Received
APR 28 2008
Casper DEQ

URS

URS Corporation
8181 East Tufts Avenue
Denver, CO 80237
Tel: 303.694.2770
Fax: 303.694.3946
Offices Worldwide

RECEIVED
APR 2008
AIR QUALITY DIVISION

April 23, 2008

Chad Schlichtemeier
Wyoming Department of Environmental Quality
Air Quality Division / NSR Program Manager
Herschler Building
122 West 25th Street
Cheyenne, WY 82002

**Subject: Medicine Bow Fuel & Power LLC**
**Proposed Integrated Gasification and Liquefaction Plant**
**(PSD Air Quality Permit Application AP-5873)**
**Response to WDEQ Comments and Request for Additional Information**

Dear Mr. Schlichtemeier:

This submittal is in response to several questions asked during the course of WDEQ review for the proposed Medicine Bow Fuel & Power Integrated Gasification and Liquefaction (IGL) Facility (MBFP Facility) in Carbon County. Specifically, this submittal addresses questions about coal mine emissions and the near-field air dispersion modeling, startup/shutdown emissions, and planned flaring operations. Several revisions to the air quality permit application have been made in conjunction with these responses, and hardcopies of revision pages for the permit application are enclosed.

**Request for Information re: Coal Mine Emissions**

In a letter dated March 18, 2008, the WDEQ requested additional information through four questions related to coal mining emissions and air dispersion modeling details. The coal mine emissions in question are those from the underground Saddleback Hills (SBH) Mine from the south and east portals and the Elk Mountain Mine (EMM). As you know, the Saddleback Hills Mine is considered to be a support facility to the IGL Plant (Plant), and the Elk Mountain Mine is considered to be a neighboring facility owned and operated by Arch of Wyoming, LLC (Arch).[1] Answers to the four questions are detailed below.

[1] The term 'Carbon Basin Mines' represents the Elk Mountain surface mine and the Saddleback Hills underground mine. These mines were initially permitted together under construction permit CT-4136, issued to Arch of Wyoming, LLC (subsidiary of Arch Coal, Inc.) on December 20, 2005. Since permit issuance, DKRW has entered into an option agreement with Arch Coal to purchase the Saddleback Hills underground coal reserves and surface real property. The Elk Mountain surface mine area will be retained by Arch, who will continue to operate the Elk Mountain surface mine and market its coal. As a result of this arrangement, the WDEQ determined that the Saddleback Hills Mine will be a support facility to the proposed Plant. The Elk Mountain surface mine is considered as a neighboring source.

MEDICINE BOW
EXHIBIT FF
PRE-HRG MEMO

*Q1. Modeled Emissions for the Carbon Basin Mines: Five area sources are used in the modeling to represent emissions from mining activities. The modeled $PM_{10}$ emission rates, in terms of grams per second per square meter ($g/s/m^2$), are shown for each of these sources in the table below [table not included here]. Also shown are the equivalent emissions in terms of grams per second and tons per year based on the calculated area of each source. Appendix B in the permit application provides a calculation sheet for $PM_{10}$ emissions from mining activity with total emissions of 60.2 tons per year. This total only accounts for a fraction of the modeled emissions. The Division requests detailed information no the basis of the modeled emissions for each area source used in the modeling for $NO_x$, CO, $SO_2$, and $PM_{10}$.*

A1: Response to this question is presented in three subsections.

***$PM_{10}$ Emissions***

Revised $PM_{10}$ emission calculation sheets are included with this submittal, to replace the Appendix B $PM_{10}$ emission calculation sheet referenced in this question. Mining emissions associated with the proposed MBFP Facility are those associated with the SBH Mine, as it will be a support facility for the Plant. Emission calculations for the EMM are not included in the permit application, because the EMM is not associated with the proposed MBFP Facility; rather, it is a neighboring facility that has already applied for and received a construction permit and is currently in operation.

As noted earlier in this section, the original mine plan for the Carbon Basin Mines was to develop both the EMM and the SBH Mine under one construction permit issued to Arch. However, as a result of the sale of underground coal reserves and surface real property, the mine plan for the SBH Mine (South and East Portals) was changed. Instead of initial coal processing at the portal sites followed by truck loading and hauling to the Seminoe II processing area in Hanna, WY, the mine plan changed in order to supply coal for the proposed Plant. Years one through three of the SBH Mine development will see coal production at the South Portal area, with temporary stack-out, truck loading, and hauling to the Seminoe II processing area. Starting in year three, coal production through the South Portal will be phased out and production will begin to be conveyed underground to the East Portal area, located within the proposed Plant fenceline. At the East Portal, coal will be conveyed and stockpiles will be created during year three. Plant startup is expected during development year four, and from this point onward, all coal produced from the SBH Mine will come out at the East Portal and will be conveyed, screened, and directed to the gasifiers in the Plant area.

The previously submitted emission calculations did not reflect this level of detail for the SBH Mine plan. Only the fugitive emissions for the East Portal area, representing emissions starting in development year four (normal plant operations) were presented. This is the 60.2 tons per year $PM_{10}$ emission rate referenced in Question 1. In order to completely reflect both point and fugitive source emissions related to the SBH mine, revised calculations are submitted for the SBH Mine and should be inserted in Appendix B to replace the one-page emission sheet included earlier.

The revised SBH Mine emission calculations are organized as follows:

- Summary of all SBH emissions (point, fugitive, road haul) for development years one through four;

Year One
- South Portal fugitive emissions (noted as page 1 of 2);
- South Portal road haul emissions (noted as page 2 of 2);

Year Two
- South Portal fugitive emissions (noted as page 1 of 2) ;
- South Portal road haul emissions (noted as page 2 of 2) ;

Year Three
- South Portal fugitive emissions (noted as page 1 of 2) ;
- South Portal road haul emissions (noted as page 2 of 2) ;
- East Portal point source emissions, for conveying along a portion of the conveying system and coal stackouts;
- East Portal fugitive emissions, for coal stackout operations and stockpile wind erosion;

Year Four
- East Portal point source emissions for conveying to the Plant;
- East Portal fugitive emissions for coal stackout, dozer reclaim from emergency stockpile, and stockpile wind erosion.

***NOx, CO, and $SO_2$ Emissions***
Regarding the NOx, CO, and $SO_2$ emissions from the SBH Mine, an emission calculation sheet is provided, to be included in the application's Appendix B. These emissions are expected to occur from fuel combustion in on-site machinery at the SBH Mine portal areas. Primarily, the emissions will occur at the South Portal area as a result of transferring coal via front-end loader from the temporary stockpile into trucks during development years one through three. Onsite machinery fuel combustion emissions at the South Portal are expected to cease by year four. NOx, CO, and $SO_2$ emissions from on-site machinery at the East Portal will begin in year four, as a result of occasional (i.e., non-routine) coal transfer from the emergency (dead) stockpile to the Plant.

It is uncertain how much fuel will be combusted in on-site machinery at either portal; therefore, these emission rates are based on emissions previously calculated for the Carbon Basin Mine permit. It is assumed that 5% of the total NOx, CO, and $SO_2$ emissions expected for both the EMM and SBH Mine will occur at the South Portal during development years one through three. On-site fuel combustion emissions at the East Portal, starting in year four, are expected to be negligible.

***Modeled Emissions for Each Area Source***

Mine emissions for the proposed MBFP Facility are modeled as area sources. Sources MineA_SP and MineA_EP represent the South Portal and East Portal areas of the SBH Mine, respectively. Sources MineA_S1 and MineA_S2 represent the two surface mine pit areas for the EMM neighboring source. As shown in Figure 6.3 of the permit application, area source MineA_S1 is located within the proposed facility's fenceline, but it will remain within the control of Arch and the coal produced from it will not be used at the IGL Plant.

Previously, these modeled source areas (MineA_SP, MineA_EP, MineA_S1, and MineA_S2) incorrectly included road hauling emissions associated with mining activities. This has been corrected with a revised dispersion model analysis, included with this submittal. In the revised analysis, the modeled area sources include only fugitive and point source emissions associated with mining-related activities in that area. Road haul emissions from the SBH Mine South Portal area and from the EMM surface pit areas are represented by a series of volume sources (V_1 through V_112) along the approximately 6.9-mile mine haul road to WY Highway 72. No road haul emissions are included for the SBH East Portal, because as explained earlier, none of the coal from the East Portal area will be sold.

Modeled emissions for the EMM Mine (MineA_S1, MineA_S2, V_1-112) are from previously submitted (by Arch) emission calculations for the Carbon Basin Mines. These calculations address both the EMM and the SBH Mine due to the fact that the original Arch mine plan included both mines, and the calculations were performed prior to the SBH Mine sale. In order to avoid double-counting $PM_{10}$ emissions associated with the SBH Mine, the previously submitted Carbon Basin emission calculations were modified to reflect a zero coal production rate from the SBH Mine. By doing this, only the $PM_{10}$ emissions associated with the EMM were calculated and represented in the model for these EMM area sources. As discussed in detail earlier in this section, emissions associated with the SBH Mine were re-calculated separately in order to match the mine's revised plan and are presented with the MBFP Facility permit application. The modified EMM emission calculations are not included with this submittal.

Year two of the project's development will result in the highest number of $PM_{10}$ emissions, due to fugitive dust from road haul operations. However, during year two, the Plant will not be operating and so emissions from the plant emission sources will be zero. Starting in development year 4, the plant will go through its initial startup year, but $PM_{10}$ emissions will be lower in that year due to cessation of road haul operations. The modeling analysis addresses impacts from development year 4 emissions (normal plant and SBH Mine East Portal operation, no emissions from South Portal).

*Q2. Modeled Sources for the Carbon Basin Mines: Sources MineA_SP, MineA_EP, MineA_S1, and MineA_S2 were modeled with non-zero emission for the $PM_{10}$ WAAQS model runs and emission rates of zero for the $PM_{10}$ PSD increment runs. For the $SO_2$ increment runs, the MineA_EP source was included with a non-zero emission rate, but no other area source was modeled. Please provide the Division with justification for the emissions used in the model runs for PSD increment.*

A2: Revised modeling analyses for $PM_{10}$ and $SO_2$ are included with this submittal, partially in response to this question. SBH Mine area sources MineA_SP and MineA_EP and EMM area sources MineA_S1 and MineA_S2 are included with both the $PM_{10}$ WAAQS and PSD increment model runs with non-zero emission rates as presented in the emission calculations described above for Question 1. In accordance with WDEQ policy, $PM_{10}$ fugitive emissions from these mine area sources, as well as the road haul fugitive emissions associated with the mines, are not included in the $PM_{10}$ short term (24-hr) WAAQS analysis or the $PM_{10}$ short term (24-hr) PSD increment analysis.

The revised $SO_2$ modeling analysis includes non-zero $SO_2$ emission rates for the mine area sources in both the WAAQS and short-term (3-hr and 24-hr) PSD increment model runs. The previously submitted long-term (annual) $SO_2$ PSD modeling analysis included non-zero $SO_2$ emission rates for all mine area sources; therefore, it was not re-done and is not included with this submittal.

Please also note the revised $SO_2$ WAAQS modeling analysis includes updated source parameters for the low pressure (LP) Flare. Per recent email correspondence with the WDEQ, the LP Flare is not included as a source in the $SO_2$ PSD increment runs included with this submittal. The LP Flare is more fully discussed in the following section on the Plant's draft Startup and Shutdown Emission Minimization Plan.

*Q3: Area and Volume Source Parameters: please provide the Division with justification for the release heights and dimensions that were used to model the volume and area sources. Specifically, please describe how the actual physical dimensions of the sources relate to the dimension used in the model as based on EPA modeling guidance.*

A3: The revised modeling analysis included revised release heights and dimensions for the mine areas. EMM $PM_{10}$ emissions (sources MineA_S1 and MineA_S2) are modeled using the "open pit" algorithm in AERMOD, at a pit depth of 100 feet and a 6-meter release height above the pit floor. These values were chosen as representative values for the Arch surface mine operations, which have begun and will continue operations during the SBH Mine development period.

The SBH Mine East Portal area source (MineA_EP) is modeled with a 12-meter emission release height. The South Portal area of the SBH Mine is not included with the model, because the model represents development year 4, and emissions from the South Portal area are expected to be zero during year 4.

Q4: *Base Elevations for Modeled Sources: Please provide the Division with justification of the base elevations that were chosen for the point, area, and volume sources at the IGL plant. For example, were the elevations determined from DEM files within AERMAP, or were they provided by MBFP based on project plans?*

A4: Base elevations for previous and the revised modeling analyses were determined using ArcGIS software, referencing 7.5-minute DEM files. Plant source heights were extracted using the ArcGIS "Spot" tool with 1-degree DEM data.

**Startup and Shutdown Emissions Minimization Plan**

In email correspondence on March 31, 2008, the WDEQ requested a startup/shutdown minimization plant for the Plant, as follows (excerpt from email):

*"After talking with Chad regarding startup and shutdown operations at the Medicine Bow IGL Plant, Chad would like to see a startup/shutdown minimization plan for the $CO_2$ vent stack and HP/LP flares. This plan should include defining points (i.e. temperature, gas quality) which indicate when gas will no longer be vented or flared or when a unit is no longer in its startup period and is accepting gas which would otherwise be vented or flared."*

The proposed Plant will be comprised of several different process units and numerous equipment that will have capability to be vented either to atmosphere or flare during startup, shutdown, and malfunction events in order to protect process equipment and ensure worker safety. Plant design is very complex, with many process streams dependent on both upstream and downstream operations, with various degrees of process control and operational requirements. Design work is proceeding at a rapid pace, but at this point in the Plant's design, a complete startup and shutdown emission minimization plan cannot be finalized. A confidential initial draft version of a startup and shutdown emission minimization plan is included with this submittal. As Plant design proceeds, particularly following the front-end engineering design (FEED) phase of the project, revisions will be made to the draft plan to reflect specific details regarding startup and shutdown operations and efforts that will be taken to minimize flaring and venting emissions. Please note that several items in the confidential draft document are typed in blue italicized font, denoting steps or actions to be confirmed during the FEED phase. Elements of the final startup and shutdown emission minimization plan will be incorporated in plant operating procedures. These specific procedures will be developed prior to initial startup, and operations staff will be trained prior to the initial plant startup on the procedures. Once finalized, the plan will be maintained and actively used to guide ongoing plant operations.

The plant will be operated such that the provisions of 40 CFR 60.11(d) are upheld:

> "*At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.*"

Accordingly, this paragraph provides the guiding statement for the startup and shutdown emissions minimization plan.

A final plan will be submitted to the WDEQ prior to initial plant startup, and a copy of the most current plan will remain onsite at the plant. If requested, routine updates and subsequent plan revisions can be submitted to the WDEQ.

***LP Flare***

The $SO_2$ modeling analysis included with this submittal includes revisions to the LP Flare parameters, based on review of proposed startup procedures and reasonable worst-case venting scenarios (in response to this request for a startup and shutdown emission minimization plan). Careful consideration was given to the question of whether any acid gas (high $H_2S$ content) from the Selexol unit must be vented to the LP Flare during startup procedures, or whether it would be possible to avoid flaring acid gas during startup. This question will be revisited as the startup and shutdown emission minimization plan is revised; however, at this time, it seems that acid gas flaring through the LP Flare during some startup operations (including initial facility or "cold" startup) will be unavoidable. This is the case presented with the Appendix B emission calculations for the LP Flare. The revised $SO_2$ modeling analysis, which demonstrates compliance with the WAAQS and PSD increments, presents the LP Flare actual height at 75 meters (246 feet). This height is necessary in order to show compliance during startup periods when acid gas is routed to the LP Flare.

**Conclusion**

1 Confidential version of Draft

But I don't believe it was attached.

We hope this subr ... :garding the permit application, and would be hap] ... ionally, we could meet with you at your offices if you ... neficial to answer additional questions relate to ... r, this submission includes the following material ...

- One (1) co: ... hutdown Emission Minimization Plan;
- One (1) CI

- Eight (8) copies of revised pages to be inserted into the permit application binders; and
- Eight (8) copies of the "Page Change History" document reflecting all changes made since submission of the December 31, 2007 amended application.

A separate CD will be submitted this week, containing an electronic file of the complete revised permit application ("MBFP Facility Permit Application 04-23-08.pdf").

Please contact me via phone at (303) 740-2684 or email to Katrina_Winborn@URSCorp.com if you need additional information or copies of the revised application. Alternatively, you can contact Susan Bassett at (303) 740-3824 or via email to Susan_Bassett@URSCorp.com.

Sincerely,

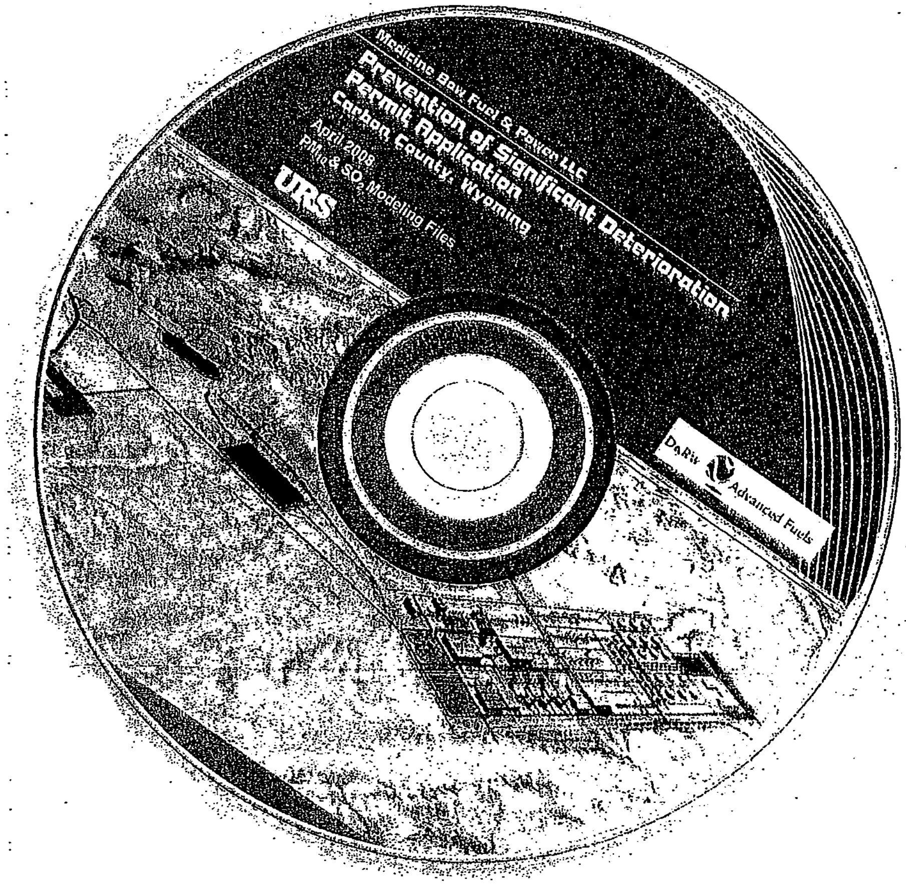
Katrina Winborn

Katrina Winborn, P.E.
Sr. Air Quality Specialist

cc: Robert Moss, DKRW
Susan Bassett, URS Corp.

Enclosures CD-ROM
Draft (Rev 0) Startup and Shutdown Emission Minimization Plan
Revised Permit Application Pages
Page Change History

Draft Startup & Shutdown Emission Minimization Plan not provided in CFO Packet.
CH


Medicine Bow Fuel & Power LLC
Prevention of Significant Deterioration
Permit Application
Carbon County, Wyoming
April 2008
$PM_{10}$ & $SO_2$ Modeling Files
URS
DKRW Advanced Fuels

# Page Change History
## MBFP PSD Permit Application Dated December 31, 2007



| Page Numbers | Revision Date | Action | Description |
|---|---|---|---|
| | 4/23/08 | Superseded | Updated Table of Contents, Acronyms |
| 1-1 | 4/23/08 | Superseded | Revised Saddleback Hills Mine coal production rate from 3.2 MMtpy to 3.25 MMtpy |
| 1-2 | 4/23/08 | Superseded | Updated emissions in Table 1.1 for PM10 |
| (1-1) 1-2 | 2/12/08 | Superseded | Updated emissions in Table 1.1 |
| 1-7 (1-8) | 2/12/08 | Superseded | Updated emissions in Table 1.2 |
| | | | |
| 2-1 to 2-2; 2-5 (2-6) | 4/23/08 | Superseded | Added sentence in Section 2.1, 2nd paragraph, to explain conveyors C6-C10 will be ¾-covered, rather than fully enclosed. Resulting text carryover to page 2-5. (Note, Figures 2.1 and 2.2 are pages 2-3 and 2-4, with no changes.) |
| 2-9 (2-10) | 2/12/08 | Superseded | Added sentence (bottom of page) about heating CO2 vent stream |
| | | | |
| 3-1 to 3.4; (3-5) 3-6 | 4/23/08 | Superseded | Revised SBH Mine Section 3.1 to clarify that some conveyors will be ¾ covered, rather than fully enclosed; Revised Tables 3.1 through 3.5 by adding revised SBH Mine development and ongoing East Portal coal storage & conveying emission rates. |
| 3-3 to 3-10 | 2/12/08 | Superseded | Revised emissions and emission-related descriptions to address operating hour and fuel simplifications requested by WDEQ * |
| | | | |
| 4-29 (4-30) | 4/23/08 | Superseded | Clarification to first paragraph under Section 4.10, to sate that the <u>expected</u> operating hours for the gasifier preheaters will be 500 hours per year, per preheater. Previously, this sentence stated the <u>maximum</u> would be 500 hours per year, per preheater, because PTE emission rates are based on this value. However, 500 hours per year per preheater is only an estimate of annual operating hours for the gasifier preheaters. |
| 4-7 (4-8) | 1/18/08 | Superseded | Revised $/ton NOx removed based on revised emissions. (Last two sentences of 1st paragraph) |
| | | | |
| 5-3 to 5-10 | 2/12/08 | Superseded | Added discussions of:<br>• --New 40 CFR Part 60, Subpart JJJJ regulations<br>• --Wyoming Chapter 6, Section 5 permitting requirements<br>Revised discussion of Subpart DDDDD NESHAP |
| | | | |
| 6-3 | 4/23/08 | Superseded | Revised Table 6.1 for modeled $PM_{10}$ emission rates |
| 6-4 | 4/23/08 | Superseded | Revised Table 6.2 for LP Flare model parameters and added table footnote. |
| (6-5) 6-6 | 4/23/08 | Superseded | Carry-over text from page 6-3, due to edits on that page. Deleted reference to year 2010 in Section 6.2.2.1, third paragraph. |
| 6-7 | 4/23/08 | Superseded | Revised Table 6.4 for coal mine area source modeling parameters and emission rates and added footnotes |

| Page Numbers | Revision Date | Action | Description |
|---|---|---|---|
| 6-8 | 4/23/08 | Superseded | Added road haul volume sources to Table 6.5 and footnote. |
| 6-9 (6-10) | 4/23/08 | Superseded | Replaced Figure 6.3 with updated version, showing road haul sources associated with the EMM and SBH Mine |
| 6-19 to 6-22 | 4/23/08 | Superseded | Updated Tables 6.10, 6.11, and Figures 6-7, 6-8 for revised 3-hr and 24-hr $SO_2$ modeling results |
| 6-24 to 6-26 | 4/23/08 | Superseded | Updated Tables 6.12, 6.13, and Figures 6-10, 6-11 for revised $PM_{10}$ modeling results |
| 6-1 to 6-48 | 2/12/08 | Superseded | Revised chapter to reflect new AERMOD near field modeling results and incorporated relevant portions from Appendix J |
| 6-19 to 6-30 | 3/3/08 | Superseded | Revised near-field modeling criteria pollutant results based on revised modeling for years 2000 and 2003 |
| 6-33 to 6-36 | 3/3/08 | Superseded | Revised near-field modeling HAP results based on revised modeling for years 2000 and 2003 |
| | | | |
| 7-1 (7-2) | 1/18/08 | Superseded | Removed first and last sentence of first paragraph after Note. Text removed was:<br><br>*MBFP is proposing to construct a 13,000 barrel per day (BPD) Industrial Gasification & Liquefaction Plant near Medicine Bow, Wyoming.*<br><br>*The proposed project is scheduled to start construction in the spring of 2008 with the construction being complete by December 2010.* |
| | | | |
| Appendix B | 4/23/08 | Superseded, Addition | Replace pages B-1 and B-2 to reflect updated coal storage & processing emission rates<br>Replace page B-29 (SBH Mine, coal storage emission calculations) with renumbered page B-29(1) and additional pages for coal mining emission calculations (pages B-29(2) through B-29(16) ).<br>Page B-30 reprinted, due to pagination detail. |
| Appendix B | 2/12/08 | Superseded | Emission revisions requested by WDEQ * and page numbering changes |
| Appendix F | 1/4/08 | Superseded | Updated coal storage BACT analysis |
| Appendix H | 1/18/08 | Addition | Added Incremental $NO_x$ Removal Cost as Appendix H |
| Appendix I | 2/12/08 | Superseded | Revised to discuss far field modeling only (since near field modeling has been re-run) |
| Appendix J | 2/12/08 | Superseded | Moved and revised near field modeling discussions to Chapter 6; far field modeling description remains |
| Appendix N | 1/18/08 | Added | Added tabbed divider |
| Appendix O | 2/13/08 | Deleted | Delete Appendix O pages (see revised Appendix H) |

* During a meeting on January 18, 2008, WDEQ requested emission changes to minimize recordkeeping and reporting requirements and simplify permit writing. For certain equipment, MBFP agreed to increase operating hours and base emission calculations on the highest-emitting fuel (natural gas) in order to streamline compliance. Consequently, potential emissions were increased. Notes reflecting actual equipment operations have been added to pertinent spreadsheets. WDEQ stated that BACT analyses would not be affected by these simplifying assumptions, and would instead be based on the actual operations of the equipment.

# TABLE OF CONTENTS

# Acronyms

| | |
|---|---|
| agl | Above grade level |
| AGR | Acid gas removal |
| AP-42 | EPA AP-42 Emission Factors |
| AQRV | Air Quality Related Value |
| ASU | Air Separation Unit |
| AVO | Audio/visual/olfactory |
| BACT | Best Available Control Technology |
| BOL | Beginning of Life |
| BPD | Barrels per day |
| bpip | Building Profile Input Program |
| Btu | British thermal unit |
| CAA | Clean Air Act |
| $CaCO_3$ | Calcium carbonate |
| CAM | Compliance Assurance Monitoring |
| CDPHE | Colorado Department of Public Health and Environment |
| CFR | Code of Federal Regulations |
| $Cl_2$ | Chlorine |
| CO | Carbon monoxide |
| $CO_2$ | Carbon dioxide |
| COS | Carbonyl sulfide |
| $CS_2$ | Carbon disulfide |
| DAT | Deposition Analysis Thresholds |
| DEM | Digital Elevation Model |
| DLN | Dry Low $NO_x$ |
| DME | Dimethyl ether |
| dscf | Dry standard cubic feet |
| EC | Elemental carbon |
| EFR | External floating roof |
| EMM | Elk Mountain Mine |
| EOL | End of life |
| EPA | U.S. Environmental Protection Agency |
| ESP | Electrostatic precipitator |
| °F | Degrees Fahrenheit |
| F | Fluorine |
| FGD | Flue gas desulfurization |
| FGR | Flue gas recirculation |
| FLAG | Federal Land Managers Air Quality Related Values Working Group |
| ft | Feet |
| g | Gram |
| gal | Gallons |
| GE | General Electric Co. |
| GEP | Good Engineering Practice |
| GPM | Gallons per minute |
| $H_2$ | Hydrogen |
| $H_2S$ | Hydrogen sulfide |
| HAP | Hazardous air pollutant |

# Acronyms

| | |
|---|---|
| HGT | Heavy gasoline treatment |
| HHV | Higher heating value |
| $HNO_3$ | Nitric acid |
| HP | High pressure |
| hp | Horsepower |
| hr | Hour |
| hr/yr | Hours per year |
| HRSG | Heat recovery steam generator |
| IDLH | Immediately Dangerous to Life or Health |
| IFR | Internal floating roof |
| IGCC | Integrated gasification combined cycle |
| IGL | Industrial Gasification and Liquefaction |
| in | Inch |
| IWAQM | Interagency Working Group on Air Quality Modeling |
| km | kilometer |
| LAC | Level of acceptable extinction change |
| LAER | Lowest Achievable Emission Rate |
| lb | Pound |
| lb/yr | Pounds per year |
| LDAR | Leak Detection and Repair |
| LHV | Lower heating value |
| LP | Low pressure |
| LPG | Liquefied petroleum gas |
| LTGC | Low-temperature gas cleanup |
| LULC | Land Use Land Cover |
| m | Meter |
| $\mu g/m^3$ | Micrograms per cubic meter |
| $m^3$ | Cubic meters |
| MACT | Maximum Achievable Control Technology |
| MDEA | Methyldiethanolamine |
| MEI | Maximally exposed individual |
| min | Minute |
| MLE | Most likely exposure |
| MMBtu | Million British thermal units |
| MMscf | Million standard cubic feet |
| MMscfd | Million standard cubic foot per day |
| MMtpy | Million tons per year |
| mol. | Molecular |
| MP | Medium pressure |
| MBFP | Medicine Bow Fuel and Power LLC |
| Mscf | Thousand standard cubic feet |
| MTBE | Methyl tertiary butyl ether |
| MTG | Methanol to gasoline |
| MW | Megawatts |
| MWh | Megawatt-hours |
| NAAQS | National Ambient Air Quality Standards |

# Acronyms

| | |
|---|---|
| NCDC | National Climate Data Center |
| neg. | Negligible |
| NESHAPs | National Emission Standards for Hazardous Air Pollutants |
| $NH_3$ | Ammonia |
| $NH_4NO_3$ | Ammonium nitrate |
| $(NH_4)_2SO_4$ | Ammonium sulfate |
| NIOSH | National Institute for Occupational Safety and Health |
| $NO_2$ | Nitrogen dioxide |
| $NO_3$ | Nitrate |
| $NO_x$ | Nitrogen oxides |
| NRCS | Natural Resources Conservation Service |
| NSCR | Non-selective catalyst reduction |
| NSPS | New Source Performance Standard |
| NSR | New Source Review |
| NWS | National Weather Service |
| ODEQ | Oregon Department of Environmental Quality |
| PBL | Planetary boundary layer |
| PM | Particulate matter |
| $PM_{10}$ | Particulate matter, less than 10 microns |
| ppmv | Parts per million by volume |
| ppmw | Parts per million by weight |
| PSD | Prevention of Significant Deterioration |
| psi | Pounds per square inch |
| psig | Pounds per square inch gauge |
| PTE | Potential to Emit |
| REL | Reference Exposure Level |
| RACT | Reasonably Available Control Technology |
| RBLC | RACT/BACT/LAER Clearinghouse |
| RfC | Reference Concentrations for Chronic Inhalation |
| RH | Relative humidity |
| RICE | Reciprocating internal combustion engine |
| RMP | Risk Management Plan |
| RVP | Reid vapor pressure |
| SBH | Saddleback Hills (Mine) |
| SCCs | Source Classification Codes |
| scf | Standard cubic feet |
| SCFH | Standard cubic foot per hour |
| scm | Standard cubic meters |
| SCR | Selective Catalytic Reduction |
| SIC | Standard Industrial Classification |
| SILs | Significant Impact Levels |
| SIP | State Implementation Plan |
| SNCR | Selective Non-Catalytic Reduction |
| $SO_2$ | Sulfur dioxide |
| $SO_4$ | Sulfate |
| SOA | Secondary Organic Aerosol |

# Acronyms

| | |
|---|---|
| SOCMI | Synthetic Organic Chemical Manufacturing Industry |
| $SO_x$ | Sulfur oxides |
| SRU | Sulfur Recovery Unit |
| SSM | Startup, shutdown, or malfunction |
| TANKS | U.S. Environmental Protection Agency Tanks Version 4.0 |
| TBD | To be determined |
| TPD | Tons per day |
| tpy | Tons per year |
| UOP | UOP, LLC |
| URF | Unit risk factor |
| USDA | US Department of Agriculture |
| USGS | U.S. Geological Survey |
| USNPS | US National Park Service |
| UTM | Universal Transverse Mercator |
| VOC | Volatile organic compound |
| vol% | Volume percent |
| WAQS&R | Wyoming Air Quality Standards and Regulations |
| WDEQ | Wyoming Department of Environmental Quality |
| WRAP | Western Regional Air Partnership |
| wt% | Weight percent |
| yr | Year |

[This page is intentionally blank.]

## 1.1 GENERAL FACILITY DESCRIPTION

Medicine Bow Fuel & Power LLC (MBFP) is proposing to construct an underground coal mine (Mine) and industrial gasification & liquefaction (IGL) plant (Plant) that will produce transportation fuels and other products near Medicine Bow, Wyoming in Carbon County. The Mine will process approximately 8,000 tons per day (TPD) of coal (on a dry basis) to produce a variety of liquid and gaseous fuels. The Mine will be a 3.25 million ton per year (MMtpy) adjacent underground coal mine known as the Saddleback Hills Mine that will supply the coal needed for the Plant.

The Plant will utilize coal, which will be gasified to produce synthesis gas (syngas) and produce various products. In order to achieve this outcome, the Plant will use several different technologies, including: General Electric's (GE) gasification technology for the quench gasification process, UOP LLC's (UOP) SELEXOL® acid gas removal process, and Davy Process Technology's (Davy) methanol synthesis process followed by the Exxon-Mobil methanol-to-gasoline (MTG) process.

Saleable products produced at the Plant during normal operation are anticipated to include approximately:

- 18,500 barrels per day (BPD) of regular gasoline to be transferred via pipeline to a nearby refinery
- 42 TPD of sulfur
- 198 million standard cubic feet per day (MMscfd) of carbon dioxide ($CO_2$)
- 712 TPD of coarse slag

In addition to the salable products listed above, Plant operation will result in the production of the following fuels to be used onsite for power generation and process heating:

- Approximately 253 million British thermal units (MMBtu/hr) of fuel gas
- Approximately 400 to 500 MMBtu/hr of liquefied petroleum gas (LPG)

Efficient use of these fuels will provide much of the energy input needed to fuel an electric generation plant that will produce approximately 400 megawatts (MW) of electricity. The Plant will either import natural gas or divert syngas as necessary to support plant power needs not met by fuel gas, LPG, and process steam and is not expected to export power to the electrical grid. Three combustion turbines will be equipped with the best available pollution control technologies, which include low-$NO_x$ burners, diluent injection, selective catalytic reduction (SCR), and oxidation catalyst to keep criteria pollutant emissions low.

Emission reduction technologies will be incorporated throughout the Plant. These controls are discussed in more detail in Sections 2 and 4. In addition, all roads and parking areas within the Plant fence will be either gravel or paved to control fugitive dust emissions.

This amended Prevention of Significant Deterioration (PSD) permit application contains fully updated information based on replacement of the previously planned Fischer-Tropsch and UOP upgrading processes with the Davy methanol synthesis unit and Exxon-Mobil MTG processes. This process change affects many process streams and emission calculations. Consequently, a complete amended permit application is being submitted. This permit application contains information describing the Mine and Plant, facility emissions, applicable regulations, best available control technology (BACT) determinations, and air quality impact analyses. Wyoming Air Quality Permit Application Forms are included in Appendix A.

## 1.2 FACILITY LOCATION

The Mine and Plant (collectively, the MBFP Facility) will be located approximately 7.5 miles north of Interstate 80, exit 260 (Elk Mountain) on County Road #3 in Section 29 of Township 21 north and Range 79 west in Carbon County, south-central Wyoming. Figure 1.1 shows the general location of the facility. The MBFP Facility encompasses two separate areas. The Mine's South Portal is shown in Figure 1.2. The Mine's East Portal, near where the Plant will be located, is shown in Figure 1.3. Figure 1.4 shows the Plant process equipment layout.

## 1.3 PREVENTION OF SIGNIFICANT DETERIORATION APPLICABILITY

The Clean Air Act (CAA) defines 28 major source categories that have a 100 ton per year (tpy) threshold for determining prevention of significant deterioration (PSD) major source status. This facility falls within the major source category of "Fuel Conversion Plant," and therefore is subject to the 100 tpy major source threshold. Annual emissions of criteria pollutant emissions are shown in Table 1.1 for normal operations without startup, shutdown, and malfunction (SSM) events. Estimates of the following pollutants are included: $NO_x$ (nitrogen oxides, including nitrogen dioxide [$NO_2$]), carbon monoxide (CO), volatile organic compounds (VOC), and particulate matter with a diameter of less than 10 microns ($PM_{10}$). Emission calculation methods are summarized in Section 3 and detailed emission calculations are included in Appendix B.

**Table 1.1 – Annual Criteria Pollutant Emissions (tpy)**

| $NO_x$ | CO | VOC | $SO_2$ | $PM_{10}$ |
|---|---|---|---|---|
| 251.63 | 176.75 | 200.18 | 32.65 | 195.84 |

Based on criteria pollutant emissions, this facility is considered to be a major source for the PSD Program (40 CFR §51.165) and the Title V Operating Permit Program (40 CFR Part 70).

Annual emissions of hazardous air pollutant (HAP) emissions from normal operations are shown in Table 1.2. HAPs with emissions greater than 0.01 tpy are included in the table. Because potential emissions of total HAPs exceed 25 tpy, the facility is a major source of HAPs and is subject to some National Emission Standards for Hazardous Air Pollutants (NESHAP) in 40 CFR Parts 61 and 63.

This section describes the coal mining and industrial production processes. Because coal mining is common in the area, the coal mining description is relatively short. Due to its relative newness and complexity, the Plant is described in much more detail; Figure 2.1 illustrates the process.

## 2.1 COAL MINING

The Mine will produce approximately 3.25 MMtpy of coal using underground continuous and longwall mining techniques. Longwall mining machines consist of multiple coal shearers mounted on a series of self-advancing hydraulic ceiling supports. Longwall mining machines are about 800 feet in width and 5 to 10 feet tall. Longwall miners extract "panels", rectangular blocks of coal, as wide as the mining machinery and as long as 12,000 feet. The shearers cut coal from a wall face, which falls onto a conveyor belt for removal. As a longwall miner advances along a panel, the roof behind the miner's path is allowed to collapse.

The mined coal will exit the mine via the East Portal. The coal will be conveyed and stored in a 300,000-ton live storage area before being conveyed to the Plant. Coal handling conveyors C1 through C5 will be fully enclosed, and conveyors C6 through C10 will be ¾-covered (not fully enclosed). All transfer points along all conveyors (C1 through C10) will be fogged to reduce emissions. An additional 300,000-ton emergency coal stockpile will be constructed. This emergency coal stockpile is considered dead storage and will not be added to or used unless the coal supply for the live storage is interrupted. Once the emergency stockpile is constructed, it will be compacted and sealed to prevent wind erosion and spontaneous combustion.

Figure 2.2 shows the above-ground coal handling process for stacking the coal and transferring it to the Plant.

## 2.2 GASOLINE PRODUCTION

Figure 2.1 contains a block flow diagram illustrating the Plant production process and associated support activities. Major processes required to produce gasoline are described in this section. Additional production steps for removing $CO_2$ and sulfur products are described in Sections 2.3 and 2.4, respectively. Ancillary operations, such as power generation, wastewater treatment, and other activities are described in Section 2.5.

### 2.2.1 Coal Preparation (1100)

The Plant process begins with coal feed preparation, shown on the left side of the process block flow diagram in Figure 2.2. Raw feed coal (run of mine) from the coal storage area is routed via an enclosed conveyor to the coal crusher. The crushed coal is screened to a maximum size of 1 inch, with oversized coal recycled back to the crusher. All transfer points are fogged to reduce emissions. The crushed and screened coal is conveyed and stored in three bins and is gravity flowed to the coal-grinding mill.

The coal is crushed with water and an additive to create a slurry, which will be pumped into the gasifier under high pressure. The coal preparation process is divided into three separate trains, each with the capacity to supply 40% of the total plant requirements. The slurry produced by any of the trains can be pumped to any of the five (5) downstream gasification trains. The coal preparation section provides a total of 8,700 tons per day (TPD) of coal to the gasifiers (wet basis); this is equivalent to 8,000 TPD of coal on a dry basis.

Drainage, wash down, and leaks in the grinding area are collected in a below-grade concrete sump. An agitator keeps the solids in suspension for pumping. Any accumulated water/solids mixture is pumped to the slurry tank.

### 2.2.2 Gasification (1200)

The Plant will utilize five (5) gasifier trains. Each gasifier train will be sized to handle one-fourth of the Plant's total capacity. In normal operation, four gasifier trains will be in operation with the fifth in hot standby. The gasifiers are fueled by a coal/water slurry, calcium carbonate ($CaCO_3$), and 98 percent pure oxygen from the air separation unit (ASU).

The gasification reaction is conducted at a pressure of 1,000 psig and generates a temperature of approximately 2,500 degrees Fahrenheit (°F). The combustion chamber is lined with refractory bricks, which maintain the outer shell of the gasifier in a temperature range of 545°F to 600°F. Each gasifier is equipped with a dedicated preheater (Gasifier Preheaters 1 through 5). During the initial gasifier startup, and during any subsequent startup following refractory replacement, the gasifier preheater combusts natural gas and slowly heats the refractory to achieve the minimum temperature needed for combustion chamber operation. Each preheater has a firing rate of 21 MMBtu/hr and is fueled with natural gas.

Combustion products of the gasification reaction consist of raw syngas, together with small amounts of a number of impurities (including chlorides, sulfides, nitrogen, argon, and methane), liquid slag, and fine solid particles. These combustion products exit the combustion chamber and flow to a quench chamber where the combustion products are cooled and most of the particle fines are removed from the syngas. The molten slag solidifies and settles to the bottom of the chamber. If necessary, calcium carbonate can be added to the coal slurry as a fluxant to facilitate free flow of the molten slag in the gasifier. Solidified coarse slag is removed from the gasifier through a lock hopper system connected to the bottom of the quench chamber, and this stream sweeps the solidified slag through a slag crusher. The crushed slag is then recycled and reused or disposed. Approximately 980 TPD of slag will be produced and approximately 712 TPD of slag will be available for sale; the remainder is recycled to the slurry because of its Btu content. The syngas exits the gasifier through a side connection.

During any startup, shutdown, or malfunction (SSM) event, the syngas will be sent to the high-pressure flare. The syngas feed to the flare is expected to have a heat rate of approximately 2,000 Btu/lb.

### 2.2.3 Syngas Conditioning (1300)

Syngas conditioning includes two main treatment processes:

- Scrubbing to remove particulate from the syngas
- Low-temperature gas cleanup (LTGC)

### 2.2.3.1 Syngas Scrubbing

The Plant includes five (5) syngas conditioning trains, each sized for one-fourth of plant capacity. Each syngas conditioning train is integrated with a specific gasifier, with four (4) such trains operating and the fifth acting as a spare during normal operations. This description refers to one syngas conditioning train only.

Raw syngas leaves the gasifier and is mixed with process condensate in the process line to prevent the buildup of solids and thoroughly wet the entrained solids to facilitate their removal in the syngas scrubber.

The syngas scrubber is a tower that contains a water sump in the bottom and four trays in the top. Wet syngas enters the scrubber below the first tray and flows downward into the water sump, which removes most of the solids in the gas, and then flows upward through the four trays. Process condensate is supplied to the top tray and flows downward, counter-currently washing the remaining solids from the syngas. From the scrubber trays, a de-mister removes any entrained water droplets, such that an essentially particulate-free syngas exits from the top of the syngas scrubber.

### 2.2.3.2 Low-Temperature Gas Cleanup

The low-temperature gas cleanup (LTGC) Unit is a single system sized for 100 percent of plant capacity. The two main purposes of this system are to:

- Cool the raw syngas while producing steam; and
- Provide other gas cleanup functions, including carbonyl sulfide (COS) hydrolysis and water gas shift.

The LTGC unit receives syngas from the four (4) operating syngas scrubber trains. The syngas is then cooled in a series of two exchangers [the Syngas Interchanger against reheating treated syngas from the SELEXOL® unit and the low pressure (LP) steam generator which produces LP steam]. The resulting partly condensed syngas is separated, and the condensate is pumped into the return condensate stream.

After the separation, the syngas is heated to 400°F with medium pressure (MP) steam and split into two streams. The syngas either enters a water shift reactor which converts CO and $H_2O$ to $CO_2$ and $H_2$ and hydrolyzes COS or enters a reactor where COS is hydrolyzed to hydrogen sulfide ($H_2S$) and $CO_2$. The flows are balanced to adjust the $H_2$ to CO ratio of the syngas for optimal methanol synthesis. The two streams are then cooled in a series of two exchangers before entering knock-out drums. Syngas in the overhead vapor streams is routed to the SELEXOL® Acid Gas Removal Unit as a shifted and unshifted syngas stream.

The condensate from the LTGC area flows to a stripper, which also receives the condensate streams from the gasification system. The stripper removes almost all of the ammonia ($NH_3$), $H_2S$, and COS from the condensate, along with some dissolved hydrogen ($H_2$) and CO. The stripper overhead gas is blended with sour flash gases from the flash separators and compressed before going to the SELEXOL® Unit, so that the $H_2$ and CO can be recovered from the sour gas. The stripper bottoms water is returned to the syngas scrubber.

### 2.2.4 SELEXOL® Acid Gas Removal (2100)

The SELEXOL® process, licensed by UOP, has been selected as the acid gas removal technology. Two SELEXOL® process trains will provide the following functions for the shifted and unshifted streams:

- Removal of sulfur compounds ($H_2S$ and COS) from the syngas to a level acceptable to the downstream Methanol Synthesis Unit,
- Recovery of most of the $CO_2$ in the syngas for further purification, and
- Recovery of a concentrated $H_2S$/COS stream to be sent to the Sulfur Recovery Unit (SRU).

The quenched sour syngas from the Syngas Conditioning Unit enters a mercury removal bed, and then is mixed with recycled stripped gas and flows to the SELEXOL® Feed/Product Exchanger to cool the feed gas against treated syngas and enhance the efficiency of absorption. The cooled feed gas flows through two successive absorbers; the first absorber removes $H_2S$ and the second absorber removes $CO_2$. In each absorber, the syngas enters at the bottom of a packed bed and flows upward through the bed where it contacts cool solvent entering the top of the tower. In these absorbers, $H_2S$, COS, $CO_2$, and other gases such as $H_2$, are transferred from the gas phase to the liquid phase. The treated gas passes through de-entrainment devices at the top of the absorbers, as well as three water wash trays to minimize solvent carry-over. The treated syngas exits the top of the $CO_2$ absorber and is sent to the downstream Methanol Synthesis Unit.

Treated syngas leaving the SELEXOL® Unit is expected to contain less than 0.1 parts per million by volume (ppmv) total sulfur. Further sulfur reduction through the use of sulfur beds is required to protect the catalyst in the downstream Methanol Synthesis Unit from poisoning and the risk of sulfur spikes that could be caused by SELEXOL® Unit upsets. Each of the parallel beds is sized for full plant capacity. For best performance, the syngas is heated to 400°F before entering the guard bed.

The syngas from the guard beds is then sent to a compressor, where the syngas pressure is increased to the levels required in the Methanol Synthesis Unit. The syngas is then sent to the Methanol Synthesis Unit.

The SELEXOL® solvent from the $H_2S$ Absorber is regenerated by stripping out less soluble gases, such as $CO_2$, $H_2$, and CO. The partially regenerated SELEXOL® solvent then flows to an $H_2S$ stripper, where the remaining $H_2S$, $CO_2$, $N_2$, and other compounds are transferred from the liquid phase to the gas phase by contact with steam. The steam and liberated gases exit the stripper, and then flow upward through a demister and into the trayed section of the column. In the trayed section, the rising gas is contacted with counter-current flowing reflux water to cool and partially condense the hot overhead vapor, as well as reduce solvent entrainment. The overhead stream passes through a de-entrainment device and exits the top of the column. The overhead gas then passes through a condenser in order to condense and recover a portion of the overhead steam. The liquid and vapor phases are separated; the $H_2S$-rich acid gas exits the unit battery limits and is sent to the SRU, and the liquid is returned to the trayed section of the $H_2S$ stripper.

## 3.1 SADDLEBACK HILLS MINE

Originally Arch of Wyoming LLC (subsidiary of Arch Coal, Inc.) permitted the Mine (underground) and the Elk Mountain (surface) Mines together under one air quality permit (Permit # CT-4136). The combined facilities were known as the Carbon Basin Mines. Arch Coal has entered into an option agreement to sell the underground coal reserve and surface real property to MBFP. Once MBFP exercises this option, Arch Coal has retained the rights to operate the Elk Mountain Mine and market the surface coal. As a result of this agreement, a determination was made by the Wyoming Department of Environmental Quality (WDEQ)/Air Quality Division (AQD) that the Saddleback Hills Mine was considered a support activity under the definition of a facility and should be included in the MBFP PSD application.

During the underground mine's development phase, approximately 2.5 million tons of coal will need to be mined over a 3-year period. The development phase constructs the underground infrastructure required to support the longwall mining system which will commence operations at approximately the time when the Plant achieves full capacity. During the development or construction phase of the mine, coal will be conveyed from the South Portal where it will be stored in a small stockpile. It is anticipated that this production will either be loaded into trucks at the South portal and hauled to the Seminoe II train loadout in Hanna, Wyoming, or placed in the designated long term storage stockpile.

During the MBFP construction phase, development will also occur at the East Portal. The following activities will occur at the East Portal:

- Construction of the East Portal entry areas that will consist of a reinforced concrete retaining wall;
- Installation of conveyors from the portal face to the coal storage facilities (some conveyors will be fully enclosed, some will be ¾-covered);
- Construction of the coal storage facilities;
- Construction of a ¾-covered overland conveyor system from the coal storage facilities to the Plant;
- Construction of the Mine's office, maintenance shop, and warehouse facilities.

Emission sources associated with the Mine during the development phase are shown in Table 3.1.

**Table 3.1 – Mine Development Particulate Emissions**

| Development Year | Coal Conveying and Loading $PM_{10}$ (tpy) | Coal to Seminoe II $PM_{10}$ (tpy) |
|---|---|---|
| 1 | 3.04 | 26.8 |
| 2 | 5.17 | 109.3 |
| 3 | 4.20 | 71.6 |

Only particulate emissions associated with the Mine are included in the table above. Emissions from mine area fuel combustion (on-site machinery) are based on calculations provided in Permit Application AP 2989 for the Carbon Basin Mines.

Detailed Mine Development emission calculation spreadsheets are included in Appendix B.

## 3.2 THE PLANT

### 3.2.1 Emission Sources

Emissions associated with this Plant include both point source and fugitive emission sources. The three combustion turbines account for the majority of $NO_x$, CO, $SO_2$, and $PM_{10}$ emissions, while storage tanks and equipment leaks emit the most VOCs and HAPs. Table 3.2 shows significant point and fugitive sources of emission.

Manufacturer specifications for the turbines and certain other equipment are included in Appendix C. With regard to the combustion turbines, a General Electric (GE) specification sheet has been included in Appendix C; this specification does not constitute a vendor guarantee from GE. Equipment-specific guarantees could not be obtained from vendors at this time. Guarantees for some equipment will be obtained at the time purchase contracts are signed.

Due to the long lead-time needed to design this Plant, specific manufacturers and models have not yet been identified for many equipment items, and manufacturer specifications are not yet available.

A list of other major equipment is included in Appendix D, along with a list of source classification codes (SCCs) for point source equipment.

**Table 3.2 – Emission Units and Fugitive Sources**

| Description | Identification | Size | Use |
|---|---|---|---|
| *Normally Operating Equipment and Fugitive Sources* | | | |
| Combustion Turbine 1 | CT-1 | 66 MW | Electrical and steam generation |
| Combustion Turbine 2 | CT-2 | 66 MW | Electrical and steam generation |
| Combustion Turbine 3 | CT-3 | 66 MW | Electrical and steam generation |
| Auxiliary Boiler | AB | 66 MMBtu/hr | Steam generation (normal service is standby at 25% load to prevent freeze ups if there is a Plant shutdown) |
| Catalyst Regenerator* | B-1 | 21.53 MMBtu/hr | Catalyst regeneration (only during catalyst regeneration; average continuous rate is approximately 9 MMBtu/hr) |
| Reactivation Heater* | B-2 | 12.45 MMBtu/hr | Reactivation heating |
| HGT Reactor Charge Heater | B-3 | 2.22 MMBtu/hr | Reactor charge heating |
| HP Flare (pilot only) | FL-1 | 0.82 MMBtu/hr | For safety and VOC control |
| LP Flare (pilot only) | FL-2 | 0.20 MMBtu/hr | For safety and VOC control |
| Equipment Leaks | EL | N/A | N/A |
| Storage Tanks | Tanks | Various | Primarily methanol and gasoline storage |
| Coal Storage & Processing | CS | N/A | Coal conveyance & feedstock storage |
| *SSM Equipment* | | | |
| Gasifier Preheater 1* | GP-1 | 21 MMBtu/hr | Gasifier refractory preheating |
| Gasifier Preheater 2* | GP-2 | 21 MMBtu/hr | Gasifier refractory preheating |
| Gasifier Preheater 3* | GP-3 | 21 MMBtu/hr | Gasifier refractory preheating |
| Gasifier Preheater 4* | GP-4 | 21 MMBtu/hr | Gasifier refractory preheating |
| Gasifier Preheater 5* | GP-5 | 21 MMBtu/hr | Gasifier refractory preheating |
| Black-Start Generator 1* | Gen-1 | 2889 hp | Electrical generation |
| Black-Start Generator 2* | Gen-2 | 2889 hp | Electrical generation |
| Black-Start Generator 3* | Gen-3 | 2889 hp | Electrical generation |
| Firewater Pump Engine* | FW-Pump | 575 hp | Supplies emergency firewater |
| $CO_2$ Vent Stack* | $CO_2$ VS | N/A | For malfunctions |

* These emission units operate less than 8,760 hr/yr.

### 3.2.2 Normal Operations

Plant emissions are broken down into three categories (normal operation, cold startup/initial year emissions, and malfunctions). Annual emissions resulting from normal operations include emissions from equipment that operates continuously (8,760 hours per year) and equipment that operates on a regular basis. For example, the firewater pump engine may operate up to 500 hours in a typical year. Consequently, firewater pump engine emissions are included in the normal operation annual emission summary and are based on 500 hr/yr rather than 8,760 hr/yr. Note that the Auxiliary Boiler normally operates at only 25 percent load, on a hot standby basis.

However, emissions are based on 8,760 hr/yr operation at full load. Table 3.3 shows emissions resulting from normal operations and the maximum number of hours of operation per year. Detailed emission calculations are included in Appendix B.

**Table 3.3 – Annual Criteria Pollutant Emissions Resulting from Normal Operations**

| Source ID | Description | Operating Hours (hr) | Potential Emissions (tpy) | | | | |
|---|---|---|---|---|---|---|---|
| | | | $NO_x$ | CO | VOC | $SO_2$ | $PM_{10}$ |
| CT-1 | Power Generation | 8,760 | 75.86 | 46.19 | 6.59 | 10.79 | 43.80 |
| CT-2 | Power Generation | 8,760 | 75.86 | 46.19 | 6.59 | 10.79 | 43.80 |
| CT-3 | Power Generation | 8,760 | 75.86 | 46.19 | 6.59 | 10.79 | 43.80 |
| AB | Steam Generation[1] | 8,760 | 14.17 | 23.81 | 1.56 | 0.17 | 2.15 |
| B-1 | Catalyst Regeneration | 8,760 [2] | 4.62 | 7.77 | 0.51 | 0.06 | 0.70 |
| B-2 | Reactivation Heater | 8,760 [2] | 2.67 | 4.49 | 0.29 | 0.03 | 0.41 |
| B-3 | HGT Reactor Charge Heater | 8,760 | 0.48 | 0.80 | 0.05 | 0.01 | 0.07 |
| Tanks | Product Storage | 8,760 | --- | --- | 102.62 | --- | --- |
| EL | Equipment Leaks | 8,760 | --- | --- | 71.32 | --- | --- |
| CS | Coal Storage & Processing | 8,760 | --- | --- | --- | --- | 61.08 |
| FW-Pump | Firewater Pump Engine [3] | 500 | 1.51 | 0.09 | 0.34 | 0.00 | 0.02 |
| FL-1 | HP Flare | 8,760 [4] | 0.49 | 0.98 | 2.97 | 0.00 | --- |
| FL-2 | LP Flare | 8,760 [4] | 0.12 | 0.25 | 0.74 | 0.00 | --- |
| **Total Emissions** | | | **251.63** | **176.75** | **200.18** | **32.65** | **195.84** |

1. Boiler will normally operate at 25% load, but potential emissions are based on continuous full load operation.
2. The catalyst regeneration heater and reactivation heaters will operate less than 8,760 hr/yr, but potential emissions are based on 8,760 hr/yr of operation.
3. The Firewater Pump combusts diesel fuel.
4. Based on continuous natural gas pilot for flares.

Table 3.4 shows annual HAP emissions resulting from normal operations. The largest HAP emission sources at the Plant are listed in the following table.

Table 3.4 – Annual HAP Emissions Resulting from Normal Operations

| Pollutant | Facility-Wide Potential Emissions (tpy) | Largest Emission Source at Facility |
|---|---|---|
| Benzene | 11.08 | Equipment Leaks |
| Formaldehyde | 0.71 | Turbines |
| Hexane | 1.29 | Auxiliary Boiler [1] |
| Methanol | 12.79 | Equipment Leaks |
| Toluene | 1.81 | Turbines |
| Other HAPs | 2.12 | N/A |
| **Total Emissions** | **29.80** | |

1. Note that HAP PTE emissions from the auxiliary boiler are calculated at continuous, full load operation. However, the boiler will normally operate at only 25% load but within compliance with its emission commitment (lb/MMBtu basis). The second-largest emission source contributing to hexane emissions at the facility will be storage tanks.

### 3.2.3 Cold Start/Initial Year Operations

Annual emissions have also been calculated for the initial year of operations (plant cold start). The complete Plant startup period may last as long as 180 days, and will involve bringing equipment online in a particular order. Emissions during the cold startup period will differ from those during a normal operating year. Certain equipment, such as Black-Start Generators and Gasifier Preheaters, will operate during cold startup. Individual emission units will have much shorter startup time periods; these unit-specific time periods are shown in Appendix B in the cold startup emission summary spreadsheet. Since the Plant will not have produced adequate in-plant fuels and power generation will ramp up slowly, most combustion equipment will initially burn only natural gas fuel, rather than the fuel mixture of fuel gas, LPG, and natural gas. Table 3.5 shows the annual emissions resulting from Cold Startup.

**Table 3.5 – Annual Criteria Pollutant Emissions Resulting from Cold Startup**

| Source ID | Description | Operating Hours Fuel Gas Mixture/NG 1 | Potential Emissions (tpy) | | | | |
|---|---|---|---|---|---|---|---|
| | | | $NO_x$ | CO | VOC | $SO_2$ | $PM_{10}$ |
| CT-1 | Power Generation | 7760 / 1000 | 76.68 | 46.61 | 6.64 | 10.90 | 43.80 |
| CT-2 | Power Generation | 7760 / 1000 | 76.68 | 46.61 | 6.64 | 10.90 | 43.80 |
| CT-3 | Power Generation | 7760 / 1000 | 76.68 | 46.61 | 6.64 | 10.90 | 43.80 |
| Gen-1 | Black-Start Generator 1 | 0 / 360 | 1.15 | 2.79 | 1.03 | 0.00 | 0.00 |
| Gen-2 | Black-Start Generator 2 | 0 / 360 | 1.15 | 2.79 | 1.03 | 0.00 | 0.00 |
| Gen-3 | Black-Start Generator 3 | 0 / 360 | 1.15 | 2.79 | 1.03 | 0.00 | 0.00 |
| AB | Steam Generation | 8000 / 760 | 14.17 | 23.81 | 1.56 | 0.17 | 2.15 |
| B-1 | Catalyst Regeneration | 8760 / 0 | 4.62 | 7.77 | 0.51 | 0.06 | 0.70 |
| B-2 | Reactivation Heater | 8000 / 760 | 2.67 | 4.49 | 0.29 | 0.03 | 0.41 |
| B-3 | HGT Reactor Charge Heater | 8000 / 760 | 0.48 | 0.80 | 0.05 | 0.01 | 0.07 |
| GP-1 | Gasifier Preheater 1 | 0 / 500 | 0.26 | 0.43 | 0.03 | 0.00 | 0.04 |
| GP-2 | Gasifier Preheater 2 | 0 / 500 | 0.26 | 0.43 | 0.03 | 0.00 | 0.04 |
| GP-3 | Gasifier Preheater 3 | 0 / 500 | 0.26 | 0.43 | 0.03 | 0.00 | 0.04 |
| GP-4 | Gasifier Preheater 4 | 0 / 500 | 0.26 | 0.43 | 0.03 | 0.00 | 0.04 |
| GP-5 | Gasifier Preheater 5 | 0 / 500 | 0.26 | 0.43 | 0.03 | 0.00 | 0.04 |
| Tanks | Product Storage | 8760 | --- | --- | 102.62 | --- | --- |
| EL | Equipment Leaks | 8760 | --- | --- | 71.32 | --- | --- |
| CS | Coal Storage & Processing | 8760 | --- | --- | --- | --- | 61.08 |
| FW-Pump | Firewater Pump Engine | 500 [2] | 1.51 | 0.09 | 0.34 | 0.00 | 0.02 |
| $CO_2$ VS | $CO_2$ Vent Stack | 8760 | --- | 314.89 | 0.84 | --- | --- |
| FL-1 | HP Flare | 8760 [3] | 10.28 | 81.86 | 3.11 | 187.70 | 0.00 |
| FL-2 | LP Flare | 8,760 [4] | 0.15 | 0.44 | 0.74 | 36.01 | 0.00 |
| **Total Emissions** | | | **268.64** | **584.48** | **204.56** | **256.69** | **196.04** |

1. Operating hours shown for firing fuel gas mixture and natural gas (NG) are based on expected operations. However, emissions are conservatively calculated based on firing natural gas, which is the higher emitting fuel.
2. The Firewater Pump combusts diesel fuel.
3. Based on continuous natural gas pilot for flare; cold startup includes 50 hr/yr of vents to HP Flare.
3. Based on continuous natural gas pilot for flare; no vents to LP Flare are expected during cold startup.

## 3.2.4 Malfunctions and Other Events

Malfunctions and other events can cause unusual emissions during short periods of time. Table 3.6 includes four types of malfunctions. Detailed emission calculations for malfunction events are included in Appendix B.

operations. Another factor is that this carbon dioxide stream is a product. Design elements that maximize the reliability of the carbon dioxide stream and minimize startup, shutdown, and malfunction periods will reduce the frequency and duration of venting events. The venting is only anticipated for a few days during initial startup (approximately 250 hrs/yr for the first year). Since the plant will be started up at reduced load, the venting will be at a reduced rate (approximately 25% of the normal process stream flow rate). Venting is anticipated for only a few hours for subsequent warm starts, not to exceed 50 hrs/yr. Again, the venting would be at a reduced load (approximately 50% of the normal process stream flow rate).

Catalytic oxidation is not technically feasible based on the low temperature of the vent stream, approximately 100°F. Based on the temperature and large flow rate, an extremely large amount of energy would be necessary to oxidize the CO with a thermal oxidizer, and may not be possible due to the size of the stream, low temperature, and high concentration of $CO_2$ in the stream. RBLC ID WY-0042 contained a process identified as "Vent, $CO_2$ Product" where incineration was not feasible due to $CO_2$ concentration in the gas. RBLC ID WY-0056 contained a process identified as "$CO_2$ Product Vent, Train III" that also vented uncontrolled.

The total annual proposed CO emissions to be permitted from the $CO_2$ stack are 275 tpy for the initial year of operation. Subsequent years will be limited to 74 tpy of CO. The proposed VOC emissions are 0.02 tpy for the first year and 0.01 tpy for subsequent years. Based on the limited operating time and resultant emissions, further controls are not warranted. Thus, an optimized process design is considered BACT for this process vent.

## 4.10 GASIFIER PREHEATING CONTROL TECHNOLOGY REVIEW (STARTUP OPERATIONS ONLY)

During the initial startup operations, or if new refractory is in place in a gasifier, a designated 21 MMBtu/hr natural gas burner is used to preheat the refractory lining prior to commencing tail gas production. Potential emissions from the natural gas combustion in the gasifiers is exhausted from a preheat vent located on each gasifier. The primary potential emissions from the gasifier preheat vents are $NO_x$ and CO. Each gasifier preheat vent has a potential to emit less than 1 ton per year of $NO_x$ and CO as discussed in the emission inventory. Emissions of VOC and particulate will also be relatively small based on the short operating time, approximately one week for each gasifier, for initial startup (and refractory replacement) only. Subsequent startup operations will be warm starts and will not include this step. The expected operating hours for the gasifier preheaters are 500 hours per year per heater, for a total of 2,500 hours per year. Good combustion controls that optimize burner efficiency will minimize potential $NO_x$, CO, VOC and particulate emissions. Because a low-sulfur-fuel (natural gas) is being used for preheating, the potential emissions of $SO_2$ will also be small.

The use of a low-sulfur-fuel, restricted operating conditions, and good combustion practices are proposed as BACT for each of the five (5) gasifier preheat burners. Table 4.4 shows the proposed BACT emission rates for each gasifier preheater.

**Table 4.4 – Gasifier Preheater BACT Analysis Summary**

| Pollutant | Proposed BACT | Proposed BACT Emission Limits (emission limits are per gasifier preheater) |
|---|---|---|
| $NO_x$ | Low Sulfur Fuel<br>Good Combustion Practices<br>Restricted Operation (startup only) | $NO_x$ Limit: 0.26 tpy |
| $SO_2$ | | $SO_2$ Limit: <0.01 tpy |
| CO | | CO Limit: 0.43 tpy |
| VOC | | VOC Limit: 0.03 tpy |
| PM | | Particulate Limit: 0.04 tpy ($PM_{10}$ - filterable) |

## 4.11 BLACK-START GENERATOR CONTROL TECHNOLOGY REVIEW (STARTUP OPERATIONS ONLY)

The proposed Plant will include three (3) 1.6 MW natural gas fired generators for use during startup. The generators will be used for commissioning and initial startup. Key utility systems such as instrument air, water supply and purification, firewater, and nitrogen will be made operational prior to initiating the startup sequence for the process. It is especially important that the flare system be ready for service before any flammable gas is present. Once critical utilities are in service, one of the three gas turbines is started on natural gas. This will produce enough power to displace the Black-Start generators. The primary potential emissions from the Black-Start generators are $NO_x$ and CO. Emissions of VOC and particulate will also be relatively small based on the short operating time and infrequent use (only initial startup and commissioning and upset conditions). The maximum hours per year proposed for the Black-Start generators are 250. Subsequent startup operations will be warm starts and are not anticipated to require firing of the Black-Start generators. Good combustion controls that optimize combustion efficiency will minimize potential $NO_x$, CO, VOC and particulate emissions. Because natural gas is being used, the potential emissions of $SO_2$ will also be small. Additionally, these natural gas fired generators will also be subject to and will comply with the NSPS for Stationary Compression Ignition Combustion Engines (Subpart IIII), as applicable.

The use of a natural gas, restricted operating conditions, and good combustion practices are proposed as BACT for the three Black-Start generators. Table 4.5 shows the proposed BACT emission rates for each Black-Start generator.

**Table 4.5 – Black-Start Generator BACT Analysis Summary**

| Pollutant | Proposed BACT | Proposed BACT Emission Limits (emission limits are per generator) |
|---|---|---|
| $NO_x$ | Natural Gas Fired<br>Good Combustion Practices<br>Restricted Operation (initial startup only) | $NO_x$ Limit: 0.80 tpy |
| $SO_2$ | | $SO_2$ Limit: <0.01 tpy |
| CO | | CO Limit: 1.93 tpy |
| VOC | | VOC Limit: 0.72 tpy |
| PM | | Particulate Limit: 0.0002 tpy ($PM_{10}$ - filterable) |

### 6.2.2 Source Emissions and Parameters

Modeled Plant emission rates were based on the activity levels and applied control technologies described in Sections 3 and 4 of this document. Conservative emission estimates were used to predict the maximum likely impacts for each modeled pollutant. Where practicable, combinations of operations were developed to allow operational flexibility for future Plant activities. For example, cold startup and operations after cold startup, and normal operations scenarios were evaluated to determine annual emissions for modeling.

Of the emitted criteria pollutants, VOC emissions, which are precursors to ozone, were not explicitly modeled. Modeling of VOC impacts is not performed for two reasons. First, no NAAQS are established for VOCs. Second, AERMOD does not have the capability to model the chemical reactions that form ozone in the atmosphere from VOCs. Given the relatively low ambient ozone concentrations in the area surrounding the Plant and the lack of significant industrial $NO_x$ and VOC emissions nearby, no ozone analysis was performed.

Emissions of criteria pollutants $NO_x$, CO, $SO_2$, and $PM_{10}$ were explicitly modeled and the maximum total short-term emission rates for all sources are shown below in Table 6.1.

**Table 6.1 – Maximum Combined Modeled Short-Term Emission Rates for All Sources in the Analysis**

| Total $NO_x$ (g/sec) Modeled | Total CO (g/sec) Modeled | Total $SO_2$ (g/sec) Modeled | Total $PM_{10}$ (g/sec) Modeled[1] |
|---|---|---|---|
| 14.691 | 853.108 | 1400.80 | 11.42/4.21 |

1. Emission rate modeled with long-term analysis, including all mining-related point and fugitive sources/emission rate modeled in short-term analysis, representing only mining-related point sources (no fugitives).

Specific source model emission rates and input parameters are shown in Table 6.2. Pollutants with short-term averaging periods (CO, $SO_2$, and $PM_{10}$) were modeled at maximum short-term rates for all operating scenarios. Note that for the LP Flare, a cold startup will not occur for a full day, but during those startup hours, the expected emissions from the LP Flare may substantially exceed its normal operation short-term emission rates. The short-term modeling analysis includes these higher short-term, startup-related, emissions from the LP Flare. Modeled pollutant emissions for the long-term (annual) $NO_x$, $SO_2$, and $PM_{10}$ analyses were based on additive operations across the highest emitting scenarios (7760 hr/yr of normal operations after startup plus 1,000 hr/yr of cold startup conditions).

Stack input parameters such as height, diameter, velocity, and temperature, are based on vendor information or established values for similar unit operations. Effective heights and diameters for the HP and LP flares during startup and normal operations were calculated and modeled per established modeling guidance documentation.

The full cumulative modeling analysis includes a nearby (35-km) source inventory, supplied by the WDEQ, for $NO_x$ and CO sources. Although the relative spatial distances are large, the point

## Table 6.2 – Modeled Plant Point Source Parameters

| Emission Unit | Emission Unit / Model ID | Location UTM | | | Modeled Exhaust Parameters | | | | Modeled Emission Rates (g/s) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | X (m) | Y (m) | Z (m) | Height (m) | Temp (K) | Velocity (m/s) | Diameter (m) | $NO_x$ | CO | $SO_2$ | $PM_{10}$ |
| Turbine and HRSG Train 1 | CTG1 | 391190.18 | 4624309.74 | 2133 | 45.73 | 366.49 | 7.65 | 5.79 | 2.206 | 1.434 | 0.336 | 1.26 |
| Turbine and HRSG Train 2 | CTG2 | 391190.18 | 4624231.74 | 2133 | 45.73 | 366.49 | 7.65 | 5.79 | 2.206 | 1.434 | 0.336 | 1.26 |
| Turbine and HRSG Train 3 | CTG3 | 391190.18 | 4624179.74 | 2133 | 45.73 | 366.49 | 7.65 | 5.79 | 2.206 | 1.434 | 0.336 | 1.26 |
| Gasifier Preheater 1 | GHEAT1 | 390998.86 | 4624266.35 | 2133 | 25.91 | 422.05 | 7.45 | 0.41 | 0.0074 | 0.218 | 0.0015 | 0.0197 |
| Gasifier Preheater 2 | GHEAT2 | 390998.46 | 4624253.85 | 2133 | 25.91 | 422.05 | 7.45 | 0.41 | 0.0074 | 0.218 | 0.0015 | 0.0197 |
| Gasifier Preheater 3 | GHEAT3 | 390998.18 | 4624241.85 | 2133 | 25.91 | 422.05 | 7.45 | 0.41 | 0.0074 | 0.218 | 0.0015 | 0.0197 |
| Gasifier Preheater 4 | GHEAT4 | 390997.86 | 4624229.85 | 2133 | 25.91 | 422.05 | 7.45 | 0.41 | 0.0074 | 0.218 | 0.0015 | 0.0197 |
| Gasifier Preheater 5 | GHEAT5 | 390997.46 | 4624217.35 | 2133 | 25.91 | 422.05 | 7.45 | 0.41 | 0.0074 | 0.218 | 0.0015 | 0.0197 |
| HP Flare | Z8901 | 390824.94 | 4624353.31 | 2133.9 | 46.0 / 86.55 * | 1273 | 20 | 0.152 / 13.64* | 0.2956 | 409.4 | 946.02 | 0.0 |
| Black-Start Generator 1 | BSG1 | 391102.68 | 4623970.7 | 2133 | 30 | 767.6 | 1.96 | 0.41 | 0.033 | 1.95 | 0.0014 | 0.00019 |
| Black-Start Generator 2 | BSG2 | 391107.68 | 4623970.7 | 2133 | 30 | 767.6 | 1.96 | 0.41 | 0.033 | 1.95 | 0.0014 | 0.00019 |
| Firewater Pump | FIREPUMP | 391247.38 | 4624293.74 | 2133 | 6.1 | 739.27 | 45 | 0.15 | 0.0433 | 0.046 | 0.00076 4 | 0.0096 |
| Auxiliary Boiler | AB | 391085.81 | 4624005.5 | 2133 | 15.24 | 422.05 | 1.6 | 0.91 | 0.4076 | 0.685 | 0.005 | 0.062 |
| Catalyst Regenerator | REGH | 391329.29 | 4624467.64 | 2133 | 15.24 | 422.05 | 1.6 | 0.91 | 0.133 | 0.223 | 0.0016 | 0.0202 |
| Reactivation Heater | REAH | 391329.5505 | 4624486.43 | 2133 | 15.24 | 422.05 | 1.6 | 0.91 | 0.077 | 0.129 | 0.00092 | 0.0117 |
| HGT Reactor Charge Heater | HGT | 391329.29 | 4624447.64 | 2133 | 15.24 | 422.05 | 1.6 | 0.91 | 0.077 | 0.023 | 0.00016 | 0.002 |
| LP Flare | Z8902 | 390856.48 | 4624591.43 | 2133.6 | 70.4 / 74.9* | 1273 | 20 | — / 4.43* | 0.00437 | 2.44 | 453.75 | 0.0 |
| Black-Start Generator 3 | BSG3 | 391112.68 | 4623970.7 | 2133 | 30 | 767.6 | 1.96 | 0.41 | 0.033 | 1.95 | 0.0014 | 0.00019 |

### Table 6.2 – Modeled Plant Point Source Parameters

| Emission Unit | Emission Unit / Model ID | Location UTM | | | Modeled Exhaust Parameters | | | | Modeled Emission Rates (g/s) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | X (m) | Y (m) | Z (m) | Height (m) | Temp (K) | Velocity (m/s) | Diameter (m) | $NO_x$ | CO | $SO_2$ | $PM_{10}$ |
| $CO_2$ Stack Vent | CO2V | 390957.03 | 4624580.2 | 2133 | 30.48 | 296.88 | 6.99 | 1.83 | 0.0 | 423.21 | 0.0 | 0.0 |

* The second number indicates the flare's effective stack height or effective diameter. Maximum modeled LP Flare (Source ID Z8902) height was 75 m (231 ft) for model year 2004 in the short-term NAAQS/WAAQS analysis, therefore, this will be the required height for the LP Flare.

### Table 6.3 – Modeled Cumulative (Nearby) Point Source Parameters

| Emission Unit / Model ID | Location UTM | | | Modeled Exhaust Parameters | | | | Modeled Emission Rates (g/s) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X (m) | Y (m) | Z (m) | Height (m) | Temp (K) | Velocity (m/s) | Diameter (m) | $NO_x$ | CO | $SO_2$ | $PM_{10}$ |
| SRC36454 | 421705 | 4587401 | 2225.9 | 13.87 | 672.04 | 12.19 | 1.07 | 15.09 | - | - | - |
| SRC36455 | 421705 | 4587401 | 2225.9 | 13.87 | 672.04 | 12.19 | 0.91 | 6.13 | 2.83 | - | - |
| SRC36456 | 421705 | 4587401 | 2225.9 | 13.87 | 672.04 | 12.19 | 1.07 | 15.09 | - | - | - |
| SRC36457 | 421705 | 4587401 | 2225.9 | 13.87 | 672.04 | 12.19 | 1.07 | 10.38 | 1.32 | - | - |
| SRC36458 | 421705 | 4587401 | 2225.9 | 8.23 | 842.04 | 78.64 | 0.24 | 3.26 | 0.377 | - | - |
| SRC36459 | 421705 | 4587401 | 2225.9 | 8.23 | 842.04 | 78.64 | 0.24 | 3.26 | 0.377 | - | - |
| SRC36462 | 421705 | 4587401 | 2225.9 | 12.19 | 685.93 | 41.76 | 1.04 | 0.618 | 0.662 | - | - |
| SRC36463 | 421705 | 4587401 | 2225.9 | 6.4 | 449.82 | 6.12 | 0.46 | 0.154 | - | - | - |
| SRC37392 | 395304.8 | 4649701 | 2023.84 | 7.92 | 596.48 | 24.05 | 0.43 | 0.975 | 0.106 | - | - |
| SRC37393 | 395304.8 | 4649701 | 2023.84 | 7.92 | 596.48 | 24.05 | 0.43 | 0.975 | 0.106 | - | - |
| SRC37771 | 399740 | 4606350 | 2332.8 | 10.97 | 922.04 | 50.51 | 1.01 | 0.710 | 0.518 | - | - |
| SRC36900 | 375778.9 | 4651513 | 2011 | 11.0 | 730.4 | 71.6 | 0.25 | 0.503 | 0.164 | - | - |
| SRC36901 | 375778.9 | 4651524 | 2011 | 11.0 | 730.4 | 71.6 | 0.25 | 0.503 | 0.164 | - | - |
| SRC36902 | 375778.9 | 4651536 | 2011 | 11.0 | 762.0 | 38.6 | 0.25 | 0.319 | 0.642 | - | - |
| SRC36903 | 375778.9 | 4651547 | 2011 | 11.0 | 762.0 | 38.6 | 0.25 | 0.319 | 0.642 | - | - |



DEQ 003282

sources included in this nearby inventory have significant emission rates. Table 6.3 details the nearby point sources used for cumulative modeling.

#### *6.2.2.1 Coal Mine Fugitive Emission Area Sources*

Existing surface and planned underground coal mining operations are located within the facility's "ambient" boundary. MBFP has an option to purchase the coal it needs from Arch Coal of Wyoming, LLC (Arch). Arch operates the existing surface mine, The Elk Mountain Mine, under permit CT – 4136 (Wyoming), which includes the projected future annual emissions and locations of its aboveground mining operations. A copy of that permit was obtained from the WDEQ.

Emission factors from the Arch surface mine permit were used to calculate future emissions from the aboveground operation locations to be constructed to support the proposed underground Saddleback Hills Mine. Area sources were created to the west of the facility for these potential future emissions.

Table 6.4 shows the area source modeling parameters for the Plant's mining operations as well as the aboveground mining operations associated with the Elk Mountain and Saddleback Hills Mine for this analysis.

#### *6.2.2.2 Industrial Gasification & Liquefaction Plant Volume Sources*

Volume sources were used to represent HAP emissions associated with storage tanks and equipment leaks. Table 6.5 shows the modeling parameters for the volume sources and Figure 6.3 shows the complete layout of all sources related to the facility (including the Elk Mountain Mine operations).

Figure 6.4 shows the locations of the Plant and the nearby sources included in the inventory sent by the WDEQ.

### 6.2.3 Additional Emission Assumptions

The following conservative assumptions were used when conducting this modeling analysis.

- Normal operations at the facility will not include the Black-Start Generator emissions. Therefore, simultaneous / concurrent emissions that were modeled for the Black-Start generators and turbines are not likely to occur. In other words, several emission units / sources are not likely to emit concurrently with other sources.
- Vehicle tailpipe $NO_x$ emissions associated with the nearby mining operations (Elk Mountain Mine) were included in the PSD increment and NAAQS analysis.
- Vehicle tailpipe, surface mining, and vehicle traffic (associated with haul roads) $PM_{10}$, $SO_2$, and CO emissions (Elk Mountain Mine) were included in the NAAQS analyses to determine cumulative impacts for each pollutant.
- Surface mining emissions are below ground level or surrounded by high walls that could prevent the release of PM/PM10 into the ambient domain; the area sources for the surface mining for this modeling analysis are above ground level.

## Table 6.4 – Area Source Modeling Parameters

| Source ID (in model) | Source Type | Source Description | Corner Easting (X) (m) | Corner Northing (Y) (m) | Base Elevation (m) | Release Height (m) | Sigma z (initial dimension) (m) | Modeled Emission Rates (g/sec/m2) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | NOx | CO | SO2 | PM10[2] |
| CoalStor | Area | On Site Coal Storage | 389896.4 | 4623397.9 | 2133 | 20.0 | 9.3 | 0.0 | 0.0 | 0.0 | 0.000075 |
| MineA_SP[1] | Area | Mine Area / South Portal | 384525.3 | 4622056.4 | 2252 | 12.0 | 13.95 | 0.0 | 0.0. | 0.0 | 0.0 |
| MineA_EP | Area | Mine Area / East Portal | 389721.7 | 4623411.5 | 2134 | 12.0 | 13.95 | 0.000004 | 0.0000034 | 0.00000007 | 0.0000082/0.0000001 |
| MineA_S1 | Area | Mine Area / Surface Mining (On-Site) | 389673.8 | 4623406.6 | 2134 | 12.0 | NA | 0.0000137 | 0.0000115 | 0.00000023 | 0.000007/0.00000057 |
| MineA_S2 | Area | Mine Area / Surface Mining (Off-Site) | 388229.3 | 4622116.0 | 2189 | 12.0 | NA | 0.0000137 | 0.0000115 | 0.00000023 | 0.000007/0.00000057 |

Notes

1. The analysis reflects development year 4 operations, where normal plant operations have begun, and all coal produced at the Saddleback Hills Mine is brought out through the mine's East Portal (Source ID MineA_EP). Mine development emissions from the Saddleback Hills Mine South Portal (Source ID MineA_SP) will begin to decline in development year 3 and will cease in year 4.
2. Where two values are shown, the $PM_{10}$ modeled emissions rates represent total point source and fugitive source emissions included in the long-term (annual) analysis, and the point source emissions included in the short-term (24-hr) analyses.

**Table 6.5 – Volume Source Modeling Parameters**

| Source ID (in model) | Source Type | Source Description | Easting (X) (m) | Northing (Y) (m) | Base Elevation (m) | Release Height (m) | Sigma y (initial dimension) (m) | Sigma z (initial dimension) (m) | Modeled Emission Rates (g/sec) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | NOx | CO | SO2 | PM10 |
| T_A | Volume | Gasoline Tank | 390966.4 | 4624652 | 2133.2 | 14.6304 | 10.6325581 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| T_B | Volume | Gasoline Tank | 391021.3 | 4624652 | 2133 | 14.6304 | 10.6325581 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| T_C | Volume | Gasoline Tank | 391109.2 | 4624652 | 2133 | 14.6304 | 10.6325581 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| T_D | Volume | Gasoline Tank | 391175.2 | 4624652 | 2133 | 14.6304 | 10.6325581 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| T_E | Volume | Gasoline Tank | 390966.4 | 4624712 | 2133.2 | 14.6304 | 10.6325581 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| T_F | Volume | Gasoline Tank | 391021.3 | 4624712 | 2133 | 14.6304 | 10.6325581 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| T_G | Volume | Gasoline Tank | 391109.2 | 4624712 | 2133 | 14.6304 | 10.6325581 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| T_H | Volume | Gasoline Tank | 391175.2 | 4624712 | 2133 | 14.6304 | 10.6325581 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| T_I | Volume | Methanol Tank | 390966.4 | 4624822 | 2133 | 14.6304 | 10.6325581 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| T_J | Volume | Methanol Tank | 391021.3 | 4624822 | 2133 | 14.6304 | 10.6325581 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| T_K | Volume | Heavy Gas Tank | 391173.8 | 4624840 | 2133 | 14.6304 | 9.21488372 | 2.32 | 0.0 | 0.0 | 0.0 | 0.0 |
| V1 | Volume | Equipment Leaks | 391224.369 | 4624457.507 | 2133 | 2.0 | 61.12 | 4.65 | 0.0 | 0.0 | 0.0 | 0.0 |
| V_1 through V_112 | Volume | Haul Roads | varying | varying | varying | 2.0 | 1.63 | 2.79 | 0.0 | 0.0 | 0.0 | 0.0284/0.0[1] |

Notes

1. Haul road $PM_{10}$ emissions are fugitives, and per WDEQ policy, are not included in short-term (24-hr) modeling analyses.

Figure 6.3 – Plant and Nearby Mining Area Sources

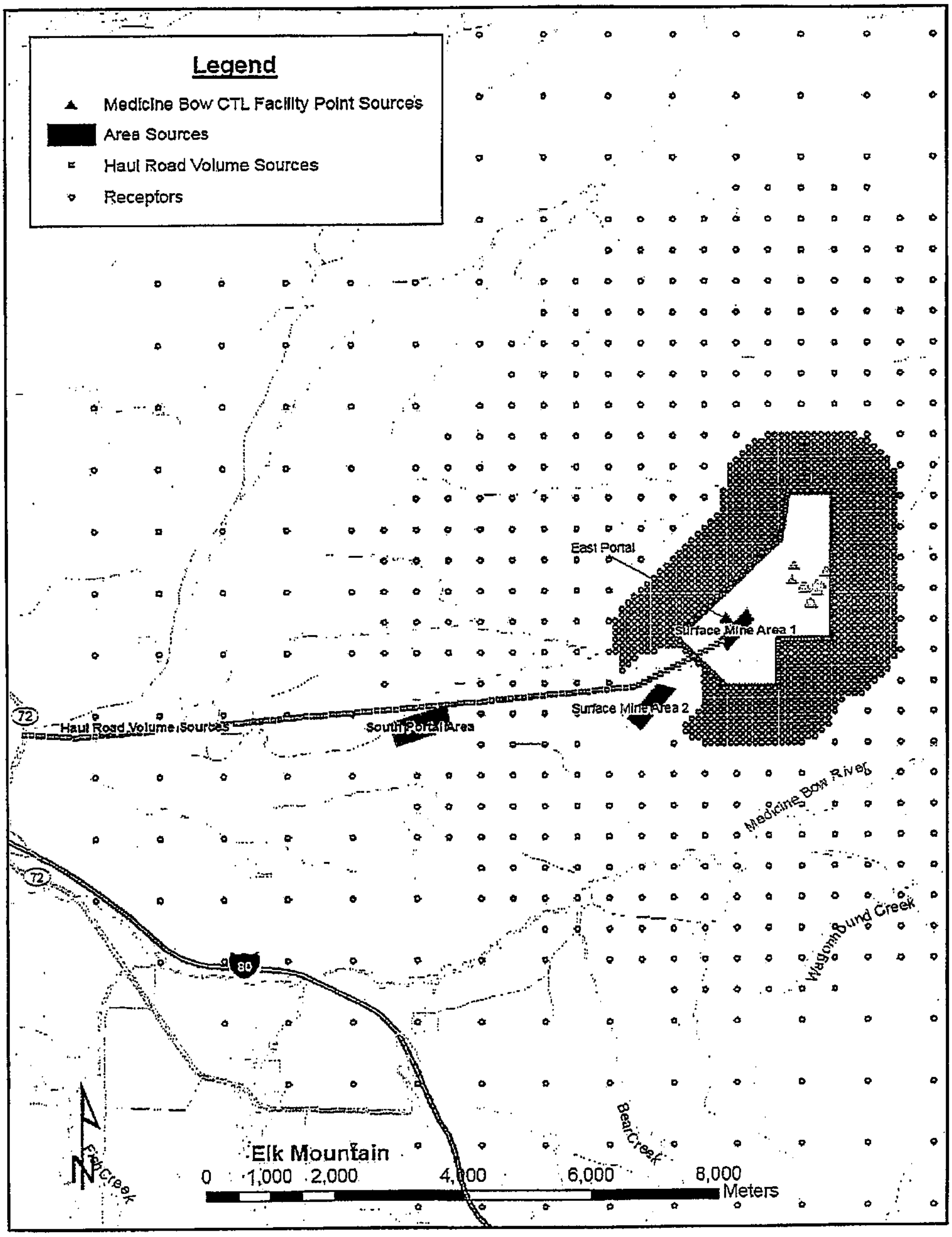
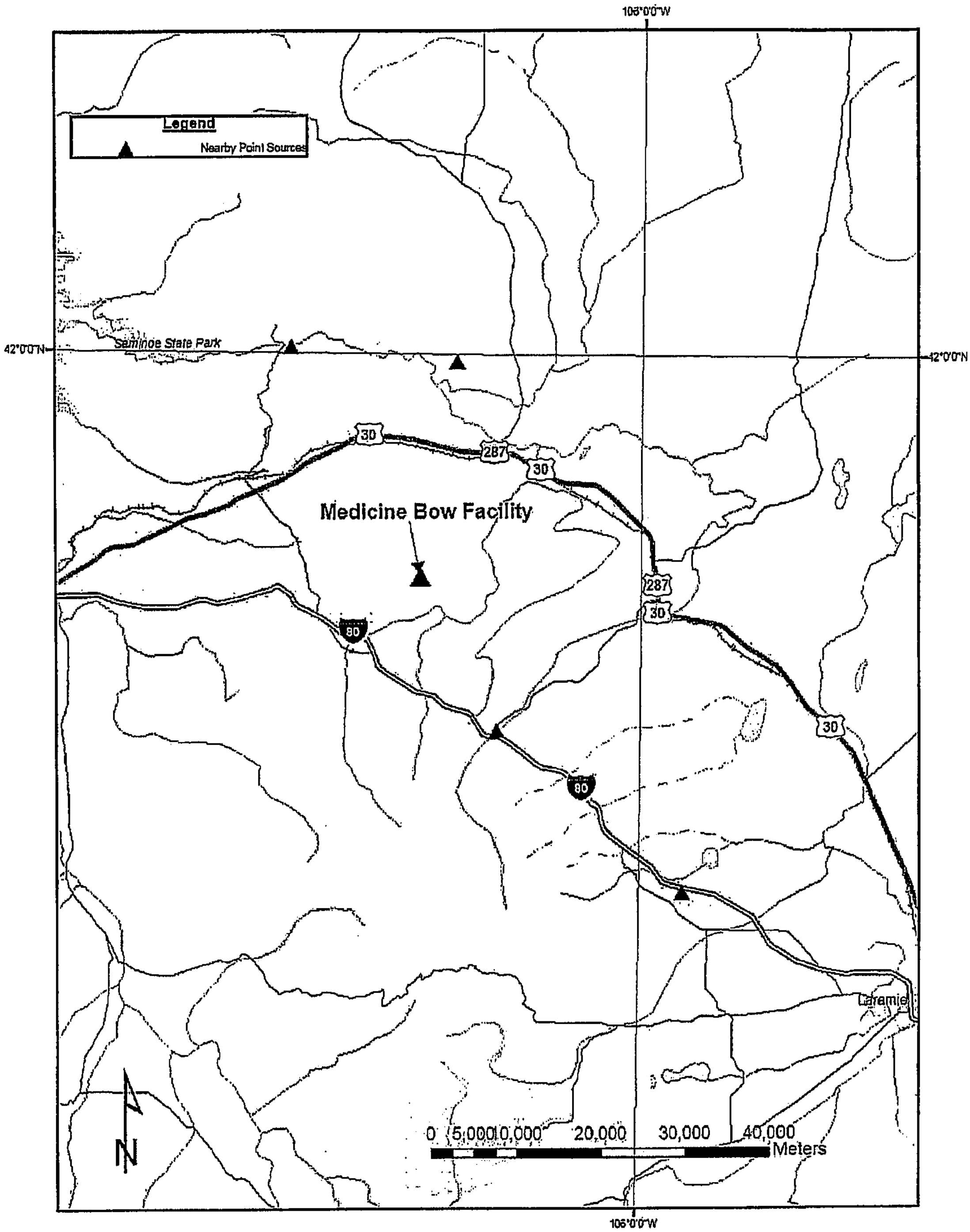


**Figure 6.4 – Plant Location Relative to the WDEQ Provided Emission Inventory**



Figures 6.7, 6.8, and 6.9 illustrate maximum PSD increment impacts for 3-hour, 24-hour, and annual averaging times.

**Table 6.10 – Predicted $SO_2$ Concentrations Compared to NAAQS / WAAQS**

| Averaging Period | Data Period | | | Receptor Location (m) | | Predicted Cumulative Concentration (ug/m3) | Background Concentration (ug/m3) | Total Concentration (Cumulative + Background) (ug/m3) | NAAQS / WAAQS (ug/m3) |
|---|---|---|---|---|---|---|---|---|---|
| | Year | Month/ Day | Hour | East | North | | | | |
| 3 Hour [1,2] | 2000 | 8/6 | 03 | 388955.38 | 4627705 | 1108.55 | 31.4 | 1139.95 | N/A / 1300 |
| | 2001 | 6/22 | 24 | 381955.38 | 4628205 | 1097.85 | 31.4 | 1129.25 | N/A / 1300 |
| | 2003 | 7/26 | 06 | 389455.38 | 4628205 | 1008.50 | 31.4 | 1039.90 | N/A / 1300 |
| | 2004 | 5/22 | 03 | 395455.38 | 4624205 | 1033.64 | 31.4 | 1065.04 | N/A / 1300 |
| | 2005 | 8/1 | 06 | 381955.38 | 4628205 | 1034.36 | 31.4 | 1065.76 | N/A / 1300 |
| 24 Hour [1,2] | 2000 | 5/30 | 24 | 389972.38 | 4624361 | 190.70 | 7.84 | 198.54 | 365 / 260 |
| | 2001 | 10/19 | 24 | 392055.38 | 4625005 | 197.92 | 7.84 | 205.76 | 365 / 260 |
| | 2003 | 12/27 | 24 | 391955.38 | 4625205 | 201.96 | 7.84 | 209.80 | 365 / 260 |
| | 2004 | 12/26 | 24 | 395455.38 | 4624205 | 241.39 | 7.84 | 249.23 | 365 / 260 |
| | 2005 | 9/15 | 24 | 395455.38 | 4624205 | 205.98 | 7.84 | 213.82 | 365 / 260 |
| Annual | 2000 | N/A | N/A | 391421.4 | 4624635 | 4.25 | 2.62 | 6.87 | 80 / 60 |
| | 2001 | N/A | N/A | 391421.4 | 4624585 | 4.51 | 2.62 | 7.13 | 80 / 60 |
| | 2003 | N/A | N/A | 391422.4 | 4624685 | 4.43 | 2.62 | 7.05 | 80 / 60 |
| | 2004 | N/A | N/A | 391420.4 | 4624485 | 4.01 | 2.62 | 6.63 | 80 / 60 |
| | 2005 | N/A | N/A | 391420.4 | 4624435 | 4.09 | 2.62 | 6.71 | 80 / 60 |

1. Based on the second-highest maximum.
2. Short-term analyses based on actual LP Flare (Source ID Z8902) maximum height of 70 m (231 ft) for model year 2004; all other model years, flare maximum height was set less than this height.

## Table 6.11 – Predicted $SO_2$ Concentrations Compared to PSD Increments

| Averaging Period | Data Period | | | Receptor Location (m) | | Predicted Concentration (ug/m3) | PSD Increment (ug/m3) |
|---|---|---|---|---|---|---|---|
| | Year | Month/Day | Hour | East | North | | |
| 3 Hour[1] | 2000 | 12/8 | 06 | 389410.38 | 4623014 | 7.04 | 512 |
| | 2001 | 9/24 | 03 | 389410.38 | 4623014 | 11.28 | 512 |
| | 2003 | 5/7 | 03 | 389410.38 | 4623014 | 8.95 | 512 |
| | 2004 | 8/27 | 06 | 389445.38 | 4622979 | 10.24 | 512 |
| | 2005 | 8/21 | 06 | 389410.38 | 4623014 | 8.23 | 512 |
| 24 Hour[1] | 2000 | 2/14 | 24 | 391455.38 | 4624505 | 1.58 | 91 |
| | 2001 | 9/24 | 24 | 389410.38 | 4623014 | 2.46 | 91 |
| | 2003 | 12/13 | 24 | 391455.38 | 4624505 | 1.97 | 91 |
| | 2004 | 1/7 | 24 | 391555.38 | 4624505 | 1.62 | 91 |
| | 2005 | 8/21 | 24 | 389516.38 | 4622908 | 2.02 | 91 |
| Annual | 2000 | N/A | N/A | 391421.4 | 4624635 | 4.25 | 20 |
| | 2001 | N/A | N/A | 391421.4 | 4624585 | 4.51 | 20 |
| | 2003 | N/A | N/A | 391422.4 | 4624685 | 4.43 | 20 |
| | 2004 | N/A | N/A | 391420.4 | 4624485 | 4.01 | 20 |
| | 2005 | N/A | N/A | 391420.4 | 4624435 | 4.09 | 20 |

1. Short-term analyses does not include LP Flare (Source ID Z8902).

Figure 6.7 – 2003 Maximum $SO_2$ 3-Hour Impacts (PSD)

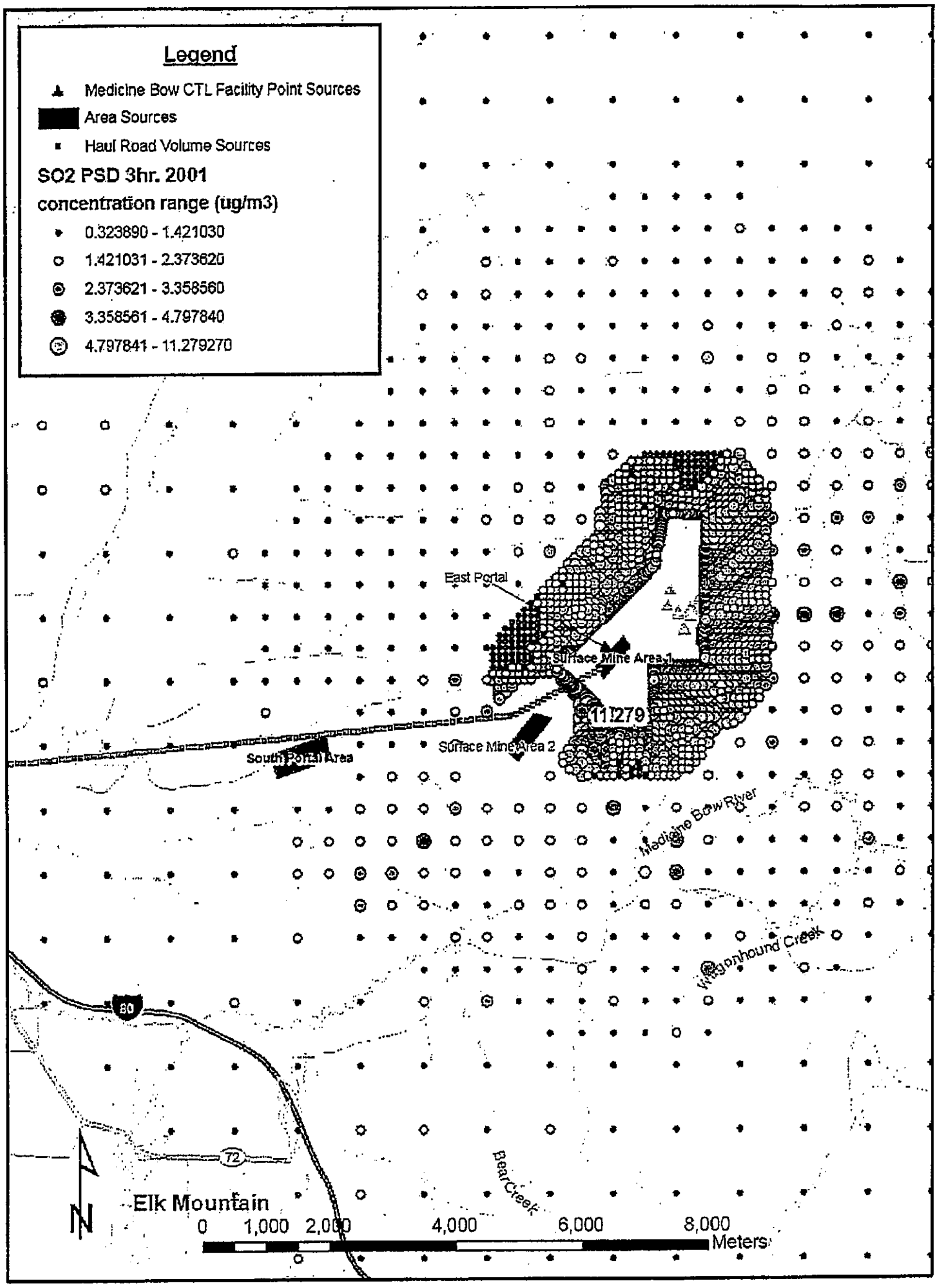
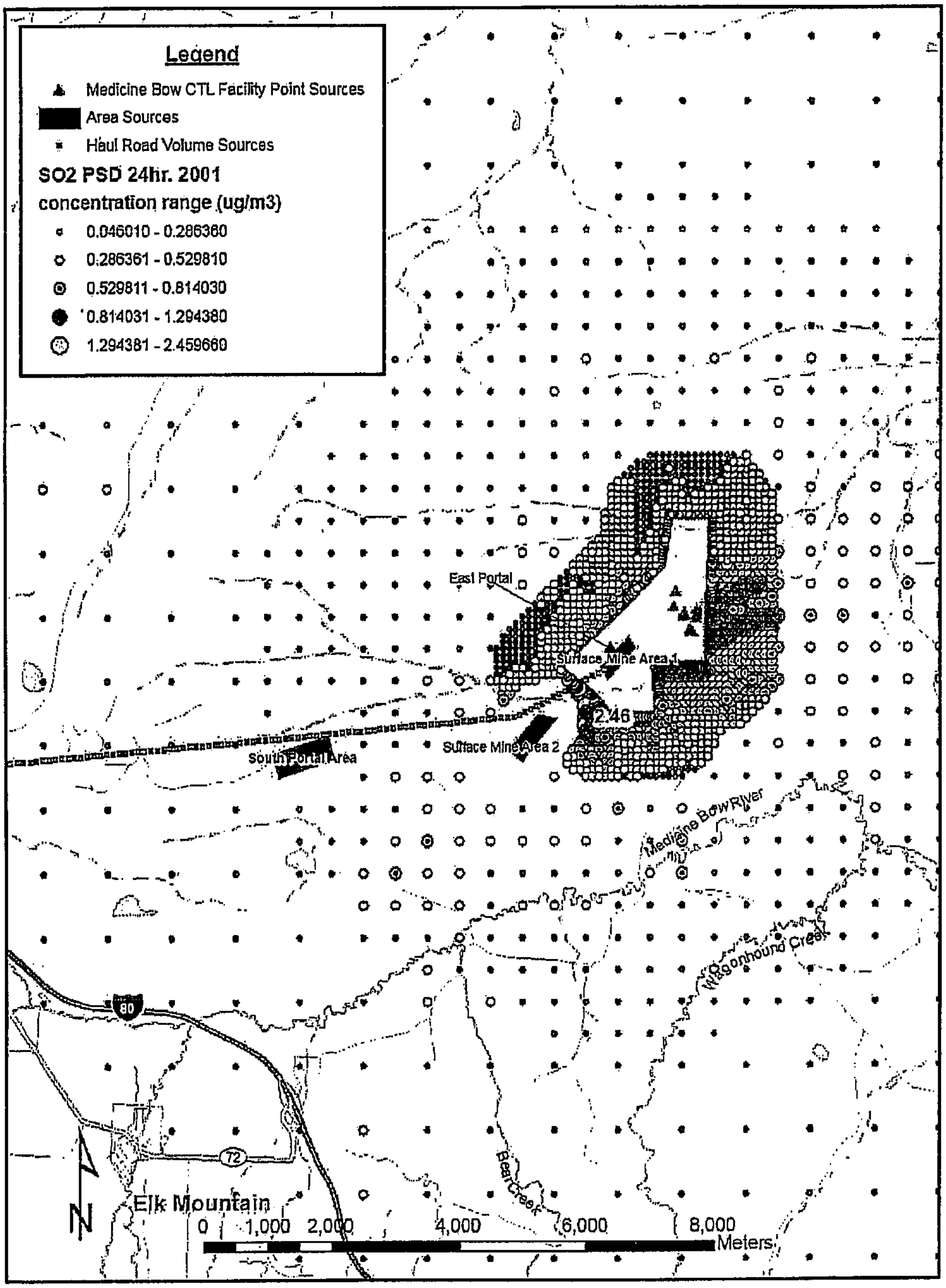


**Figure 6.8 – 2000 Maximum $SO_2$ 24-Hour Impacts (PSD)**



Figures 6.10 and 6.11 illustrate maximum PSD increment impacts for 24-hour and annual averaging times.

**Figure 6.10 – 2005 Maximum $PM_{10}$ 24-Hour Impacts (PSD)**

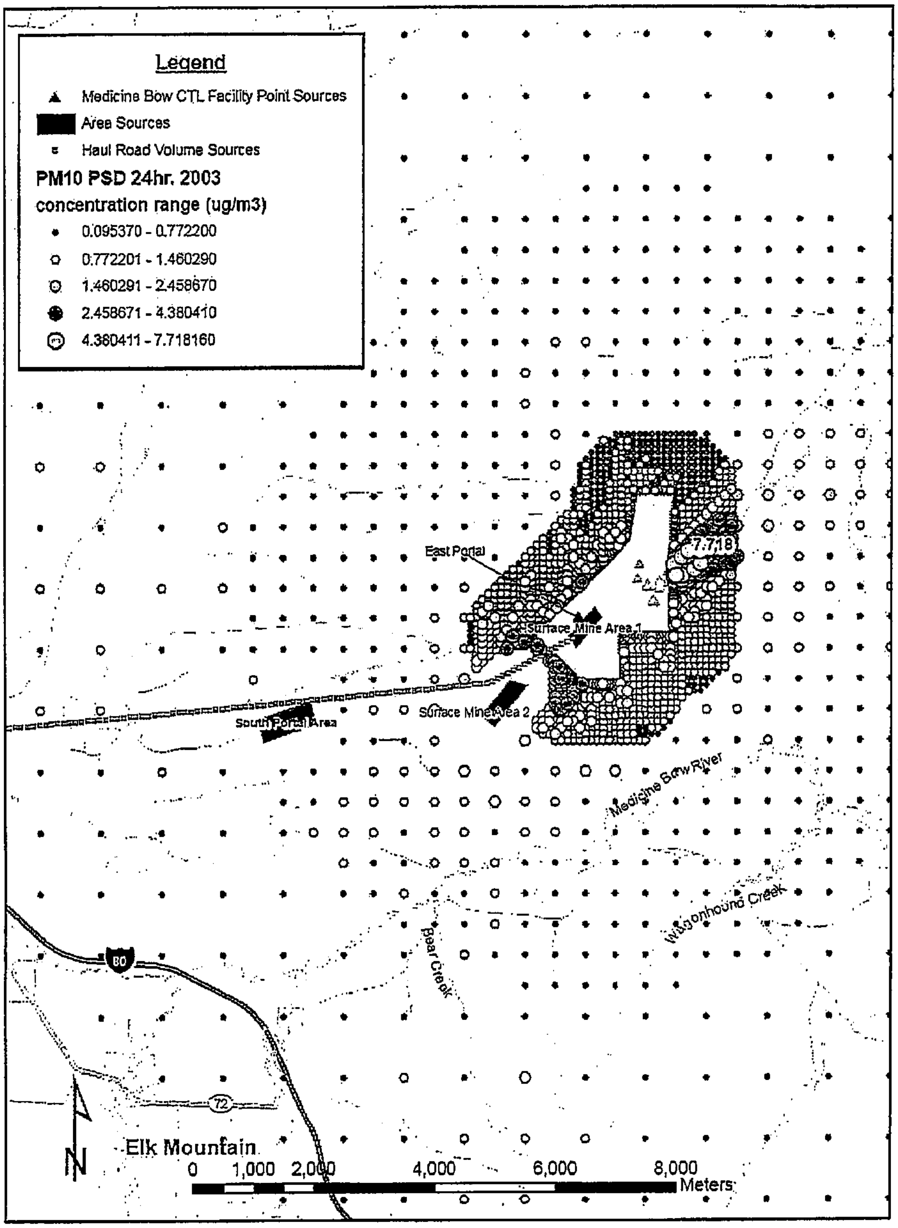
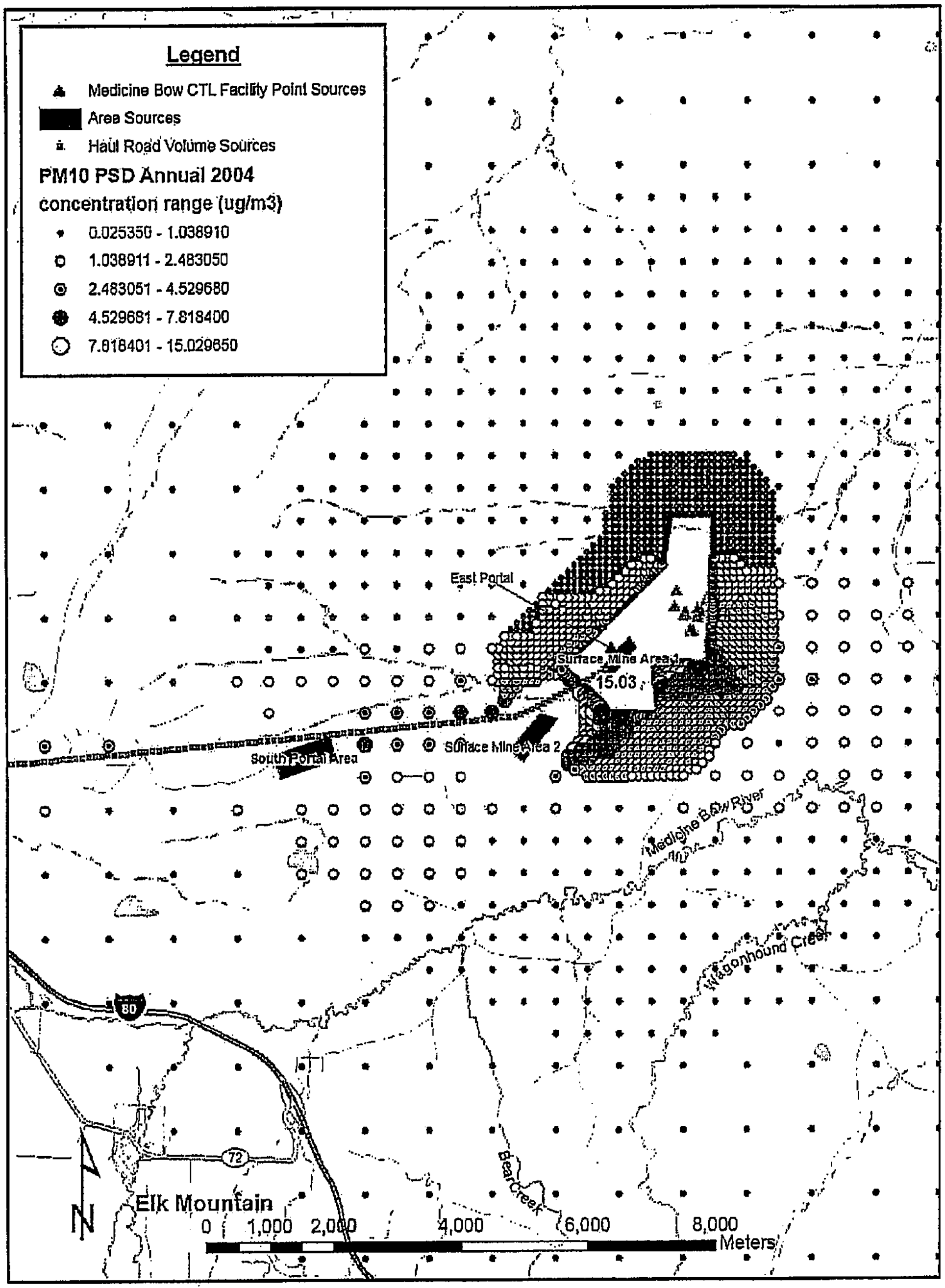


**Figure 6.11 – 2005 Maximum $PM_{10}$ Annual Impacts (PSD)**



**Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant**
**Emission Summary Sheet**

**Normal Operations (8760 hr/yr)**

| | | | Operation | Potential Emissions (tpy) | | | | | HAPs Emissions (tpy) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID No. | Description | Usage | (hr/yr) | $NO_x$ | CO | VOC | $SO_2$ | $PM_{10}$ | 1,3-Butadiene | Acetaldehyde | Acrolein | 2,2,4-Trimethylpentane | Benzene | Carbonyl Sulfide | Dichlorobenzene | Ethyl Benzene | Formaldehyde | Hexane | Mercury | Methanol | Naphthalene | PAH | Propylene Oxide | Toluene | Xylene | TOTALS |
| CT-1 | Turbine and HRSG Train 1 | General Electric, 66 MW | 8,760 | 75.86 | 46.19 | 6.59 | 10.79 | 43.80 | 1.37E-03 | 1.27E-01 | 2.03E-02 | | 3.81E-02 | | | 1.02E-01 | 2.26E-01 | | 1.23E-04 | | 4.13E-03 | 6.98E-03 | 9.21E-02 | 4.13E-01 | 2.03E-01 | 1.23E+00 |
| CT-2 | Turbine and HRSG Train 2 | General Electric, 66 MW | 8,760 | 75.86 | 46.19 | 6.59 | 10.79 | 43.80 | 1.37E-03 | 1.27E-01 | 2.03E-02 | | 3.81E-02 | | | 1.02E-01 | 2.25E-01 | | 1.23E-04 | | 4.13E-03 | 6.98E-03 | 9.21E-02 | 4.13E-01 | 2.03E-01 | 1.23E+00 |
| CT-3 | Turbine and HRSG Train 3 | General Electric, 66 MW | 8,760 | 75.86 | 46.19 | 6.59 | 10.79 | 43.80 | 1.37E-03 | 1.27E-01 | 2.03E-02 | | 3.81E-02 | | | 1.02E-01 | 2.25E-01 | | 1.23E-04 | | 4.13E-03 | 6.98E-03 | 9.21E-02 | 4.13E-01 | 2.03E-01 | 1.23E+00 |
| AB | Auxiliary Boiler | Heater, 66 MMBtu/hr [1] | 8,760 | 14.17 | 23.81 | 1.56 | 0.17 | 2.15 | | | | | 5.95E-04 | | 3.40E-04 | | 2.13E-02 | 5.10E-01 | | | 1.73E-04 | | | 9.64E-04 | | 5.33E-01 |
| B-1 | Catalyst Regenerator Heater | Heater, 21.53 MMBtu/hr [1] | 8,760 | 4.62 | 7.77 | 0.51 | 0.08 | 0.70 | | | | | 1.94E-04 | | 1.11E-04 | | 6.93E-03 | 1.66E-01 | | | 5.64E-05 | | | 3.14E-04 | | 1.74E-01 |
| B-2 | Reactivation Heater | Heater, 12 MMBtu/hr [1] | 8,760 | 2.67 | 4.49 | 0.29 | 0.03 | 0.41 | | | | | 1.12E-04 | | 6.42E-05 | | 4.01E-03 | 9.62E-02 | | | 3.26E-05 | | | 1.82E-04 | | 1.01E-01 |
| B-3 | HGT Reactor Charge Heater | Heater, 2 MMBtu/hr [1] | 8,760 | 0.48 | 0.80 | 0.05 | 0.01 | 0.07 | | | | | 2.00E-05 | | 1.14E-05 | | 7.15E-04 | 1.72E-02 | | | 5.82E-06 | | | 3.24E-05 | | 1.79E-02 |
| Tanks | Storage Tanks | Product Storage | 8,760 | | | 102.62 | | | | | | | 5.27E-01 | | | 3.79E-02 | | 4.95E-01 | | 2.39E+00 | | | | 5.67E-01 | 1.60E-01 | 4.17E+00 |
| EL | Equipment Leaks | Fugitives | 8,760 | | | 71.32 | | | | | | | 1.04E+01 | 2.60E-01 | | | | | | 1.04E+01 | | | | | | 2.11E+01 |
| CS | Coal Storage & Processing | Conveyance (point) & Fugitives | 8,760 | | | | | 61.08 | | | | | | | | | | | | | | | | | | 0.00E+00 |
| FW-Pump | Firewater Pump[2] | Engine, 575 HP | 500 | 1.51 | 0.09 | 0.34 | 1.52E-03 | 0.02 | 3.77E-05 | 7.39E-04 | 8.81E-05 | | 8.99E-04 | | | | 1.14E-03 | | | | 8.17E-05 | | 2.49E-03 | 3.94E-04 | 2.75E-04 | 6.14E-03 |
| FL-1 | HP / Emergency Flare[3] | Flare, 0.816 MMBtu/hr | 8,760 | 0.49 | 0.98 | 2.97 | 2.10E-03 | | | | | | | | | | | | | | | | | | | 0.00E+00 |
| FL-2 | LP Flare[2] | Flare, 0.204 MMBtu/hr | 8,760 | 0.12 | 0.25 | 0.74 | 0.00 | | | | | | | | | | | | | | | | | | | |
| *Total Emissions* | | | | 251.63 | 176.75 | 200.18 | 32.65 | 195.84 | 0.00 | 0.38 | 0.06 | 0.00 | 11.08 | 0.28 | 0.00 | 0.34 | 0.71 | 1.29 | 0.00 | 12.79 | 0.01 | 0.02 | 0.28 | 1.81 | 0.77 | 29.80 |

Notes:
[1] Emissions from auxiliary boiler and process heaters assume operation at full design capacity, firing natural gas; however, the equipment may not always fire at full load, and in many cases, will be firing a lower-BTU fuel gas mixture instead of
[2] $SO_2$ emissions from the Firewater Pump are are based on burning ultra-low sulfur diesel (15 ppm).
[3] Flare emissions include pilot emissions for 8760 hr/yr.

**Malfunctions and Other Events**

| | | | Operation | Potential Emissions (tons) | | | | | HAPs Emissions (tpy) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID No. | Description | Usage | (hours)[1] | $NO_x$ | CO | VOC | $SO_2$ | $PM_{10}$ | 1,3-Butadiene | Acetaldehyde | Acrolein | 2,2,4-Trimethylpentane | Benzene | Carbonyl Sulfide | Dichlorobenzene | Ethyl Benzene | Formaldehyde | Hexane | Mercury | Methanol | Naphthalene | Propylene Oxide | Toluene | Xylene | TOTALS |
| CO2 VS | CO2 Vent Stack | CO2 Vent Stack | 50 | | 83.97 | 0.23 | | | | | | | | 2.25E-01 | | | | | | | | | | | 2.25E-01 |
| FL-1 | HP / Emergency Flare | Flare, 0.816 MMBtu/hr | 40 | 7.83 | 64.99 | 0.12 | 150.16 | | | | | | | | | | | | | | | | | | 0.00E+00 |
| FL-2 | LP Flare | Flare, 0.204 MMBtu/hr | 8 | 1.15E-02 | 2.25E-04 | 6.79E-04 | 14.40 | | | | | | | | | | | | | | | | | | |
| GP-1 | Gasification Preheater | Heater, 21.00 MMBtu/hr | 500 | 0.26 | 0.43 | 0.03 | 3.09E-03 | 0.04 | | | | | 1.08E-05 | | 6.18E-06 | | 3.86E-04 | 9.26E-03 | | | | | 1.75E-05 | | 9.69E-03 |

Notes:
[1] The hours shown are annual estimates, except for the Gasification Preheater which is based on 500 hours per preheating event for one gasifier.

Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant
Emission Summary Sheet

### Initial Year Including Cold Startup Emissions

This sheet includes total emissions from a cold startup (second set of emissions) and from the remainder of the initial year of operations. The total emissions shown at the bottom of this sheet provide the total emissions for the initial year (or any year with a cold startup).

#### Normal Operations (After Startup)

| | | | | Potential Emissions (tpy) | | | | | HAPs Emissions (tpy) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID No. | Description | Usage | Normal Operating Hours After Startup (hr/yr) | $NO_x$ | CO | VOC | $SO_2$ | $PM_{10}$ | 1,3-Butadiene | Acetaldehyde | Acrolein | 2,2,4-Trimethylpentane | Benzene | Carbonyl Sulfide | Dichlorobenzene | Ethyl Benzene | Formaldehyde | Hexane | Mercury | Methanol | Naphthalene | PAH | Propylene Oxide | Toluene | Xylene | TOTALS |
| CT-1 | Turbine and HRSG Train 1 | General Electric, 66 MW | 7,760 | 67.20 | 40.92 | 5.84 | 9.56 | 38.80 | 1.21E-03 | 1.12E-01 | 1.80E-02 | | 3.37E-02 | | | 9.00E-02 | 2.00E-01 | | 1.09E-04 | | 3.66E-03 | 6.19E-03 | 8.16E-02 | 3.66E-01 | 1.80E-01 | 1.09E+00 |
| CT-2 | Turbine and HRSG Train 2 | General Electric, 66 MW | 7,760 | 67.20 | 40.92 | 5.84 | 9.56 | 38.80 | 1.21E-03 | 1.12E-01 | 1.80E-02 | | 3.37E-02 | | | 9.00E-02 | 2.00E-01 | | 1.09E-04 | | 3.66E-03 | 6.19E-03 | 8.16E-02 | 3.66E-01 | 1.80E-01 | 1.09E+00 |
| CT-3 | Turbine and HRSG Train 3 | General Electric, 66 MW | 7,760 | 67.20 | 40.92 | 5.84 | 9.56 | 38.80 | 1.21E-03 | 1.12E-01 | 1.80E-02 | | 3.37E-02 | | | 9.00E-02 | 2.00E-01 | | 1.09E-04 | | 3.66E-03 | 6.19E-03 | 8.16E-02 | 3.66E-01 | 1.80E-01 | 1.09E+00 |
| AB | Auxiliary Boiler | Heater, 66 MMBtu/hr [1] | 8,760 | 14.17 | 23.81 | 1.56 | 0.17 | 2.15 | | | | | 5.95E-04 | | 3.40E-04 | | 2.13E-02 | 5.10E-01 | | | 1.73E-04 | | | 9.64E-04 | | 5.33E-01 |
| B-1 | Catalyst Regenerator Heater | Heater, 21.53 MMBtu/hr [1,2] | 8,760 | 4.62 | 7.77 | 0.51 | 0.08 | 0.70 | | | | | 1.94E-04 | | 1.11E-04 | | 6.93E-03 | 1.66E-01 | | | 5.64E-05 | | | 3.14E-04 | | 1.74E-01 |
| B-2 | Reactivation Heater | Heater, 12 MMBtu/hr [1] | 8,760 | 2.67 | 4.49 | 0.29 | 0.03 | 0.41 | | | | | 1.12E-04 | | 6.42E-05 | | 4.01E-03 | 9.62E-02 | | | 3.26E-05 | | | 1.82E-04 | | 1.01E-01 |
| B-3 | HGT Reactor Charge Heater | Heater, 2 MMBtu/hr [1] | 8,760 | 0.48 | 0.80 | 0.05 | 0.01 | 0.07 | | | | | 2.00E-05 | | 1.14E-05 | | 7.15E-04 | 1.72E-02 | | | 5.82E-06 | | | 3.24E-05 | | 1.79E-02 |
| Tanks | Storage Tanks | Product Storage | 8,760 | | | 102.62 | | | | | | | 5.27E-01 | | | 3.79E-02 | | 4.95E-01 | | 2.39E+00 | | | | 5.67E-01 | 1.60E-01 | 4.17E+00 |
| EL | Equipment Leaks | Fugitives | 8,760 | | | 71.32 | | | | | | | 1.04E+01 | 2.60E-01 | | | | | | 1.04E+01 | | | | | | 2.11E+01 |
| CS | Coal Storage & Processing | Conveyance (point) & Fugitives | 8,760 | | | | | 61.08 | | | | | | | | | | | | | | | | | | 0.00E+00 |
| FW-Pump | Firewater Pump [3] | Engine, 575 HP | 500 | 1.61 | 0.09 | 0.34 | 1.52E-03 | 0.02 | 3.77E-05 | 7.39E-04 | 8.91E-05 | | 8.99E-04 | | | | 1.14E-03 | | | | 8.17E-05 | | 2.49E-03 | 3.94E-04 | 2.75E-04 | 6.14E-03 |
| FL-1 | HP / Emergency Flare [4] | Flare Pilot, 0.816 MMBtu/hr | 8,760 | 0.49 | 0.98 | 2.97 | 2.10E-03 | | | | | | | | | | | | | | | | | | | 0.00E+00 |
| FL-2 | LP Flare [4] | Flare Pilot, 0.204 MMBtu/hr | 8,760 | 0.12 | 0.25 | 0.74 | 0.00 | | | | | | | | | | | | | | | | | | | |
| *Total Emissions (Partial Year of Normal Operations)* | | - | - | 225.65 | 160.94 | 197.92 | 28.95 | 180.84 | 3.67E-03 | 3.38E-01 | 5.41E-02 | 0.00E+00 | 1.11E+01 | 2.60E-01 | 5.27E-04 | 3.08E-01 | 6.33E-01 | 1.29E+00 | 3.28E-04 | 1.28E+01 | 1.13E-02 | 1.86E-02 | 2.47E-01 | 1.67E+00 | 7.00E-01 | 29.36 |

Notes:

[1] Emissions from auxiliary boiler and process heaters assume operation at full design capacity, firing natural gas; however, the equipment may not always fire at full load, and in many cases, will be firing a lower-BTU fuel gas mixture instead of natural gas.
During startup periods, the equiment will fire natural gas, and may or may not operate at full capacity. Emissions are based on operation at full load and 8,760 hrs/year as a conservative estimate.

[2] The catalyst regenerator heater (B-1) will not operate during startup conditions; it will operate only during times of normal facility operation. Therefore, in a startup year, the heater will operate less than 8,760 hrs. A full year of operation is assumed as a conservative emission estimate.

[3] $SO_2$ emissions from the Firewater Pump are are based on burning ultra-low sulfur diesel (15 ppm).

[4] Flare emissions include pilot emissions for 8760 hr/yr.

#### Cold Startup

| | | | | Potential Emissions (tpy) | | | | | HAPs Emissions (tpy) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID No. | Description | Usage | Startup Operating Hours (hr/yr) | $NO_x$ | CO | VOC | $SO_2$ | $PM_{10}$ | 1,3-Butadiene | Acetaldehyde | Acrolein | 2,2,4-Trimethylpentane | Benzene | Carbonyl Sulfide | Dichlorobenzene | Ethyl Benzene | Formaldehyde | Hexane | Mercury | Methanol | Naphthalene | PAH | Propylene Oxide | Toluene | Xylene | TOTALS |
| CT-1 | Turbine and HRSG Train 1 | General Electric, 66 MW | 1,000 | 9.48 | 5.69 | 0.81 | 1.33 | 5.00 | 1.69E-04 | 1.57E-02 | 2.51E-03 | | 4.71E-03 | | | 1.26E-02 | 2.79E-02 | | 1.52E-05 | | 5.10E-04 | 8.64E-04 | 1.14E-02 | 5.10E-02 | 2.51E-02 | 1.52E-01 |
| CT-2 | Turbine and HRSG Train 2 | General Electric, 66 MW | 1,000 | 9.48 | 5.69 | 0.81 | 1.33 | 5.00 | 1.69E-04 | 1.57E-02 | 2.51E-03 | | 4.71E-03 | | | 1.26E-02 | 2.79E-02 | | 1.52E-05 | | 5.10E-04 | 8.64E-04 | 1.14E-02 | 5.10E-02 | 2.51E-02 | 1.52E-01 |
| CT-3 | Turbine and HRSG Train 3 | General Electric, 66 MW | 1,000 | 9.48 | 5.69 | 0.81 | 1.33 | 5.00 | 1.69E-04 | 1.57E-02 | 2.51E-03 | | 4.71E-03 | | | 1.26E-02 | 2.79E-02 | | 1.52E-05 | | 5.10E-04 | 8.64E-04 | 1.14E-02 | 5.10E-02 | 2.51E-02 | 1.52E-01 |
| Gen-1 | Black-Start Generator | Caterpillar, 2889 HP | 360 | 1.15 | 2.79 | 1.03 | 2.06E-03 | 2.71E-04 | 9.37E-04 | 2.93E-02 | 1.80E-02 | 8.77E-04 | 7.44E-04 | | | | 1.85E-01 | 3.90E-04 | | | | | | 1.43E-03 | 6.46E-04 | 2.38E-01 |
| Gen-2 | Black-Start Generator | Caterpillar, 2889 HP | 360 | 1.15 | 2.79 | 1.03 | 2.06E-03 | 2.71E-04 | 9.37E-04 | 2.93E-02 | 1.80E-02 | 8.77E-04 | 7.44E-04 | | | | 1.85E-01 | 3.90E-04 | | | | | | 1.43E-03 | 6.46E-04 | 2.38E-01 |
| Gen-3 | Black-Start Generator | Caterpillar, 2889 HP | 360 | 1.15 | 2.79 | 1.03 | 2.06E-03 | 2.71E-04 | 9.37E-04 | 2.93E-02 | 1.80E-02 | 8.77E-04 | 7.44E-04 | | | | 1.85E-01 | 3.90E-04 | | | | | | 1.43E-03 | 6.46E-04 | 2.38E-01 |
| GP-1 | Gasifier Preheater | Heater, 21.00 MMBtu/hr | 500 | 0.26 | 0.43 | 0.03 | 3.09E-03 | 0.04 | | | | | 1.08E-05 | | 6.18E-06 | | 3.86E-04 | 9.26E-03 | | | | | | 1.75E-05 | | 9.69E-03 |
| GP-2 | Gasifier Preheater | Heater, 21.00 MMBtu/hr | 500 | 0.26 | 0.43 | 0.03 | 3.09E-03 | 0.04 | | | | | 1.08E-05 | | 6.18E-06 | | 3.86E-04 | 9.26E-03 | | | | | | 1.75E-05 | | 9.69E-03 |
| GP-3 | Gasifier Preheater | Heater, 21.00 MMBtu/hr | 500 | 0.26 | 0.43 | 0.03 | 3.09E-03 | 0.04 | | | | | 1.08E-05 | | 6.18E-06 | | 3.86E-04 | 9.26E-03 | | | | | | 1.75E-05 | | 9.69E-03 |
| GP-4 | Gasifier Preheater | Heater, 21.00 MMBtu/hr | 500 | 0.26 | 0.43 | 0.03 | 3.09E-03 | 0.04 | | | | | 1.08E-05 | | 6.18E-06 | | 3.86E-04 | 9.26E-03 | | | | | | 1.75E-05 | | 9.69E-03 |
| GP-5 | Gasifier Preheater | Heater, 21.00 MMBtu/hr | 500 | 0.26 | 0.43 | 0.03 | 3.09E-03 | 0.04 | | | | | 1.08E-05 | | 6.18E-06 | | 3.86E-04 | 9.26E-03 | | | | | | 1.75E-05 | | 9.69E-03 |
| CO2 VS | CO2 Vent Stack | CO2 Vent Stack | 250 | | 314.89 | 0.84 | | | | | | | | 8.44E-01 | | | | | | | | | | | | 8.44E-01 |
| FL-1 | HP / Emergency Flare [1] | Venting to Flare, 0.816 MMBtu/hr | 50 | 9.78 | 80.88 | 0.14 | 187.70 | | | | | | | | | | | | | | | | | | | 0.00E+00 |
| FL-2 | LP Flare [1] | Venting to Flare, 0.204 MMBtu/hr | 20 | 0.03 | 0.19 | 0.00 | 36.01 | | | | | | | | | | | | | | | | | | | 0.00E+00 |
| *Total Emissions (Cold Startup Only, Partial Year)* | | | | 42.99 | 423.55 | 6.64 | 227.74 | 15.20 | 3.32E-03 | 1.35E-01 | 6.16E-02 | 2.63E-03 | 1.64E-02 | 8.44E-01 | 3.09E-05 | 3.77E-02 | 6.41E-01 | 4.75E-02 | 4.55E-05 | 0.00E+00 | 1.53E-03 | 2.59E-03 | 3.42E-02 | 1.57E-01 | 7.73E-02 | 2.08 |

Notes:

[1] Flare operating hours include cold startup and malfunctions. Up to 50 hr/yr of venting to the HP Flare and up to 20 hr/yr of venting to the LP Flare are included. Pilot emissions are included above in the Normal Operations summary.

| | Potential Emissions (tpy) | | | | | HAPs Emissions (tpy) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $NO_x$ | CO | VOC | $SO_2$ | $PM_{10}$ | 1,3-Butadiene | Acetaldehyde | Acrolein | 2,2,4-Trimethylpentane | Benzene | Carbonyl Sulfide | Dichlorobenzene | Ethyl Benzene | Formaldehyde | Hexane | Mercury | Methanol | Naphthalene | PAH | Propylene Oxide | Toluene | Xylene | TOTALS |
| TOTAL EMISSIONS FOR COLD STARTUP YEAR | 268.64 | 584.48 | 204.58 | 255.69 | 196.04 | 0.01 | 0.47 | 0.12 | 0.00 | 11.08 | 1.10 | 0.00 | 0.35 | 1.27 | 1.33 | 0.00 | 12.79 | 0.01 | 0.02 | 0.28 | 1.82 | 0.78 | 31.44 |

Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant
Saddleback Hills Mine - Mine Emissions Summary ($PM_{10}$)

| Project Year | Notes | South Portal $PM_{10}$ (tpy) | | | East Portal $PM_{10}$ (tpy) | | | Totals $PM_{10}$ (tpy) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | point | road haul | other fugitives | point | road haul | other fugitives | point | road haul | other fugitives | Grand Total |
| Year 1 | No plant operations during this year | 0 | 26.80 | 3.04 | 0 | 0 | 0 | 0.00 | 26.80 | 3.04 | 29.84 |
| Year 2 | No plant operations during this year | 0 | 109.31 | 5.17 | 0 | 0 | 0 | 0.00 | 109.31 | 5.17 | 114.48 |
| Year 3 | Partial plant operations during this year | 0 | 71.63 | 4.20 | 0.10 | 0 | 10.51 | 0.10 | 71.63 | 14.70 | 86.43 |
| Year 4 | Plant operations have begun. | 0 | 0 | 0 | 0.86 | 0 | 60.23 | 0.86 | 0.00 | 60.23 | 61.08 |

Additional Comments:

South Portal emission sources are fugitives and road haul (transport) to Seminoe II processing area.
At South Portal, fugitives are from coal stackout, wind erosion from stockpile, and truck loading via front-end loader.
South Portal emissions are due to mine development activity; after plant operations commence, emissions from South Portal are expected to cease.

East Portal emissions are fugitive and point sources. No transport from East Portal to offsite processing is planned.
Fugitive emissions are from stackout, wind erosion from stockpiles, and dozer reclaim to conveyor belt (from emergency stockpile).
Point source emissions are from conveyor drop points, controlled with water fogger.
East Portal Conveyors C1 through C10 will be completely enclosed.
East Portal Conveyors C6 through C10 will have three-quarter (3/4) cover, rather than being completely enclosed.

Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant
Saddleback Hills Mine - Emissions from On-Site Fuel Combustion

| Development Year | Carbon Basin Mine (2004 Application) | | | Percentage to SBH Mine [1] | SBH Mine South Portal | | | SBH Mine East Portal[2] |
|---|---|---|---|---|---|---|---|---|
| | NOx [tpy] | CO [tpy] | SO2 [tpy] | | NOx [tpy] | CO [tpy] | SO2 [tpy] | NOx, CO, SO2 [tpy] |
| Year 1 | 238.7 | 200.4 | 4.1 | 5% | 12 | 10 | 0.2 | 0 |
| Year 2 | 238.7 | 200.4 | 4.1 | 5% | 12 | 10 | 0.2 | 0 |
| Year 3 | 238.7 | 200.4 | 4.1 | 5% | 12 | 10 | 0.2 | 0 |
| Year 4 | 238.7 | 200.4 | 4.1 | 5% | 0 | 0 | 0 | Negl |

Notes

1. Percentage assumed attributable to on-site fuel combustion at SBH Mine. Previous fuel consumption values were based on coal transfer operations at SBH Mine to support mine plan to transport and sell coal at offsite location. Due to mine plan changes, the amount of fuel consumption is expected to be less than originally planned.
2. During development years, no on-site fuel combustion is expected at East Portal. Once normal Plant operations begin in Year 4, some on-site fuel combustion may occur as a result of moving coal from the emergency (dead) stockpile to the conveying system. However, this is expected to be an infrequent activity; thus, annual emissions will be negligible.

# Saddleback Hills Mine – Emission Calculations

## Year One

**Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant**
**Saddleback Hills Detail Sheet - South Portal Emissions**
**Fugitive Emissions**

Production Rates are based on the 2007 Mine Plan Revisions
Total production, Years 1-3 2,538,000 tons

**Development Emission Summary (South Portal)**

| Year | Coal Handling Emissions | Transportation Fugitive Emissions |
|---|---|---|
| | PM10 (tpy) | PM10 (tpy) |
| 1 | 3.04 | 26.8 |
| 2 | 5.17 | 109.3 |
| 3 | 4.20 | 71.6 |

**Year 1**



**Production rate =** 218,000 tpy; All coal to be sold at Hanna, WY

## Emissions from handling coal at South Portal - stackout and truck loading

| | | | | |
|---|---|---|---|---|
| **Coal Stacker** | **Coal Dumping to Stockpile** | **Temporary, portable stacker (stacking tube)** | | Fugitive |
| | Emission Factor | 0.017 Lb/Ton | *WDEQ Emission Factor* | |
| | % Suspended | 0.75 | *WDEQ Emission Factor* | |
| | Control Factor | 50.00% | *Estimated* | |
| | Material Dumped | 218,000 Tons/Yr | *Total Coal Through Storage* | |
| | TSP Emissions | 0.69 Tons/Yr | *E=(EFx% sus x MD/2000)x(1-CF)* | |
| | **PM-10 Emissions** | **0.21 Tons/Yr** | *30% of TSP* | |
| **Coal Stockpile** | **Wind Erosion on Stockpiles** | **Water** | | Fugitive |
| | Emission Factor | 1.2 Lb/Acre/Hr | *WDEQ Emission Factor* | |
| | Pile Size | 1.0 Acres | *Estimate (assume 10,000 ton pile)* | |
| | Fraction Suspended | 0.75 | *WDEQ Emission Factor* | |
| | Hours | 8,760 Hours | *Total Annual* | |
| | Ave. Wind Speed | 5.03 meters/Sec | *Adjusted for in-pit* | |
| | Wet Days | 60 | *Seminoe Mine 5-Year Average* | |
| | Control Factor | 50% | *assumed* | |
| | TSP Emissions | 8.28 Tons/Yr | *E=(EF x AWS x %sus x PS x* | |
| | **PM-10 Emissions** | **2.48 Tons/Yr** | *((365-WD)/365) x (1-CF))/2000* | |
| **Dozer Reclaim** | **Cat D11 Dozer to Trucks** | **No emisson controls** | | Fugitive |
| | Emission Factor | 8.0 Lb/Hr | *WDEQ 2002 Guidance* | |
| | Total Throughput | 218,000 Tons/Yr | *Total Coal Through Storage* | |
| | Dozed Throughput | 218,000 Tons/Yr | | |
| | Dozer Productivity | 750 Tons/Hr | *Estimate* | |
| | Operating Hrs | 291 Hrs | *Productivity/Throughput* | |
| | TSP Emissions | 1.16 Tons/Yr | E=(EF x Op Hrs)/2000 | |
| | **PM-10 Emissions** | **0.35 Tons/Yr** | 30% of TSP | |

**Total South Portal $PM_{10}$ Emissions**

$PM_{10}$ = 3.04 tpy
0.087 g/sec

Conversions:

| | |
|---|---|
| 453.6 g/lb | 8760 hr/yr |
| 2000 lb/ton | 3600 sec/hr |

Year 1

Production rate = 218,000 tpy; All coal to be sold at Hanna, WY

## Emissions from the transport of coal with highway trucks on plant roads (South Portal to Seminoe II)

These roadways are reconstructed gravel roads for the purpose of connecting loadout with public roads using Wyoming hauling emission factor, with a tire factor adjustment for highway hauler

| Input Data | | | Reference |
|---|---|---|---|
| Plant road silt content (s) = | 5.1 | % | AP-42 table 13.2.2-1 (gravel-upgraded roadway) |
| Tire factor = | 3.5 | | Assuming each pair is equivalent to a single large truck tire, a truck and pup combination have 14 equivalent tires, for a tire factor of 14/4 = 3.5 |
| Mean speed | 40 | mph | Mine estimate |
| Grader hrs - Carbon Basin Road | 975 | hrs | |
| Grader hrs - Seminoe II Road | 2,000 | hrs | |

Conversions:

| | |
|---|---|
| 453.6 g/lb | 8760 hr/yr |
| 2000 lb/ton | 3600 s/hr |

| *CARBON BASIN COAL TRANSPORT ROAD* | | | *SEMINOE II COAL TRANSPORT ROAD* | | |
|---|---|---|---|---|---|
| Emission Factor | 11.57 | lb/VMT | Emission Factor | 11.57 | lb/VMT |
| Number of Wet Days | 100 | | Number of Wet Days | 100 | |
| Truck Capacity | 70 | tons | Truck Capacity | 70 | tons |
| Truck Speed | 40 | mph | Truck Speed | 40 | mph |
| Surface Silt Content | 5.1 | % | Surface Silt Content | 5.1 | % |
| Tire Correction Factor | 3.5 | | Tire Correction Factc | 3.5 | |
| Percent Suspended (%) | 62 | | Percent Suspended ( | 62 | |
| Control Factor (%) | 60 | | Control Factor (%) | 60 | |
| Control Method | Water/Chemicals | | Control Method | Water/Chemicals | |
| Coal Hauled | 0.218 | MMtpy | Coal Hauled | 0.218 | MMtpy |
| Vehicle Miles Traveled | 18,686 | VMT | Vehicle Miles Travel | 12,457 | VMT |
| RT Haul Distance | 6.0 | miles | RT Haul Distance | 4.0 | miles |
| PM-10 Emissions (tpy) | 12.97 | | PM-10 Emissions (tp | 8.648 | |

| *CARBON BASIN TRANSPORT ROAD REPAIR* | | | *SEMINOE II TRANSPORT ROAD REPAIR* | | |
|---|---|---|---|---|---|
| Emission Factor | 32 | lb/hr | Emission Factor | 32 | lb/hr |
| Number of Wet Days | 100 | | Number of Wet Days | 100 | |
| Control Factor (%) | 50 | | Control Factor (%) | 50 | |
| Control Method | Water | | Control Method | Water | |
| Grader Hours/Year | 975 | | Grader Hours/Year | 2,000 | |
| PM-10 Emissions (tpy) | 1.70 | | PM-10 Emissions (tp | 3.48 | |

*CARBON BASIN TRANSPORT ROAD EMISSIONS*

| TOTALS | PM10 | TSP |
|---|---|---|
| tpy | 14.7 | 48.9 |
| g/s | 0.4 | 1.4 |

*SEMINOE II TRANSPORT ROAD EMISSIONS*

| TOTALS | PM10 | TSP |
|---|---|---|
| tpy | 12.1 | 40.4 |
| g/s | 0.3 | 1.2 |

Saddleback Hills Mine – Emission Calculations

Year Two

**Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant**
**Saddleback Hills Detail Sheet - South Portal Emissions**
**Fugitive Emissions**

Production Rates are based on the 2007 Mine Plan Revisions

Total production, Years 1-3 2,538,000 tons

**Development Emission Summary (South Portal)**

| Year | Coal Handling Emissions | Transportation Fugitive Emissions |
|---|---|---|
| | PM10 (tpy) | PM10 (tpy) |
| 1 | 3.04 | 26.8 |
| 2 | 5.17 | 109.3 |
| 3 | 4.20 | 71.6 |



**Year 2**

**Production rate =** 1,050,000 tpy; All coal to be sold at Hanna, WY

**Emissions from handling coal at South Portal - stackout and truck loading**

| | | | | |
|---|---|---|---|---|
| **Coal Stacker** | **Coal Dumping to Stockpile** | **Temporary, portable stacker (stacking tube)** | | Fugitive |
| | Emission Factor | 0.017 Lb/Ton | *WDEQ Emission Factor* | |
| | % Suspended | 0.75 | *WDEQ Emission Factor* | |
| | Control Factor | 50.00% | *Estimated* | |
| | Material Dumped | 1,050,000 Tons/Yr | *Total Coal Through Storage* | |
| | TSP Emissions | 3.35 Tons/Yr | *E=(EFx% sus x MD/2000)x(1-CF)* | |
| | **PM-10 Emissions** | **1.00 Tons/Yr** | *30% of TSP* | |
| **Coal Stockpile** | **Wind Erosion on Stockpiles** | **Water** | | Fugitive |
| | Emission Factor | 1.2 Lb/Acre/Hr | *WDEQ Emission Factor* | |
| | Pile Size | 1.0 Acres | *Estimate (assume 10,000 ton pile)* | |
| | Fraction Suspended | 0.75 | *WDEQ Emission Factor* | |
| | Hours | 8,760 Hours | *Total Annual* | |
| | Ave. Wind Speed | 5.03 meters/Sec | *Adjusted for in-pit* | |
| | Wet Days | 60 | *Seminoe Mine 5-Year Average* | |
| | Control Factor | 50% | *assumed* | |
| | TSP Emissions | 8.28 Tons/Yr | *E=(EF x AWS x %sus x PS x* | |
| | **PM-10 Emissions** | **2.48 Tons/Yr** | *((365-WD)/365) x (1-CF))/2000* | |
| **Dozer Reclaim** | **Cat D11 Dozer to Trucks** | **No emisson controls** | | Fugitive |
| | Emission Factor | 8.0 Lb/Hr | *WDEQ 2002 Guidance* | |
| | Total Throughput | 1,050,000 Tons/Yr | *Total Coal Through Storage* | |
| | Dozed Throughput | 1,050,000 Tons/Yr | | |
| | Dozer Productivity | 750 Tons/Hr | *Estimate* | |
| | Operating Hrs | 1,400 Hrs | *Productivity/Throughput* | |
| | TSP Emissions | 5.60 Tons/Yr | E=(EF x Op Hrs)/2000 | |
| | **PM-10 Emissions** | **1.68 Tons/Yr** | 30% of TSP | |

Total South Portal $PM_{10}$ Emissions

$PM_{10}$ = 5.17 tpy
0.149 g/sec

Conversions:

| | |
|---|---|
| 453.6 g/lb | 8760 hr/yr |
| 2000 lb/ton | 3600 sec/hr |

**Year 2**

**Production rate =** 1,050,000 tpy; All coal to be sold at Hanna, WY

## Emissions from the transport of coal with highway trucks on plant roads (South Portal to Seminoe II)

These roadways are reconstructed gravel roads for the purpose of connecting loadout with public roads using Wyoming hauling emission factor, with a tire factor adjustment for highway hauler

| Input Data | | Reference |
|---|---|---|
| Plant road silt content (s) = | 5.1 % | AP-42 table 13.2.2-1 (gravel-upgraded roadway) |
| Tire factor = | 3.5 | Assuming each pair is equivalent to a single large truck tire, a truck and pup combination have 14 equivalent tires, for a tire factor of 14/4 = 3.5 |
| Mean speed | 40 mph | Mine estimate |
| Grader hrs - Carbon Basin Road | 975 hrs | |
| Grader hrs - Seminoe II Road | 2,000 hrs | Conversions: |

Conversions:

| | |
|---|---|
| 453.6 g/lb | 8760 hr/yr |
| 2000 lb/ton | 3600 s/hr |

*CARBON BASIN COAL TRANSPORT ROAD*

| | |
|---|---|
| Emission Factor | 11.57 lb/VMT |
| Number of Wet Days | 100 |
| Truck Capacity | 70 tons |
| Truck Speed | 40 mph |
| Surface Silt Content | 5.1 % |
| Tire Correction Factor | 3.5 |
| Percent Suspended (%) | 62 |
| Control Factor (%) | 60 |
| Control Method | Water/Chemicals |
| Coal Hauled | 1.050 MMtpy |
| Vehicle Miles Traveled | 90,000 VMT |
| RT Haul Distance | 6.0 miles |
| PM-10 Emissions (tpy) | 62.48 |

*SEMINOE II COAL TRANSPORT ROAD*

| | |
|---|---|
| Emission Factor | 11.57 lb/VMT |
| Number of Wet Day: | 100 |
| Truck Capacity | 70 tons |
| Truck Speed | 40 mph |
| Surface Silt Content | 5.1 % |
| Tire Correction Factc | 3.5 |
| Percent Suspended ( | 62 |
| Control Factor (%) | 60 |
| Control Method | Water/Chemicals |
| Coal Hauled | 1.050 MMtpy |
| Vehicle Miles Travel | 60,000 VMT |
| RT Haul Distance | 4.0 miles |
| PM-10 Emissions (tp | 41.652 |

*CARBON BASIN TRANSPORT ROAD REPAIR*

| | |
|---|---|
| Emission Factor | 32 lb/hr |
| Number of Wet Days | 100 |
| Control Factor (%) | 50 |
| Control Method | Water |
| Grader Hours/Year | 975 |
| PM-10 Emissions (tpy) | 1.70 |

*SEMINOE II TRANSPORT ROAD REPAIR*

| | |
|---|---|
| Emission Factor | 32 lb/hr |
| Number of Wet Day: | 100 |
| Control Factor (%) | 50 |
| Control Method | Water |
| Grader Hours/Year | 2,000 |
| PM-10 Emissions (tp | 3.48 |

*CARBON BASIN TRANSPORT ROAD EMISSIONS*

| TOTALS | PM10 | TSP |
|---|---|---|
| tpy | 64.2 | 213.9 |
| g/s | 1.8 | 6.2 |

*SEMINOE II TRANSPORT ROAD EMISSIONS*

| TOTALS | PM10 | TSP |
|---|---|---|
| tpy | 45.1 | 150.5 |
| g/s | 1.3 | 4.3 |

# Saddleback Hills Mine – Emission Calculations

## Year Three

**Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant**
**Saddleback Hills Detail Sheet - South Portal Emissions**
**Fugitive Emissions**

Production Rates are based on the 2007 Mine Plan Revisions
Total production, Years 1-3 2,538,000 tons

**Development Emission Summary (South Portal)**

| Year | Coal Handling Emissions | Transportation Fugitive Emissions |
|---|---|---|
| | PM10 (tpy) | PM10 (tpy) |
| 1 | 3.04 | 26.8 |
| 2 | 5.17 | 109.3 |
| 3 | 4.20 | 71.6 |

**Year 3**



**Production rate =** 1,270,000 tpy; 600,000 tons to be sent via underground tunnel to East Portal
670,000 tpy of remaining coal to be sold at Hanna, WY from South Portal

## Emissions from handling coal at South Portal - stackout and truck loading

| | | | | |
|---|---|---|---|---|
| **Coal Stacker** | **Coal Dumping to Stockpile** | **Temporary, portable stacker (stacking tube)** | | Fugitive |
| | Emission Factor | 0.017 Lb/Ton | *WDEQ Emission Factor* | |
| | % Suspended | 0.75 | *WDEQ Emission Factor* | |
| | Control Factor | 50.00% | *Estimated* | |
| | Material Dumped | 670,000 Tons/Yr | *Total Coal Through Storage* | |
| | TSP Emissions | 2.14 Tons/Yr | *E=(EFx% sus x MD/2000)x(1-CF)* | |
| | **PM-10 Emissions** | **0.64 Tons/Yr** | *30% of TSP* | |
| **Coal Stockpile** | **Wind Erosion on Stockpiles** | **Water** | | Fugitive |
| | Emission Factor | 1.2 Lb/Acre/Hr | *WDEQ Emission Factor* | |
| | Pile Size | 1.0 Acres | *Estimate (assume 10,000 ton pile)* | |
| | Fraction Suspended | 0.75 | *WDEQ Emission Factor* | |
| | Hours | 8,760 Hours | *Total Annual* | |
| | Ave. Wind Speed | 5.03 meters/Sec | *Adjusted for in-pit* | |
| | Wet Days | 60 | *Seminoe Mine 5-Year Average* | |
| | Control Factor | 50% | *assumed* | |
| | TSP Emissions | 8.28 Tons/Yr | *E=(EF x AWS x %sus x PS x* | |
| | **PM-10 Emissions** | **2.48 Tons/Yr** | *((365-WD)/365) x (1-CF))/2000* | |
| **Dozer Reclaim** | **Cat D11 Dozer to Trucks** | **No emisson controls** | | Fugitive |
| | Emission Factor | 8.0 Lb/Hr | *WDEQ 2002 Guidance* | |
| | Total Throughput | 670,000 Tons/Yr | *Total Coal Through Storage* | |
| | Dozed Throughput | 670,000 Tons/Yr | | |
| | Dozer Productivity | 750 Tons/Hr | *Estimate* | |
| | Operating Hrs | 893 Hrs | *Productivity/Throughput* | |
| | TSP Emissions | 3.57 Tons/Yr | E=(EF x Op Hrs)/2000 | |
| | **PM-10 Emissions** | **1.07 Tons/Yr** | 30% of TSP | |

**Total South Portal $PM_{10}$ Emissions**

$PM_{10}$ = 4.20 tpy
0.121 g/sec

Conversions:

| | |
|---|---|
| 453.6 g/lb | 8760 hr/yr |
| 2000 lb/ton | 3600 sec/hr |

**Year 3**

**Production rate =** 1,270,000 tpy; 600,000 tons to be sent via underground tunnel to East Portal

## Emissions from the transport of coal with highway trucks on plant roads (South Portal to Seminoe II)

These roadways are reconstructed gravel roads for the purpose of connecting loadout with public roads using Wyoming hauling emission factor, with a tire factor adjustment for highway hauler

| Input Data | | | Reference |
|---|---|---|---|
| Plant road silt content (s) = | 5.1 | % | AP-42 table 13.2.2-1 (gravel-upgraded roadway) |
| Tire factor = | 3.5 | | Assuming each pair is equivalent to a single large truck tire, a truck and pup combination have 14 equivalent tires, for a tire factor of 14/4 = 3.5 |
| Mean speed | 40 | mph | Mine estimate |
| Grader hrs - Carbon Basin Road | 975 | hrs | |
| Grader hrs - Seminoe II Road | 2,000 | hrs | |

Conversions:

| | |
|---|---|
| 453.6 g/lb | 8760 hr/yr |
| 2000 lb/ton | 3600 s/hr |

*CARBON BASIN COAL TRANSPORT ROAD*

| | | |
|---|---|---|
| Emission Factor | 11.57 | lb/VMT |
| Number of Wet Days | 100 | |
| Truck Capacity | 70 | tons |
| Truck Speed | 40 | mph |
| Surface Silt Content | 5.1 | % |
| Tire Correction Factor | 3.5 | |
| Percent Suspended (%) | 62 | |
| Control Factor (%) | 60 | |
| Control Method | Water/Chemicals | |
| Coal Hauled | 0.670 | MMtpy |
| Vehicle Miles Traveled | 57,429 | VMT |
| RT Haul Distance | 6.0 | miles |
| PM-10 Emissions (tpy) | 39.87 | |

*SEMINOE II COAL TRANSPORT ROAD*

| | | |
|---|---|---|
| Emission Factor | 11.57 | lb/VMT |
| Number of Wet Days | 100 | |
| Truck Capacity | 70 | tons |
| Truck Speed | 40 | mph |
| Surface Silt Content | 5.1 | % |
| Tire Correction Factc | 3.5 | |
| Percent Suspended ( | 62 | |
| Control Factor (%) | 60 | |
| Control Method | Water/Chemicals | |
| Coal Hauled | 0.670 | MMtpy |
| Vehicle Miles Travel | 38,286 | VMT |
| RT Haul Distance | 4.0 | miles |
| PM-10 Emissions (tp | 26.578 | |

*CARBON BASIN TRANSPORT ROAD REPAIR*

| | | |
|---|---|---|
| Emission Factor | 32 | lb/hr |
| Number of Wet Days | 100 | |
| Control Factor (%) | 50 | |
| Control Method | Water | |
| Grader Hours/Year | 975 | |
| PM-10 Emissions (tpy) | 1.70 | |

*SEMINOE II TRANSPORT ROAD REPAIR*

| | | |
|---|---|---|
| Emission Factor | 32 | lb/hr |
| Number of Wet Days | 100 | |
| Control Factor (%) | 50 | |
| Control Method | Water | |
| Grader Hours/Year | 2,000 | |
| PM-10 Emissions (tp | 3.48 | |

*CARBON BASIN TRANSPORT ROAD EMISSIONS*

| TOTALS | PM10 | TSP |
|---|---|---|
| tpy | 41.6 | 138.6 |
| g/s | 1.2 | 4.0 |

*SEMINOE II TRANSPORT ROAD EMISSIONS*

| TOTALS | PM10 | TSP |
|---|---|---|
| tpy | 30.1 | 100.2 |
| g/s | 0.9 | 2.9 |

**Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant**
**Saddleback Hills Mine - East Portal, Point Source Emissions**
**Point Source Emissions**

Production Rates are based on the 2007 Mine Plan Revisions

Activity at East Portal: bring coal out from underground mine; material handling, screening, send to gasifier (following Plant startup in Year 4). During Development Years 1-3, coal will be stockpiled; at start of Plant operations, coal will be directed to gasifier.

**Year 3**

**Production rate =** 300,000 tpy; to "run of mine" stockpiles (no coal to plant gasifiers)
300,000 tpy; to emergency (bankers) stockpile (no coal to plant gasifiers)

Material Handling Emissions (coal):

$PM_{10}$ = k (.0032) ((U/5)^1.3 / (M/2)^1.4) — *AP-42, Section 13.2.4 Aggregate handling factors*

k = 0.35 — *AP-42, Section 13.2.4 Aggregate handling factors*

U = 14 mph — *Seminoe II Measurement*

M = 6.9 % — *AP-42 Table13.2.4-1, Western Sfc Coal Mining, median*

$PM_{10}$ = 8E-04 *lb/ton*

**Conveying by belt from conveyor C1 to C2 (material transfer)** — **Controlled by fogger**

Fogger control value = 90% — *AP-42, Section 13.2.4.4*

$PM_{10}$ = 0.023 tpy

**Conveying by belt from conveyor C2 to C3 (material transfer)** — **Controlled by fogger**

Fogger control value = 90% — *AP-42, Section 13.2.4.4*

$PM_{10}$ = 0.02 tpy

**Conveying by belt from conveyor C3 to C4 (material transfer)** — **Controlled by fogger**

Fogger control value = 90% — *AP-42, Section 13.2.4.4*

$PM_{10}$ = 0.01 tpy

**Conveying by belt from reclaim conveyor C5 to C6 (material transfer)** — **Controlled by fogger**

Fogger control value = 90% — *AP-42, Section 13.2.4.4*

$PM_{10}$ = 0.01 tpy

**Conveying by belt from conveyor C6 to Screener (material transfer)** — **Controlled by fogger**

*Note: Conveyor C6 will be 3/4 covered, rather than completely enclosed.*

Fogger control value = 90% — *AP-42, Section 13.2.4.4*

$PM_{10}$ = 0.01 tpy

**Conveying by belt from Screener to conveyor C7 (material transfer)** — **Controlled by fogger**

*Note: Conveyor C7 will be 3/4 covered, rather than completely enclosed.*

Fogger control value = 90% — *AP-42, Section 13.2.4.4*

$PM_{10}$ = 0.01 tpy

**Conveying by belt from conveyor C7 to C8 (material transfer)** — **Controlled by fogger**

*Note: Conveyors C7, C8, & C9 will be 3/4 covered, rather than completely enclosed.*

Fogger control value = 90% — *AP-42, Section 13.2.4.4*

$PM_{10}$ = 0.01 tpy

**Conveying by belt from hopper to conveyor C10 material transfer)** — **Controlled by fogger**

*Note: Conveyor C10 will be 3/4 covered, rather than completely enclosed.*

Fogger control value = 90% — *AP-42, Section 13.2.4.4*

$PM_{10}$ = 0.01 tpy

**Total East Portal Point Source $PM_{10}$ Emissions**

$PM_{10}$ = 0.10 tpy
0.003 g/sec

Conversions:

| | |
|---|---|
| 453.6 g/lb | 8760 hr/yr |
| 2000 lb/ton | 3600 sec/hr |

**Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant**
**Saddleback Hills Mine, East Portal Fugitive Emissions**
**Fugitive Emission Calculations**
***(BACT Option: In-Pit Stacking Tubes)***

**Emissions starting in Year 3:** **300,000 tons to "run of mine" stockpiles**
**300,000 tons to emergency (bankers) stockpile**

| Emission Source | Description | | Control | Additional Information |
|---|---|---|---|---|
| **Dozer Reclaim** | **Cat D11 Dozer** | | **None** | |
| | Emission Factor | 8.0 | Lb/Hr | *WDEQ 2002 Guidance* |
| | Total Throughput | 0 | Tons/Yr | *No dozer reclaim in Year 3* |
| | Dozed Throughput | 0 | Tons/Yr | |
| | Dozer Productivity | 750 | Tons/Hr | *Estimate for 300,000 Ton Pile* |
| | Operating Hrs | 0 | Hrs | *Productivity/Throughput* |
| | TSP Emissions | 0.00 | Tons/Yr | E=(EF x Op Hrs)/2000 |
| | **PM-10 Emissions** | **0.00** | **Tons/Yr** | 30% of TSP |
| **Coal Stacker** | **Coal Dumping to Stockpile** | | **Stacking Tubes** | |
| | Emission Factor | 0.017 | Lb/Ton | *WDEQ Emission Factor* |
| | % Suspended | 0.75 | | *WDEQ Emission Factor* |
| | Control Factor | 50.00% | | *Estimated* |
| | Material Dumped | 600,000 | Tons/Yr | *Total Coal Through Storage* |
| | TSP Emissions | 1.91 | Tons/Yr | *E=(EFx% sus x MD/2000)x(1-CF)* |
| | **PM-10 Emissions** | **0.57** | **Tons/Yr** | *30% of TSP* |
| **Coal Reclaim** | **Vibratory & Pile Activator Feeder** | | **Passive Control** | |
| | Emission Factor | 0.017 | Lb/Ton | *WDEQ Emission Factor* |
| | % Suspended | 0.75 | | *WDEQ Emission Factor* |
| | Control Factor | 100.00% | | *Estimated* |
| | Material Reclaimed | 300,000 | Tons/Yr | *Coal directed on to Emergency Pile* |
| | TSP Emissions | 0.00 | Tons/Yr | *E=(EFx% sus x MR/2000)x(1-CF)* |
| | **PM-10 Emissions** | **0.00** | **Tons/Yr** | *30% of TSP* |
| **Coal Stockpile** | **Wind Erosion on Stockpiles** | | **Water** | |
| | Emission Factor | 1.2 | Lb/Acre/Hr | *WDEQ Emission Factor* |
| | Pile Size | 2.0 | Acres | *Estimated* |
| | Fraction Suspended | 0.75 | | *WDEQ Emission Factor* |
| | Hours | 8,760 | Hours | *Total Annual* |
| | Ave. Wind Speed | 5.03 | meters/Sec | *Adjusted for in-pit* |
| | Wet Days | 60 | | *Seminoe Mine 5-Year Average* |
| | Control Factor | 0.00% | | |
| | TSP Emissions | 33.10 | Tons/Yr | *E=(EF x AWS x %sus x PS x ((365-WD)/365) x (1-CF))/2000* |
| | **PM-10 Emissions** | **9.93** | **Tons/Yr** | |
| TOTAL PM-10 EMISSIONS | | **10.5** | **Tons/Yr** | |

# Saddleback Hills Mine – Emission Calculations

## Year Four

**Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant**
**Saddleback Hills Mine - East Portal, Point Source Emissions**
**Point Source Emissions**

Production Rates are based on the 2007 Mine Plan Revisions

Activity at East Portal: bring coal out from underground mine; material handling, screening, send to gasifier (following Plant startup in Year 4). During Development Years 1-3, coal will be stockpiled; at start of Plant operations, coal will be directed to gasifier.

**Year 4**

**Production rate =** 3,250,000 tpy

Material Handling Emissions (coal):

$PM_{10}$ = k (.0032) ((U/5)^1.3 / (M/2)^1.4) — *AP-42, Section 13.2.4 Aggregate handling factors*

k = 0.35 — *AP-42, Section 13.2.4 Aggregate handling factors*

U = 14 mph — *Seminoe II Measurement*

M = 6.9 % — *AP-42 Table13.2.4-1, Western Sfc Coal Mining, median*

$PM_{10}$ = 8E-04 *lb/ton*

**Conveying by belt from conveyor C1 to C2 (material transfer)** — **Controlled by fogger**
Fogger control value = 90% — *AP-42, Section 13.2.4.4*
$PM_{10}$ = 0.123 tpy

**Conveying by belt from conveyor C2 to C3 (material transfer)** — **Controlled by fogger**
Fogger control value = 90% — *AP-42, Section 13.2.4.4*
$PM_{10}$ = 0.12 tpy

**Conveying by belt from conveyor C3 to C4 (material transfer)** — **Controlled by fogger**
Fogger control value = 90% — *AP-42, Section 13.2.4.4*
$PM_{10}$ = 0.12 tpy

**Conveying by belt from reclaim conveyor C5 to C6 (material transfer)** — **Controlled by fogger**
Fogger control value = 90% — *AP-42, Section 13.2.4.4*
$PM_{10}$ = 0.12 tpy

**Conveying by belt from conveyor C6 to Screener (material transfer)** — **Controlled by fogger**
*Note: Conveyor C6 will be 3/4 covered, rather than completely enclosed.*
Fogger control value = 90% — *AP-42, Section 13.2.4.4*
$PM_{10}$ = 0.12 tpy

**Conveying by belt from Screener to conveyor C7 (material transfer)** — **Controlled by fogger**
*Note: Conveyor C7 will be 3/4 covered, rather than completely enclosed.*
Fogger control value = 90% — *AP-42, Section 13.2.4.4*
$PM_{10}$ = 0.12 tpy

**Conveying by belt from conveyor C7 to C9 (material transfer)** — **Controlled by fogger**
*Note: Conveyors C7, C8, & C9 will be 3/4 covered, rather than completely enclosed.*
Fogger control value = 90% — *AP-42, Section 13.2.4.4*
$PM_{10}$ = 0.12 tpy

**Conveying by belt from hopper to conveyor C10 material transfer)** — **Controlled by fogger**
*Note: Conveyor C10 will be 3/4 covered, rather than completely enclosed.*
*Assume only 1.2 Mmtpy directed from emergency stockpile to reclaim hopper*
Fogger control value = 90% — *AP-42, Section 13.2.4.4*
$PM_{10}$ = 0.05 tpy

**Total East Portal Point Source $PM_{10}$ Emissions**

$PM_{10}$ = 0.86 tpy
0.025 g/sec

Conversions:

| | |
|---|---|
| 453.6 g/lb | 8760 hr/yr |
| 2000 lb/ton | 3600 sec/hr |

**Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant**
**Saddleback Hills Mine, East Portal Fugitive Emissions**
**Fugitive Emission Calculations**
***(BACT Option: In-Pit Stacking Tubes)***

**Emissions starting in Year 4** **All coal through processing equipment to IGL Plant gasifiers**

| Emission Source | Description | | Control | Additional Information |
|---|---|---|---|---|
| **Dozer Reclaim** | **Cat D11 Dozer** | | **None** | |
| | Emission Factor | 8.0 | Lb/Hr | *WDEQ 2002 Guidance* |
| | Total Throughput | 3,250,000 | Tons/Yr | *Total Coal Through Storage* |
| | Dozed Throughput | 1,500,000 | Tons/Yr | *Portion to Dead Storage* |
| | Dozer Productivity | 750 | Tons/Hr | *Estimate for 300,000 Ton Pile* |
| | Operating Hrs | 2,000 | Hrs | *Productivity/Throughput* |
| | TSP Emissions | 8.00 | Tons/Yr | E=(EF x Op Hrs)/2000 |
| | **PM-10 Emissions** | **2.40** | **Tons/Yr** | 30% of TSP |
| **Coal Stacker** | **Coal Dumping to Stockpile** | | **Stacking Tubes** | |
| | Emission Factor | 0.017 | Lb/Ton | *WDEQ Emission Factor* |
| | % Suspended | 0.75 | | *WDEQ Emission Factor* |
| | Control Factor | 50.00% | | *Estimated* |
| | Material Dumped | 3,250,000 | Tons/Yr | *Total Coal Through Storage* |
| | TSP Emissions | 10.36 | Tons/Yr | *E=(EFx% sus x MD/2000)x(1-CF)* |
| | **PM-10 Emissions** | **3.11** | **Tons/Yr** | *30% of TSP* |
| **Coal Reclaim** | **Vibratory & Pile Activator Feeder** | | **Passive Control** | |
| | Emission Factor | 0.017 | Lb/Ton | *WDEQ Emission Factor* |
| | % Suspended | 0.75 | | *WDEQ Emission Factor* |
| | Control Factor | 100.00% | | *Estimated* |
| | Material Reclaimed | 3,250,000 | Tons/Yr | *Total Coal Through Storage* |
| | TSP Emissions | 0.00 | Tons/Yr | *E=(EFx% sus x MR/2000)x(1-CF)* |
| | **PM-10 Emissions** | **0.00** | **Tons/Yr** | *30% of TSP* |
| **Coal Stockpile** | **Wind Erosion on Stockpiles** | | **Water** | |
| | Emission Factor | 1.2 | Lb/Acre/Hr | *WDEQ Emission Factor* |
| | Pile Size | 11.0 | Acres | *Calculated from Pile Size* |
| | Fraction Suspended | 0.75 | | *WDEQ Emission Factor* |
| | Hours | 8,760 | Hours | *Total Annual* |
| | Ave. Wind Speed | 5.03 | meters/Sec | *Adjusted for in-pit* |
| | Wet Days | 60 | | *Seminoe Mine 5-Year Average* |
| | Control Factor | 0.00% | | |
| | TSP Emissions | 182.40 | Tons/Yr | *E=(EF x AWS x %sus x PS x* |
| | **PM-10 Emissions** | **54.72** | **Tons/Yr** | *((365-WD)/365) x (1-CF))/2000* |
| **TOTAL PM-10 EMISSIONS** | | **60.2** | **Tons/Yr** | |

**Medicine Bow Fuel & Power Industrial Gasification & Liquefaction Plant**
**Equipment Leaks Emission Summary**

| | | *Controlled Emissions* | | *Uncontrolled Emsisions* | |
|---|---|---|---|---|---|
| | | SOCMI Factors | | SOCMI Factors | |
| **Process Stream** | **Service Type** | **VOC Emissions (ton/yr)** | **HAP Emissions (ton/yr)** | **VOC Emissions (ton/yr)** | **HAP Emissions (ton/yr)** |
| Acid Gas | Gas | 0.09 | 0.09 | 0.12 | 0.12 |
| Flare KO Drum Drainage | Gas | 4.99 | 1.61 | 6.70 | 2.16 |
| Gasifier Vent | Gas | 0.16 | 0.16 | 0.22 | 0.22 |
| Gasoline (Gas) | Gas | 9.87 | 3.18 | 12.38 | 3.99 |
| Gasoline (Light Liquid) | Light Liquid | 17.12 | 5.52 | 36.22 | 11.67 |
| Gasoline (Heavy Liquid) | Heavy Liquid | 0.26 | 0.09 | 0.26 | 0.09 |
| LPG | Light Liquid | 1.12 | 0.00 | 2.21 | 0.00 |
| Methanol Gas | Gas | 1.04 | 1.04 | 1.28 | 1.28 |
| Methanol Pure Liquid | Light Liquid | 0.65 | 0.65 | 1.44 | 1.44 |
| Methanol Product (MeOH 1) | Light Liquid | 7.86 | 7.85 | 14.90 | 14.86 |
| Methanol Product (MeOH 2) | Light Liquid | 0.23 | 0.23 | 0.54 | 0.54 |
| Methanol Product (MeOH 3) | Light Liquid | 0.23 | 0.23 | 0.54 | 0.54 |
| Methanol Product (MeOH 5) | Gas | 0.40 | 0.40 | 0.50 | 0.50 |
| Mixed Fuel Gas | Gas | 0.52 | 0.02 | 1.77 | 0.06 |
| MTG Fuel Gas | Gas | 4.42 | 0.05 | 5.44 | 0.06 |
| Propylene | Gas | 22.35 | 0.00 | 24.36 | 0.00 |
| **Total** | | **71.32** | **21.10** | **108.86** | **37.52** |

| | *Controlled Emissions* | | *Uncontrolled Emsisions* | |
|---|---|---|---|---|
| | SOCMI Factors | | SOCMI Factors | |
| **Individual HAPs** | **HAP Emissions (lb/hr)** | **HAP Emissions (ton/yr)** | **HAP Emissions (lb/hr)** | **HAP Emissions (ton/yr)** |
| Carbonyl Sulfide (COS) | 0.06 | 0.26 | 0.08 | 0.35 |
| Methanol (MeOH) | 2.37 | 10.40 | 4.39 | 19.22 |
| C6 - C10 Aromatics (Assumed to be Benzene) | 2.38 | 10.44 | 4.10 | 17.96 |
| **Total** | **4.82** | **21.10** | **8.57** | **37.52** |