumped per year per pump:	n/a	n/a	n/a	9,106	4	60,720	1,087	4	30,660	360	300	500	
Fraction of annual usage by season:	Spring	n/a	n/a	n/a	22%	15%	25%	31%	10%	33%	n/a	n/a	n/a
	Summer	n/a	n/a	n/a	17%	0%	25%	0%	0%	25%	n/a	n/a	n/a
	Autumn	n/a	n/a	n/a	22%	15%	25%	31%	10%	33%	n/a	n/a	n/a
	Winter	n/a	n/a	n/a	42%	25%	75%	37%	25%	80%	n/a	n/a	n/a

¹ Pump data fields above are not representative of all survey data; some operators provided total vented volumes rather than pump specifications.

- **Southwest Wyoming Basin:** Data for this basin reflects only survey data for pumps that operate outside of the Jonah-Pinedale Anticline Development.
- **Powder River Basin:** Operator data provided allowed for estimates of all chemical injection pump parameters.
- **Wind River Basin:** Limited operator data for pump characteristics and operational data fields did not allow for reporting of these values.
- **Uinta Basin:** Operator data provided allowed for estimates of all chemical injection pump parameters.
- **Great Plains Basin:** Survey data was not collected for pump piston size, injection pressure, or seasonality.
- **Williston Basin:** Data was not available from surveys to characterize pump operations; surveys did indicate infrequent use of pneumatic pumps at oil wells.

Pneumatic Heat-Trace Pumps

In general, limited data was available to characterize heat-trace pump characteristics and activity distinct from chemical injection pumps. Lack of survey responses, in some basins, for heat-trace pumps may indicate low prevalence, incomplete survey responses, and/or inclusion of these pumps in the chemical injection pump data.

- **Denver Julesburg (DJ) Basin:** Survey data was provided for a very small number of heat-trace pumps; no detailed data is available for these pumps.
- **Piceance Basin:** Survey data was provided for a very small number of heat-trace pumps; no detailed data is available for these pumps.
- **South San Juan Basin:** Survey data was not available to characterize heat-trace pump use in this basin.
- **North San Juan Basin:** Operator survey data for pneumatic pumps was not collected for this basin. Emissions for pneumatic pumps were estimated from the Southern Ute Indian Tribe Programmatic Environmental Assessment³.
- **Southwest Wyoming Basin:** Operator survey data indicates the usage of heat-trace pumps in this basin. While detailed pump operational and characteristic data is not available, the following pump types were specified: Graco 1040, Husky, Kimray 2015, Kimray 4015.
- **Powder River Basin:** Survey data was not available to characterize heat-trace pump use in this basin.
- **Wind River Basin:** Survey data was not available to characterize heat-trace pump use in this basin.
- **Uinta Basin:** Operator survey data indicates the usage of heat-trace pumps in this basin. While detailed pump operational and characteristic data is not available, the following pump types were specified: Sandpiper and Kimray.

- **Great Plains Basin:** Operators did not provide information on heat-trace pump use in this basin.
- **Williston Basin:** Operators did not provide information on heat-trace pump use in this basin.

Total Pneumatic Pump Count Estimates by Basin

Table 2 shows estimates of the total number of pneumatic pumps by basin based on operator survey data from the Montana-Dakotas and the WRAP Phase III O&G emission inventory studies.

Table 2. Total number of pneumatic pumps by basin.

Basin ¹	Total Number of Pumps
DJ	1,339
Piceance	793
Uinta	5,774
South San Juan	7,787
Powder River	1,106
Southwest Wyoming ²	6,842
Wind River	105
Williston	1,486
Great Plains	3,301

¹ Pneumatic pump counts not available for the North San Juan Basin

² Southwest Wyoming pneumatic pump counts only include pumps outside of the Jonah-Pinedale Anticline Development