DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION
ACTIVITY REPORT: Scheduled Inspection

B722043281

FACILITY: ANR Pipeline Co - Woolfolk Compressor Station		**SRN / ID:** B7220
LOCATION: 11039 150th Ave., BIG RAPIDS		**DISTRICT:** Grand Rapids
CITY: BIG RAPIDS		**COUNTY:** MECOSTA
CONTACT: Brad Stermer , Sr. Environmental Specialist		**ACTIVITY DATE:** 02/06/2018
STAFF: Chris Robinson	**COMPLIANCE STATUS:** Compliance	**SOURCE CLASS:** MAJOR
SUBJECT: FY '18 on-site inspection to determine the facility's compliance status with MI-ROP-B7220-2017and other applicable air quality rules and regulations.		
RESOLVED COMPLAINTS:		

On February 6, 2018 AQD staff Chris Robinson (CR) conducted a scheduled announced on-site inspection of the ANR Pipeline Company Woolfolk Compressor Station (Woolfolk, SRN B7220) to determine the facility's compliance status with Renewable Operating Permit (ROP) MI-ROP-B7220-2017 and any other applicable air quality rules and regulations.

Woolfolk is located at 11039 150th Avenue, in Big Rapids, Michigan. AQD staff CR arrived at this location at approximately 9:30 am and met with Mr. Brad Stermer, ANR Sr. Environmental Specialist. CR provided Mr. Stermer with proper AQD credentials and informed him of AQD's intent to perform an inspection of the facility. Mr. Stermer generously provided a tour of the facility as well as pertinent information. No visible emissions or odors were observed. Records for the Winfield Dehydration Plant (SRN N6245) were also reviewed remotely during this inspection.

Weather conditions on February 6, 2018 were approximately 15°F cloudy with light snow and calm winds.

Facility Description

The ANR Pipeline Company owns and operates facilities throughout Michigan for natural gas transmission and storage. Woolfolk is located near Big Rapids in Austin Township, Mecosta County, in a remote rural area. This facility consists of a Compressor Station and associated naturally occurring underground reservoirs used for storing natural gas. The reservoirs consist of a natural porous rock, ideal for natural gas storage. The reservoirs are located in the Austin Field (Austin formation), which was discovered in the 1930's.

Woolfolk is used to maintain pipeline pressure for transporting sweet natural gas through storage wells into the Austin Formation for temporary storage and for transporting natural gas through pipelines to storage and distribution facilities located throughout Michigan. Woolfolk consists of seventeen reciprocating internal combustion engines (RICE), a sorbead gas-liquid separator/dehydrator and auxiliary equipment. During periods of natural gas withdrawal, natural gas flows freely from the Austin Formation into the pipeline, slowly reducing the pressure in the reservoirs. When the reservoir pressure drops too low gas cannot move freely and one or more of the seventeen internal combustion engines are used to compress the natural gas for transport.

As summarized in **Table 1** below, the facility operates different types of natural gas fired only internal combustion engines. There are six two stroke engines and eleven four-stroke engines. These engines are further characterized as rich burn or lean burn. Rich-burn engines operate near the stoichiometric air-to-fuel ratio (16:1) with exhaust excess oxygen levels less than 4%. Lean-burn engines may operate up to the lean flame extinction limit, with exhaust oxygen levels of 12% or greater. The air to fuel ratios of lean-burn engines range from 20:1 to 50:1 and are typically higher than 24:1. Emergency generator and boiler information is also provided in table 1.

Table 1: Emission Unit Summary

Emission Unit ID	Description	Type	Installation Date
EUWL001 - EUWL005	Ingersoll-Rand Compressor Engine Model KVG-103, **1000 hp**	4-stroke, rich burn, natural gas fired reciprocating compressor engines	1949
EUWL006 - EUWL009	Ingersoll-Rand Compressor Engine Model KVG-123, **1320 hp**		EUWL006-8 1950 EUWL009 1951
EUWL010 - EUWL013	Cooper-Bessemer Compressor Engine Model GMW-10, **2500 hp**	2-stroke lean burn, natural gas fired reciprocating compressor engines	EUWL010-12 1951 EUWL013 1952
EUWL014 - EUWL015	Ingersoll-Rand Compressor Engines Model 616-KVH, **4500 hp**	4-stroke, lean burn, natural gas fired reciprocating compressor engines	1962
EUWL016	Cooper-Bessemer Compressor Engine Model 16Z-330, **11,000 hp**	2-stroke, lean burn, natural gas fired reciprocating compressor engine	1973
EUWL017	Cooper-Bessemer Compressor Engine Model 12Q145H, **4000 hp**	--	1980
EUWLGEN001	Emergency generators **370 hp/each**	natural gas fired spark ignition internal combustion engines	Installed in 1951 Removed in 2017 and will be replaced with EUWLGEN004
EUWLGEN002			

Table 1continued: Emission Unit Summary

Emission Unit ID	Description	Type	Installation Date
EUWLGEN003	Waukesha emergency generator **871 hp**	natural gas fired spark ignition internal combustion engine	2005
EUWLGEN004	Waukesha emergency generator Model P48GL, **1,174 hp**	4-stroke, lean burn, natural gas fired spark ignition internal combustion engine	Not yet installed will be replacing EUWLGEN001 and EUWLGEN002
EUWLBOILER001	Cleaver Brooks boiler, 5.82 MMBtu/hr	Natural gas-fired	1986
EUWLBOILER002	Cleaver Brooks boiler, 2.93 MMBtu/hr	Natural gas-fired	1986
EUWLBOILER003	Kewanee boiler, 3.35 MMBtu/hr	Natural gas-fired	1986
EUWLBOILER004	Kewanee boiler, 0.004 MMBtu/hr	Natural gas-fired	--
EUWLFURN001	Broch Furnace (Austin Dehydrator), 5.00 MMBtu/hr	Natural gas-fired dry bed dehydration furnace	Installed in 1986, Replaced with EUWLFURN002 on 12/14/2017
EUWLFURN002	Broch Furnace (Austin Dehydrator), 5.00 MMBtu/hr	Natural gas-fired dry bed dehydration furnace	12/14/2017

Regulatory Requirements

Mecosta County is currently designated by the USEPA as attainment/unclassified for all criteria pollutants. Woolfolk is subject to Title 40 CFR Part 70, because the potential to emit (PTE) of Nitrogen Oxides (NOx) and VOCs exceed 100 tons per year (tpy). The PTE of any single Hazardous Air Pollutant (HAP) (formaldehyde and Acetaldehyde) regulated by the federal Clean Air Act, Section 112, is equal to or more than 10 tons per year and the PTE of all HAPs combined is equal to or more than 25 tpy.

Woolfolk is considered a "synthetic minor" source in regard to the Prevention of Significant Deterioration (PSD) regulations of 40 CFR 52.21 because the stationary source accepted legally enforceable permit conditions limiting the potential to emit of NOx to less than 250 tpy for compressor engine Model 12Q145H (EGWL017), which was installed in 1980. The remaining processes at the facility are currently not subject to PSD regulations because the process equipment was constructed/installed prior to June 19, 1978, the promulgation date of the PSD regulations or did not exceed PSD threshold. Future modifications to the process equipment at the facility may be subject to PSD requirements.

Except for Engine 17, the reciprocating compressor engines were installed prior to August 15, 1967. As a result, this equipment is considered "grandfathered" and exempt from New Source Review (NSR) permitting requirements. Although Compressor Engine 16 was installed in 1973, this engine was exempt under an existing permit exemption rule at the time it was installed. The sorbead dehydrator equipment, initially installed prior to August 15, 1967, removes moisture from natural gas extracted from the Austin Field. Therefore, the facility refers to this equipment as the Austin dehydrator. The dehydrator consists of 6 dry bed adsorption towers and a Broch furnace for drying the sorbeads. The Broch furnace was replaced in 1986 and again in 2017, therefore no longer considered "grandfathered". The 2017 replacement was conducted under exemption Rule 282(b)(i) for boilers rated at no more than 50,000,000 Btu/hr and burns only sweet natural gas. The project did not trigger PSD because it did not exceed the 250 tpy PSD threshold.

Engines 1-9 are subject to Rule 336.1818, based on size, and considered "Large NOx SIP call engines". A Large NOx SIP call engine is an engine that emits more than 1 ton of oxides of nitrogen per average ozone control period day in 1995. These engines are also subject to the Maximum Achievable Control Technology (MACT) Standards for Reciprocating Internal Combustion Engines (RICE) promulgated in 40 CFR Part 63, Subparts A and ZZZZ.

Emergency generators EUWLGEN001 and EUWLGEN002 were recently removed from the site and will be replaced with emergency generator EUWLGEN004. At the time of this inspection, Woolfolk, had not taken receipt of EUWLGEN004. However, it's arrival was anticipated to be soon and the footings had been constructed. Emergency generators EUWLGEN003 and EUWLGEN004 are subject to the RICE MACT (40 CFR Part 63 Subparts A and ZZZZ). Emergency Generators EUWLGEN001 and EUWLGEN002, although removed, remain subject to the Rice MACT until the ROP Minor Modification process has been completed. A RICE MACT Initial Notification of Applicability for EUWLGEN004 was received by the AQD on 8/17/2017 and an NSPS Subpart JJJJ Initial Notification of Construction was received by the AQD on August 7, 2017 for EUWLGEN004 also.

Woolfolk has five 5) natural gas-fired boilers (EUWBOILER001, EUWBOILER002, EUWBOILER003 and EUWBOILER004) and a sorbead dehydrator (EUWLFURN001) subject to the National Emission Standard for HAPs for boilers/process heaters promulgated in 40 CFR Part 63, Subparts A and DDDDD. Initially, the facility mistakenly believed that EUWBOILER004 (400,000 BTU/hr) originally provided only building heat (water Heater) and therefore not subject to NESHAP 5(D) requirements. Recently the facility deteremined that this boiler provides both building heat and is part of a fuel temperature regulation system (Process Heater), making it subject to NESHAP 5(D) requirements. Woolfolk is in the process of preparing a Minor Modification to add this boiler to the ROP. Energy Assessments, notifications and tune-up reports were received by the AQD as requested and included in **Attachment A**. Submission dates are provided in **Table 2** below. Boiler MACT 5(D) requirements were previously reviewed in 2015 and 2016, see Compliance Activity Reports CA_B722029850 and CA_B722033870.

Table 2: 5(d) Submittal/Completion Dates

Boiler ID	Date of Energy Assessment	Date of Initial Notification (Received by AQD)		Required Tune-up Frequency (years)	Date of Initial Tune-up	Date of Follow-up Tune-ups
EUWLBOILER001	4/17/2015	5/30/2013	11/2/2015	2	9/14/2015	9/13/2017
EUWLBOILER002	4/17/2015	5/30/2013	11/2/2015	5	9/14/2015	Due in 2020
EUWLBOILER003	4/17/2015	5/30/2013	11/2/2015	5	9/14/2015	Due in 2020
EUWLBOILER004	**NA	5/30/2013		5	9/11/2017	Due in 2022
~~*EUWLBOILER005~~	~~**NA~~	~~5/30/2013~~		~~5~~	--	--
~~EUWLFURN001~~	~~??~~	~~5/30/2013~~		~~?~~	~~3/16/2015~~	~~3/16/2015~~
EUWLFURN002	***NA	1/5/2018		2	NA	Due in 2019

NA = Not Applicable
TBD = To be Determined
*Boiler was determined to be for comfort heat only and not subject to 5(D) Requirements.
** Not Required. See Boiler MACT discussion below.
*** Installed in 2017. Energy assessments and initial tune-ups are not required for "new" units.

On-site Observations & Records Review

All engines are equipped with continuous monitoring systems (CMS) and are monitored and operated from the control room. Monitoring data and records are also kept in the control room for a minimum of 5 years. All emission units on-site and discussed further below are natural gas-fired only. The facility continuously monitors and records fuel consumption and operating hours (**Attachment B**) for every engine. The operating status of each engine, as observed during this inspection, is detailed in **Table 2** below.

Table 2: Engine Status

Engine No.	Operating Status	Engine No.	Operating Status
1	Available	8	Available
2	Running	9	Unavailable
3	Running	14	Running
4	Available	15	Running
5	Unavailable	16	Available
6	Available	17	Unavailable
7	Unavailable	--	--

During this inspection, CR did not specifically measure any stack heights or diameters. However, visual inspections appeared to reflect the measurements specified in the ROP. The facility is currently preparing the 2017 annual certification which is due March 15, 2017. Otherwise, required 2016 and 2017 semi-annual reports and annual certifications have been submitted as required and on time. No issues or problems were reported.

➢ **ROP Emission Unit EUWL017 (Engine 17)**

Engine 17 was not operating during this inspection. NOx testing is required to be completed at least once within the five-year ROP cycle. Testing was last conducted on May 11, 2017 (CA_B722039866).

Engine 17 is typically operated at approximately 90% speed and torque, however, for the previous May 11, 2017, test the engine was operated at nearly 100%. The May 11, 2017 NOx test data indicates that Engine 17 operated with an emission rate of less than 9.7 g/bhp-hr. The 9.7g/bhp-hr calculates out to a lb/hr emission limit of 85.7 for a 4,000HP engine. Monthly records for January 2017 through December 2017 indicate that the highest NOx emission rate was in July 2017 at 22.1 lbs/hr, 2.9049 mmscf of fuel consumed and 146.25 hours of operation that month. The following records were provided and are included in **Attachment B:**

- Monthly engine fuel consumption
- Monthly engine hours of operation

- Calculations of hourly NOx emissions average over each month with an emissions factor based on the previous stack test.

➢ **ROP Flexible Group FG-RICE-818-WLENGINES (Engines 1-9)**
Engines 1-9 are subject to Rule 336.1818 and the NESHAP RICE MACT (40 CFR Part 63, Subparts A and ZZZZ) requirements. Engines no. 2 and 3 were operating during this inspection. No visible emissions or odors were observed. These engines are subject to a 76%, or greater, formaldehyde reduction limit. The facility meets this limit by operating the engines with a properly maintained Non-Selective Catalytic Reduction (NSCR) unit. Each unit has a pressure and temperature sensor installed as required.

The facility continuously monitors and records atmospheric pressure and NSCR inlet pressure and temperature and maintains the catalyst so that the pressure drop across the catalyst does not change by more than 2 inches of water at 100 percent load plus or minus 10 percent from the pressure drop across the catalyst measured during the initial performance test and a catalyst inlet temperature of greater than or equal to 750°F and less than or equal to 1250°F (40 CFR Part 63.6600). NSCR units are tested as required when replaced and differential pressure is continuously monitored to determine if maintenance or replacement is necessary. The Engine 4 catalyst is scheduled to be replaced in the near future due to elevated differential pressure. The AQD received a Test Protocol and Notification on January 30, 2018 for testing during the week of March 12, 2018. The AQD was notified on February 14, 2018 that engine 8 will also be tested during the week of March 12, 2018. Control room screen shots capturing the operating conditions during this inspection were provided for the operating engines **(Attachment C)** and summarized in **Table 3** below. All NSCR units appeared to be operating properly at the time of this inspection.

The facility prefers to use multiple engines at reduced workloads rather than a single engine at maximum load for reliability and flexibility purposes. These levels of operation, for which conventional MACT differential pressure monitoring might not be appropriate, are covered by their EPA-approved alternative monitoring supplement for load conditions less than 90%. These hours are tracked and totaled each semi-annual operating period.

Each engine has passed required MACT testing. Engines 1-8 have passed 2017 annual NOx testing. Engine 9 was not tested in 2017 due to mechanical issues. However, this engine did not operate during the 2017 Ozone Season. If an engine experiences a MACT excursion, then (per their MACT plan) it is shut down, catalyst replaced and re-tested.

Table 3: Engine Operating Conditions

Engine No.	Catalyst Operating Parameters		DP Limits (based on most recent Stack Test, "w.c.)	
	Inlet Temp (F)	DP ("w.c.)	Min/DP	Max D/P
1	--	--	3.52	7.52
2	1,004	5.05	2.99	6.99
3	999	4.29	2.07	6.07
4	--	--	2.91	6.91
5	--	--	2.93	6.93
6	--	--	1.47	5.47
7	--	--	1.35	5.35
8	--	--	0.40	4.40
9	--	--	1.28	5.28

Rule 336.1818 requires the engines to be tested annually for NOx. Except for engine 9, which was down for repair, these engines were last tested in June 19, 2017. Engine 9 was last tested in June 2016 but did not operate during the 2017 Ozone season (May 1 – September 30). Testing notification and protocols were submitted to AQD, as required. Based on the 2016 and 2017 test reports, these engines are compliant with the 20.50 g/bhp emission testing limit specified in special condition I.2 of the ROP. The 2017 test results are summarized in **Table 4** below. As proven by the calculations below the 20.50 g/bhp test limit calculates out to an emission limit of 45.19 lbs/hr for 1,000HP engines (engines 1-5) and 59.66 lbs/hr for 1,320 HP engines (engines 6-9). Per Rule 336.1818 these emission limits only apply during the annual ozone season (May 1st through September 30th). The underlying applicable requirement (UAR) provided in the Emission Limits Table Special Condition I.3 and I.4 are incorrect (R336.1213(2)(c)) and should be R336.1213(2). This UAR will be corrected in the next ROP Renewal.

Table 4: 2017 NOx testing Results

Engine No.	Limit (g/bhp-hr)	% Load	
		Emission Rate (g/bhp-hr)	% Load
1	20.50 / engine	8.7	96.6
2		8.4	90.8
3		9.8	95.9
4		11.2	94.6

5		9.2	96.4
6		5.6	92.3
7		5.1	91.5
8		8.1	93.0
9		7.0	91.3

(20.50 grams/brake HP Hour x (1lb/453.59237 grams)) x 1,000 HP = 45.19 lbs/hr
(20.50 grams/brake HP Hour x (1lb/453.59237 grams)) x 1,320 HP = 59.66 lbs/hr

The 2017 Monthly NOx emission calculations were provided and are included in **Attachment B** and summarized in **Table 5**.

Table 5: 2017 Calculated NOx Emissions

Month	Engine No.								
	1	2	3	4	5	6	7	8	9
** *May*	*10.1*	*11.2*	*12.1*	*15.9*	*12.1*	*9.8*	*	*	*13.3*
** *June*	*11.1*	*10.5*	*10.5*	*14.5*	*11.4*	*9.3*	*	*	*
** *July*	*9.9*	*8.7*	*15.1*	*8.5*	*15.0*	*10.9*	*	*	*10.3*
** *August*	*8.9*	*9.6*	*11.3*	*	*12.6*	*11.1*	*	*	*10.4*
** *September*	*10.4*	*1.0*	*15.8*	*3.5*	*17.5*	*11.0*	*	*	*12.2*
lb/hr limit per engine	**45.19 (May 1 – Sept. 30)					**59.66 (May 1 – Sept. 30)			

* Denotes an engine that did not operate during the month.
** The ROP NOx emission limits specified in the table for engines 1-5 (SC I.3) and engines 6-9 (SC I.4) does not specify whether the limit is for the group of engines or individual engines. These limits are meant to be on a per engine basis. A note clarifying this will be added to the next ROP renewal. These limits only apply during the Ozone Season (May 1 – September 3) of each year.

➢ **ROP Flexible Group FGWLENGINES (Engines 10-16)**
Engines 14 & 15 were operating during this inspection. Engine 16, which was not operating, is equipped with 6 compressors with hydraulic loaders. The hydraulic loaders allow the operator to load all 6 compressors simultaneously or independently as needed. No visible emissions were observed. The facility continuously monitors and records engine operating hours and natural gas consumption. These records were provided and are included in **Attachment B**. Printouts of the CMS data for these engines are included in **Attachment C.**

➢ **ROP Flexible Group FGSI-RICEMACT (Generators 1 & 2)**
Emergency generators 1 and 2 were removed in December 2017 as discussed above. These generators were subject to 40 CFR Part 63, Subparts A and ZZZZ maintenance work practice standards, monitoring of engine use, identification of emergency use and testing/readiness checks. All requirements appeared to be properly addressed and implemented. Hour meters and operation logs were readily accessible on each unit's control panels, which were still installed. Metered operating hours through the date of this inspection were 443.6 hours (Generator 1) and 842.8 hours (Generator 2). Since the last inspection, Generator 1 did not run, and Generator 2 ran for 29.8 hours. Generators at this facility typically do not operate for more than 500 hours per year. Therefore, the facility has opted to utilize an oil analysis program to extend the oil change requirement. Otherwise, the facility inspects the air cleaner every 1,000 hours of operation or annually and inspects all hoses and belts every 500 hours of operation or annually as required. The most recent oil analysis and maintenance records are included with the 4/4/2017 inspection report (**CA_B722039268**).

➢ **ROP Flexible Group FGLIMITED-RICEMACT**
Emergency generator no. 3 is located adjacent to Engine 17 and was not operating during this inspection. This generator is subject to 40 CFR Part 63, Subparts A and ZZZZ. All requirements appear to be properly addressed and implemented. Required hour meter and operating logs were readily accessible on the control panel. Metered hours through the date of this inspection for this generator was 382.7 hours. In addition, 2017 generator logs were provided by the facility (**Attachment D**). Based on these logs Generator 3 operated for emergency use in March (22 hours) and November (4.3 hours). Generator 3 also operated for a total of 16.1 hours in 2017 for maintenance. Generators at this facility typically do not operate for more than 500 hours per year. Therefore, the facility has opted to utilize an oil analysis program in order to extend the oil change requirement. Otherwise, the facility inspects the air cleaner every 1,000 hours of operation or annually and inspects all hoses and belts every 500 hours of operation or annually as required. The most recent oil analysis and maintenance records are included with the 4/4/2017 inspection report (**CA_B722039268**).

➢ **ROP Flexible Group FGWL-BOILERMACT**
The facility operates four (4) boilers (EUWBOILER001, EUWBOILER002, EUWBOILER003 and EUWBOILER004) and one process heater (EUWLFURN001) subject to the NESHAP BOILER MACT 5(D) requirements. As discussed above EUWLFURN001 has been replaced with EUWLFURN002.

The facility originally indicated 5 subject natural gas (only)-fired boilers, but the Energy Assessment covered only 3 boilers because it was based on the facility's heat input for the affected sources (5 small units up to about 6 mmBtu/hr), the Assessment is only required to cover 50% of the heat input capacity (and 8 on-site hours of activity.) By analyzing the 3 largest units, this 50% requirement was met.

Boiler EUWLFURN002 is installed but has not yet operated. An Energy Assessment is not required for this boiler because this boiler is considered a "new" unit. An initial tune-up is scheduled to be conducted in 2018. The facility is required to complete a tune-up every five (5) years for boilers/process heaters less than or equal to 5mbtu/hr and every two (2) years for boilers greater than 5mbtu/hr and less than 10mbtu/hr. All required Energy Assessments and tune-ups have been completed and submitted as required. The facility appears to be current and up-to-date with all boiler MACT 5(D) requirements.

MAERS

MAERs information submitted by the facility was reviewed on April 10, 2017 for the 2016 reporting season. The 2016 MAERS report is included in **Attachment E.** Information for boilers EUWLBOILER001, EUWLBOILER002 and EUWLBOILER003 was added by AQD for inclusion during the 2016 reporting season in 2017. ANR will now need to add boilers EUWLBOILER004 to the 2017 MAERS submittal and EUWLFURN002 to the 2018 MAERS submittal.

Conclusion

Based on observations made during this inspection and a records review, Woolfolk appears to be in compliance with ROP MI -ROP-B7220-2017, Boiler MACT 5D requirements, and any other applicable air rules and regulations.

Attachments

A - Boiler MACT 5D Documentation
B - Fuel Usage, Operating Hours, Engine 17 NOx emission Records & RICE MACT 24hr logs
C - Operations Screen Shots & RICE-MACT Catalyst D/P Set Points
D - Generator Logs
E - 2017 MAERS Report

NAME _____ DATE 3/6/2018 SUPERVISOR _____