



November 10, 2022

Ms. Julie Murphy, Director
Colorado Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801
Denver, Colorado 80203

RE: COGCC Rule 304.d.(2) Lesser Impact Area Exemption: Carbon America, Inc. Denova Project
Revised November 2022

Dear Director Murphy,

Denova Sequestration LLC, a wholly-owned subsidiary of Carbon America (Carbon America), has filed a Form 2A with the Colorado Oil and Gas Conservation Commission (COGCC) for the Denova Project (Project). Carbon America wishes to locate and drill a stratigraphic test well to obtain geologic samples to evaluate the suitability of deep formations for injection and sequestration of CO₂. The Project is located in Sections 27 & 28, Township 1 North, and Range 49 West.

COGCC Rule 304.d. stipulates that the Director may exempt an Operator from submitting any of the information required by Rule 304.b. or any plan required by Rule 304.c. Carbon America requests an exemption under the following COGCC Rules listed below. Please see Table 1 for additional details.

- 304.b.(6)
- 304.b.(7).G
- 304.c.(2)
- 304.c.(3)
- 304.c.(12)
- 304.c.(13)
- 304.c.(18)
- 304.c.(21)
- 304.b.(4)

Pursuant to COGCC Rule 304.d.(2), Operators may request an exemption from the Director in writing, without proceeding through the ordinary Rule 502 variance process. As such, this letter serves as the required exemption request.

If you have any questions or require additional information, please do not hesitate to contact me at (720) 838-5458 via email at Jessica.gregg@carbonamerica.com. Thank you for your consideration of this matter.

Respectfully,
Jessica Gregg
Environmental and Regulatory Compliance Manager



Table 1. Lesser Impact Exemption Requests

COGCC Rule Exemption Being Requested From	Resource Concern	Exemption Circumstance	Description	Rule Requirements	Requesting Exemption
304.b.(6)	Flowline Descriptions	Oil and gas will not be produced by this project.	Oil and gas will not be produced by this project.	Process flow diagrams depicting: i. Flowback operations; and ii. Oil and gas production operations.	Yes
304.b.(7).G	Related Location and Flowline Drawings	There are no oil and gas operations, locations, or facilities within 2,000 feet of the proposed location, and no flowline corridors will be proposed as part of this project.	There are no oil and gas operations, locations, or facilities within 2,000 feet of the proposed location.	A U.S. Geological Survey topographic map, or scaled aerial photograph showing: i. All existing, approved, and proposed Oil and Gas Locations within 2,000 feet of the area affected by the proposed Oil and Gas Development Plan; ii. All proposed Flowline corridors, including Off-Location Flowline corridors, to or from the proposed Oil and Gas Location and to or from associated Oil and Gas Facilities.	Yes
304.c.(2)	Noise Mitigation	The impacted resource is not present.	An onsite survey and a review of available map data indicated the closest building unit is over 2.8 miles from the edge of the Project location. Additionally, there are no High Priority Habitats within one mile of the location and an on-site visit conducted by a qualified Tetra Tech biologist, determined there are no species of concern within the Project Area.	A noise mitigation plan consistent with the requirements of Rule 423.a.	Yes
304.c.(3)	Light Mitigation	The impacted resource is not present.	An onsite survey and a review of available map data indicated the closest building unit is over 2.8 miles from the edge of the Project location. Additionally, there are no High Priority Habitats within one mile of the location and an on-site visit conducted by a qualified Tetra Tech biologist, determined there are no species of concern within the Project Area.	A light mitigation plan consistent with the requirements of Rule 424.a.	Yes
304.c.(12)	Gas Capture Plan	Gas will not be produced by this project.	Gas will not be produced by this project. Please see Attachment A following this Table.	Gas Capture Plans should be submitted as an attachment to a Form 2A. While not identified specifically by rule, Gas Capture Plans may also be submitted with a Form 4.	Yes
304.c.(13)	Fluid Leak Detection Plan	Oil and gas will not be produced by this project.	Oil and gas will not be produced by this project.	A fluid leak detection plan.	Yes
304.c.(18)	Water Plan	Water use is minimal for this project because the well does not require a typical oil and gas completion operation.	Please see Attachment B .	A water plan.	Yes
304.c.(21)	Geologic Hazard Plan	No geologic hazards in the project vicinity.	As the Geologic Hazard Map indicates no geologic hazards exist; as such, a Geologic Hazard Plan is not required. Please see Attachment C .	If the Operator identifies any Geologic Hazards pursuant to Rule 304.b.(7).I, the Operator will submit a Geologic Hazard plan describing proposed mitigation measures.	Yes
304.b.(4)	Stake in Photos	The impacted resource is not present.	Carbon America personally walked the area with the Colorado State Land Board and they advised the cattle would knock over the stakes so we did not use stakes during surveying.	Stakes in location photos	Yes

Attachment A

To: Jessica Gregg, Environmental and Regulatory Compliance Manager, Carbon America

Cc: Clay Roesler, Tetra Tech

From: Jeff Harrington, Lysa Modica, Tiffanie Ramos, and Audrey Allen – Tetra Tech

Date: March 8, 2022, *Revised November 2022*

Subject: Carbon America DeNova Emissions Inventory

Dear Jessica:

Tetra Tech, Inc. (Tetra Tech) has summarized mobile and on-site equipment emissions for the construction and drilling of Carbon America's Denova Strat 1 Carbon Sequestration Well (the "Project"), located in Washington County, Colorado. Per correspondence with Colorado Department of Public Health and Environment on November 3, 2022, the Project is not considered a stationary source of emissions. Mobile source emissions from construction vehicles and equipment have been calculated using the United States Environmental Protection Agency's (USEPA) Motor Vehicle Emission Simulator (MOVES), estimated vehicle operation details, and the onsite road round-trip distance of 4.4 miles (i.e., distance from County Road 30 to well site and back). On-site equipment emissions have been calculated using published emissions factors, and estimated operation time and fuel burning capacity. The anticipated equipment required for the construction and drilling of Strat 1 Well, the number of trips to deliver that equipment, and required hours of operation and firing rate, were provided by Carbon America. Emissions for the Project's Cumulative Impacts were calculated for the following pollutants, as required per the Colorado Oil and Gas Conservation Commission's (COGCC) Rule 303(a)(5)(A) and (B).

- Oxides of nitrogen (NO_x)
- Carbon monoxide (CO)
- Volatile Organic Compounds (VOCs)
- Methane (CH₄)
- Ethane (C₂H₆)
- Carbon dioxide (CO₂)
- Nitrous oxide (N₂O)
- Total HAPs
- Benzene
- Toluene
- Ethylbenzene
- Xylene
- n-Hexane
- 2,2,4-Trimethylpentane (2,2,4-TMP)
- Hydrogen sulfide (H₂S)
- Formaldehyde
- Methanol

It should be noted that ethane, hydrogen sulfide (H₂S) and methanol were not included in the emissions inventory table, as they are not available pollutants to be modeled in MOVES and are not expected in mobile or stationary source construction emissions for this project. The following Memo further discusses the emissions modeling and calculation methodology and results.

Mobile Source Emissions

Mobile source emission factors for on-road and non-road vehicle and equipment engines were estimated using the most recent version of MOVES, model version MOVES3.0. MOVES-classified on-road sources for the Project include on-road construction vehicles (i.e., diesel haul trucks and gasoline passenger trucks) used on the job site and for vehicles driven by construction workers commuting to and from the work site during construction. MOVES-classified non-road sources for the Project include construction equipment and generator sets. MOVES outputs on-road emission factors in grams per vehicle mile traveled and non-road emission factors in grams per horsepower-hour for different road types. For on-road sources, Carbon America provided an estimated vehicle trip count along with descriptions of each trip purpose. Since emissions were calculated only for activity along ranch roads, emission factors for the 'Off-network' road type were used. Tetra Tech assigned a MOVES vehicle class and associated emission factor for each trip scenario and calculated emissions by multiplying by the number of trips and the miles per trip on dirt roads throughout the project site. For non-road sources, Carbon America provided estimates for the number of days construction would be required and the associated equipment required. Tetra Tech assumed worst case emissions by assuming non-road equipment would be running 24 hours per day.

Project Emissions

Carbon America provided information on the on-site emitting equipment and operating hours for project construction, including a diesel boiler and a diesel Tier II generator engine for drilling.

Boiler emissions were calculated using published emission factors, estimated hours of operation, and anticipated boiler firing rate. Emission factors were mainly taken from USEPA's AP-42 Compilation of Air Emissions Factors for ultra-low sulfur diesel (ULSD) in Tables 1.3-1, 1.3-2, 1.3-3, and 1.3-9. The sulfur dioxide emission factor was based on the fuel sulfur requirement of 15 ppm/gallon (40 CFR 80.510) and AP-42 Table 3.3-2 emission factor for SO₂ adjusted to 15 ppm/gallon. For greenhouse gases, emission factors were taken from 40 CFR 98, Tables C-1 and C-2 for oil combustion.

The drilling engine was assumed to be a Tier 2 engine, and therefore Subpart IIII Tier 2 emission factors were used when available; otherwise, AP-42 Table 3.3-2 and 40 CFR 98, Tables C-1 and C-2 emission factors were used. The sulfur dioxide emission factor was based on the fuel sulfur requirement of 15 ppm/gallon (40 CFR 80.510) and AP-42 Table 3.3-2 emission factor for SO₂ adjusted to 15 ppm/gallon. Drilling emissions were then calculated using these published emission factors, estimated hours of operation, and anticipated firing rate.

Emissions Summary

On-site equipment and mobile source emissions for the Project's Cumulative Impacts are summarized in the table below. The emissions are based on a six-week construction duration and are typical of well drilling activities of that duration.

Pollutant	On-site Equipment (tons)	Mobile - Off-road Emission (tons)	Mobile - On-road Emissions (tons)	TOTAL (tons)
Oxides of Nitrogen (NO_x)	2.23	0.64	0.003	2.88
Carbon Monoxide (CO)	1.24	0.17	0.003	1.41
Volatile Organic Compounds (VOCs)	0.22	0.05	0.0003	0.27
Methane (CH₄)	2.3E-02	2.3E-03	9.6E-05	2.6E-02
Nitrous Oxide (N₂O)	4.6E-03	2.3E-04	4.8E-06	4.9E-03
Carbon Dioxide (CO₂)	570	137	1.6	708.8
Carbon Dioxide Equivalents (CO₂e)	572	137	1.6	710.8
Benzene	1.3E-03	1.8E-03	2.8E-06	3.1E-03
Toluene	5.7E-04	1.3E-03	9.6E-06	1.9E-03
Ethyl Benzene	N/A	3.0E-04	2.9E-06	3.0E-04
Xylene	3.9E-04	8.3E-04	1.7E-05	1.2E-03
Hexane	N/A	6.9E-05	1.9E-06	7.1E-05
2,2,4-Trimethylpentane	N/A	3.9E-04	2.3E-06	3.9E-04
Formaldehyde	1.6E-03	1.2E-02	9.9E-06	1.4E-02

Public Health Review

The site is remote and emissions are low and of short duration. No sensitive receptors are located within 8 miles of the well. The closest residence is 2.25 miles to the southeast of the well. Public health impacts will be negligible.

CARBON AMERICA DENOVA STRAT 1 WELL

Summary - Mobile and Project Source Emissions for 2022

Source	Stationary (TPY)	Mobile - Off-road Emissions (TPY)	Mobile - On-road Emissions (TPY)	TOTAL (TPY)
Oxides of Nitrogen (NOx)	2.23	0.64	0.003	2.88
Carbon Monoxide (CO)	1.24	0.17	0.003	1.41
Volatile Organic Compounds	0.22	0.05	0.0003	0.27
Methane (CH ₄)	2.3E-02	2.3E-03	9.6E-05	2.6E-02
Nitrous Oxide (N ₂ O)	4.6E-03	2.3E-04	4.8E-06	4.9E-03
Carbon Dioxide (CO ₂)	570	137	1.6	708.75
CO ₂ Equivalents (CO ₂ e)	572	137	1.6	710.84
Benzene	1.3E-03	1.8E-03	2.8E-06	3.1E-03
Toluene	5.7E-04	1.3E-03	9.6E-06	1.9E-03
Ethyl Benzene	6.9E-09	3.0E-04	2.9E-06	3.0E-04
Xylene	3.9E-04	8.3E-04	1.7E-05	1.2E-03
Hexane	N/A	6.9E-05	1.9E-06	7.1E-05
2,2,4-Trimethylpentane	N/A	3.9E-04	2.3E-06	3.9E-04
Formaldehyde	1.6E-03	1.2E-02	9.9E-06	1.4E-02

Mobile Source Emissions
Nonroad - 2022

Construction Equipment	Fuel Type	HP per unit	HP	Total Operating Hours	MOVES Equipment Type	Emissions (TPY)												
						Oxides of Nitrogen (NOx)	Carbon Monoxide (CO)	Volatile Organic Compounds	Methane (CH4)	Atmospheric CO2	Nitrous Oxide (N2O)	Benzene	Toluene	Ethyl Benzene	Xylene	Hexane	2,2,4-Trimethyl pentane	Formalde hyde
Land-based Nonroad Equip.																		
D 6 Dozer	Diesel	175 < hp <= 300	215	72	Crawler Tractor/Dozers	6.5E-03	2.3E-03	4.8E-04	3.8E-05	9.16	3.8E-06	2.1E-05	1.6E-05	2.7E-06	1.1E-05	1.1E-07	3.5E-06	1.2E-04
Generator Operations	Diesel	100 < hp <= 175	175	768	Generator Sets	3.9E-01	1.0E-01	3.1E-02	1.4E-03	78.59	1.4E-04	1.1E-03	7.9E-04	1.8E-04	5.1E-04	4.3E-05	2.4E-04	7.6E-03
Generator Operations	Diesel	100 < hp <= 175	175	480	Generator Sets	2.4E-01	6.4E-02	1.9E-02	8.9E-04	49.12	8.9E-05	6.8E-04	4.9E-04	1.1E-04	3.2E-04	2.7E-05	1.5E-04	4.7E-03
				TOTAL NONROAD EMISSIONS (TPY)		0.639	0.168	5.02E-02	2.34E-03	136.86	2.34E-04	1.79E-03	1.30E-03	2.96E-04	8.32E-04	6.95E-05	3.88E-04	1.24E-02

Mobile Source Emissions

Onroad - 2022

Round Trip Distance (on dirt roads)

4.4

 miles

PHASE	No. of Vehicles	Trips per Vehicle	Total Trips per Well	Total Vehicle Miles Traveled (VMT)	MOVES Vehicle Type	Emissions (TPY)													
						Oxides of Nitrogen (NOx)	Carbon Monoxide (CO)	Volatile Organic Compounds	Methane (CH4)	Atmospheric CO2	Nitrous Oxide (N2O)	Benzene	Toluene	Ethyl Benzene	Xylene	Hexane	2,2,4-Trimethyl pentane	Formalde hyde	
WELL PAD AND ACCESS CONSTRUCTION																			
D 6 Dozer	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Supervisor pickups	2	4	8	35.2	Passenger Truck	1.1E-05	1.7E-04	6.6E-06	5.8E-07	1.5E-02	1.8E-07	2.2E-07	6.7E-07	1.1E-07	4.1E-07	1.7E-07	1.5E-07	4.0E-08	
DRILLING RIG MOB & DEMOB																			
Solids Control Eqpmt and Mud Tanks	2	2	4	17.6	Combination Short-Haul Truck	6.9E-05	3.2E-05	3.1E-06	2.8E-07	3.0E-02	3.2E-08	8.3E-09	3.0E-08	1.7E-08	1.1E-07	3.4E-09	7.7E-09	1.2E-07	
Pitless Fluid Recycling Equipment	2	2	4	17.6	Combination Short-Haul Truck	6.9E-05	3.2E-05	3.1E-06	2.8E-07	3.0E-02	3.2E-08	8.3E-09	3.0E-08	1.7E-08	1.1E-07	3.4E-09	7.7E-09	1.2E-07	
High Walled Solids Bin to Segregate Solids	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
4 x 400bbls Tanks to Recycle Fluids	2	2	4	17.6	Combination Short-Haul Truck	6.9E-05	3.2E-05	3.1E-06	2.8E-07	3.0E-02	3.2E-08	8.3E-09	3.0E-08	1.7E-08	1.1E-07	3.4E-09	7.7E-09	1.2E-07	
Rig Matting	2	2	4	17.6	Combination Short-Haul Truck	6.9E-05	3.2E-05	3.1E-06	2.8E-07	3.0E-02	3.2E-08	8.3E-09	3.0E-08	1.7E-08	1.1E-07	3.4E-09	7.7E-09	1.2E-07	
Rig Substructure	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Rig Carrier and Derrick	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Top Doghouse/Water tank	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Generator House	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
BOP Equipment	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Pump 1	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Pump 2	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Fuel Tank	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Catwalks & pipe racks	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Junk Basket	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
7500' 4" pipe and 21 collars	3	2	6	26.4	Combination Short-Haul Truck	1.0E-04	4.7E-05	4.6E-06	4.2E-07	4.5E-02	4.8E-08	1.3E-08	4.6E-08	2.6E-08	1.7E-07	5.0E-09	1.2E-08	1.8E-07	
Loader w/ Bucket-Forks	1	1	1	4.4	Combination Short-Haul Truck	1.7E-05	7.9E-06	7.7E-07	7.1E-08	7.6E-03	8.1E-09	2.1E-09	7.6E-09	4.3E-09	2.8E-08	8.4E-10	1.9E-09	3.1E-08	
Drilling Fluid Chemicals - Tandem	1	1	1	4.4	Single Unit Short-Haul Truck	7.1E-06	4.4E-06	8.1E-07	4.2E-07	4.3E-03	1.3E-08	2.7E-09	1.3E-08	7.4E-09	5.3E-08	1.0E-09	3.3E-09	3.6E-08	
Drilling Fluid Chemicals - Tandem	1	1	1	4.4	Single Unit Short-Haul Truck	7.1E-06	4.4E-06	8.1E-07	4.2E-07	4.3E-03	1.3E-08	2.7E-09	1.3E-08	7.4E-09	5.3E-08	1.0E-09	3.3E-09	3.6E-08	
Accommodations Trailers	2	1	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Septic/Fresh water system	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
PortaPotties, Trash Basket Misc	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Mobilization crew pickups	3	8	24	105.6	Passenger Truck	3.2E-05	5.0E-04	2.0E-05	1.8E-06	4.4E-02	5.3E-07	6.5E-07	2.0E-06	3.4E-07	1.2E-06	5.2E-07	4.6E-07	1.2E-07	
Supervisor pickups	2	5	10	44	Passenger Truck	1.3E-05	2.1E-04	8.3E-06	7.3E-07	1.8E-02	2.2E-07	2.7E-07	8.4E-07	1.4E-07	5.2E-07	2.2E-07	1.9E-07	5.0E-08	
Water Truck Dust Suppression	1	4	4	17.6	Single Unit Short-Haul Truck	2.9E-05	1.7E-05	3.2E-06	1.7E-06	1.7E-02	5.1E-08	1.1E-08	5.1E-08	3.0E-08	2.1E-07	4.2E-09	1.3E-08	1.4E-07	
Water Truck Dust Suppression	1	4	4	17.6	Single Unit Short-Haul Truck	2.9E-05	1.7E-05	3.2E-06	1.7E-06	1.7E-02	5.1E-08	1.1E-08	5.1E-08	3.0E-08	2.1E-07	4.2E-09	1.3E-08	1.4E-07	

Mobile Source Emissions

Onroad - 2022

Round Trip Distance (on dirt roads)

4.4

 miles

PHASE	No. of Vehicles	Trips per Vehicle	Total Trips per Well	Total Vehicle Miles Traveled (VMT)	MOVES Vehicle Type	Emissions (TPY)													
						Oxides of Nitrogen (NOx)	Carbon Monoxide (CO)	Volatile Organic Compounds	Methane (CH4)	Atmospheric CO2	Nitrous Oxide (N2O)	Benzene	Toluene	Ethyl Benzene	Xylene	Hexane	2,2,4-Trimethyl pentane	Formalde hyde	
DRILLING																			
Water Supply truck - 120 bbl. Semi	1	15	15	66	Single Unit Short-Haul Truck	1.1E-04	6.5E-05	1.2E-05	6.3E-06	6.5E-02	1.9E-07	4.0E-08	1.9E-07	1.1E-07	8.0E-07	1.6E-08	4.9E-08	5.4E-07	
Water Supply truck - 120 bbl. Semi	1	15	15	66	Single Unit Short-Haul Truck	1.1E-04	6.5E-05	1.2E-05	6.3E-06	6.5E-02	1.9E-07	4.0E-08	1.9E-07	1.1E-07	8.0E-07	1.6E-08	4.9E-08	5.4E-07	
Fuel truck - Tandem	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Fuel truck - Tandem	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Cuttings haul truck - Tandem	1	3	3	13.2	Single Unit Short-Haul Truck	2.1E-05	1.3E-05	2.4E-06	1.3E-06	1.3E-02	3.8E-08	8.0E-09	3.9E-08	2.2E-08	1.6E-07	3.1E-09	9.9E-09	1.1E-07	
Cuttings haul truck - Tandem	1	3	3	13.2	Single Unit Short-Haul Truck	2.1E-05	1.3E-05	2.4E-06	1.3E-06	1.3E-02	3.8E-08	8.0E-09	3.9E-08	2.2E-08	1.6E-07	3.1E-09	9.9E-09	1.1E-07	
Crew Vehicles	2	4	8	35.2	Passenger Truck	1.1E-05	1.7E-04	6.6E-06	5.8E-07	1.5E-02	1.8E-07	2.2E-07	6.7E-07	1.1E-07	4.1E-07	1.7E-07	1.5E-07	4.0E-08	
Tool Pusher and Supervisor Vehicle	2	4	8	35.2	Passenger Truck	1.1E-05	1.7E-04	6.6E-06	5.8E-07	1.5E-02	1.8E-07	2.2E-07	6.7E-07	1.1E-07	4.1E-07	1.7E-07	1.5E-07	4.0E-08	
Potable water	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Potable water	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Septic Fluids Disposal	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
BOP Pressure Testing Truck	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Logging truck	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Surface Casing pipe trucks	1	1	1	4.4	Combination Short-Haul Truck	1.7E-05	7.9E-06	7.7E-07	7.1E-08	7.6E-03	8.1E-09	2.1E-09	7.6E-09	4.3E-09	2.8E-08	8.4E-10	1.9E-09	3.1E-08	
Surface Casing pipe trucks	1	1	1	4.4	Combination Short-Haul Truck	1.7E-05	7.9E-06	7.7E-07	7.1E-08	7.6E-03	8.1E-09	2.1E-09	7.6E-09	4.3E-09	2.8E-08	8.4E-10	1.9E-09	3.1E-08	
Production Casing pipe trucks	2	1	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Production Casing pipe trucks	2	1	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Surface Casing Cement pickup	1	2	2	8.8	Passenger Truck	2.6E-06	4.2E-05	1.7E-06	1.5E-07	3.7E-03	4.4E-08	5.5E-08	1.7E-07	2.8E-08	1.0E-07	4.3E-08	3.8E-08	9.9E-09	
Surface Casing Cement pump truck	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Surface Casing Cement bulk truck	1	1	1	4.4	Single Unit Short-Haul Truck	7.1E-06	4.4E-06	8.1E-07	4.2E-07	4.3E-03	1.3E-08	2.7E-09	1.3E-08	7.4E-09	5.3E-08	1.0E-09	3.3E-09	3.6E-08	
Surface Casing Cement bulk truck	1	1	1	4.4	Single Unit Short-Haul Truck	7.1E-06	4.4E-06	8.1E-07	4.2E-07	4.3E-03	1.3E-08	2.7E-09	1.3E-08	7.4E-09	5.3E-08	1.0E-09	3.3E-09	3.6E-08	
Production Casing Cement pickup	1	2	2	8.8	Passenger Truck	2.6E-06	4.2E-05	1.7E-06	1.5E-07	3.7E-03	4.4E-08	5.5E-08	1.7E-07	2.8E-08	1.0E-07	4.3E-08	3.8E-08	9.9E-09	
Production Casing Cement pump truck	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Production Casing Cement bulk trucks	2	1	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Production Casing Cement bulk trucks	2	1	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Water Truck Dust Suppression	1	4	4	17.6	Single Unit Short-Haul Truck	2.9E-05	1.7E-05	3.2E-06	1.7E-06	1.7E-02	5.1E-08	1.1E-08	5.1E-08	3.0E-08	2.1E-07	4.2E-09	1.3E-08	1.4E-07	
Water Truck Dust Suppression	1	4	4	17.6	Single Unit Short-Haul Truck	2.9E-05	1.7E-05	3.2E-06	1.7E-06	1.7E-02	5.1E-08	1.1E-08	5.1E-08	3.0E-08	2.1E-07	4.2E-09	1.3E-08	1.4E-07	
Drilling Fluids transfer to next Location	1	4	4	17.6	Single Unit Short-Haul Truck	2.9E-05	1.7E-05	3.2E-06	1.7E-06	1.7E-02	5.1E-08	1.1E-08	5.1E-08	3.0E-08	2.1E-07	4.2E-09	1.3E-08	1.4E-07	
Drilling Fluids transfer to next Location	1	3	3	13.2	Single Unit Short-Haul Truck	2.1E-05	1.3E-05	2.4E-06	1.3E-06	1.3E-02	3.8E-08	8.0E-09	3.9E-08	2.2E-08	1.6E-07	3.1E-09	9.9E-09	1.1E-07	
Drilling Fluids Disposal	2	12	24	105.6	Single Unit Short-Haul Truck	1.7E-04	1.0E-04	1.9E-05	1.0E-05	1.0E-01	3.0E-07	6.4E-08	3.1E-07	1.8E-07	1.3E-06	2.5E-08	7.9E-08	8.7E-07	
Drilling Fluids Disposal	2	12	24	105.6	Single Unit Short-Haul Truck	1.7E-04	1.0E-04	1.9E-05	1.0E-05	1.0E-01	3.0E-07	6.4E-08	3.1E-07	1.8E-07	1.3E-06	2.5E-08	7.9E-08	8.7E-07	
Drilling Solids Disposal	2	12	24	105.6	Single Unit Short-Haul Truck	1.7E-04	1.0E-04	1.9E-05	1.0E-05	1.0E-01	3.0E-07	6.4E-08	3.1E-07	1.8E-07	1.3E-06	2.5E-08	7.9E-08	8.7E-07	
Drilling Solids Disposal	2	12	24	105.6	Single Unit Short-Haul Truck	1.7E-04	1.0E-04	1.9E-05	1.0E-05	1.0E-01	3.0E-07	6.4E-08	3.1E-07	1.8E-07	1.3E-06	2.5E-08	7.9E-08	8.7E-07	

Mobile Source Emissions

Onroad - 2022

Round Trip Distance (on dirt roads)

4.4

 miles

PHASE	No. of Vehicles	Trips per Vehicle	Total Trips per Well	Total Vehicle Miles Traveled (VMT)	MOVES Vehicle Type	Emissions (TPY)													
						Oxides of Nitrogen (NOx)	Carbon Monoxide (CO)	Volatile Organic Compounds	Methane (CH4)	Atmospheric CO2	Nitrous Oxide (N2O)	Benzene	Toluene	Ethyl Benzene	Xylene	Hexane	2,2,4-Trimethyl pentane	Formalde hyde	
COMPLETION + Mob/Demob and Complete																			
Completion Rig	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Rig Tankage, misc	2	2	4	17.6	Combination Short-Haul Truck	6.9E-05	3.2E-05	3.1E-06	2.8E-07	3.0E-02	3.2E-08	8.3E-09	3.0E-08	1.7E-08	1.1E-07	3.4E-09	7.7E-09	1.2E-07	
Fuel truck - Tandem	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Fuel truck - Tandem	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Pressure Test Truck	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
CH Logging and Perf Truck	1	2	2	8.8	Combination Short-Haul Truck	3.4E-05	1.6E-05	1.5E-06	1.4E-07	1.5E-02	1.6E-08	4.2E-09	1.5E-08	8.5E-09	5.6E-08	1.7E-09	3.8E-09	6.2E-08	
Water Supply Trucks - 120 bbl.	1	4	4	17.6	Single Unit Short-Haul Truck	2.9E-05	1.7E-05	3.2E-06	1.7E-06	1.7E-02	5.1E-08	1.1E-08	5.1E-08	3.0E-08	2.1E-07	4.2E-09	1.3E-08	1.4E-07	
Water supply Trucks	1	3	3	13.2	Single Unit Short-Haul Truck	2.1E-05	1.3E-05	2.4E-06	1.3E-06	1.3E-02	3.8E-08	8.0E-09	3.9E-08	2.2E-08	1.6E-07	3.1E-09	9.9E-09	1.1E-07	
Supervisor pickups	2	5	10	44	Passenger Truck	1.3E-05	2.1E-04	8.3E-06	7.3E-07	1.8E-02	2.2E-07	2.7E-07	8.4E-07	1.4E-07	5.2E-07	2.2E-07	1.9E-07	5.0E-08	
Crew pickups	1	5	5	22	Passenger Truck	6.6E-06	1.0E-04	4.1E-06	3.7E-07	9.2E-03	1.1E-07	1.4E-07	4.2E-07	7.0E-08	2.6E-07	1.1E-07	9.5E-08	2.5E-08	
Tubing trucks	1	1	1	4.4	Combination Short-Haul Truck	1.7E-05	7.9E-06	7.7E-07	7.1E-08	7.6E-03	8.1E-09	2.1E-09	7.6E-09	4.3E-09	2.8E-08	8.4E-10	1.9E-09	3.1E-08	
Tubing trucks	1	1	1	4.4	Combination Short-Haul Truck	1.7E-05	7.9E-06	7.7E-07	7.1E-08	7.6E-03	8.1E-09	2.1E-09	7.6E-09	4.3E-09	2.8E-08	8.4E-10	1.9E-09	3.1E-08	
Water Truck Dust Suppression	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Water Truck Dust Suppression	1	2	2	8.8	Single Unit Short-Haul Truck	1.4E-05	8.7E-06	1.6E-06	8.4E-07	8.7E-03	2.5E-08	5.3E-09	2.6E-08	1.5E-08	1.1E-07	2.1E-09	6.6E-09	7.2E-08	
Water transfer Trucks - 120 bbl.	1	4	4	17.6	Single Unit Short-Haul Truck	2.9E-05	1.7E-05	3.2E-06	1.7E-06	1.7E-02	5.1E-08	1.1E-08	5.1E-08	3.0E-08	2.1E-07	4.2E-09	1.3E-08	1.4E-07	
Water transfer Trucks - 120 bbl.	1	3	3	13.2	Single Unit Short-Haul Truck	2.1E-05	1.3E-05	2.4E-06	1.3E-06	1.3E-02	3.8E-08	8.0E-09	3.9E-08	2.2E-08	1.6E-07	3.1E-09	9.9E-09	1.1E-07	
					Pollutant	Oxides of Nitrogen (NOx)	Carbon Monoxide (CO)	Volatile Organic Compounds	Methane (CH4)	Atmospheric CO2	Nitrous Oxide (N2O)	Benzene	Toluene	Ethyl Benzene	Xylene	Hexane	2,2,4-Trimethyl pentane	Formalde hyde	
					TOTAL ONROAD EMISSIONS (TPY)	2.77E-03	3.06E-03	2.82E-04	9.59E-05	1.56	4.84E-06	2.79E-06	9.61E-06	2.89E-06	1.68E-05	1.95E-06	2.27E-06	9.89E-06	

Mobile Sources - MOVES Emission Factors
Onroad - 2022

Row Labels	Fuel Type Name	Emission Factor (g/mi)												
		Oxides of Nitrogen (NOx)	Carbon Monoxide (CO)	Volatile Organic Compounds	Methane (CH4)	Atmospheric CO2	Nitrous Oxide (N2O)	Benzene	Toluene	Ethyl Benzene	Xylene	Hexane	2,2,4-Trimethylpen tane	Formaldehyd e
Single Unit Short-haul Truck	Diesel Fuel	1.473	0.897	0.167	0.087	895.336	2.60E-03	5.50E-04	2.65E-03	1.54E-03	1.10E-02	2.16E-04	6.78E-04	7.44E-03
Combination Short-haul Truck	Diesel Fuel	3.533	1.630	0.159	0.015	1561.509	1.66E-03	4.30E-04	1.57E-03	8.81E-04	5.82E-03	1.73E-04	3.95E-04	6.34E-03
Passenger Truck	Gasoline	0.271	4.321	0.170	0.015	380.029	4.56E-03	5.62E-03	1.73E-02	2.89E-03	1.06E-02	4.48E-03	3.93E-03	1.02E-03

Nonroad - Diesel - 2022

Equipment	Horsepower	Emission Factor (g/hp-hr)												
		Oxides of Nitrogen (NOx)	Carbon Monoxide (CO)	Volatile Organic Compounds	Methane (CH4)	Atmospheric CO2	Nitrous Oxide (N2O)	Benzene	Toluene	Ethyl Benzene	Xylene	Hexane	2,2,4-Trimethylpen tane	Formaldehyd e
Crawler Tractor/Dozers	100 < hp <= 175	0.536	0.192	0.029	0.003	536.748	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.008
Generator Sets	100 < hp <= 175	2.628	0.690	0.207	0.010	530.449	0.001	0.007	0.005	0.001	0.003	0.000	0.002	0.051

Mobile Sources - Vehicle Classes

SCC (7 digits)	Description	Source Type	Description
2201001	Gasoline Light-Duty Vehicles (Passenger Cars)	21	Passenger Car
2201020	Gasoline Light-Duty Trucks (0-6,000 lbs. GVWR)	31	Passenger Truck
2201020	Gasoline Light-Duty Trucks (0-6,000 lbs. GVWR)	32	Light Commercial Truck
2201040	Gasoline Light-Duty Trucks (6,001-8,500 lbs. GVWR)	31	Passenger Truck
2201040	Gasoline Light-Duty Trucks (6,001-8,500 lbs. GVWR)	32	Light Commercial Truck
2201070	Gasoline Heavy-Duty Gasoline Vehicles (8501 lbs. and greater GVWR)	31	Passenger Truck
2201070	Gasoline Heavy-Duty Gasoline Vehicles (8501 lbs. and greater GVWR)	32	Light Commercial Truck
2201070	Gasoline Heavy-Duty Gasoline Vehicles (8501 lbs. and greater GVWR)	42	Transit Bus
2201070	Gasoline Heavy-Duty Gasoline Vehicles (8501 lbs. and greater GVWR)	43	School Bus
2201070	Gasoline Heavy-Duty Gasoline Vehicles (8501 lbs. and greater GVWR)	51	Refuse Truck
2201070	Gasoline Heavy-Duty Gasoline Vehicles (8501 lbs. and greater GVWR)	52	Single Unit Short-Haul Truck
2201070	Gasoline Heavy-Duty Gasoline Vehicles (8501 lbs. and greater GVWR)	53	Single Unit Long-Haul Truck
2201070	Gasoline Heavy-Duty Gasoline Vehicles (8501 lbs. and greater GVWR)	54	Motor Home
2201070	Gasoline Heavy-Duty Gasoline Vehicles (8501 lbs. and greater GVWR)	61	Combination Short-Haul Truck
2201080	Gasoline Motorcycles	11	Motorcycle
2230001	Diesel Light-Duty Vehicles (Passenger Cars)	21	Passenger Car
2230060	Diesel Light-Duty Trucks (0-8,500 lbs. GVWR)	31	Passenger Truck
2230060	Diesel Light-Duty Trucks (0-8,500 lbs. GVWR)	32	Light Commercial Truck
2230071	Diesel Class 2b Heavy-Duty Vehicles (8501-10,000 lbs. GVWR)	31	Passenger Truck
2230071	Diesel Class 2b Heavy-Duty Vehicles (8501-10,000 lbs. GVWR)	32	Light Commercial Truck
2230072	Diesel Class 6 & 7 Heavy-Duty Vehicles (19,501- 33,000 lbs. GVWR)	31	Passenger Truck
2230072	Diesel Class 6 & 7 Heavy-Duty Vehicles (19,501- 33,000 lbs. GVWR)	32	Light Commercial Truck
2230073	Diesel Class 6 & 7 Heavy-Duty Vehicles (19,501- 33,000 lbs. GVWR)	51	Refuse Truck
2230073	Diesel Class 6 & 7 Heavy-Duty Vehicles (19,501- 33,000 lbs. GVWR)	52	Single Unit Short- Haul Truck
2230073	Diesel Class 6 & 7 Heavy-Duty Vehicles (19,501- 33,000 lbs. GVWR)	53	Single Unit Long-Haul Truck
2230073	Diesel Class 6 & 7 Heavy-Duty Vehicles (19,501- 33,000 lbs. GVWR)	54	Motor Home
2230073	Diesel Class 6 & 7 Heavy-Duty Vehicles (19,501- 33,000 lbs. GVWR)	61	Combination Short- Haul Truck
2230073	Diesel Class 6 & 7 Heavy-Duty Vehicles (19,501- 33,000 lbs. GVWR)	62	Combination Long-Haul Truck
2230074	Diesel Class 8a & 8b Heavy-Duty Vehicles (33,001 lbs. and greater GVWR)	51	Refuse Truck
2230074	Diesel Class 8a & 8b Heavy-Duty Vehicles (33,001 lbs. and greater GVWR)	52	Single Unit Short-Haul Truck
2230074	Diesel Class 8a & 8b Heavy-Duty Vehicles (33,001 lbs. and greater GVWR)	53	Single Unit Long-Haul Truck
2230074	Diesel Class 8a & 8b Heavy-Duty Vehicles (33,001 lbs. and greater GVWR)	54	Motor Home
2230074	Diesel Class 8a & 8b Heavy-Duty Vehicles (33,001 lbs. and greater GVWR)	61	Combination Short- Haul Truck
2230074	Diesel Class 8a & 8b Heavy-Duty Vehicles (33,001 lbs. and greater GVWR)	62	Combination Long-Haul Truck
2230075	Diesel Buses	41	Intercity Bus
2230075	Diesel Buses	42	Transit Bus
2230075	Diesel Buses	43	School Bus

Reference: <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockkey=P10007VJ.pdf>

* Orange highlighted vehicle classes were used for emissions calculations.

Summary - Project Source Emissions

Pollutant	Drilling Engine (TPY)	Boiler (TPY)	Total (TPY)	Drilling Engine (lb/hr)	Boiler (lb/hr)	Total (lb/hr)
PM10	0.07	0.05	0.12	0.13	0.10	0.23
PM2.5	0.07	0.05	0.12	0.13	0.10	0.23
SO2	6.24E-04	3.22E-03	3.84E-03	6.24E-04	6.39E-03	0.01
NOx	1.93	0.30	2.23	3.83	0.60	4.43
CO	1.16	0.08	1.24	2.31	0.15	2.46
VOC	0.21	0.01	0.22	0.43	0.01	0.44
CO2	225.17	345.15	570.32	446.77	684.83	1131.59
CH4	9.13E-03	1.40E-02	2.31E-02	1.81E-02	2.78E-02	4.59E-02
N2O	1.83E-03	2.80E-03	4.63E-03	3.62E-03	5.56E-03	9.18E-03
CO2e	225.94	346.34	572.28	448.30	687.18	1135.48
Formaldehyde	1.63E-03	3.56E-06	1.63E-03	3.23E-03	7.07E-06	3.24E-03
2,2,4-Trimethylpentane	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	1.29E-03	2.31E-08	1.29E-03	2.56E-03	4.59E-08	2.56E-03
Ethylbenzene	N/A	6.87E-09	6.87E-09	N/A	1.36E-08	1.36E-08
Xylenes	3.94E-04	1.18E-08	3.94E-04	7.81E-04	2.34E-08	7.81E-04
Hydrogen Sulfide	N/A	N/A	N/A	N/A	N/A	N/A
n-Hexane	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	5.65E-04	6.70E-07	5.65E-04	N/A	1.33E-06	1.33E-06
Methanol	N/A	N/A	N/A	N/A	N/A	N/A
Ethane	N/A	N/A	N/A	N/A	N/A	N/A
Total HAPs	3.88E-03	4.28E-06	3.88E-03	7.69E-03	8.48E-06	7.70E-03

Drilling Engine - Emissions Calculations

Item	Value
Source Name	Drilling Rig Engine-TBD
Description	Generator Engine
Quantity	EU 1
Make	TBD
Model	TBD
Serial Number	TBD
Manufacture Date	After 2006
Fuel Type	Diesel Tier 2
Engine Type	Diesel
Ignition Type	CI
IIII Engine?	Yes
ZZZZ Engine?	No

Item	Value	Units	Source
Rated Horsepower	EU 402	hp	Manufacturer
Maximum Engine Power:	EU 360	kW	Manufacturer
Efficiency	EU 0	%	
Engine Power Electric:	EU 300	kWe	Conservative Estimation
Heat Rate	EU 3	MMBtu/hr	Calculated
Fuel Consumption	EU 6811	Btu/hp-hr	Engineering Estimate (assumes 20 gal/hr)
	EU 20160	gal/yr	
Heating Value	EU 137000	Btu/gal	40 CFR 98
Heat Rate	EU 3	MMBtu/hr	Calculated
Emission Controls	TBD		Manufacturer
Engine Speed	EU 1800	RPM	Manufacturer
Potential Operation *	EU 1008	hr/yr	Calculated

* (24 hrs/day*7 days/week * 6 weeks)

Drilling Engine - Potential Emissions Per Engine

Pollutant	Tier 2 Emissions				Source of Emission Factor
	Emission Factor	Units	(lb/hr)	(tpy)	
NOx	4.32	g/hp-hr	3.83	1.93	NSPS Subpart IIII
Total VOC	0.48	g/hp-hr	0.43	0.21	NSPS Subpart IIII
CO	2.60	g/hp-hr	2.31	1.16	NSPS Subpart IIII
SO2 *	1.39E-03	g/hp-hr	0.001	0.001	AP-42 Table 3.3-2 adjusted for 0.0015% S
PM10/PM2.5	1.49E-01	g/hp-hr	0.13	0.07	NSPS Subpart IIII
CO2	163.05	lb/mmBtu	446.8	225.17	40 CFR 98 Subpart C Tables C-1 and C-2
CH4	0.01	lb/mmBtu	1.81E-02	9.13E-03	40 CFR 98 Subpart C Tables C-1 and C-2
N2O	0.001	lb/mmBtu	3.62E-03	1.83E-03	40 CFR 98 Subpart C Tables C-1 and C-2
CO2e	N/A	lb/mmBtu	448.3	225.94	40 CFR 98 Subpart C Tables C-1 and C-2
Formaldehyde	1.18E-03	lb/mmBtu	3.23E-03	0.002	AP-42 Table3.3-2
2,2,4-Trimethylpentane	N/A	lb/mmBtu	N/A	N/A	---
Benzene	9.33E-04	lb/mmBtu	2.56E-03	0.001	AP-42 Table3.3-2
Ethylbenzene	N/A	lb/mmBtu	N/A	N/A	---
Xylenes	2.85E-04	lb/mmBtu	7.81E-04	0.0004	AP-42 Table3.3-2
Hydrogen Sulfide	N/A	lb/mmBtu	N/A	N/A	---
n-Hexane	N/A	lb/mmBtu	N/A	N/A	---
Toluene	4.09E-04	lb/mmBtu	1.12E-03	0.0006	AP-42 Table3.3-2
Methanol	N/A	lb/mmBtu	N/A	N/A	---
Ethane	N/A	lb/mmBtu	N/A	N/A	---
Total HAPs	---	---	0.01	0.004	---

* Sulfur Dioxide emissions based on the fuel sulfur requirement of 15 ppm/gallon (40 CFR 80.510). SO2 Emission Factor: AP-42 Table 3.3-2 adjusted for 15 PPM S Fuel Oil

2.05E-03 lb/hp-hr SO2 from AP-42 Section 3.3

3.08E-06 lb/hp-hr at 15 ppm S fuel

0.001394797 g/hp-hr

** Conversion of EPA Tier 2 Standard: assumes NOx = 80% NOx + HC and NMHC = 20% NOx + HC.

Pollutant	g/kW-hr	g/hp-hr
NOx*	5.76	4.32
VOC*	0.64	0.48
CO	3.50	2.60
PM10	0.20	0.15

*** Conversion: 1 kW = 1.341 hp

Boiler - Emissions Calculations

Cleaver-Brooks.CB-700-100

Operation 1,008 hrs/yr
Firing Rate 30 gal/hr
Horsepower 100 HP

Pollutant	GWP	Fuel Oil Emission Factor				Boiler Emissions	
		(lb/10 ³ gal)	(kg/MMBtu)	(lb/MMBtu)	Source	(lb/hour)	(TPY)
PM10	---	3.3	---	2.36E-02	AP42, Tables 1.3-1 and 1.3-2	0.10	4.99E-02
PM2.5	---	3.3	---	2.36E-02	AP42, Tables 1.3-1 and 1.3-2	0.10	4.99E-02
SO2	---	0.2	---	1.52E-03	AP42, Table 1.3-1 and ULSD	0.01	3.22E-03
NOx	---	20	---	1.43E-01	AP42, Table 1.3-1	0.60	3.02E-01
CO	---	5	---	3.57E-02	AP42, Table 1.3-1	0.15	7.56E-02
VOC	---	0.34	---	2.43E-03	AP42, Table 1.3-3	0.01	5.14E-03
CO2	1	22,828	73.96	163.1	40 CFR 98, Tables C-1 & C-2	684.83	345.15
CH4	25	0.9	3.00E-03	6.61E-03	40 CFR 98, Tables C-1 & C-2	2.78E-02	1.40E-02
N2O	298	0.2	6.00E-04	1.32E-03	40 CFR 98, Tables C-1 & C-2	5.56E-03	2.80E-03
CO2e	---	---	---	---	---	687.2	346.3
Formaldehyde	---	0.033	---	2.36E-04	AP42, Table 1.3-9	7.07E-06	3.56E-06
2,2,4-Trimethylpentane	---	N/A	---	N/A	---	N/A	N/A
Benzene	---	0.0002	---	1.53E-06	AP42, Table 1.3-9	4.59E-08	2.31E-08
Ethylbenzene	---	0.0001	---	4.54E-07	AP42, Table 1.3-9	1.36E-08	6.87E-09
Xylenes	---	0.0001	---	7.79E-07	AP42, Table 1.3-9	2.34E-08	1.18E-08
Hydrogen Sulfide	---	N/A	---	N/A	---	N/A	N/A
n-Hexane	---	N/A	---	N/A	---	N/A	N/A
Toluene	---	0.0062	---	4.43E-05	AP42, Table 1.3-9	1.33E-06	6.70E-07
Methanol	---	N/A	---	N/A	---	N/A	N/A
Ethane	---	N/A	---	N/A	---	N/A	N/A
Total HAPs	---	---	---	---	---	8.48E-06	4.28E-06

Attachment B



September 28, 2022

Ms. Julie Murphy, Director
Colorado Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801
Denver, Colorado 80203

RE: Water Use Planning for Denova Sequestration, LLC's Denova Stratigraphy Well Project

Dear Director Murphy,

Denova Sequestration LLC, a wholly-owned subsidiary of Carbon America (Carbon America), has filed a Form 2A with the Colorado Oil and Gas Conservation Commission (COGCC) for the Denova Project (Project). Carbon America wishes to locate and drill a stratigraphic test well to obtain geologic samples to evaluate the suitability of deep formations for injection and sequestration of CO₂. The Project is located in Sections 27 & 28, Township 1 North, and Range 49 West.

Pursuant to COGCC Rule 304.d.(2), Operators may request an exemption from the Director in writing, without proceeding through the ordinary Rule 502 variance process. Carbon America feels the water use under this rule qualifies for a Lesser Exemption Request, but we did want to provide as much information on our water use as possible given Carbon America put careful thought into water conservation while planning this project.

We anticipate the following water volumes for the duration of the project: CMT: 3000 bbls, surface hole: 700 bbls, long string: 1250 bbls, and road and pad construction: 7800 bbls. Water for this project is being sourced by contracts through the City of Yuma and City of Akron.

If you have any questions or require additional information, please do not hesitate to contact me at (720) 838-5458 via email at jessica.gregg@carbonamerica.com. Thank you for your consideration of this matter.

Respectfully,

Jessica Gregg
Director Environmental and Regulatory Compliance

Attachment C

STATE OF UTAH
DEPARTMENT OF COMMERCE
ACTIVE LICENSE

Stephanie JF Phippen

EFFECTIVE
01/07/2004

EXPIRATION
03/31/2023

REFERENCE NUMBER(S), CLASSIFICATION(S) & DETAIL(S)

5557302-2250 Professional Geologist

SIGNATURE OF HOLDER

IMPORTANT LICENSURE REMINDERS:

- Your license is valid until the expiration date listed on this form. Approximately 60 days prior to this expiration you will receive a renewal notice in the mail.
- Please note the address listed below. This is your public address of record for the division, and all future correspondence from the division will be mailed to this address. If you move, it is your responsibility to notify us directly of the change. Maintaining your current address with us is the easiest way to ensure continuous licensure.

STEPHANIE JF PHIPPEN
13692 W AMHERST PL
LAKEWOOD CO 80228

Please visit our web site at
www.dopl.utah.gov should you have any
questions in the future.

STATE OF UTAH
DEPARTMENT OF COMMERCE
DIVISION OF OCCUPATIONAL & PROFESSIONAL LICENSING

ACTIVE LICENSE

EFFECTIVE DATE: 01/07/2004


EXPIRATION DATE: 03/31/2023

ISSUED TO: Stephanie JF Phippen

REFERENCE NUMBER(S), CLASSIFICATION(S) & DETAIL(S)

5557302-2250 Professional Geologist

SIGNATURE OF HOLDER



Attachment D



September 28, 2022

Ms. Julie Murphy, Director
Colorado Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801
Denver, Colorado 80203

RE: Stakeholder Engagement for Denova Sequestration, LLC's Denova Stratigraphy Well Project

Dear Director Murphy,

Denova Sequestration LLC, a wholly-owned subsidiary of Carbon America (Carbon America), has filed a Form 2A with the Colorado Oil and Gas Conservation Commission (COGCC) for the Denova Project (Project). Carbon America wishes to locate and drill a stratigraphic test well to obtain geologic samples to evaluate the suitability of deep formations for injection and sequestration of CO₂.

In response to the COGCC's question regarding whether a consultation is required. Carbon America does not feel further consultation is required, and I wanted to take the opportunity to summarize the extensive engagement effort Carbon America has undertaken to date for this project.

- 2021-2022 Carbon America was a member of Colorado's Greenhouse Gas Pollution Reduction Roadmap CCUS Task Force
- October 8, 2021 Carbon America presented this project to the COGCC
- November 2021 Carbon America begins meeting with private land owners in the stratigraphy well area and has had ongoing discussions with local stakeholders throughout 2022
- January 6, 2022 Tetra Tech conducted a site visit to assess the potential for federally and state-listed threatened and endangered species and their associated habitats, raptor nests, and potential wetlands and other waters of the U.S. features. None were identified.
- January 13, 2022 Carbon America participated in a public hearing at the Colorado State Land Board
- January 13, 2022 Carbon America presented project to Federal and Regional EPA UIC Teams
- February 22, 2022 Carbon America met with EPA to present on the geology of the project
- February 27, 2022 Carbon America met with the Colorado Technology Committee including Senator Jeff Bridges, Representative Brianna Titone, and Governor Jared Polis
- March 29, 2022 Carbon America submitted this Form 2A making the document and attachments available to the public
- April 18, 2022 an official notice was sent to the following parties: Colorado State Land Board, Washington County, Colorado Parks and Wildlife, and Colorado Department of Public Health. The COGCC did not receive any comments on this notice.
- April 26, 2022 Carbon America met with Washington County Commissioners and Road and Bridge Departments

- May 12, 2022 Carbon America issued a press release about this project which was picked up by the AP and widely distributed internationally
- June 2, 2022 Carbon America met with Colorado Parks and Wildlife
- June 3, 2022 Carbon America met with Senator Hickenlooper's Staff
- June 6, 2022 Carbon America met with The Colorado Energy Office and Colorado Department of Public Health and Environment
- June 6, 2022 Carbon America met with Senator Hansen
- June 22, 2022 Carbon America participated in a public COGCC hearing
- July 29, 2022 Carbon America met with Colorado Parks and Wildlife
- August 16, 2022 Carbon America met with EPA and COGCC to present testing and monitoring strategies
- September 7, 2022 Carbon America meeting to discuss CO2 monitoring tools with the EPA and COGCC
- September 13, 2022 Carbon America traveled to Washington County to present to the public and press. You can find an article covering our discussion on the Akron News-Reporter's Webpage.

This list is just a snapshot of some of the stakeholder engagement our team has conducted for this project. There are numerous other informal phone calls and meetings not listed above. We have also contracted a consultant to begin a formal stakeholder outreach planning effort which will continue this engagement momentum moving forward. We are excited about this project and want all stakeholders informed and engaged with us throughout the project. If you have any questions or require additional information, please do not hesitate to contact me at (720) 838-5458 via email at jessica.gregg@carbonamerica.com. Thank you for your consideration of this matter.

Respectfully,

Jessica Gregg
Director Environmental and Regulatory Compliance