ENVIRONMENTAL ANALYSIS IN COAL LEASING

GREEN HOUSE GASES AND CLIMATE CHANGE

LAWS AFFECTING COAL LEASING

MINERALS LEASING ACT OF 1920 (MLA)
FEDERAL COAL LEASING AMENDMENTS ACT OF 1976 (FCLAA)
FEDERAL LAND POLICY AND MANAGEMENT ACT OF 1976 (FLPMA)
SURFACE MINING CONTROL AND RECLAMATION ACT 1977(SMCRA)
NATIONAL ENVIRONMENTAL POLICY ACT 1969 (NEPA)
ENERGY POLICY ACT 2005

COAL REGULATIONS (IMPLEMENTATION OF LAWS)

43 CFR § 3400 (BLM regs)

COMPETITIVE LEASING 43 CFR § 3420

LEASE MODIFICATIONS 43 CFR § 3432

30 CFR § 700 (OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT (OSM) regs)

- BLM IS REQUIRED BY LAW (MLA) TO CONSIDER LEASING FEDERALLY OWNED MINERALS
- LEASING CONVEYS RIGHTS TO THE MINERAL RESOURCE
- LEASING IS NECESSARY REQUISITE FOR MINING, BUT DOES NOT AUTHORIZE MINING
- PERMITTING ACTIONS THROUGH THE COLORADO DIVISION OF RECLAMATION MINING AND SAFETY (CDRMS) ARE REQUIRED TO AUTHORIZE MINING
- PERMITTING ACTIONS FALL UNDER PROCEDURES SET FORTH IN 30 CFR § 700 (OSM) AND CDRMS COAL MINING REGULATIONS (CDRMS – OSM MOU)
- OSM SUBMITS A DECISION DOCUMENT THAT RECOMMENDS MINE PLAN APPROVAL, CONDITIONAL APPROVAL, OR DISAPPROVAL TO THE ASSISTANT SECRETARY OF INTERIOR

NEPA

- Currently there is no BLM policy regarding coal mine methane

- EPA, Section 202(a) of the Clean Air Act (CAA) rules for GHG's are the Mandatory Reporting Rule (74 FR 56260) and Tailoring Rule (70 FR 31514).

- Under GHG Mandatory Reporting Rule, Underground Coal Mine rules are not finalized at this time. Under the Tailoring Rule, a facility emitting GHG's in excess of 100,000tpy of CO_2e would be subject to Prevention of Significant Deterioration (PSD) permitting.

- Center for Environmental Quality (CEQ) considers methane, carbon dioxide, nitrous oxide and several fluorinated species of gases Greenhouse Gases.

- US coal mines account for approximately 10 % of all man-made methane emissions.

- Methane's lifetime in the atmosphere is much shorter than CO_2, but is more efficient at trapping radiation than CO_2. Pound for pound, methane has 20 times greater impact than CO_2over 100 year period.

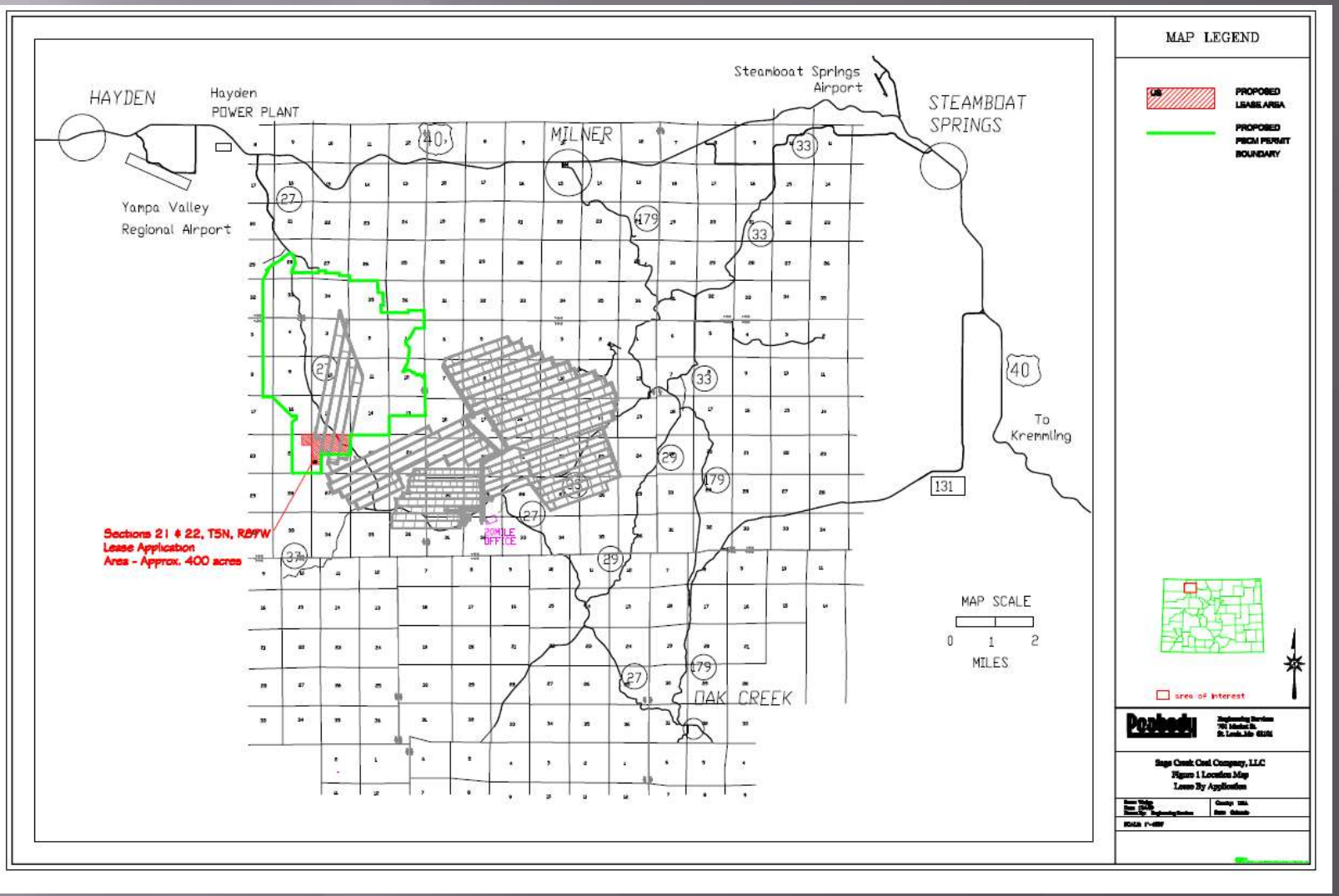
- Given the variability of the Earth's climate, it is difficult to determine the extent of change that humans cause. Computer based models show rising concentrations of GHG produce an increase in the average temperature of the Earth. Rising temperatures may produce changes in weather, sea levels, and land use patterns referred to as 'climate change.' (DOE, EIA)

PALM FROND FOSSIL, TRAPPER MINE

RECENT BLM NEPA COAL LEASING DOCUMENTS

- NEPA document is required for coal leasing by application (LBA) and lease modifications

- Purpose of NEPA is disclosure of environmental consequences of actions, so that decisions may be made if necessary, to protect, restore and enhance the environment. NEPA ensures compliance with environmental laws


HAYDEN
Hayden
POWER PLANT
Yampa Valley
Regional Airport
Steamboat Springs
Airport
STEAMBOAT
SPRINGS
MILNER
40
33
27
179
131
To
Kremmling
Sections 21 & 22, T5N, R89W
Lease Application
Area - Approx. 400 acres
POWELL
OFFICE
MAP SCALE
0 1 2
MILES
OAK CREEK
MAP LEGEND
PROPOSED
LEASE AREA
PROPOSED
PRCM PERMIT
BOUNDARY
area of interest
Sage Creek Coal Company, LLC
Figure 1 Location Map
Lease By Application

- Little Snake Field Office: Sage Creek 400 acre LBA, 3.2 million recoverable tons, DOI-BLM-CO-N010-2010-0003EA. Analyzed GHG emissions in mining because mining is logical consequence of leasing.

- Methane is emitted during the production and transport of coal, natural gas and oil.

- GHG'S have various capacities to trap heat in the atmosphere.

- Capacities are known as global warming potentials (GWP).

- Carbon dioxide has a GWP of 1. GHG analysis is standardized to carbon dioxide equivalent (CO_2e), or the equivalent amount of CO_2 mass the GHG would represent. The 20 year GWP of methane is 72; methane will trap 72 more times heat than CO2 over 20 years.

DIRECT CRITERIA AND GHG EMISSIONS FROM STATIONARY AND MOBILE SOURCES , 2011(tons)

Stationary Sources	AIRS ID	PM (TSP)	PM_{10}	$PM_{2.5}$	NMOG	CO	NO_X	SO_2	CO_2	CH_4	N_2O
Aggregates / Mine Vents / Fugitives (10RO1175F)	01 - 04	328.45	86.30	9.48	NA	NA	NA	NA	NA	NA	NA
Fuel Storage Tanks (XA)	NA	NA	NA	NA	3.99[1]	NA	NA	NA	NA	NA	NA
Aggregates Processing (93RO1204)[2]	101-198	76.36	24.11	4.94	NA	NA	NA	NA	NA	NA	NA
Emergency Generator (TBD)	NA	0.01	0.01	0.01	0.01	0.14	0.13	0.00	19.43	0.00	ND
Methane Sources (VAM)	NA	NA	NA	NA	NA	NA	NA	NA	ND	298[3]	NA
Mics. Heating Equipment[4]	NA	0.23	0.07	0.17	0.27	2.50	4.33	0.17	4,158.87	0.07	0.03
Fugitives[5]	NA	5.84	1.11	0.28	NA	NA	NA	NA	NA	NA	NA
Mobile Sources[6]	SCC	PM (TSP)	PM_{10}	$PM_{2.5}$	NMOG	CO	NO_X	SO_2	CO_2	CH_4	N_2O
Underground Mining Equipment	2270009000	3.08	3.08	2.99	5.02	20.44	22.75	0.02	1,709.42	0.08	0.04
Surface Mining Equipment	NA	ND	7.5	7.5	ND	65.2	147.8	0.1	14,587	ND	ND
Haul Trucks & LDGT	HDDT (Class 7) & LDGT	0.012	0.012	0.339	0.752	3.649	7.187	0.009	3,308.37	ND	ND
Total Direct Emissions (tons)		413.98	122.19	25.71	10.04	91.93	182.20	0.30	23,783.09	298.15	0.07

NOT ANALYSED IN THE EA

- It can be assumed that Sage Creek coal will be used in power generation, however, the types and location of the facilities the coal might be processed and consumed in is speculative and not foreseeable.
- Contracts between the coal fired power plant and the coal supply company are outside the scope of the EA.
- Power Plants vary in age, emission control devices, firing practices and efficiency.
- IBLA and District Court have upheld appeals to Records of Decision (IBLA 2012-130).

POTENTIAL IMPACTS ANALYSIS FOR GHG POLLUTANTS

- Methane emissions from the Sage Creek mine are anticipated to be very low compared to other Colorado underground mines. No gob vent boreholes (GVB) are necessary. All mine methane (CMM) is ventilated through mine fans.
- Estimated CMM from the 400 acres is approximately 298 short tons of CO_2e. This is 0.0055% of total CO_2 equivalent emissions from Colorado and 0.0004% from the U.S.

- Climate Change – predicting the degree of impact any single emitter of GHG's may have on global climate change is not possible at this time. The extent GHG emissions resulting from continued mining may contribute to global climate change cannot be quantified or predicted. Given the current state of science BLM determined that it is not possible to reach conclusions as to the extent or significance of the effects on global climate from future emissions of electricity-generating power plants using Sage Creek coal.

ALTERNATIVES NOT CONSIDERED

If an alternative is considered during the EA process but the agency decides not to analyze the alternative in detail, the Lead Agency must identify those alternatives and briefly explain why they were eliminated from detailed analysis (40 C.F.R. § 1502.14). An action alternative may be eliminated from detailed analysis if:

- It is ineffective (does not respond to the purpose and need).
- It is technically or economically infeasible (consider whether implementation of the alternative is likely, given past and current practice and technology).
- It is inconsistent with the basic policy objectives for the management of the area (such as, not in conformance with the LUP).
- Its implementation is remote or speculative.
- It is substantially similar in design to an alternative that is analyzed.
- It would have substantially similar effects to an alternative that is analyzed.

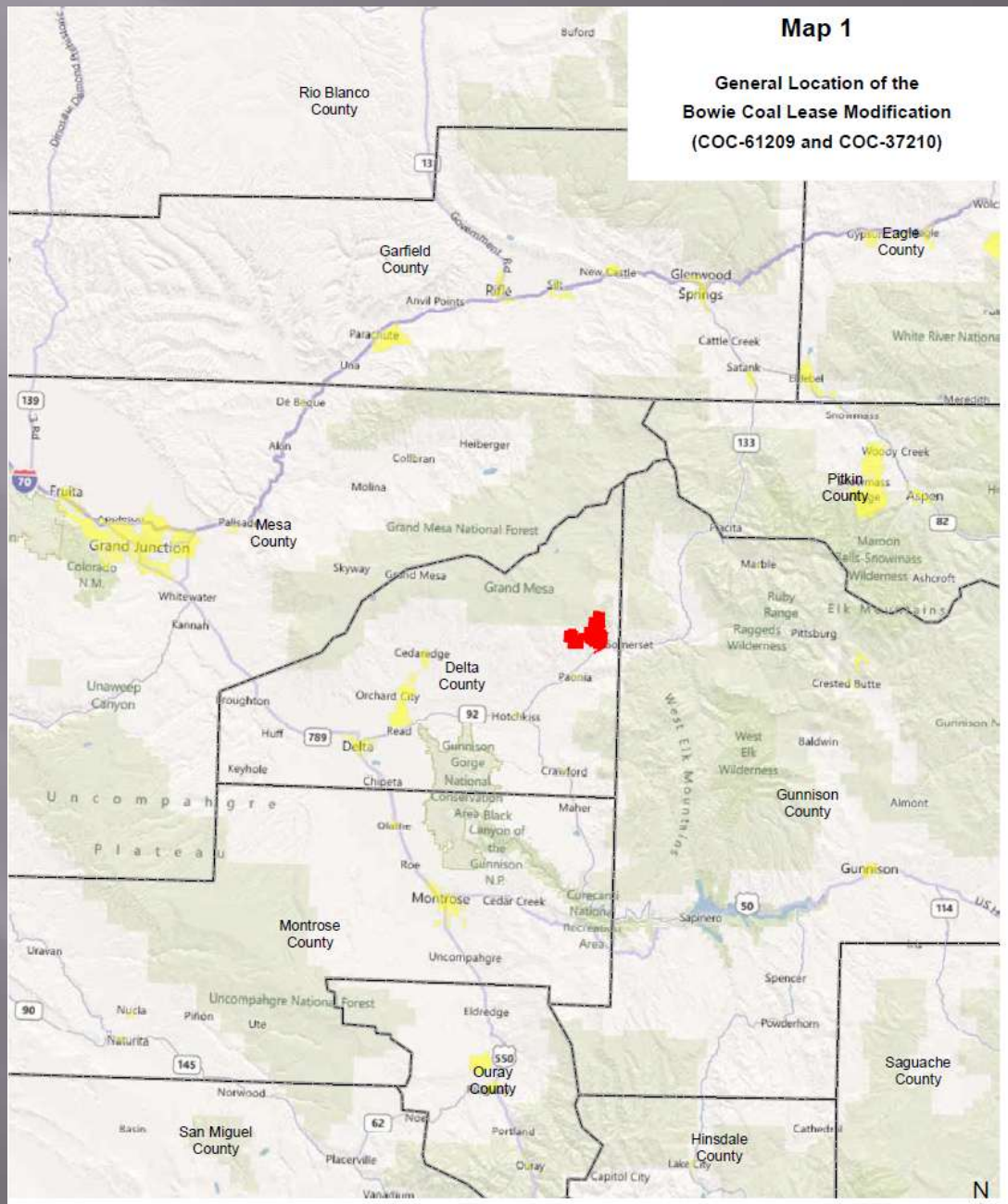
- Methane Capture was eliminated because it is technically or economically infeasible and is remote or speculative. The coal company does not have the rights to the gas. All CMM can be vented through existing fans. A degasification well would require surface disturbance.
- Practical constraints on commercial development of methane include resource quality and quantity and limitations relative to effective resource development. Methane in the Ventilation Air Methane (VAM) is less than 1%, making collection and concentration for sale infeasible. There is no network of pipelines, compressors and storage tanks. Only high quality methane (>95%) can be used for pipeline injection if a pipeline existed.
- Technologies for VAM capture are still in the developmental stage. There are 3 VAM capture projects in the U. S, only one at an active mine.
- Methane flaring was eliminated as it is technologically speculative at this time. Hazard that flaring could create an underground ignition exists. To date, MSHA has not approved a flaring system for a coal mine in the Western U.S. Unclear legally whether a gas lease would be required. Flaring of methane can release criteria pollutants such as NO_2 and CO.

NORTH FORK COAL LEASING

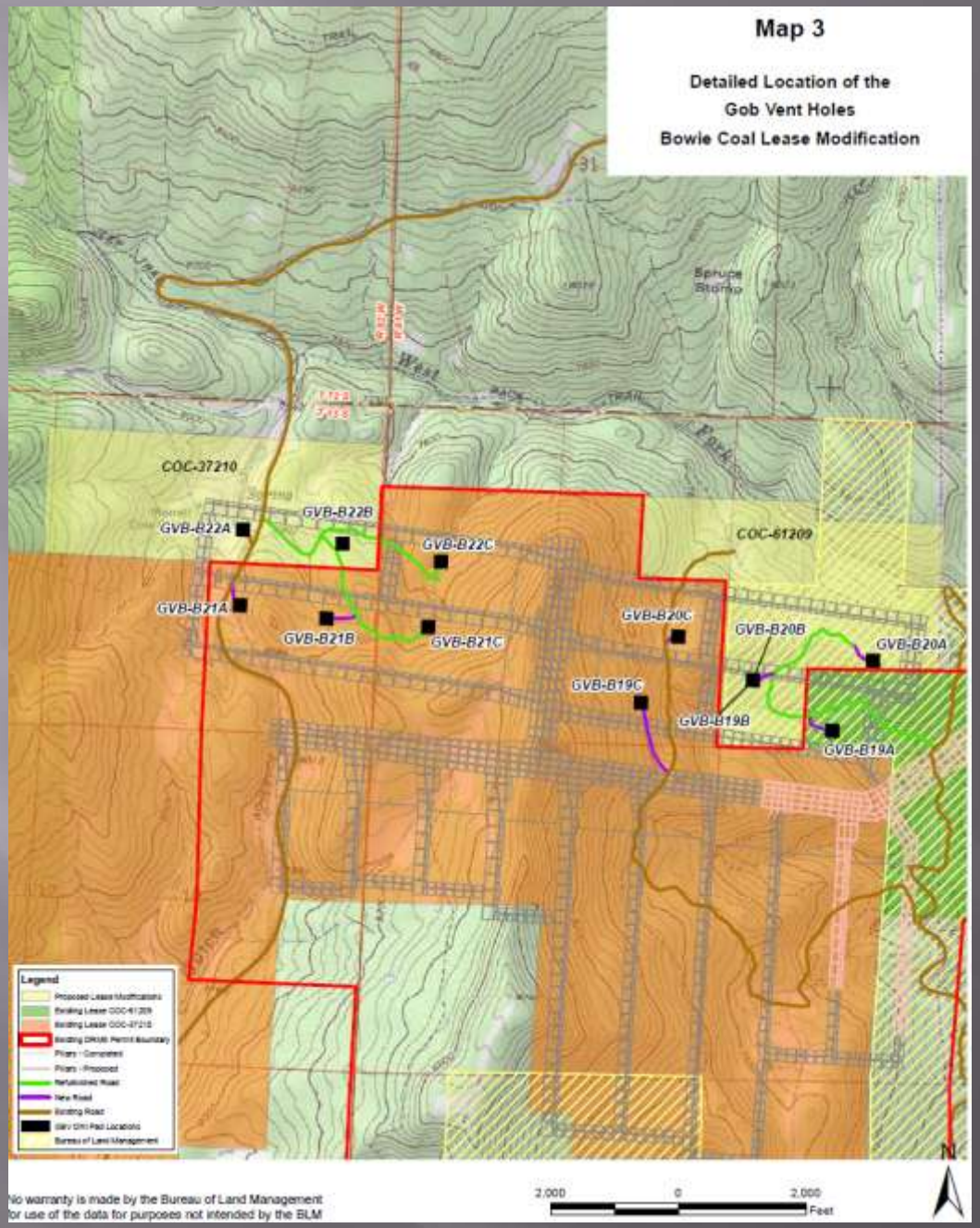
- DOI-BLM-CO-SO50-2012-0001 Bowie Lease Modification; 502 acres, 2.05 millions tons recoverable coal.
- GVB'S are drilled at Bowie and West Elk and Oxbow to reduce methane in the mine – can't all be vented by the fans.
- Methane is not captured either as VAM or at GVBs as Gob vent gas (GVG). The location of the GVB's is too far from Bowie surface facilities to provide ready access for either electric or natural gas markets or to utilize process heat loads.
- In 2011, Vessels Coal Gas Inc. evaluated the technical and economic feasibility of capturing CMM and GVG at Bowie and determined current conditions made methane capture technologies economically unfeasible.
- Methane emissions would be 474,464 tonnes/year (CO_2 e), or 0.0068% of total calculated CO2 e for the US

Map 1

General Location of the Bowie Coal Lease Modification (COC-61209 and COC-37210)



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM


Map 3
Detailed Location of the
Gob Vent Holes
Bowie Coal Lease Modification
COC-37210
COC-61209
GVB-B22A
GVB-B22B
GVB-B22C
GVB-B21A
GVB-B21B
GVB-B21C
GVB-B20C
GVB-B20B
GVB-B20A
GVB-B19C
GVB-B19B
GVB-B19A
Legend
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
2,000
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Feet
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ALTERNATIVES NOT CONSIDERED

- GVG: The geographic location of the proposed new longwall panels are too far from the existing Bowie surface facilities to provide ready access for GVG to be made available for either electric or natural gas markets or to utilize process heat loads.
- Methane flaring was eliminated as Vessels Coal Gas (VGC) report found methane flaring would not be economically feasible. Hazard that flaring could create an underground ignition exists. To date, MSHA has not approved a flaring system for a coal mine in the Western U.S. Unclear legally whether a gas lease would be required. Flaring of methane can release criteria pollutants such as NO_2 and CO.
- Technologies for VAM capture are still in the developmental stage and cost information is still limited.

DIRECT CRITERA AND GHG EMISSIONS FROM STATIONARY AND MOBILE SOURCES (TPY)

Stationary Sources	CDPHE-APDC Permit	Stationary PM_{10}	Fugitive PM_{10}	$PM_{2.5}$	NMOG	CO	NO_X	SO_2	CO_2	CH_4	N_2O
Screen	96DL103-1	6.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
Crusher	96DL103-6	6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
Conveyor Transfer, Haul, Stockpiles	96DL103-7F	4.2	161.2	NA	NA	NA	NA	NA	NA	NA	NA
Ventilation Shaft	98DL0726	14	NA	NA	NA	NA	NA	NA	NA	NA	NA
Train Loading	01DL0685	8.76	NA	NA	NA	NA	NA	NA	NA	NA	NA
Portal Development	03DL0099F	NA	39.7	NA	NA	NA	NA	NA	NA	NA	NA
Coal Prep/Wash Plant	03DL0596	8.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOB Handling	03DL0923F	NA	40	NA	NA	NA	NA	NA	NA	NA	NA
Underground Conveyor	04DL0560	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOB Pile Operations	06DL1082F	2.1	55	NA	NA	NA	NA	NA	NA	NA	NA
Methane Sources	None	NA	NA	NA	NA	NA	NA	NA	ND	24,905[3]	NA
Mobile Sources[2]	**SCC**		**PM_{10}**	**$PM_{2.5}$**	**NMOG**	**CO**	**NO_X**	**SO_2**	**CO_2**	**CH_4**	**N_2O**
Underground Mining Equipment	2270009000		6.82	6.62	10.46	40.38	47.97	0.65	3031.54	0.16	0.02
Surface Mining Equipment	2270002036 2270002051 2270002060 2270002069 2270002033		1.79	1.73	2.18	11.55	24.68	0.39	1795.79	0.03	0.02
Gasoline Trucks	LDGT		0.03	0.03	0.05	0.73	0.08	0.02	107.64	NA	NA
Total Direct Emissions (tons)		**50.2**	**304.54**	**8.38**	**12.69**	**52.66**	**72.73**	**1.06**	**4934.97**	**24905.2**	**0.04**

[1] All PM10 assumed to be PM2.5, site specific data is not known.
[2] Mobile sources emissions are for exhaust only.
[3] Reported in short tons. The CO_2e of the methane gas is approximately 474,464 metric tons.

TECHNOLOGIES

- CMM may be mitigated by methane recovery projects at underground mines. Potential applications that have been demonstrated in the US and other countries include:
  - electricity generation
  - Fuel for on-site preparation plants or mine vehicles
  - Cutting edge application such as fuel cells and VAM technologies
- VOCSIDIZER (Regenerative Thermal Oxidizers , RTO) – converts VAM methane into CO_2 and water (abatement) or VAM to Energy. One abandoned underground mine uses this technology in the US.
- RTO's are designed for oxidative destruction of volatile organic compounds. Methane destruction efficiency ≥ 96%
- Self-sustained operation on very dilute (0.2 – 1.4%) methane streams
- Convert methane to CO_2 and water, reducing global warming potential by 87%
- Produces essentially no SOx, NOx, CO, or particulate matter.

VOCSIDIZER

SOME TECHNOLOGIES IN ACTION

- Coal Mine Methane (CMM) – use pre-mine drainage wells and coal mine gas from gob wells to heat mine ventilation air to keep air shafts free from ice – Jim Walters Resources (JWR) mines in Alabama.
- Jim Walters' Blue Creek No. 4 and No. 7 mine capture CMM from drainage wells and sends majority to pipeline. Gas is owned by JWR; built low quality gas plant to process CMM to meet pipeline quality specifications. GHG emissions avoided: 4.5 million tonnes CO_2e per year.
- Jim Walter's Blue Creek No. 4 and No. 7 also use VAM – VAMOX system heats mine exhaust air which converts methane into carbon dioxide and water. The oxidation reaction releases heat which VAMOX recovers and uses to fuel system.
- CONSOL's Enlow Fork mine in PA using RTO for VAM.
- West Elk Mine, Somerset, CO . Uses captures methane to heat mine ventilation air. GHG emissions avoided: 69,000 tonnes CO_2e per year.
- New project at Oxbow's Elk Creek Mine, Somerset, CO. Using methane to fuel electrical generator to produce electricity which is fed back onto electric supply grid. Aspen Skiing Co. invested $5.4 million.

VAMOX AT JWR IN ALABAMA