



Centralized E&P Waste Management

Form 28 Permit: Narrative Report

Vaneta Dissolved Air Flotation Unit

February 26, 2019

NENE, Section 32, T7N R80W

Jackson County, Colorado

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1.0 Introduction

SandRidge Exploration and Production LLC. (SandRidge) is applying for a Form 28 permit under COGCC Rule 908 for a Centralized E&P Waste Management Facility. SandRidge has installed a Dissolved Air Flotation Unit at the Vaneta 67N80W location (VDAF) and is currently pilot testing the feasibility of flowback water clean-up (for disposal in the adjacent SWD Facility 159446) under Rule 907 with an existing Form 4 (Doc#401590362) as directed by the Colorado Oil and Gas Conservation Commission (COGCC). A Form 4 and a Form 42 were filed with the COGCC at a notification prior to pilot testing initiation that began on February 14, 2019. Pilot testing is anticipated to be completed by June 30, 2019 and the VDAF would come online permanently approximately July 1, 2019.

The following report provides supplemental information for a COGCC Form 28 Permit which includes appendices of applicable information.

2.0 Permit Information – 908.b

Operator

SandRidge Exploration and Production LLC.

Corporate Office

Spence Laird - EHS&R Manager
123 Robert S. Kerr
Oklahoma City, OK 73120
Office: 405-429-6518

Field Office

Person in Charge

Grant Hewins – Operations Manager
365 County Road 34
Coalmont, CO 80430
Office: 405-651-6853

The filing fee is included with this permit application.

The VDAF is operated by SandRidge in their North Park Field and is located at 365 County Road 34, Coalmont, CO and may be accessed by turning east from Highway 14 onto Jackson County Road 34 and travel east approximately 1500 feet and then turn south to the well pad. The VDAF was installed on an existing well pad and tank battery associated with the Vaneta1-32D injection well. The well pad is located approximately three (3) miles southeast of Coalmont, CO. The nearest municipality is the Town of Walden, CO located approximately 20.1 miles north of the facility. The terrain is relatively flat and slopes gently down to the north. The elevation at the site is approximately 8,171 feet above sea level. A vicinity topographic map is provided in Appendix A. The location of the VDAF is relatively remote.

Surface Owner

Jack & Veneta Haworth
910 County Road 34
Coalmont, Colorado 80430

SandRidge has obtained written authorization from the surface owner to operate the VDAF and is provided in Appendix B.

Legal Description

NE ¼ NE ¼ of Section 32, T7N, R80W, 6th P.M., Jackson County, Colorado

General Description

The VDAF is located in a rural setting within the North Park Basin, Colorado. The land usage within a 1,500-foot radius includes: oil and gas exploration and production, livestock grazing, and wildlife habitat. The terrain is relatively flat and slopes down to the north and slightly east. The elevation at the site is approximately 8,171 feet above sea level. There are (2) private residences and (1) commercial field office (SandRidge) within a one (1) mile radius of the site. The surrounding land uses are not adversely impacted by operation of the VDAF due to the remote location and existing surrounding area historically used for oil/gas exploration and production operations. Lands adjacent to the VDAF are currently used for livestock grazing or oil/gas exploration and production operations.

3.0 Facility Siting Requirements

A site survey plat is provided in Appendix C. The site facility plan is provided in Appendix D.

The DAF unit and all associated infrastructure are contained within an enclosed steel building which can only be accessed by authorized personnel. The VDAF has perimeter control BMPs that restrict run-on and eliminate the discharge of sediment and other pollutants. The BMPs include compacted earthen berms, dikes, and sediment basins. Additional surface water Best Management Practice (BMP) information is provided in Appendix E (Stormwater Management Plan).

4.0 Waste Profile - 908.b.(6)

Sampling and characterization analysis of flowback water to be treated using the VDAF was collected on 2/12/2019. Analytical reports are provided in Appendix F. The VDAF will treat flowback water from SandRidge owned wells in the North Park areas. A list of current or anticipated contributing wells is provided in Appendix G. New wells that are drilled within the SandRidge North Park areas will also contribute to future VDAF treatment and will be described in the annual report. The VDAF is anticipated, on average, to treat roughly 6,500 barrels (bbls.) of flowback water per day, although this number varies depending upon the water balance within the well field. The treated water will be pumped to the SandRidge Vaneta 1-32D Injection well (API # 05-057-06467) for disposal. The current sludge volume (without pressing) is estimated to be 50 bbls. of sludge per 3,500 bbls. of treated water.

5.0 Facility Design and Engineering - 908.b.(7)

Geology - 908.b.(4) & 908.b(7)A

Site geology is comprised of terrace deposits from the Quaternary Period. The Site is 30 to 40 feet above present stream level and consists of outwash gravels deposited during past glaciation events (Kinney and Hail, 1970). Surface soil texture at the Site is sandy loam. Soil characteristics observed at the VDAF were compared to the Natural Resources Conservation Service's Web Soil Survey to determine soil type. Soils within the site consist of a single primary soil series; the Cabin sandy loam (NRCS 2019). These soils occur on benches and terraces between 8,200 and 9,000 feet with mean annual precipitation of 15 to 16 inches, mean annual air temperature of 35 to 37 degrees Fahrenheit, and a frost-free period of 30 to 40 days. Cabin sandy loam soil occur on slopes of two (2) to five (5) percent. These soils' parent material consists of gravelly alluvium that occurs at depths greater than 80 inches below the ground surface. The soils are well-drained and their restrictive features occur at depths greater than 80 inches below the ground surface. No geologic hazards that may affect the design and operation of the facility were identified.

Hydrology - 908.b.(4) & 908.b(7)B

The DAF unit and associated infrastructure are contained within an enclosed steel building that is surrounded by lined secondary containment. Also, there are no open water pits for this location and the facility is designed to operate within a closed system. Therefore, potential impact to the adjacent hydrology are considered to be minimal. Annual precipitation average for the Coalmont, CO area is 14.76 inches. Annual evaporation average in the Coalmont, CO area is 22.65 inches.

Surface Water - 908.b(7)B.i

Surface water is mostly restricted to seasonal irrigation ditches in the VDAF vicinity. A map of surface water features within 2 miles is provided in Appendix H. The Grizzly and Buffalo Creeks are located within one mile of the VDAF location. Surface topography of the site trends north, ultimately towards the Spicer Ditch (590') and Grizzly Creek (2358').

Table 1: Surface water within 1-mile radius of the Veneta DAF Unit.

<i>Name</i>	<i>Distance (ft)</i>	<i>Name</i>	<i>Distance (ft)</i>
Spicer Ditch	590	Castle Ditch	3833
Unnamed Irrigation Ditch	1483	Wisconsin Ditch	3844
Damfino Ditch	1763	Coyote Ditch	3990
Grizzly Creek	2358	Mutual Ditch	4356
Buffalo Creek	2395	New Burke Ditch	5122
Unnamed Irrigation Ditch	2610		

Groundwater

Shallow Alluvium constitutes the major source of ground water in the North Park area. The alluvium consists primarily of sand and gravel in a matrix of silt and other fine-grained material. Most wells in the area identify ground bearing alluvial deposits to be less than 25 feet thick. The Coalmont Formation is a secondary source of groundwater and consists of Paleocene and Eocene age shale, sandstone, coal beds, and conglomerate. The Coalmont Formation is highly irregular in thickness and differs greatly in distribution from place to place within the area. Most wells that are drilled into the Coalmont Formation are drilled to depths greater than 200 feet (Voegeli, 1965). Depth to groundwater at the VDAF is estimated to be approximately 20 to 40 feet below ground surface (bgs). A water well record search identified that seven (7) records are located within 1.0 mile of the VDAF.

Table 2: Water wells within 1-mile radius of the VDAF Unit (DWR 2019).

<i>Well Owner</i>	<i>Receipt</i>	<i>Permit</i>	<i>Use</i>	<i>Status</i>
Evans, Blaine & Judy	9119034	112473	Domestic	BWQ sample collected 1/9/19.
Evans, Blaine & Judy	0421184	204347	Domestic	BWQ sample collected 1/9/19.
Haworth, Jack	9601298	273561	Stock	BWQ sample collected 10/11/2018.
Haworth, Jack	3672962	299984	Commercial	BWQ sample collected 10/11/2018.
US DOI	0918795A	None	Monitoring well	Present. Unable to sample according to 609 regulations.
US DOI	0918795B	None	Monitoring well	Removed.
US DOI	0918795C	None	Monitoring well	Unknown.

Table 3: Construction of water wells within 1-mile radius of the VDAF Unit. Taken from DWR (2019).

<i>Receipt</i>	<i>Permit</i>	<i>Well Depth (ft)</i>	<i>Water Level (ft)</i>	<i>Screened Intervals (ft)</i>	<i>Maximum Yield (gallons per minute)</i>	<i>Aquifer Name</i>
9119034	112473	45	N/A	N/A	15	All Unnamed Aquifers
0421184	204347	162	39	133-153	15	All Unnamed Aquifers
9601298	273561	200	40	80-100, 140-200	15	All Unnamed Aquifers
3672962	299984	251	20	111-131, 171-191, 231-251	15	All Unnamed Aquifers
0918795A	None	25	N/A	N/A	N/A	All Unnamed Aquifers
0918795B	None	55	N/A	N/A	N/A	All Unnamed Aquifers
0918795C	None	45	N/A	N/A	N/A	All Unnamed Aquifers

Four (4) wells, permit numbers 112473, 204347, 273561, and 299984, were sampled according to COGCC Rule 609 Statewide Groundwater Baseline Sampling and Monitoring (BWQ) protocols. Further information is provided in the Groundwater section 7.0 for 908.b.(9) requirements. Three (3) wells, owned by the United States Department of The Interior (US DOI) were not sampled. Records on file

with the Colorado Department of Water Resources (CO DWR) showed that the wells are currently owned by the United States Geological Survey (USGS). Multiple attempts were made to contact the USGS to discuss well status and possible sampling. SandRidge was unable to contact any knowledgeable parties from the USGS. One (1) US DOI owned well, receipt number 0918795B, was located on public land managed by the Bureau of Land Management (BLM). A field investigation did not identify any wells at the coordinates listed on the water well's record. Attempts were also made to locate the other two (2) US DOI owned wells, receipt numbers 0918795A and 0918795C. One (1) US DOI owned well, receipt number 0918795A, was able to be viewed from Jackson County Road 34, approximately 2,000 feet to the south. Field investigations identified PVC protruding from the ground but no aboveground electrical infrastructure within one-quarter mile of the well. No feasible groundwater sampling sources were identified.

Engineering Data

A design drawing of the VDAF is provided in Appendix I. The VDAF unit and all associated infrastructure are contained within an enclosed steel building.

6.0 Operation Plan - 908.b.(8)

Process Description

Flowback fluids are trucked to the VDAF location and offloaded to a single 500 bbl. holding tank. This holding tank has a riser at ten (10) feet that equalizes to two (2)-500 bbl. holding tanks. Flowback is pumped from these two (2) tanks through a static mixer where a coagulant is injected at a dose rate of approximately 800 parts per million (ppm). The fluid flows through a pipe reactor that provides residence time for the coagulant to charge and neutralize small particulate and emulsified oil in the flowback fluid. The coagulant dosed flowback flows into the Dissolved Air Flotation (DAF) unit. A 0.4% solution of made-down polymer is injected into the DAF unit. The purpose of the polymer is to amalgamate the pinhead coagulant created by the addition of the coagulant in to popcorn-sized particles. Dissolved air is created in the DAF using compressed air in an external recycle on the DAF unit. This "whitewater" is pumped back into the DAF where small bubbles evolve, attach to the popcorn floc, and float to the surface. The sludge formed at the surface in the DAF is raked using a scraper bar and is collected in a waste compartment within the DAF. From here it is pumped in to a sludge storage tank which is periodically emptied using a vac-truck and disposed of at a properly licensed disposal facility. The treated fluid is pumped from the DAF into a manifold that ties in with the produced water off-load into the Vaneta SWD Facility 159446.

Dust and Moisture Control

Moisture control is achieved by having the processing system constructed of completely sealed pipe or process vessels and tanks which are vented to atmosphere using sealed vents and ducts. Waste product going out is solidified and transported as bulk material to a properly licensed disposal facility. Additionally, the DAF unit and associated infrastructure are contained within an enclosed steel building and the outside surrounding location is constructed out of CDOT Class VI road base material that is watered periodically to minimize dust created by trucking activity.

Sampling

Pre-treatment composited flowback fluids and produced waste will be sampled semi-annually and analyzed for COGCC Table 910-1 constituents that are applicable to waste water. Samples shall be collected, preserved, documented, and shipped using standard environmental sampling procedures in a manner to ensure accurate representation of site conditions. Laboratories shall analyze samples using standard methods (such as EPA SW-846 or API RP-45) appropriate for detecting the target analyte. The method selected shall have detection limits less than or equal to the concentrations in Table 910-1. Also, the amounts to be received and managed by the facility shall be estimated on a monthly average basis.

Inspection and Maintenance

Facility was pressure tested prior to start-up in accordance with COGCC Rule 1101. While operating, this facility will be visually inspected daily for leaks by a pumper. Any leaks detected will be immediately corrected by either the facility operator or third-party mechanical crews. Periodic maintenance will be conducted per the manufacture's recommended schedule. The manufacture's operation and maintenance (O&M) manual is provided in Appendix J.

Emergency Response

Emergency response will be conducted in accordance with the SandRidge Emergency Response Plan (Doc 7-2017 Version 1.0) and is provided in Appendix K.

Record Keeping

Paper records of daily and periodic O&M checks and sampling results will be maintained in the SD Field Office for 2 years. Waste manifests will be maintained in the SandRidge Field Office for 3 years.

Site Security

The DAF unit and all associated infrastructure are contained within an enclosed steel building which can only be accessed by authorized personnel. Location is posted as private property and monitored by

SandRidge staff when present and remotely operated cameras when staff is not onsite. Facility is fenced to prevent livestock from entering the location.

Hours of Operation

This facility will be operated 24 hours per day, 7 days per week.

Noise and Odor Mitigation

Noise is mitigated by having all compressors and mechanical equipment within an enclosure. All waste is contained in either tanks or piping to minimize any odor.

Final Disposition of Waste

All waste will be disposed of at Twin Enviro in Milner, CO, COGCC Facility ID 211979. It will be transported by truck.

7.0 Groundwater Monitoring - 908.b.(9)

Four (4) wells, permit numbers 112473, 204347, 273561, and 299984, were sampled according to COGCC Rule 609 State-wide Groundwater Baseline Sampling and Monitoring (BWQ) protocols. Analytical results are provided in Appendix L. Analytical results have or will be provided to the surface owner within three (3) months of collecting the samples

8.0 Surface water Monitoring - 908.b.(10)

A surface water sample was collected from Grizzly Creek on 2/12/2019. The sample was collected according to industry standard operating procedure (SOP) for surface water sampling. Sample water was collected into laboratory provided containers and immediately placed on ice. The surface water samples were then delivered to SGS Laboratories in Wheat Ridge CO. The sample was analysed for COGCC Rule 609 BWQ Constituents. The analytical report is provided in Appendix M. At the time of sampling no water was observed running through the Spicer Ditch. In the spring of 2019, if water is present in the Spicer Ditch, it will be sampled and analysed for 609 BWQ Constituents and reported to the COGCC.

9.0 Contingency Plan – 908.b.(11)

A site-specific safety and evacuation plan has been prepared for the facility and is provided in Appendix K. This plan includes directions to the site, emergency contact information, and designated muster points. This plan is kept on-site at all times.

Spill Prevention, Control and Countermeasure Plan

A spill prevention plan is in place for the facility in accordance with EPA regulations. The current version of the plan (updated in March 2016) is provided in Appendix N. The SPCC plan demonstrates that the secondary containment systems for the tanks are designed to contain the volume of the largest tank,

plus precipitation from a 25 year, 24 hour storm event.

10.0 Financial Assurance - 908.d.

Financial assurance, as required by Rule 704 will be provided upon approval of the cost estimate (Appendix O) and the finalization of this Form 28 permit.

11.0 Facility Modifications - 908.g.(1)

Any future major modifications to the facility design, operations plan, permit data or permit conditions will be submitted to the COGCC for prior approval under a Form 4 Sundry notice and in accordance with Rule 908.e. Any minor modifications to the facility design, operations plan, permit data or permit conditions (from entities other than the COGCC) will be provided in the annual report submitted to the COGCC per Rule 908.f.

12.0 Annual Permit Review - 908.g.(1)

A report summarizing VDAF information will be submitted to the COGCC annually and will include:

- Types and volumes of solid waste exiting the facility
- Volume of water entering and exiting the facility
- Source water well additions
- Injection well additions
- Surface and/or ground water sampling results
- Any facility modifications, per Rule 908.e.

13.0 Preliminary Closure Plan - 908.g.(1)

The VDAF is expected to operate for twenty (20) years or greater. However, the facility could be closed earlier due to unforeseen circumstances. At closure, the following tasks will be undertaken at VDAF:

- Removal of the following items:
 - Industrial waste and chemicals including bottom solids, polymer, and coagulants
 - Equipment including pumps, pipelines, motor control center, etc.
 - Steel tanks
 - Drainage controls
 - Other industrial components, as required by COGCC regulations at the time of closure
- Soil sampling and analysis for Table 910-1 constituents
- Comparison of closure samples with baseline samples to determine if Table 910-1 concentrations of concern have been exceeded
- Completion of remediation activities required by soil sampling results
- Site restoration to pre-facility conditions, including re-contouring back to the original well pad grading. A cost estimate to decommission the entire VDAF facility is provided in Appendix O.

Vaneta DAF Unit

- Final reclamation in accordance with COGCC regulations will be pursued at the time of closure of the entire Vaneta SWD Facility.

References

- Colorado DWR, 2019. Colorado's Decision Support Systems, Colorado Department of Natural Resources, Department of Water Resources. Website: <https://dnrweb.state.co.us/cdss/WellPermits>. Retrieved January 2019.
- Kinney, D.M., and Hail, W.J., 1970, Preliminary geologic map of the Walden quadrangle, North Park, Jackson County, Colorado: U.S. Geological Survey, Open-File Report OF-70-185, scale 1:48,000. Retrieved January 2019.
- Voegeli, Paul T. Sr. Ground-Water Resources of North Park and Middle Park Colorado – A Reconnaissance. Geological Survey Water-Supply Paper 1809-G, 1965. Retrieved February 2019

Appendices

Appendix A – Topographic Map

Appendix B – Surface Owner Agreement

Appendix C – Vaneta Plat

Appendix D – Facility Layout

Appendix E – Stormwater Management Plan

Appendix F – Flowback Analytical Report

Appendix G – Contributing Wells List

Appendix H – Surface Water Map

Appendix I – Vaneta DAF Unit Design

Appendix J – DAF Operation and Maintenance Manual

Appendix K – Emergency Response Plan

Appendix L – Groundwater Analytical Reports

Appendix M – Surface Water Analytical Report

Appendix N – Spill Prevention Countermeasures and Controls Plan

Appendix O – Cost Estimate

