A4.0 ENERGY

A4.1. PROPOSED ACTION

The construction of a rail line along the proposed route would affect the use of energy in the project area. The net energy impact was determined by estimating the amount of energy that the anticipated coal mines would produce and by comparing that figure with the amount of energy that would be consumed in the construction and in the operation of both the railroad and the mines. The net energy balance was calculated in terms of British Thermal Units (BTUs) and is presented in Section A4.1.5.[1]

A4.1.1. Construction

The major fuel-consuming activity involved in rail line construction along the proposed route would be earthwork--including the transportation of ballast and sub-ballast materials, and the preparation of the roadbed. Approximately 20 million cubic yards of material would be moved for the construction of the railroad. Fuel consumption by heavy equipment is estimated to range from 0.25 to 0.75 gallon of diesel fuel per cubic yard of material moved.[2] Thus, the fuel consumption for this construction activity would range from 5 million to 15 million gallons. The analysis of the net energy impact used the midpoint of this range, 10 million gallons. The estimate in BTUs then becomes 1.387 times 10^{12}, or approximately 1.4 trillion BTUs, when a single gallon of diesel fuel contains 138,700 BTUs.[3]

With the Ashland NW Alignment, the construction fuel consumption would be somewhat less, since the large cut encountered on the Ashland SE Alignment would not be excavated and because a slightly shorter right-of-way width would be required.

A4.1.2. Operation and Maintenance

A4.1.2.1. Coal Shipped

Five potential coal mines might be served by the proposed railroad. Between 430 and 690 million tons of coal may be hauled through the year 2011. This estimated cumulative production then was translated into BTU equivalents.[4] The energy produced during the analysis period would vary by scenario:

Low Scenario:	$7{,}430.4 \times 10^{12}$	(7.4 trillion) BTUs
Medium Scenario:	$9{,}012.8 \times 10^{12}$	(9 trillion) BTUs
High Scenario:	$11{,}885.2 \times 10^{12}$	(11.9 trillion) BTUs

A4.1.2.2 Fuel Consumed in the Transportation of the Coal

Train operations would require the largest portion of the energy consumed by the railroad. The method employed to estimate the fuel consumed by railroad operations involved the use of the Train Performance Calculator (TPC), a model which simulates a rail line's operating characteristics. This model assumes that a single coal train would comprise 105 hopper cars, each containing 96 tons of coal. On this basis, the TPC can generate an estimate of the fuel consumed, per train, on a round trip to each mining area. These estimates are presented in Table A4-1. They are based upon the conditions prevailing, were the railroad to transport 38 million tons of coal per year.

TABLE A4-1

FUEL CONSUMPTION
PROPOSED ACTION/MEDIUM PRODUCTION SCENARIO

FROM MILES CITY TO:	GALLONS OF FUEL CONSUMED PER ROUND TRIP
Ashland Mines	1,048
Montco Mine	1,221
Otter Creek Mines	1,221

The fuel consumed per round trip was translated into the fuel consumed for the entire analysis period (1986/87-2011) by estimating the number of round trips that would be completed to each mine site during this period. The cumulative tons produced by each mine were divided by the 10,080 tons of coal hauled per round trip--105 cars x 96 tons per car--to determine round trips per mine. The figure for fuel consumed per round trip, multiplied by the fuel consumed per round trip to each mine, provided an estimate of the total fuel consumed for the transport of coal from each mine. Summing the fuel consumption of each of the five mines produced a determination of 61 million gallons of diesel fuel consumed for the railroad along the proposed route, under the medium coal production scenario.

A4.1.3 Downline Operations

The calculation of the fuel consumed by the downline movement of the Tongue River Railroad Company's (TRRC) trains used the factor for fuel consumed in net ton-miles. The TPC approach was not applied downline because the extent of the downline corridors prohibited obtaining the data required for the TPC. Therefore, downline analysis for this section begins at the Miles City terminus of the proposed rail line. The fuel consumption factor used was 0.0022 gallons per net ton-mile.[5] The weighted average length of a round trip on the downline corridors was estimated, based upon the annual distribution of Tongue River coal among its ultimate destinations. The weighted mileage for the downline corridor--with a Miles City terminus for the proposed rail line--is 852 miles.

Applying these calculations, the ton-miles of coal hauled were computed for the three coal production scenarios; the ton-mile figures then were multiplied by 0.0022 to determine the downline fuel consumption. The total downline fuel consumption during the analysis period is 977 million gallons of diesel fuel for the medium production scenario (see Table A4-2).[6]

TABLE A4-2

ANNUAL FUEL CONSUMPTION BY TRAINS
PROPOSED ACTION/MEDIUM PRODUCTION SCENARIO

	PROPOSED RAIL LINE		DOWNLINE		TOTAL	
YEAR	BTUs (billions)	GALLONS (000s)	BTUs (billions)	GALLONS (000s)	BTUs (billions)	GALLONS (000s)
1986/1987	33.6	242.3	525.0	3,785.3	558.6	4,027.6
1991	90.7	654.1	1,417.5	10,220.4	1,508.2	10,874.5
1996	252.0	1,817.0	3,937.4	28,390.0	4,189.4	30,207.0
2001	412.8	2,976.8	6,562.4	47,316.7	6,975.2	50,293.5
2006	494.6	3,566.3	8,137.3	58,672.7	8,631.9	62,239.0
2011	595.5	4,294.0	9,974.8	71,921.3	10,570.3	76,215.3
CUMULATIVE TOTAL[a]	8,477.1	61,118.3	135,447.3	976,616.0	143,924.4	1,036,734.3

[a] Cumulative total includes all years from 1986/87-2011

Fuel consumption for the low coal production scenario is an estimated 18 percent less than that for the medium scenario. The high coal production scenario would result in 32 percent more fuel consumed than would the medium scenario.

A4.1.4 Related Actions

A4.1.4.1 Construction of the Mines

The energy used to construct the five potential mines includes the diesel fuel consumed by bulldozers and scrapers for site preparation and the diesel fuel expended by cranes and welders in facility erection. The fuel consumption estimate is based upon estimates of the equipment hours required and of the fuel consumption characteristics of the equipment. This estimate then was increased to include the energy consumed in miscellaneous mine construction activities. Four million gallons of diesel fuel would be consumed to construct each mine. Thus, a total of 20 million gallons would be used to establish all of the mines. The BTU equivalent of this amount of fuel is 2,774 billion.

A4.1.4.2 Operation of the Mines

The energy consumed in mining operations includes both diesel fuel and electricity. These estimates for energy use during mining rely upon the assumption that the mines would be truck-shovel operations. Consumption of approximately 1.2 kilowatt hours of electricity is anticipated for the removal of each ton of overburden. For each of the five mines, it is assumed that an average of 4.5 yards of overburden would be removed for each ton of coal mined. Thus, the effective stripping ratio would be 4.5:1.[7] Based upon these two figures, a factor was developed to relate electricity use to the tonnage mined. For each ton of coal mined, 5.4 kilowatts of electricity would be required; this kilowattage is the equivalent of 18,425 BTUs.[8]

The diesel fuel consumed in mining operations is estimated as a function of the tonnage mined. This study assumed that 1 gallon of diesel fuel, or 138,700 BTUs, would be required to mine each ton of coal--postulating a truck-shovel operation and a stripping ratio of 4.5:1. Combining the electricity and the diesel fuel consumption rates results in a factor of 157,125 BTUs of energy consumed for each ton of coal mined. Applying this factor to the cumulative coal production, by scenario, produces the following amounts of energy consumed in mining operations:[9]

Low Scenario:	67.9×10^{12} BTUs
Medium Scenario:	82.3×10^{12} BTUs
High Scenario:	108.6×10^{12} BTUs

A4.1.5 Energy Balance

The energy balance for the proposed rail line, under each of the three coal production scenarios, is summarized in Table A4-3. The data reveal that the amount of energy produced as a result of the construction of the proposed rail line would exceed the amount consumed by almost 40 times. An amount of energy equal to less than 3 percent of the energy produced would be consumed by the proposed mine development, railroad construction, and coal transportation. These statistics essentially are the same for all three scenarios.

TABLE A4-3

ENERGY CONSUMED AND PRODUCED, PROPOSED ACTION, 1984-2011
(trillions of BTUs)

ENERGY CONSUMED AND PRODUCED	COAL PRODUCTION SCENARIO LOW	MEDIUM	HIGH
Energy Produced (Coal)	7,430.4	9,012.8	11,885.2
Energy Consumed:			
Mine Operations	67.9	82.3	108.6
Railroad Operations[a]	117.9	143.9	190.5
Railroad Construction	1.4	1.4	1.4
Mine Construction	2.8	2.8	2.8
Total Energy Consumed	190.0	230.4	303.3
Net Energy Balance	7,240.4	8,782.4	11,581.9

[a] Only railroad operation energy consumption would vary among the route alternatives

A4.2 TONGUE RIVER ROAD ALTERNATIVE

A4.2.1 Construction

The energy consumption for the construction of the proposed rail line would be the same as the energy consumption for the construction of the rail line along the Tongue River Road alternative route. That total consumption would approach 1.4 trillion BTUs.

A4.2.2 Operation and Maintenance

A4.2.2.1 Coal Shipped

The amount of coal that would be produced by the five projected mines and would be shipped along the Tongue River Road alternative route is the same as that amount discussed for the proposed rail line.

A4.2.2.2 Fuel Consumed in the Transportation of the Coal

Applying the same procedure as that described for the proposed rail line, the fuel consumed by trains that would use the Tongue River Road alternative route was calculated. The resultant estimate of fuel consumption for a train's round trip to each mining area, as generated by the Train Performance Calculator (TPC), is presented in Table A4-4.

Multiplying the fuel expended for a round trip to a mining area by the estimated number of round trips made to that mining area during the analysis period provides a determination of the total fuel consumed for the transport of coal from that mine. These estimates of fuel consumption for each of the five mines then were summed to obtain the total figure for TRRC fuel consumption, under the medium scenario, using the Tongue River Road alternative route (see Table A4-5). The BTU equivalents of these figures also are presented. Fuel consumption is higher for this route than for the route of the proposed rail line due to the additional positive and negative grades involved.

TABLE A4-4

RAILROAD FUEL CONSUMPTION
TONGUE RIVER ROAD ALTERNATIVE/MEDIUM PRODUCTION SCENARIO

FROM MILES CITY TO:	GALLONS OF FUEL CONSUMED PER ROUND TRIP
Ashland Mines	1,456
Montco Mine	1,694
Otter Creek Mines	1,694

TABLE A4-5

ANNUAL FUEL CONSUMPTION BY TRAINS
TONGUE RIVER ROAD ALTERNATIVE/MEDIUM PRODUCTION SCENARIO[a]

YEAR	BTUs (billion)	GALLONS (000)
1986/1987	46.6	336.1
1991	126.0	907.5
1996	349.6	2,520.9
2001	572.9	4,130.6
2006	686.5	4,950.0
2011	826.7	5,961.
CUMULATIVE TOTAL	11,834.2	85,322.3[b]

[a] For downline consumption see Table A4-2.
[b] Cumulative total includes all years, 1986/87-2011

A4.2.3 Downline Operations

Since the TRRC's downline operations would remain the same whether the Tongue River Road alternative route or the proposed rail line were selected, the fuel consumption figures for the downline portion of these routes would be the same.

A4.2.4 Related Actions

A4.2.4.1 Construction and Operation of the Mines

Energy usage for the construction and operation of the five projected mines would be the same for the Tongue River Road alternative route as for the proposed rail line.

A4.2.5 Energy Balance

The energy balance for the Tongue River Road alternative route is summarized in Table A4-6.

TABLE A4-6

ENERGY CONSUMED AND PRODUCED, TONGUE RIVER ROAD ALTERNATIVE, 1984-2011
(trillions of BTUs)

	COAL PRODUCTION SCENARIO		
ENERGY CONSUMED AND PRODUCED	LOW	MEDIUM	HIGH
Energy Produced (Coal)	7,430.4	9,012.8	11,885.2
Energy Consumed:			
Mine Operations	67.9	82.3	108.6
Railroad Operations[a]	120.6	147.3	194.7
Railroad Construction	1.4	1.4	1.4
Mine Construction	2.8	2.8	2.8
Total Energy Consumed	192.7	233.8	307.5
Net Energy Balance	7,237.7	8,779.0	11,577.7

[a] Only railroad operation energy consumption would vary among the route alternatives

A4.3 MOON CREEK ALTERNATIVE

A4.3.1 Construction

The energy consumption for the construction of the proposed rail line would be the same as the energy consumption for the construction of the Moon Creek alternative route. That total consumption would approach 1.4 trillion BTUs.

A4.3.2 Operation and Maintenance

A4.3.2.1 Coal Shipped

The amount of coal that would be produced by the five projected mines and shipped along the Moon Creek alternative route is the same as that amount discussed for the proposed rail line.

A4.3.2.2 Fuel Consumed in the Transportation of the Coal

Applying the same procedure as that described for the proposed rail line, the fuel consumed by trains that would use the Moon Creek alternative route was calculated. The resultant estimate of fuel consumption for a train's round trip to each mining area, as generated by the Train Performance Calculator (TPC), is presented in Table A4-7. Multiplying the fuel expended for a round trip to a mining area by the estimated number of round trips made to that mining area during the analysis period provides a determination of the total fuel consumed for the transport of coal from that mine. These estimates of fuel consumption for each of the five mines then were summed to obtain the total figure for TRRC fuel consumption, under the medium scenario, using the Moon Creek alternative route (see Table A4-8). The BTU equivalents of these figures also are presented.

TABLE A4-7

RAILROAD FUEL CONSUMPTION
MOON CREEK ALTERNATIVE/MEDIUM PRODUCTION SCENARIO

FROM MILES CITY TO:	GALLONS OF FUEL CONSUMED PER ROUND TRIP
Ashland Mines	1,573
Montco Mine	1,838
Otter Creek Mines	1,838

A4.3.3 Downline Operations

Since the TRRC's downline operations would remain the same whether the Moon Creek alternative route or the proposed rail line were selected, the fuel consumption figures for the downline portion of these routes would be the same.

TABLE A4-8

ANNUAL FUEL CONSUMPTION BY TRAINS
MOON CREEK ALTERNATIVE/MEDIUM PRODUCTION SCENARIO[a]

YEAR	BTUs (billion)	GALLONS (000)
1986/1987	50.6	364.7
1991	136.6	984.7
1996	379.3	2,735.1
2001	621.3	4,479.7
2006	743.9	5,363.4
2011	895.3	6,455.7
CUMULATIVE TOTAL	12,829.4	92,497.4[b]

[a] For downline consumption see Table A4-2
[b] Cumulative total includes all years, 1986/87-2011

A4.3.4 Related Actions

A4.3.4.1 Construction and Operation of the Mines

Energy usage for the construction and operation of the five projected mines would be the same for the Moon Creek alternative route as for the proposed rail line.

A4.3.5 Energy Balance

The energy balance for the Moon Creek alternative route is summarized in Table A4-9.

TABLE A4-9

ENERGY CONSUMED AND PRODUCED, MOON CREEK ALTERNATIVE, 1984-2011
(trillions of BTUs)

ENERGY CONSUMED AND PRODUCED	COAL PRODUCTION SCENARIO LOW	MEDIUM	HIGH
Energy Produced (Coal)	7,430.4	9,012.8	11,885.2
Energy Consumed:			
Mine Operations	67.9	82.3	108.6
Railroad Operations[a]	121.5	148.3	196.1
Railroad Construction	1.4	1.4	1.4
Mine Construction	2.8	2.8	2.8
Total Energy Consumed	193.6	234.8	308.9
Net Energy Balance	7,236.8	8,778.0	11,576.3

[a] Only railroad operation energy consumption would vary among the route alternatives

A4.4 COLSTRIP ALTERNATIVE

A4.4.1 Construction

The energy consumption for the construction of the proposed rail line would be the same as the energy consumption for the construction of the Colstrip alternative route. That total consumption would approach 1.4 trillion BTUs. Although this route is shorter than the route of the proposed rail line, energy consumption would be comparable due to the increased number of cuts and fills involved.

A4.4.2 Operation and Maintenance

A4.4.2.1 Coal Shipped

The amount of coal that would be produced by the five projected mines and would be shipped along the route of the Colstrip alternative is the equivalent of that amount discussed for the proposed rail line.

A4.4.2.2 Fuel Consumed in the Transportation of the Coal

The fuel consumption figures for trains transporting coal along the Colstrip alternative route were derived by the same method described for the proposed rail line. The figures for fuel consumption using the Colstrip alternative route are presented in Table A4-10. Although the Colstrip alternative route is only one-half the length of the route of the proposed rail line, its more varied, steeper topography produces a relatively higher per train fuel consumption (see Table A4-11). However, the consumption of fuel when the coal is transported along either the Ashland SW or the Ashland NW Alignments is applicable to the Colstrip alternative route.

TABLE A4-10

RAILROAD FUEL CONSUMPTION
COLSTRIP ALTERNATIVE/MEDIUM PRODUCTION SCENARIO

FROM COLSTRIP TO:	GALLONS OF FUEL CONSUMED PER ROUND TRIP
Ashland Mines	1,118
Montco Mine	1,356
Otter Creek Mines	1,356

TABLE A4-11

ANNUAL FUEL CONSUMPTION BY TRAINS
COLSTRIP ALTERNATIVE/MEDIUM PRODUCTION SCENARIO[a]

YEAR	BTUs (billion)	GALLONS (000)
1986/1987	37.3	269.0
1991	100.7	726.5
1996	279.9	2,017.9
2001	450.2	3,245.8
2006	518.7	3,740.3
2011	611.4	4,408.3
CUMULATIVE TOTAL	9,148.1	65,956.2[b]

[a] For downline consumption, see Table A4-2
[b] Cumulative total includes all years 1986/87-2011

A4.4.3 Downline Operations

The downline operation of TRRC trains using the Colstrip alternative route would differ from the downline operations of trains using the route of the proposed rail line. The downline portion of the Colstrip alternative route would be 911 miles. These routes would require 1,044 million gallons of diesel fuel, given the medium production scenario. This translates into 144,831 billion BTUs.

A4.4.4 Related Actions

A4.4.4.1 Construction and Operation of the Mines

Energy usage for the construction and operation of the five projected mines would be the same whether the Colstrip alternative route or the route of the proposed rail line were selected.

A4.4.5 Energy Balance

The energy balance for the Colstrip alternative route is summarized in Table A4-12. The higher energy requirement for this alternative, in comparison to the other routes, would exert only a slight effect on the net energy balance.

TABLE A4-12

ENERGY CONSUMED AND PRODUCED, COLSTRIP ALTERNATIVE, 1984-2011
(trillions of BTUs)

	COAL PRODUCTION SCENARIO		
ENERGY CONSUMED AND PRODUCED	LOW	MEDIUM	HIGH
Energy Produced (Coal)	7,430.4	9,012.8	11,885.2
Energy Consumed:			
Mine Operations	67.9	82.3	108.6
Railroad Operations[a]	126.3	154.2	204.0
Railroad Construction	1.4	1.4	1.4
Mine Construction	2.8	2.8	2.8
Total Energy Consumed	198.4	240.7	316.8
Net Energy Balance	7,232.0	8,772.1	11,568.4

[a] Only railroad operation energy consumption would vary among the route alternatives.

A4.5 FOOTNOTES

1. A British Thermal Unit (BTU) is the quantity of heat required to raise the temperature of 1 pound of water through 1 degree Fahrenheit. It is equal to 251•997 calories or 1055•06 joules.

2. Robert Wiley (IntraSearch), letter to Monica Liff (Ernst and Whinney), May 7, 1981.

3. TetraTech, Inc., Energy Fact Book, prepared for the U.S. Department of the Navy, Office of Naval Research, Arlington, Virginia, June, 1975, no pages given.

4. A BTU content of 8,600 per pound of coal was assumed in making calculations. This is the weighted average for the coal assumed to be produced by the five mines. 1979 Keystone Coal Company Manual (New York: McGraw-Hill, 1977), pp. 626-628. Also assumes mine locations according to IntraSearch.

5. Mark Yachmetz, Federal Railroad Administration, Washington, DC, March, 1981.

6. Peat, Marwick, Mitchell and Company prepared the fuel consumption estimates using a proprietary Train Performance Calculator. The data base (train consist and grade and curve characteristics) was prepared by Ernst and Whinney with the assistance of IntraSearch.

7. Robert Wiley (IntraSearch), letter to Monica Liff (Ernst and Whinney), May 7, 1981.

8. Oak Ridge National Laboratory, Regional Transportation Energy Conservation Data Book, Oak Ridge, Tennessee, September 1978.

9. Robert Wiley (IntraSearch), letter to Monica Liff (Ernst and Whinney), May 7, 1981.

A5.0 AIR QUALITY

A5.1 PROPOSED ACTION

A5.1.1 Construction

The construction of a rail line along the proposed route would affect the existing air quality in the project area. The major sources of pollutant emissions from construction would be the wind erosion of surfaces cleared of vegetation, the entrainment of dust during scraper and dozer operations, and the combustion of diesel fuel by heavy equipment.[1]

Approximately 1,278 acres would be disturbed by rail line construction along the proposed route with the Ashland SE Alignment, with 1,168 acres being disturbed to the Montco terminus (1985-1987), and an additional 110 acres being disturbed as a result of the completion of construction to the Otter Creek terminus (1988-1989). This would result in an average of 48.7 acres of disturbance per month during the first phase and 4.6 acres per month during the final phase. These acreage figures were determined by multiplying the length and average width of the affected right-of-way. Actual disturbance figures will vary according to construction schedules as dictated by weather conditions.

The construction of the rail line with the Ashland NW Alignment would result in a total acreage disturbance of 1,232 acres, 1,093 of which would be disturbed to the Montco terminus. This would result in an average monthly disturbance of 45.5 acres. Construction to the Otter Creek terminus would increase the disturbance by 139 acres, or by 5.8 acres per month.

The estimates for windblown emissions from disturbed acreage are based on the generally accepted wind erosion equation.[2] This equation yields a fugitive dust emission factor (E) in tons/acre/year: E = a I K C L' V'.[3] The variables in the wind erosion equation assume different values according to soil type, terrain configuration, and prevailing climate. The assumed values for all variables are representative of conservative, "worst case" values. On this basis, the wind erosion emission factor then was computed as 0.325 tons/acre/year.

By multiplying the wind erosion emission factor by the acreage disturbed, an estimate of the annual windblown dust associated with construction was made. The total emissions along the route including the Ashland SE Alignment would be 832 tons for the construction period. With the Ashland NW Alignment, the total would be approximately 800 tons for the construction period.

The second source of fugitive dust emissions encountered during the construction of the proposed rail line is heavy earthwork operation by scrapers and dozers. The figures for dust emissions during the period of construction were derived first from a study addressing emission factors accompanying the removal of overburden prior to strip-mining activities.[4] This study determined an emission rate of 16 pounds of particulate matter for each hour of scraper operation. Given a total fuel consumption assumed between 5 million and 15 million gallons for railroad construction, and making the conservative assumption that all fuel would be burned by scrapers at a rate of 40 gallons per hour, then the total scraper time would vary from 125,000 hours to 379,000 hours. At 16 pounds of dust generated during each scraper-hour, heavy earthwork construction would generate from 1,000 tons to 3,000 tons of dust over the construction period.

Another source of pollutant emissions, which would result from the construction of the proposed rail line, is the combustion of diesel fuel by heavy equipment. Pollutants generated by diesel fuel combustion are total suspended particulate matter (TSP), sulfur dioxide (SO_2), carbon monoxide (CO), hydrocarbons, (HC), and nitrogen dioxide (NO_2). Fuel combustion emission factors have been based upon a recent publication of the Environmental Protection Agency.[5] These figures apply to the operation of a scraper and represent, in most instances, the "worst case" emissions from the heavy equipment that will be used in construction of the proposed rail line. It was assumed that between 5 million and 15 million gallons of diesel fuel would be combusted during the construction phase. A multiplication of these fuel use rates by the pertinent emission factors yields the estimated emission totals (see Table A5-1).

To exemplify the impact of construction activity on air quality, a cut on the route of the Ashland SE Alignment was examined in detail. The cut would be the largest along the route and thus represents a "worst case" instance of construction activity. This cut would not be necessary under the Ashland NW Alignment. The cut would be 10,200 feet long and would require moving 4,600,000 cubic yards of scoria. Nine scrapers and six dozers working 200 days over two construction seasons would be required at the site, and about 3.24×10^6 gallons of diesel fuel would be consumed.

Emissions from construction associated with the cut would come from fuel combustion and construction activity. Using the fuel combustion factor discussed earlier (27.3 lbs particulate/10^3 gallons), the total emission rate of particulate matter (the major pollutant of concern) from fuel combustion over 200 days would be:

$$\frac{3.24 \text{ gallons} \times 106 \times 0.0273 \text{ lb/gal}}{2{,}000 \text{ lb/ton}} = 44.2 \text{ tons}$$

TABLE A5-1

TOTAL ANNUAL EMISSIONS FROM CONSTRUCTION ACTIVITIES
PROPOSED ACTION

DIESEL FUEL COMBUSTION (TOTAL)[a]	EMISSIONS (tons)
Particulate Matter (TSP)	68-205
Sulfur Dioxide (SO_2)	78-234
Carbon Monoxide (CO)	246-737
Hydrocarbons (HC)	106-317
Nitrogen Dioxide (NO_2)	1,048-3,143
DISTURBED LAND[b]	
Construction TSP (total, 1985-1989)	1,000-3,000
Windblown Dust TSP (annual, 1985-1987)	380/355[c]
Windblown Dust TSP (annual, 1988-1989)	36/45
Windblown Dust TSP (total, 1985-1989)	832/800

[a] Emission factors from EPA Publication "Compilation of Air Pollutant Emission Factors," AP-42. EPA, Research Triangle Park, NC

[b] Emission factors from "Evaluation of Fugitive Dust Emissions from Mining--Task I Report," PEDCo-Environmental Specialists, Inc., under EPA Contract No. 68-02-1321. April, 1976.

[c] Figures represent Ashland SE Alignment/Ashland NW Alignment.

The emissions from construction activity can be computed at 16 lbs/scraper/hr with a total of 200 18-hour days required to complete the job. Assuming that dozers emit dust at the same rate as scrapers, and since nine scrapers and six dozers would work simultaneously, the total emissions associated with construction activity are given by:

15	x	200	x	18	x	16	÷	2,000	= 432 tons
(scrapers & dozers)		(days)		(hr/day)		(lb/scraper hour)		(lb/ton)	

The size of the cut, and the fact that the activity could be controlled by water spray, suggests that wind erosion losses, by themselves, would be small. The total particulate emissions associated with the cut would be the sum of those due to construction activity plus fuel combustion, or 432 tons + 44.2 tons = 476.2 tons. Clearly, the construction of the Ashland cut would generate a major portion of the total particulate matter emitted by construction of the Tongue River Railroad.

To further assess the ambient air impact of the cut, the pollutant dispersion downwind of the cut was modeled using the EPA model PAL.[6] Using the total particulate emission and the assumptions that:

(1) the dust would be generated during the 200 18-hour working days and (2) the emissions would be uniformly distributed over a cut size of 5,100 feet x 187 feet, the resultant TSP emission flux is given by:

476.2	·/. 200	·/. 18	·/. 5,100	·/. 187	$= 1.39 \times 10^{-7}$
(tons)	(days)	(hr/day)	(feet)	(feet)	(tons/hr-ft^2)

This emission flux is equivalent to 3.76×10^{-4} grams/square meter-second, or 53.0 tons/acre/year.

A5.1.2 Operation and Maintenance

Air quality assumptions and methodologies that apply to the operation-and-maintenance phase of the proposed railroad involve the topics of fugitive coal dust and the combustion of diesel fuel by locomotives. Both of these factors derive from the operation activity. The maintenance activities along the route of the proposed railroad would not be likely to significantly impact air quality.

Specific calculations and figures have not been generated for the emission of fugitive coal dust from coal cars in transit along the proposed rail line. Although this issue has been addressed in preceding environmental impact statements, no consensus has emerged regarding the specific magnitude of these emissions. Some coal dust could be blown from hopper cars and might affect the area immediately adjacent to the right-of-way. However, the Montana Air Quality Bureau has stated that coal dust should settle to the bottom of hopper cars within the first few miles of the mine site and that it should, therefore, not pose a threat to federal or state air quality standards.[7]

The major source of air pollution emissions involved in the operation activity along the route of the proposed railroad is the combustion of diesel fuel by locomotive engines. The resultant emissions are assumed to be distributed evenly along the length of the rail line. The value of these emissions depends directly upon the quantity of fuel consumed. Those annual fuel consumption quantities have been determined for low production, for medium production, and for high production scenarios (see Table A5-2).

The base figures for specific pollutant emissions have been derived from the widely recognized publication of the Environmental Protection Agency and apply to a two-stroke, turbo-charged locomotive engine.[8] Using these base figures, the annual emission rates for the specific pollutants generated along the rail line were calculated by multiplying each specific pollution emission factor by the maximum fuel consumption figure, and then by dividing that total by the length of the rail line:

$$Q\ (\text{tons-mile}^{-1}\text{-year}^{-1}) = \frac{(\text{fuel use})\ (\text{emission factor})}{\text{alignment length}}$$

TABLE A5-2

ANNUAL FUEL CONSUMPTION BY TRAINS
PROPOSED ACTION (000 gallons)

YEAR	MONTCO	OTTER CREEK	ASHLAND	DOWNLINE	TOTAL
		LOW PRODUCTION SCENARIO			
1986/87	242.3	--	--	3,785.3	4,027.6
1991	635.9	--	--	9,936.5	10,572.5
1996	1,453.6	121.1	--	24,604.7	26,179.4
2001	1,453.6	726.8	--	34,068.0	36,248.4
2006	--	1,938.1	623.8	41,638.7	44,200.6
2011	--	2,059.2	1,663.5	62,458.0	66,180.7
CUMULATIVE TOTAL[a]	21,319.0	20,955.6	7,589.7	798,705.1	848,569.4
		MEDIUM PRODUCTION SCENARIO			
1986/87	242.3	--	--	3,785.3	4,027.6
1991	654.2	--	--	10,220.4	10,874.6
1996	1,453.6	363.4	--	28,390.0	30,207.0
2001	1,453.6	1,211.3	311.9	47,316.7	50,293.5
2006	--	2,422.6	1,143.7	58,672.7	62,239.0
2011	--	2,422.6	1,871.4	71,921.3	76,215.3
CUMULATIVE TOTAL[a]	21,561.6	26,527.5	12,060.4	976,616.0	1,036,765.5
		HIGH PRODUCTION SCENARIO			
1986/87	242.3	--	--	3,785.3	4,027.6
1991	774.0	258.5	--	16,125.5	17,157.6
1996	1,453.6	605.7	--	32,175.3	34,234.6
2001	1,453.6	2,180.3	415.9	64,350.7	68,400.5
2006	--	2,907.1	2,079.5	83,277.3	88,263.9
2011	--	2,907.1	2,079.3	83,277.3	88,263.9
CUMULATIVE TOTAL[a]	21,561.3	40,909.3	18,090.5	1,292,691.4	1,372,437.5

[a] Includes all years, 1986/87-2011

Table A5-3 presents the emission rate figures for all three scenarios for operation of the TRRC railroad.

TABLE A5-3

ESTIMATED EMISSION RATES FROM LOCOMOTIVE DIESEL FUEL COMBUSTION
PROPOSED ACTION (tons/mile-year)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
			LOW PRODUCTION SCENARIO		
1986/87	0.04	0.09	0.24	0.04	0.50
1991	0.10	0.22	0.63	0.11	1.30
1996	0.24	0.56	1.56	0.27	3.23
2001	0.34	0.77	2.17	0.38	4.47
2006	0.41	0.93	2.62	0.46	5.40
2011	0.61	1.39	3.90	0.68	8.03
			MEDIUM PRODUCTION SCENARIO		
1986/87	0.04	0.09	0.24	0.04	0.50
1991	0.10	0.23	0.65	0.11	1.34
1996	0.28	0.64	1.81	0.32	3.72
2001	0.47	1.07	3.00	0.52	6.18
2006	0.57	1.31	3.68	0.64	7.57
2011	0.70	1.60	4.49	0.79	9.25
			HIGH PRODUCTION SCENARIO		
1986/87	0.04	0.09	0.24	0.04	0.50
1991	0.16	0.36	1.02	0.17	2.11
1996	0.32	0.73	2.05	0.36	4.22
2001	0.64	1.45	4.07	0.71	8.40
2006	0.81	1.85	5.20	0.91	10.72
2011	0.81	1.85	5.20	0.91	10.72

Pollutant concentrations from diesel fuel consumption are highest near the rail line and decrease with distance from it. Maximum estimated 24-hour concentrations along the proposed route, as a result of locomotive operation, have been calculated for the three scenarios between the year 1986 and the year 2011 and are shown in Table A5-4. These maximum concentration figures were derived by combining the anticipated emission rates for specific pollutants with data resulting from a mathematical air quality dispersion model. The maximum 24-hour concentrations along the route rely on a modification of 1-hour totals computed by the modeling process (see Table A5-5).[9] All of these concentration estimates fall well below the applicable federal and state air quality standards, as well as below the Prevention of Significant Deterioration (PSD) Regulations' Class II increments.

TABLE A5-4

ESTIMATED MAXIMUM 24-HOUR POLLUTANT CONCENTRATION DUE TO LOCOMOTIVE EMISSIONS: PROPOSED ACTION (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
		LOW PRODUCTION SCENARIO			
1986/87	<0.1	0.3	0.7	0.1	1.5
1991	0.3	0.7	1.8	0.3	3.8
1996	0.7	1.6	4.6	0.8	9.5
2001	1.0	2.2	6.3	1.1	13.2
2006	1.2	2.7	7.8	1.4	15.8
2011	1.7	4.1	11.6	2.1	23.7
		MEDIUM PRODUCTION SCENARIO			
1986/87	<0.1	0.3	0.7	0.1	1.5
1991	0.3	1.8	2.0	0.4	4.0
1996	0.8	1.9	5.4	1.0	10.9
2001	1.4	3.2	8.9	1.5	19.0
2006	1.7	3.8	10.9	1.9	22.2
2011	2.1	4.8	13.3	2.4	27.0
		HIGH PRODUCTION SCENARIO			
1986/87	<0.1	0.3	0.7	0.1	1.5
1991	0.5	1.1	3.1	0.5	6.2
1996	1.0	2.2	6.0	1.1	12.5
2001	1.9	4.3	12.1	2.1	25.3
2006	2.4	5.6	15.4	2.7	31.7
2011	2.4	5.6	15.4	2.7	31.7

The dispersion model also was used to estimate the maximum pollutant concentrations generated by operation along that portion of the proposed railroad near the Northern Cheyenne Indian Reservation. The Reservation has been designated (August 5, 1977) a Class I air quality area under the PSD regulations, with the exception of visibility values. In this case, the most applicable model run was selected to reflect the area's prevailing winds, and the dispersion model produced both 1-hour and 24-hour emission concentration totals for the three operation scenarios (see Tables A5-6 and A5-7). These totals are significantly less than all applicable federal and state air quality standards, including PSD Class I increments.

TABLE A5-5

ESTIMATED MAXIMUM 1-HOUR POLLUTANT CONCENTRATION DUE TO LOCOMOTIVE EMISSIONS: PROPOSED ACTION (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
LOW PRODUCTION SCENARIO					
1986/87	0.7	1.6	4.3	0.7	8.8
1991	2.3	5.3	15.2	2.7	30.4
1996	4.3	9.5	27.6	4.8	57.1
2001	6.0	13.3	38.1	6.8	79.0
2006	7.2	16.2	46.6	8.2	95.2
2011	10.5	24.7	69.5	12.4	142.7
MEDIUM PRODUCTION SCENARIO					
1986/87	0.7	1.6	< 0.1	0.7	8.8
1991	3.0	6.9	19.0	3.3	40.0
1996	4.9	11.4	32.4	5.7	65.7
2001	8.4	19.0	53.3	9.2	114.2
2006	10.5	22.8	65.7	11.4	133.2
2011	12.4	28.5	79.9	14.3	161.8
HIGH PRODUCTION SCENARIO					
1986/87	0.7	1.6	4.3	0.7	8.8
1991	3.9	9.0	25.7	4.5	52.3
1996	5.7	13.3	36.2	6.4	75.2
2001	11.4	25.7	72.3	12.4	152.2
2006	14.3	33.3	92.3	16.2	190.3
2011	14.3	33.3	92.3	16.2	190.3

The locomotive smokestack plume would provide no significant visual impact because of its rapid dispersion and the fact that the unit train will pass a typical route point in less than 2 minutes.

Maintenance of the proposed railroad would involve activities of short duration. Maintenance vehicle emissions would not impact air quality significantly. Revegetation ultimately would reduce any short term fugitive dust emissions that might accompany construction or repair activities associated with maintenance. Further, any impacts that might occur as a result of maintenance activities would decrease as a function of distance from the right-of-way.

TABLE A5-6

ESTIMATED 1-HOUR POLLUTANT CONCENTRATIONS IN THE NORTHERN CHEYENNE INDIAN RESERVATION: PROPOSED ACTION (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
LOW PRODUCTION SCENARIO					
1986/87	0.1	0.2	0.4	0.1	0.9
1991	0.2	0.5	1.5	0.3	3.0
1996	0.4	0.9	2.7	0.5	5.6
2001	0.6	1.3	3.7	0.7	7.8
2006	0.7	1.6	4.6	0.8	9.4
2011	1.0	2.4	6.8	1.2	14.1
MEDIUM PRODUCTION SCENARIO					
1986/87	0.1	0.2	0.4	0.1	0.9
1991	0.3	0.7	1.9	0.3	3.9
1996	0.5	1.1	3.2	0.6	6.5
2001	0.8	1.9	5.2	0.9	11.2
2006	1.0	2.2	6.5	1.1	13.1
2011	1.2	2.8	7.9	1.4	15.9
HIGH PRODUCTION SCENARIO					
1986/87	0.1	0.2	0.4	0.1	0.9
1991	0.4	0.9	2.5	0.4	5.2
1996	0.6	1.3	3.6	0.6	7.4
2001	1.1	2.5	7.1	1.2	15.0
2006	1.4	3.3	9.1	1.6	18.7
2011	1.4	3.3	9.1	1.6	18.7

A5.1.3 Downline Operations

To quantify the potential impact of activities downline from the proposed railroad, this study has assumed a terminus at Miles City, Montana. It has been calculated that the downline distance from this point to the east is 775 miles, and that the downline distance to the west is 1,011 miles, totalling 1,786 miles of downline distance. It further has been assumed that all downline tracks are in existence, and that no construction activities--either of tracks or of support facilities--would be required. Some new trackage in existing rights-of-way might be necessary by the year 1991. Should this occur, construction of the second line would cause some temporary impacts to air

TABLE A5-7

ESTIMATED 24-HOUR POLLUTANT CONCENTRATION IN THE NORTHERN CHEYENNE INDIAN RESERVATION: PROPOSED ACTION (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
LOW PRODUCTION SCENARIO					
1986/87	<0.1	<0.1	<0.1	<0.1	<0.1
1991	<0.1	<0.1	0.2	<0.1	0.4
1996	<0.1	0.2	0.2	<0.1	0.9
2001	<0.1	0.2	0.6	0.1	1.3
2006	0.1	0.3	0.8	0.1	1.6
2011	0.2	0.4	1.1	0.2	2.3
MEDIUM PRODUCTION SCENARIO					
1986/87	<0.1	<0.1	<0.1	<0.1	<0.1
1991	<0.1	<0.1	0.2	<0.1	0.4
1996	<0.1	0.2	0.5	<0.1	1.1
2001	0.1	0.3	0.9	0.2	1.8
2006	0.2	0.4	1.1	0.2	2.2
2011	0.2	0.5	1.3	0.2	2.7
HIGH PRODUCTION SCENARIO					
1986/87	<0.1	<0.1	<0.1	<0.1	<0.1
1991	<0.1	<0.1	0.2	<0.1	0.8
1996	<0.1	0.2	0.6	0.1	1.2
2001	0.2	0.4	1.2	0.2	2.4
2006	0.2	0.5	1.5	0.3	3.1
2011	0.2	0.5	1.5	0.3	3.1

quality. As discussed in section A5.1.2, it is not anticipated that coal dust will be a factor in impacts to downline air quality.

Impacts to air quality from downline operations of the TRRC railroad would derive principally from locomotive emissions. Downline operations would generate the same pollutants caused by the combustion of diesel fuel as were listed for railroad operations. The rates of emission for these pollutants are calculated using the same figures as those for the proposed railroad and weighted percentages for fuel consumption east and west. Table A5-8 presents the emission rates calculated for the downline operation of the proposed railroad.

TABLE A5-8

CALCULATED EMISSION RATES FOR DOWNLINE OPERATIONS
PROPOSED ACTION (ton/mile/year)

YEAR	PARTICULATE MATTER (TSP)		SULFUR DIOXIDE (SO_2)		CARBON MONOXIDE (CO)		HYDRO-CARBONS (HC)		NITROGEN DIOXIDE (NO_2)	
	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST
				LOW PRODUCTION SCENARIO						
1986/87	0.02	0.01	0.04	0.02	0.10	0.07	0.02	0.01	0.21	0.14
1991	0.04	0.04	0.09	0.09	0.24	0.23	0.04	0.04	0.50	0.48
1996	0.10	0.07	0.24	0.15	0.67	0.43	0.12	0.08	1.39	0.89
2001	0.15	0.09	0.33	0.21	0.93	0.60	0.16	0.10	1.92	1.23
2006	0.18	0.11	0.40	0.26	1.14	0.73	0.20	0.13	2.36	1.50
2011	0.27	0.17	0.61	0.39	1.70	1.09	0.30	0.19	3.52	2.26
				MEDIUM PRODUCTION SCENARIO						
1986/87	0.02	0.01	0.04	0.02	0.10	0.07	0.02	0.01	0.21	0.14
1991	0.04	0.04	0.04	0.08	0.24	0.23	0.04	0.04	0.50	0.48
1996	0.12	0.08	0.28	0.18	0.77	0.50	0.14	0.09	1.60	1.03
2001	0.20	0.13	0.46	0.30	1.29	0.83	0.23	0.15	2.66	1.71
2006	0.25	0.16	0.57	0.37	1.60	1.03	0.28	0.18	3.30	2.15
2011	0.31	0.20	0.70	0.45	1.96	1.26	0.34	0.22	4.05	2.60
				HIGH PRODUCTION SCENARIO						
1986/87	0.02	0.01	0.04	0.02	0.10	0.07	0.02	0.01	0.21	0.14
1991	0.07	0.05	0.16	0.10	0.44	0.29	0.08	0.05	0.90	0.60
1996	0.14	0.09	0.31	0.20	0.88	0.56	0.15	0.10	1.81	1.16
2001	0.27	0.18	0.63	0.40	1.76	1.13	0.31	0.20	3.62	2.33
2006	0.36	0.23	0.81	0.52	2.27	1.46	0.40	0.26	4.69	3.01
2011	0.36	0.23	0.81	0.52	2.27	1.46	0.40	0.26	4.69	3.01

Maximum 24-hour concentrations were calculated for downline operations using the methodology used to calculate those concentrations along the route of the railroad (for specific values, see Table A5-9). As with the proposed railroad, these figures result from modification of the modeling process. Pollutant impacts would be greatest near the rail line and would decrease with distance from it. The heaviest rail traffic downline of the Tongue River Railroad will occur between Miles City, Montana, and Casselton, North Dakota. If coal traffic is limited to the Burlington Northern North Dakota route (instead of the

TABLE A5-9

ESTIMATED MAXIMUM 24-HOUR POLLUTANT CONCENTRATIONS FOR DOWNLINE OPERATIONS: PROPOSED ACTION (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)		SULFUR DIOXIDE (SO_2)		CARBON MONOXIDE (CO)		HYDRO-CARBONS (HC)		NITROGEN DIOXIDE (NO_2)	
	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST
					LOW PRODUCTION SCENARIO					
1986/87	<0.1	<0.1	0.1	<0.1	0.3	0.2	<0.1	<0.1	0.6	0.4
1991	0.1	0.1	0.3	0.2	0.7	0.7	0.1	0.1	1.4	1.4
1996	0.3	0.2	0.7	0.4	1.9	1.2	0.3	0.2	3.9	2.5
2001	0.4	0.3	0.9	0.6	2.6	1.7	0.5	0.3	5.4	3.5
2006	0.5	0.3	1.1	0.7	3.2	2.1	0.6	0.4	6.7	4.3
2011	0.8	0.5	1.7	1.1	4.8	3.1	0.9	0.5	10.0	6.4
					MEDIUM PRODUCTION SCENARIO					
1986/87	<0.1	<0.1	0.1	<0.1	0.3	0.2	<0.1	<0.1	0.6	0.4
1991	0.1	0.1	0.3	0.2	0.7	0.7	0.1	0.1	1.4	1.4
1996	0.3	0.2	0.8	0.5	2.2	1.4	0.4	0.3	4.5	2.9
2001	0.6	0.4	1.3	0.9	3.7	2.4	0.7	0.4	7.5	4.8
2006	0.7	0.5	1.6	1.0	4.5	2.9	0.8	0.5	9.4	6.1
2011	0.9	0.6	2.0	1.3	5.6	3.6	1.0	0.6	11.5	7.4
					HIGH PRODUCTION SCENARIO					
1986/87	<0.1	<0.1	0.1	<0.1	0.3	0.2	<0.1	<0.1	0.6	0.4
1991	0.2	0.1	0.4	0.4	1.2	1.1	0.2	0.1	2.5	2.3
1996	0.4	0.3	0.9	0.6	2.5	1.6	0.4	0.3	5.1	3.3
2001	0.8	0.5	1.8	1.1	5.0	3.2	0.9	0.6	10.3	6.6
2006	1.0	0.7	2.3	1.5	6.4	4.1	1.1	0.7	13.3	8.5
2011	1.0	0.7	2.3	1.5	6.4	4.1	1.1	0.7	13.3	8.5

Burlington Northern South Dakota route) from Miles City to Casselton, the air quality impacts would be higher than predicted in Table A5-9 because of stop-and-go traffic. These impacts still would be of short duration and would fall well below applicable federal and state air quality standards, as well as below pertinent PSD increments.

A5.1.4 Related Actions

The construction and operation of the TRRC's line is expected to serve a number of coal mines in the Tongue River region. These mines include the Montco project and four additional mining projects, which are designated Mine #2, Mine #3, Mine #4, and Mine #5, respectively. Air pollution associated with these mines would result from two activities: mine construction and mine operations.

A5.1.4.1 Mine Construction

Air pollution related to mine construction would be produced by the activities of overburden removal, site preparation, and the location of such support facilities as crushers and loaders. The pollutants include fugitive dust from construction activities and from exposed, disturbed areas (particularly stockpiles) and those products of the combustion of diesel fuel (TSP, SO_2, CO, HC, and NO_2).

The disturbed acreage for construction of the Montco project is estimated at 299 acres, of which 132 acres represent facilities and 167 acres involve stockpiles. The disturbed acreage for the construction of the four additional mine projects is estimated to be 330 acres for each mine, of which 150 acres involve facilities and 180 acres represent stockpiles. The figures for fugitive dust emissions from both facility construction and windblown sources have been computed using the same methodology as that applied to produce fugitive dust emissions for the construction of the proposed rail line (see Table A5-10).[10] The estimates for fugitive dust losses from stockpiles could be reduced if revegetation efforts are successful in less than the stipulated period of 2 years.

TABLE A5-10

ESTIMATED FUGITIVE DUST EMISSIONS FROM MINE CONSTRUCTION ACTIVITIES (tons)

	SOURCE	
MINE CONSTRUCTION	FACILITY CONSTRUCTION	WINDBLOWN DUST
Montco Mine	3,802	6
Mine #2	4,320	7
Mine #3	4,320	7
Mine #4	4,320	7
Mine #5	4,320	7

Construction of the Montco mine project and of the other four mine projects would require the combustion of an estimated 20 million gallons of diesel fuel. The magnitude of the resultant pollutants (TSP,

SO_2, CO, HC, and NO_2) was determined by multiplying each specific fuel consumption emission factor by the total fuel consumption (see Table A5-11).[11] In projecting these estimated totals, it was assumed that mine construction activities would extend for 2 years.

TABLE A5-11

FUEL COMBUSTION EMISSIONS DURING MINE CONSTRUCTION[a]
(tons)

Particulate Matter (TSP)	225
Sulfur Dioxide (SO_2)	312
Carbon Monoxide (CO)	953
Hydrocarbons (HC)	361
Nitrogen Dioxide (NO_2)	4,715

a Based on the consumption of 20 million gallons of diesel fuel during construction of Montco Mine and Mines #2, #3, #4, and #5.

Impacts to the air quality of the Tongue River Region are not expected to be significant as a result of the construction of the Montco project and of the other four mine projects. Primary construction impacts would occur within the mine boundaries and would be of relatively short duration.

A5.1.4.2 Mine Operations

Air pollution related to the operation of the Montco Mine project and to the other four mine projects in the Tongue River Region is assumed to extend for the life of each project, although the five peak pollution levels ("worst case" situations) would be staggered through the projected several decades of their sequential operation. This pollution would take the form of fugitive dust emissions and products of diesel fuel combustion by heavy-duty mine equipment.

Fugitive dust emissions would result from the removal of overburden and from such coal removal activities as drilling, blasting, scraping, truck loading, and truck unloading. Nonfugitive dust would be produced by the activities of crushing, conveying, and train-loading the coal. The computed figures for fugitive dust emissions from disturbed acreage during mine operations are based upon annual figures derived for the Montco project and then extrapolated to Mine #2 through Mine #5 (see Table A5-12). This extrapolation relies on the projected production scenarios and on the estimated exposed acreage of each additional mine project.

This methodology--i.e., extrapolating from the air quality modeling analyses completed for the Montco project--has been followed consistently in estimating the impacts on air quality from the other four

TABLE A5-12

MAXIMUM ESTIMATED EMISSION RATES OF FUGITIVE DUST FROM DISTURBED ACREAGES DURING MINING OPERATIONS AT EACH MINE (tons/year)

	PRODUCTION SCENARIO		
MINING OPERATIONS	LOW	MEDIUM	HIGH
Montco Mine	27.1	27.1	27.1
Mine #2	20.0	21.1	23.4
Mine #3	18.8	21.1	23.4
Mine #4	18.8	20.0	21.1
Mine #5	18.8	20.0	21.1

mine projects. This extrapolation was necessitated because baseline data exists and a dispersion model has been used only for the Montco situation. Thus the projected pollutant figures for Mine #2 through Mine #5 rely heavily upon the document by Science Applications, Inc., entitled "Report on the Air Quality Modeling Analyses Conducted for the Montco Project," (May 1, 1981).[12] Using the Montco project figures as representative of the "worst case" situation at the other four mines (presented in Tables A5-13 and A5-14), annual figures for total mine operation emissions have been produced. Table A5-15 presents these emissions.

TABLE A5-13

SUMMARY OF THE PREDICTED ANNUAL TSP CONCENTRATION FOR THE MONTCO PROJECT[a]

		PREDICTED CONCENTRATIONS	
LIMITING STANDARD	STANDARD (ug/m^3)	ON-SITE (ug/m^3)	OFF-SITE (ug/m^3)
Federal Primary[b]	75	52.7	52.1
Federal Secondary[b]	60	52.7	52.1
State[c]	75	65.1	64.3
Incremental: Class I[b]	5	n/a	0.8
Class II[b]	19	1.9	1.7

[a] Source: "A Report on the Air Quality Modeling Analyses Conducted for the Montco Project," Science Applications, Inc., May 1, 1981.
[b] Geometric Mean
[c] Arithmetic Mean

TABLE A5-14

SUMMARY OF THE PREDICTED 24-HOUR TSP CONCENTRATIONS FOR THE MONTCO PROJECT[a]

LIMITING STANDARD	ALLOWABLE INCREASE (ug/m^3)	PREDICTED CONCENTRATIONS ON-SITE (ug/m^3)	PREDICTED CONCENTRATIONS OFF-SITE (ug/m^3)
Class I Increment	10	n/a	4.0
Class II Increment	37	11.8	4.0

[a] Source: "A Report on the Air Quality Modeling Analyses Conducted for the Montco Project," Science Applications, Inc., May 1, 1981.

TABLE A5-15

MAXIMUM ESTIMATED EMISSION RATES FROM DIESEL FUEL COMBUSTION DURING MINING OPERATIONS (tons/year)

Particulate Matter (TSP)	495.1
Sulfur Dioxide (SO_2)	945.2
Carbon Monoxide (CO)	2,096.5
Hydrocarbons (HC)	794.3
Nitrogen Dioxide (NO_2)	10,373.1

The concentrations presented in Table A5-13 and A5-14 do not include the estimated impact due to fugitive dust emissions from the unpaved access road from Ashland to the Montco site. The Ashland area already exceeds the federal and Montana Air Quality Standards because of emissions from unpaved roads. Increased activity along FAS 566 is expected to increase slightly the number of violations of air quality standards around Ashland. The effect of unpaved roads on air quality near Mines #2 and #5 is unknown since the length of the roads is unknown. Tables A5-13 and A5-14 show that the operations in and near the boundaries of the Montco Mine are not anticipated to exceed the federal and Montana AAQS nor the PSD Class I or Class II increments.

Based upon the methodology of extrapolating mine operation figures for Mine #2 through Mine #5 from the Montco project operation computations, violations are anticipated of neither federal or state air-quality standards nor PSD Class I or Class II increments.

A5.2 TONGUE RIVER ROAD ALTERNATIVE

A5.2.1 Construction

The construction of a rail line along the Tongue River Road alternative route with the Ashland SE Alignment would disturb 1,413 acres, with 1,303 acres being disturbed during construction to the Montco terminus (1985-1987), and 110 acres being disturbed during construction to the Otter Creek terminus (1988-1989). This would result in an average of 54 acres of disturbance per month during construction to the Montco terminus and 4.6 acres of disturbance per month during construction to the Otter Creek terminus.

The construction of the rail line over the Tongue River Road alternative route, including the Ashland NW Alignment, would disturb 1,367 acres, with 1,228 acres being disturbed to the Montco terminus, and with 139 acres being disturbed to the Otter Crek terminus. This would result in an average of 50.7 acres per month of disturbance to the Montco terminus, and an additional 5.8 acres per month of disturbance to the Otter Creek terminus. Estimated windblown emissions, based on these acreage figures, were derived in the manner described for the construction of the proposed rail line (see Table A5-16).

TABLE A5-16

TOTAL ANNUAL EMISSIONS FROM CONSTRUCTION ACTIVITIES
TONGUE RIVER ROAD ALTERNATIVE

DIESEL FUEL COMBUSTION (TOTAL)[a]	EMISSION (tons)
Particulate Matter (TSP)	68-205
Sulfur Dioxide (SO_2)	78-234
Carbon Monoxide (CO)	246-737
Hydrocarbons (HC)	106-317
Nitrogen Dioxide (NO_2)	1,048-3,143
DISTURBED LAND[b]	
Construction TSP (total, 1985-1989)	1,000-3,000
Windblown Dust TSP (annual, 1985-1987)	424/399[c]
Windblown Dust TSP (annual, 1988-1989)	36/45
Windblown Dust TSP (total, 1985-1989)	920/888

[a] Emission factors from EPA Publication "Compilation of Air Pollutant Emission Factors," AP-42. EPA, Research Triangle Park, NC.

[b] Emission factors from "Evaluation of Fugitive Dust Emissions from Mining--Task I Report," PEDCo-Environmental Specialists, Inc., under EPA Contract No. 68-02-1321. April, 1976.

[c] Figures represent Ashland SE Alignment/Ashland NW Alignment.

The combustion of diesel fuel by heavy-construction equipment would produce the same pollutants along the Tongue River Road alternative route as were discussed for the proposed rail line. The same methods were employed in determining the magnitude of these emissions (see Table A5-16).

The methods and findings pertaining to the extensive cut near Ashland that were discussed for the proposed rail line also apply to the Tongue River Road alternative route. With the incorporation of the Ashland NW Alignment, however, the cut would not be included.

A5.2.2 Operation and Maintenance

Air quality assumptions and methodologies that apply to the operation-and-maintenance phase of the Tongue River Road route involve the topics of fugitive coal dust and the combustion of diesel fuel by locomotives. Both of these factors derive from the operation activity. Maintenance activities along the alternative route would not be likely to impact air quality significantly.

As noted in the discussion of the proposed rail line, no consensus exists concerning the magnitude of fugitive coal dust emissions from railcars in transit. Nevertheless the impact to ambient air quality is conceded to be minimal.

The major source of air pollution emissions involved in the alternative routes' operation activity is the combustion of diesel fuel by locomotive engines. The determination of specific emission figures for pollutants was accomplished using methods described for the proposed railroad (see Table A5-17). Figures developed to estimate the dispersion of emissions along the alignment of the Tongue River Road Alternative rely upon the same dispersion model process as that used for the proposed railroad. Tables A5-18 and A5-19 present 24-hour and 1-hour concentrations that were projected. These figures indicate that the operation activity along the alternative--including operation adjacent to the Northern Cheyenne Indian Reservation--would violate neither federal or state air quality standards nor PSD Class I and Class II increments. (Table A5-20 summarizes 24-hour concentrations in the Reservation.)

As in the case of the proposed railroad, maintenance activities along the Tongue River Road alternative route would be of short duration, and maintenance vehicle emissions would be minimal. Although the operation and maintenance activities would continue along the alternative route for the life of the project, in no case would air quality impacts be significant along the line--and these impacts will decrease as a factor of distance from the right-of-way.

TABLE A5-17

ESTIMATED EMISSION RATES FROM LOCOMOTIVE DIESEL FUEL COMBUSTION
TONGUE RIVER ROAD ALTERNATIVE (ton/mile/year)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
		LOW PRODUCTION SCENARIO			
1986/87	0.05	0.12	0.34	0.06	0.70
1991	0.14	0.32	0.89	0.16	1.84
1996	0.35	0.79	2.22	0.39	4.57
2001	0.48	1.09	3.07	0.54	6.33
2006	0.58	1.32	3.71	0.65	7.66
2011	0.86	1.97	5.53	0.97	11.40
		MEDIUM PRODUCTION SCENARIO			
1986/87	0.05	0.12	0.34	0.06	0.70
1991	0.14	0.33	0.93	0.12	1.90
1996	0.40	0.91	2.56	0.40	5.28
2001	0.66	1.51	4.25	0.70	8.76
2006	0.82	1.86	5.22	0.90	10.76
2011	0.99	2.27	6.37	1.10	13.13
		HIGH PRODUCTION SCENARIO			
1986/87	0.05	0.12	0.34	0.00	0.70
1991	0.23	0.52	1.46	0.21	2.99
1996	0.45	1.03	2.90	0.50	5.98
2001	0.90	2.06	5.78	1.00	11.91
2006	1.15	2.63	7.38	1.20	15.21
2011	1.15	2.63	7.38	1.20	15.21

A5.2.3 Downline Operations

The downline operations for trains beginning on the Tongue River Road alternative rail line would be identical for trains using the route of the proposed rail line. Therefore, the impacts described for the proposed rail line would be the same for the Tongue River Road alternative route (see Tables A5-8 and A5-9).

TABLE A5-18

ESTIMATED MAXIMUM 24-HOUR POLLUTANT CONCENTRATIONS
TONGUE RIVER ROAD ALTERNATIVE (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
		LOW PRODUCTION SCENARIO			
1986/87	0.1	0.3	1.0	0.2	2.1
1991	0.5	1.0	2.6	0.5	5.5
1996	1.0	2.4	6.5	1.1	13.5
2001	1.4	3.2	9.0	1.6	19.0
2006	1.7	4.0	10.9	1.9	22.2
2011	2.5	5.9	15.9	2.9	33.3
		MEDIUM PRODUCTION SCENARIO			
1986/87	0.1	0.3	1.0	0.2	2.1
1991	0.4	1.0	2.8	0.5	5.6
1996	1.2	2.7	7.6	1.3	15.5
2001	1.9	4.4	12.5	2.2	25.3
2006	2.4	5.6	15.4	2.7	31.7
2011	2.9	6.7	19.0	3.3	38.1
		HIGH PRODUCTION SCENARIO			
1986/87	0.1	0.3	1.0	0.2	2.1
1991	0.1	1.6	4.3	0.8	8.9
1996	1.3	3.0	8.6	1.5	17.4
2001	2.7	6.0	17.4	3.0	34.9
2006	3.3	7.8	22.2	3.8	44.4
2011	3.3	7.8	22.2	3.8	44.4

A5.2.4 Related Actions

The discussion of the impact due to mine construction and to mine operation that was presented in the section on the proposed railroad can be adopted for the Tongue River Road alternative route. The effect of mining development on air quality would be the same regardless of the route chosen for the railroad.

TABLE A5-19

ESTIMATED MAXIMUM 1-HOUR POLLUTANT CONCENTRATIONS DUE TO LOCOMOTIVE EMISSIONS: TONGUE RIVER ROAD ALTERNATIVE (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
		LOW PRODUCTION SCENARIO			
1986/87	0.8	2.1	6.0	1.0	12.4
1991	3.3	7.6	20.9	3.7	43.7
1996	6.2	14.3	39.0	6.9	80.8
2001	8.5	19.0	54.2	9.5	114.2
2006	10.5	23.8	65.6	11.4	133.2
2011	15.2	35.2	95.2	17.1	199.8
		MEDIUM PRODUCTION SCENARIO			
1986/87	0.8	2.1	6.0	1.0	12.4
1991	4.3	9.5	27.6	4.8	56.1
1996	7.1	16.2	45.6	8.0	93.2
2001	11.4	26.6	75.2	13.3	152.2
2006	14.3	33.3	92.3	16.2	190.3
2011	17.1	39.9	114.2	19.9	288.4
		HIGH PRODUCTION SCENARIO			
1986/87	8.6	2.1	6.0	1.0	12.4
1991	5.7	13.3	36.2	6.4	75.2
1996	8.0	18.1	51.4	9.0	104.6
2001	16.2	36.2	104.7	18.1	209.3
2006	19.9	46.6	133.2	22.8	266.4
2011	19.9	46.6	133.2	22.8	266.4

TABLE A5-20

MAXIMUM ESTIMATED 24-HOUR POLLUTANT CONCENTRATIONS IN THE NORTHERN CHEYENNE INDIAN RESERVATION TONGUE RIVER ROAD ALTERNATIVE (ug/m^3)

Particulate Matter (TSP)	0.2
Sulfur Dioxide (SO_2)	0.5
Carbon Monoxide (CO)	1.5
Hydrocarbons (HC)	0.3
Nitrogen Dioxide (NO_2)	3.1

A5.3 MOON CREEK ALTERNATIVE

A5.3.1 Construction

The construction of a rail line along the Moon Creek alternative route with the Ashland SE Alignment would disturb 1,323 acres, with 1,213 acres being disturbed during construction to the Montco terminus (1985-1987), and 110 acres being disturbed during construction to the Otter Creek terminus (1988-1989). This would result in an average of 50.6 acres of disturbance per month to the Montco terminus, and 4.6 acres of disturbance per month to the Otter Creek terminus.

The construction of the rail line over the route of the Moon Creek alternative including the Ashland NW Alignment would disturb 1,277 acres, with 1,138 acres being disturbed to the Montco terminus, and an additional 139 acres being disturbed to the Otter Creek terminus. This would result in an average of 46.9 acres per month of disturbance and 5.8 acres per month of disturbance during construction to the terminal points, respectively. The estimated windblown emissions, based on these average figures, were derived in the manner described for a rail line along the proposed route (see Table A5-21).

TABLE A5-21

TOTAL ANNUAL EMISSIONS FROM CONSTRUCTION ACTIVITIES
MOON CREEK ALTERNATIVE

DIESEL FUEL COMBUSTION (TOTAL)[a]	EMISSIONS (tons)
Particulte Matter (TSP)	68-205
Sulfur Dioxide (SO_2)	78-234
Carbon Monoxide (CO)	246-737
Hydrocarbons (HC)	106-317
Nitrogen Dioxide (NO_2)	1,048-3,143
DISTURBED LAND[b]	
Construction TSP (total, 1985-1989)	1,000-3,000
Windblown Dust TSP (annual, 1985-1987)	394/370[c]
Windblown Dust TSP (annual, 1988-1989)	36/45
Windblown Dust TSP (total, 1985-1989)	860/830

[a] Emission factors from EPA Publication "Compilation of Air Pollutant Emission Factors," AP-42. EPA, Research Triangle Park, NC.

[b] Emission factors from "Evaluation of Fugitive Dust Emissions from Mining--Task I Report," PEDCo-Environmental Specialists, Inc., under EPA Contract No. 68-02-1321. April, 1976.

[c] Figures represent Ashland SE Alignment/Ashland NW Alignment

The combustion of diesel fuel by heavy-construction equipment would produce the same pollutants along the Moon Creek alternative route as were discussed for the proposed rail line. The same methods were employed in determining the magnitude of these emissions (see Table A5-21).

The methods and findings pertaining to the extensive cut near Ashland that were discussed for the proposed rail line also apply to the Moon Creek alternative route. With the incorporation of the Ashland NW Alignment, however, the cut would not be included in this alternative route.

A5.3.2 Operation and Maintenance

Air quality assumptions and methods that apply to the operation-and-maintenance phase of the Moon Creek route are primarily concerned with fugitive coal dust and the combustion of diesel fuel by locomotives. Both of these considerations derive from operation activities. Maintenance activities along the alternative would be insignificant in terms of impact to air quality.

As noted in the discussion of the proposed railroad, no consensus exists concerning the magnitude of fugitive coal dust emissions from railcars in transit. Nevertheless the impact to ambient air quality is conceded to be minimal.

The major source of air pollution emissions involved in operation activity along the Moon Creek alternative route is the combustion of diesel fuel by locomotive engines. The determination of specific emission figures for pollutants employs the same methods described for the proposed railroad (see Table A5-22). Figures developed to estimate the dispersion of emissions along the alignment of the Moon Creek alternative route rely upon the same dispersion model process as that used for the proposed railroad. Tables A5-23 and A5-24 present the predicted 24-hour and 1-hour concentrations. These figures indicate that the operation activity along the alternative--including operation adjacent to the Northern Cheyenne Indian Reservation--would violate neither federal or state air-quality standards nor PSD Class I and Class II increments. (Table A5-25 summarizes 24-hour concentrations in the Reservation.)

As in the case of the proposed rail line, maintenance activities along the Moon Creek alternative route would be of short duration, and maintenance vehicle emissions would be minimal. Although the operation and maintenance activities would continue along the alternative route for the life of the project, in no case would air quality impacts be significant along the line--and these impacts will decrease as a factor of distance from the right-of-way.

TABLE A5-22

ESTIMATED EMISSION RATES FROM LOCOMOTIVE DIESEL FUEL COMBUSTION
MOON CREEK ALTERNATIVE (ton/mile/year)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
		LOW PRODUCTION SCENARIO			
1986/87	0.06	0.13	0.37	0.06	0.76
1991	0.15	0.35	0.97	0.17	1.98
1996	0.37	0.85	2.39	0.42	4.92
2001	0.52	1.18	3.31	0.58	6.82
2006	0.62	1.42	4.00	0.70	8.24
2011	0.93	2.12	5.94	1.04	12.25
		MEDIUM PRODUCTION SCENARIO			
1986/87	0.06	0.13	0.37	0.06	0.76
1991	0.16	0.35	0.99	0.17	2.04
1996	0.43	0.98	2.76	0.48	5.68
2001	0.71	1.63	4.57	0.80	9.43
2006	0.88	2.00	5.61	0.98	11.57
2011	1.07	2.44	6.84	1.20	14.11
		HIGH PRODUCTION SCENARIO			
1986/87	0.06	0.13	0.37	0.06	0.76
1991	0.24	0.56	1.57	0.23	3.28
1996	0.49	1.11	3.12	0.55	6.44
2001	0.97	2.21	6.22	1.09	12.82
2006	1.24	2.82	7.93	1.39	16.35
2011	1.24	2.82	7.93	1.39	16.35

A5.3.3 <u>Downline Operations</u>

The downline operations for trains beginning on the Moon Creek alternative rail line route would be identical for trains using the route of the proposed rail line. Therefore, the impacts described for the proposed rail line would be the same for the Moon Creek alternative route (see Tables A5-8 and A5-9).

TABLE A5-23

ESTIMATED MAXIMUM 24-HOUR POLLUTANT CONCENTRATIONS
MOON CREEK ALTERNATIVE (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
LOW PRODUCTION SCENARIO					
1986/87	0.2	0.4	1.1	0.2	2.2
1991	0.5	1.1	2.9	0.5	5.9
1996	1.1	2.5	7.1	1.2	14.6
2001	1.5	3.5	9.8	1.7	20.6
2006	1.9	4.3	11.9	2.1	23.7
2011	2.7	6.3	17.4	3.0	36.5
MEDIUM PRODUCTION SCENARIO					
1986/87	0.2	0.4	1.1	0.2	2.2
1991	0.5	1.1	2.9	0.6	6.1
1996	1.3	2.9	8.1	1.4	15.9
2001	2.1	4.8	13.5	2.4	28.5
2006	2.5	5.9	15.9	2.9	34.9
2011	3.2	7.3	20.6	3.5	41.2
HIGH PRODUCTION SCENARIO					
1986/87	0.2	0.4	1.1	0.2	2.2
1991	0.7	1.7	4.3	0.9	9.6
1996	1.4	3.3	9.2	1.6	19.0
2001	2.9	6.5	19.0	3.2	38.1
2006	3.6	8.4	23.8	4.1	47.6
2011	3.6	8.4	23.8	4.1	47.6

A5.3.4 Related Actions

The discussion of the impact due to mine construction and to mine operation presented in the section on the proposed railroad is applicable to the Moon Creek Alternative. The effect of mining development on air quality would be the same regardless of the route chosen for the railroad.

TABLE A5-24

ESTIMATED MAXIMUM 1-HOUR POLLUTANT CONCENTRATION DUE TO LOCOMOTIVE EMISSIONS: MOON CREEK ALTERNATIVE (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
		LOW PRODUCTION SCENARIO			
1986/87	1.0	2.3	6.6	1.0	13.3
1991	3.5	8.2	22.8	4.1	46.6
1996	6.6	1.5	42.8	7.4	87.5
2001	9.2	20.9	58.9	10.5	123.7
2006	11.4	25.7	71.4	12.4	142.7
2011	16.2	38.1	104.7	18.1	218.8
		MEDIUM PRODUCTION SCENARIO			
1986/87	1.0	2.3	6.6	1.0	13.3
1991	4.6	10.5	29.5	5.1	60.9
1996	7.6	17.1	48.5	8.5	104.7
2001	12.4	28.5	80.8	14.3	171.3
2006	15.2	35.2	95.2	17.1	209.3
2011	19.0	43.7	123.7	20.9	247.4
		HIGH PRODUCTION SCENARIO			
1986/87	1.0	2.3	6.6	1.0	13.3
1991	6.0	14.3	39.0	6.9	80.8
1996	8.6	19.9	55.2	9.5	114.2
2001	17.0	39.0	114.2	19.0	228.4
2006	21.9	50.4	142.7	24.7	285.5
2011	21.9	50.4	142.7	24.7	285.5

TABLE A5-25

MAXIMUM ESTIMATED 24-HOUR POLLUTANT CONCENTRATIONS IN THE NORTHERN CHEYENNE INDIAN RESERVATION MOON CREEK ALTERNATIVE (ug/m^3)

Particulate Matter (TSP)	0.2
Sulfur Dioxide (SO_2)	0.5
Carbon Monoxide (CO)	1.5
Hydrocarbons (HC)	0.3
Nitrogen Dioxide (NO_2)	3.1

A5.4 COLSTRIP ALTERNATIVE

A5.4.1 Construction

The construction of a rail line along the Colstrip alternative route with the Ashland SE Alignment would disturb 838 acres, with 728 acres being disturbed during construction to the Montco terminus (1985-1987), and an additional 110 acres being disturbed during construction to the Otter Creek terminus (1988-1989). This would result in an average of 30 acres of disturbance per month to the Montco terminus, and 4.6 acres of disturbance per month to the Otter Creek terminus.

The construction of the rail line over the Colstrip alternative route, including the Ashland NW Alignment, would disturb 792 acres, with 653 acres being disturbed to the Montco terminus, and an additional 139 acres being disturbed to the Otter Creek terminus. This would result in an average of 27 acres per month of disturbance and 5.8 acres per month of disturbance to the Montco and Otter Creek terminals, respectively. The estimated windblown emissions, based on these acreage figures, were derived in the same manner described for a rail line along the proposed route (see Table A5-26).

TABLE A5-26

TOTAL ANNUAL EMISSIONS FROM CONSTRUCTION ACTIVITIES
COLSTRIP ALTERNATIVE

DIESEL FUEL COMBUSTION (TOTAL)[a]	EMISSION (tons)
Particulte Matter (TSP)	68-205
Sulfur Dioxide (SO_2)	78-234
Carbon Monoxide (CO)	246-737
Hydrocarbons (HC)	106-317
Nitrogen Dioxide (NO_2)	1,048-3,143
DISTURBED LAND[b]	
Construction TSP (total, 1985-1989)	1,000-3,000
Windblown Dust TSP (annual, 1985-1987)	237/212[c]
Windblown Dust TSP (annual, 1988-1989)	36/45
Windblown Dust TSP (total, 1985-1989)	546/514

[a] Emission factors from EPA Publication "Compilation of Air Pollutant Emission Factors," AP-42. EPA, Research Triangle Park, NC.

[b] Emission factors from "Evaluation of Fugitive Dust Emissions from Mining--Task I Report," PEDCo-Environmental Specialists, Inc., under EPA Contract No. 68-02-1321. April, 1976.

[c] Figures represent Ashland SE Alignment/Ashland NW Alignment.

The combustion of diesel fuel by heavy-construction equipment would produce the same pollutants along the Colstrip alternative route as were discussed for the proposed rail line. The same methods were employed in determining the magnitude of these emissions (see Table A5-26).

The methods and findings pertaining to the extensive cut near Ashland that were discussed for the proposed rail line also apply to the Moon Creek alternative route. With the incorporation of the Ashland NW Alignment, however, the cut would not be included.

A5.4.2 Operation and Maintenance

Air quality assumptions and methodologies that were discussed for the operation and maintenance of the proposed railroad also apply to the Colstrip alternative route. As discussed previously, the impact of fugitive coal dust emissions from rail cars is conceded to be minimal. The operation of a railroad along the Colstrip alternative route would violate neither federal or state air quality standards nor PSD Class I and Class II increments--except where the route transects the designated Colstrip Nonattainment Area.[13] Tables A5-26 through A5-30 present emission and concentration estimates for the pollutants resulting from locomotive operation.

As in the case of the proposed railroad, maintenance activities along the Colstrip alternative route would be of short duration, and maintenance vehicle emissions would be minimal.

A5.4.3 Downline Operations

Downline distances for the Colstrip alternative route have been calculated at 769 miles east and 1,092 miles west--totaling 1,861 miles of downline trackage. It is assumed that all downline tracks are in existence and that no construction activities would be required. Impacts to air quality from downline operation originating on the Colstrip alternative route derive from fugitive coal dust and from locomotive emissions. Fugitive coal dust emissions downline are anticipated to be even less than those levels generated along the alternative route itself.

The more significant impact on air quality by downline operations would be caused by the emission of pollutants resulting from the combustion of diesel fuel. The downline mileage for the Colstrip route is slightly different than for the proposed railroad. Trackage to the east is calculated at 865 miles and to the west it is 1,000 miles, for a 1,865-mile total. Applicable emission figures for the Colstrip alternative route have been generated using the same methods as have those for the proposed rail line (see Tables A5-31 and A5-32). In the case of the Colstrip alternative route, the emissions from downline operations, by themselves, would not cause violations of either federal or state air quality regulations nor of PSD Class I or Class II increments.

TABLE A5-27

ESTIMATED EMISSION RATES FROM LOCOMOTIVE DIESEL FUEL COMBUSTION
COLSTRIP ALTERNATIVE (ton/mile/year)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
		LOW PRODUCTION SCENARIO			
1986/87	0.09	0.20	0.56	0.10	1.15
1991	0.23	0.49	1.37	0.26	3.03
1996	0.57	1.29	3.63	0.64	7.49
2001	0.79	1.79	5.00	0.88	10.38
2006	0.94	2.14	6.01	1.05	12.40
2011	1.38	3.15	8.80	1.55	18.23
		MEDIUM PRODUCTION SCENARIO			
1986/87	0.09	0.20	0.56	0.10	1.15
1991	0.23	0.54	1.51	0.26	3.11
1996	0.66	1.49	4.19	0.73	8.65
2001	1.08	2.47	6.92	1.21	14.27
2006	1.31	2.99	8.41	1.47	17.34
2011	1.59	3.63	10.19	1.78	21.02
		HIGH PRODUCTION SCENARIO			
1986/87	0.09	0.20	0.56	0.10	1.15
1991	0.37	0.85	2.38	0.42	4.92
1996	0.74	1.69	4.75	0.83	9.80
2001	1.47	3.36	8.95	1.57	18.45
2006	1.85	4.21	11.82	2.07	24.37
2011	1.85	4.21	11.82	2.07	24.37

A5.4.4 Related Actions

The impact of mining development on air quality would be the same regardless of the route used by the railroad. Consequently, the discussion of related actions for the proposed railroad can be applied to this discussion for the Colstrip alternative route.

TABLE A5-28

ESTIMATED MAXIMUM 24-HOUR POLLUTANT CONCENTRATION DUE TO LOCOMOTIVE EMISSION: COLSTRIP ALTERNATIVE (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
LOW PRODUCTION SCENARIO					
1986/87	0.3	0.6	1.6	0.3	3.3
1991	0.7	1.6	4.4	0.8	8.9
1996	1.7	3.8	10.8	1.9	22.2
2001	2.4	5.2	14.7	2.5	30.1
2006	2.9	6.3	17.4	3.2	36.4
2011	4.1	9.4	25.4	4.6	53.9
MEDIUM PRODUCTION SCENARIO					
1986/87	0.3	0.6	1.6	0.3	3.3
1991	0.7	1.7	4.5	0.8	9.2
1996	1.9	4.4	12.4	2.2	25.3
2001	3.2	7.3	20.6	3.6	42.8
2006	3.8	8.7	25.4	4.3	50.7
2011	4.8	10.8	30.1	5.2	61.9
HIGH PRODUCTION SCENARIO					
1986/87	0.3	0.6	1.6	0.3	3.3
1991	1.1	2.5	7.0	1.2	14.7
1996	2.2	4.9	14.0	2.4	28.5
2001	4.3	10.0	27.0	4.6	53.9
2006	5.4	12.4	34.9	6.2	71.4
2011	5.4	12.4	34.9	6.2	71.4

TABLE A5-29

ESTIMATED MAXIMUM 1-HOUR POLLUTANT CONCENTRATION DUE TO LOCOMOTIVE EMISSIONS: COLSTRIP ALTERNATIVE (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)	SULFUR DIOXIDE (SO_2)	CARBON MONOXIDE (CO)	HYDRO-CARBONS (HC)	NITROGEN DIOXIDE (NO_2)
LOW PRODUCTION SCENARIO					
1986/87	1.6	3.5	9.5	1.8	19.9
1991	5.5	12.4	35.2	6.0	71.4
1996	10.5	22.8	64.7	11.4	133.2
2001	14.3	31.4	88.5	15.2	180.8
2006	17.1	38.1	104.7	19.0	218.0
2011	24.7	56.1	152.2	27.6	323.5
MEDIUM PRODUCTION SCENARIO					
1986/87	1.6	3.5	9.5	1.8	19.9
1991	6.9	16.2	44.7	7.8	92.3
1996	11.4	26.6	74.2	13.3	152.2
2001	19.0	43.7	123.7	21.9	256.9
2006	22.8	52.3	152.2	25.7	304.5
2011	28.5	64.7	180.8	31.4	371.1
HIGH PRODUCTION SCENARIO					
1986/87	1.6	3.5	9.5	1.8	19.9
1991	9.2	20.9	58.9	10.5	123.7
1996	13.3	29.5	83.7	14.3	171.3
2001	25.7	59.9	161.7	27.6	323.5
2006	32.4	74.2	209.3	37.1	428.2
2011	32.4	74.2	209.3	37.1	428.2

TABLE A5-30

MAXIMUM ESTIMATED 24-HOUR POLLUTANT CONCENTRATIONS IN THE NORTHERN CHEYENNE INDIAN RESERVATION COLSTRIP ALTERNATIVE (ug/m^3)

Particulate Matter (TSP)	0.2
Sulfur Dioxide (SO_2)	0.5
Carbon Monoxide (CO)	1.5
Hydrocarbons (HC)	0.3
Nitrogen Dioxide (NO_2)	3.1

TABLE A5-31

CALCULATED EMISSION RATES FOR DOWNLINE OPERATIONS
COLSTRIP ALTERNATIVE (ton/mile/year)

YEAR	PARTICULATE MATTER (TSP)		SULFUR DIOXIDE (SO_2)		CARBON MONOXIDE (CO)		HYDRO-CARBONS (HC)		NITROGEN DIOXIDE (NO_2)	
	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST
					LOW PRODUCTION SCENARIO					
1986/87	0.02	0.01	0.04	0.02	0.11	0.06	0.02	0.01	0.23	0.12
1991	0.05	0.03	0.14	0.08	0.39	0.22	0.07	0.04	0.80	0.45
1996	0.11	0.06	0.26	0.15	0.72	0.41	0.13	0.07	1.48	0.84
2001	0.16	0.09	0.35	0.20	1.00	0.56	0.17	0.10	2.05	1.16
2006	0.19	0.11	0.43	0.25	1.22	0.69	0.21	0.12	2.51	1.43
2011	0.29	0.16	0.65	0.37	1.82	1.04	0.32	0.18	3.76	2.14
					MEDIUM PRODUCTION SCENARIO					
1986/87	0.02	0.01	0.04	0.02	0.11	0.06	0.02	0.01	0.23	0.12
1991	0.05	0.03	0.14	0.08	0.39	0.22	0.07	0.04	0.80	0.45
1996	0.13	0.07	0.30	0.17	0.83	0.47	0.15	0.08	1.71	0.97
2001	0.22	0.12	0.49	0.28	1.38	0.79	0.24	0.14	2.85	1.62
2006	0.27	0.15	0.61	0.35	1.71	0.98	0.30	0.17	3.54	2.01
2011	0.33	0.19	0.75	0.43	2.10	1.20	0.37	0.21	4.33	2.47
					HIGH PRODUCTION SCENARIO					
1986/87	0.02	0.01	0.04	0.02	0.11	0.06	0.02	0.01	0.23	0.12
1991	0.07	0.04	0.16	0.10	0.45	0.34	0.08	0.06	0.92	0.62
1996	0.15	0.08	0.33	0.19	0.94	0.54	0.16	0.09	1.94	1.10
2001	0.29	0.17	0.67	0.38	1.88	1.07	0.33	0.19	3.88	2.21
2006	0.38	0.21	0.87	0.49	2.43	1.39	0.43	0.24	5.02	2.86
2011	0.38	0.21	0.87	0.49	2.43	1.39	0.43	0.24	5.02	2.86

TABLE A5-32

ESTIMATED MAXIMUM 24-HOUR POLLUTANT CONCENTRATIONS FOR DOWNLINE OPERATIONS: COLSTRIP ALTERNATIVE (ug/m^3)

YEAR	PARTICULATE MATTER (TSP)		SULFUR DIOXIDE (SO_2)		CARBON MONOXIDE (CO)		HYDRO-CARBONS (HC)		NITROGEN DIOXIDE (NO_2)	
	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST
				LOW PRODUCTION SCENARIO						
1986/87	<0.1	<0.1	0.1	<0.1	0.3	0.2	<0.1	<0.1	0.7	0.3
1991	0.2	0.1	0.3	0.2	0.8	0.6	0.2	0.1	1.6	1.3
1996	0.3	0.2	0.7	0.4	2.0	1.2	0.4	0.2	4.2	2.4
2001	0.5	0.3	1.0	0.6	2.8	1.6	0.5	0.3	5.8	3.3
2006	0.5	0.3	1.2	0.7	3.5	2.0	0.6	0.3	7.1	4.1
2011	0.8	0.5	1.8	1.0	5.2	2.9	0.9	0.5	10.6	6.1
				MEDIUM PRODUCTION SCENARIO						
1986/87	<0.1	<0.1	0.1	<0.1	0.3	0.2	<0.1	<0.1	0.7	0.3
1991	0.2	0.1	0.3	0.2	0.8	0.6	0.2	0.1	1.6	1.3
1996	0.4	0.2	0.9	0.5	2.4	1.3	0.4	0.2	4.8	2.7
2001	0.6	0.3	1.4	0.8	3.9	2.2	0.7	0.4	8.1	4.6
2006	0.8	0.4	1.7	1.0	4.8	2.8	0.9	0.5	10.0	5.7
2011	0.9	0.5	2.1	1.2	6.0	3.4	1.0	0.6	12.3	7.0
				HIGH PRODUCTION SCENARIO						
1986/87	<0.1	<0.1	0.1	<0.1	0.3	0.2	<0.1	<0.1	0.7	0.3
1991	0.2	0.2	0.4	0.4	1.2	1.1	0.2	0.2	2.3	2.2
1996	0.4	0.2	0.9	0.5	2.7	1.5	0.5	0.3	5.5	3.1
2001	0.8	0.5	1.9	1.1	5.3	3.0	0.9	0.5	11.0	6.3
2006	1.1	0.6	2.5	1.4	16.7	3.9	1.2	0.7	14.2	8.1
2011	1.1	0.6	2.5	1.4	16.7	3.9	1.2	0.7	14.2	8.1

A5.5 FOOTNOTES

1. Because the areas in which cut and fill operations will occur generally are comprised of unconsolidated silt and sand or of loose clay, little, if any, blasting is anticipated during the construction of the Proposed Action or of any of the alternative alignments.

2. See U.S. Environmental Protection Agency, "Evaluation of Fugitive Dust Emissions from Mining--Task I Report," prepared by PEDCo. Environmental Specialists, Inc., April, 1976, passim.

3. In this equation the following equivalents exist:

E = emission factor, ton/acre/year
a = portion of total wind-erosion losses that would be measured as suspended particles
I = soil erodibility, ton/acre/year
K = surface roughness factor
C = climatic factor
L' = unsheltered-field-width factor
V' = vegetative cover

The values of a and I are functions of soil type, and are displayed as follows:

Surface Soil Type	a	I, ton/acre/year
Rocky, gravelly	0.025	38
Sandy	0.010	134
Fine	0.041	52
Clay loam	0.025	47

The values of K range from 0.5 to 1.0; the value of L depends upon the disturbed area width; V is a function of vegetative cover. Within the Tongue River Region, the variables listed carry the following values:

a = 0.025 (an average for all surface soil types)
I = 52 (the highest value for rocky, gravelly, fine, and clay-loam soils)
K = 1 (denoting a smooth surface)
C = 0.5 (the highest possible value for the Tongue River Region)
L' = 0.5 (indicating an approximately 400-foot-wide area)
V' = 1 (denoting little or no vegetation)

On this basis, the following computations were made:

$E = a \times I \times K \times C \times L' \times V'$
$E = .025 \times 52 \times 1 \times .5 \times .5 \times 1$
E = 0.325 tons/acre/year, wind erosion emission factor

4. U.S. Environmental Protection Agency, Region VIII, "Summary of Past BACT Determinations Made by Region VIII for Large Surface Coal and Uranium Operations," December 10, 1979, passim. From this study the operation specifications for a heavy-duty scraper were taken, because this piece of machinery offers, in most instances, the "worst case" example.

5. U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors," AP-42, Research Triangle Park, North Carolina, passim. This report determines that the primary air pollutants resulting from the combustion of diesel fuel by a scraper exist as the following emission factors:

Pollutant	Emission Rate
TSP (total suspended particulates)	25 lb./10^3 gallons
SO_2 (sulphur oxides measured as sulphur dioxide)	27 lb./10^3 gallons
CO (carbon monoxide)	160 lb./10^3 gallons
HC (hydrocarbons)	28 lb./10^3 gallons
NO_2 (nitrogen oxides measured as nitrogen dioxide)	330 lb./10^3 gallons

6. The EPA's PAL model (an acronym for Point, Area, and Line source algorithm) is especially useful in modeling the ambient air impact from a railroad because curved and straight line source segments that approximate the rail line can be easily accommodated. See U.S., EPA, User's Guide for PAL, Environmental Sciences Research Laboratory, Office of Research and Development, Research Triangle Park, North Carolina, February, 1978.

7. See U.S. Department of the Interior, and Montana Department of State Lands, "Final Environmental Impact Statement--Northern Powder River Basin Coal, Montana," 1979; U.S. Department of Transportation, "Proposed Final Environmental Impact Statement--Coal Line Project," May, 1981. J. Olson, Montana Air Quality Bureau, personal communication, May 22, 1981.

8. U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors," passim. This report determines that the primary air pollutants resulting from the combustion of diesel fuel by a two-stroke, turbo-charged locomotive engine exist as the following emission factors:

Pollutant	Emission Rate
TSP (total suspended particulates)	27.3 lb./10^3 gallons
SO_2 (sulphur oxides measured as sulphur dioxide)	31.2 lb./10^3 gallons
CO (carbon monoxide)	98.3 lb./10^3 gallons
HC (hydrocarbons)	42.2 lb./10^3 gallons
NO_2 (nitrogen oxides measured as nitrogen dioxide)	419.0 lb./10^3 gallons

9. Derived 24-hour concentrations appear in the previous table, entitled "Estimated Maximum 24-hour Concentration: Proposed Action" (table number A5-4). The constructed model permits the inclusion of various components--the initial dispersion of variables, aerodynamic drag, meteorological data, and the geometric relationship between the pollutant source and the point at which that pollutant is computed (source--reception configuration)--to project estimated peak pollutant concentrations.

10. See the discussion in section 2.1--Construction. The figure for the production of construction dust (1.2 ton/acre/month) relies on U.S. EPA 1976; see footnote 2. Wind erosion figures were derived from the Montco modeling report: Science Applications, Inc., "Report on the Air Quality Modeling Analyses Conducted for the Montco Project," May 1, 1981.

11. The fuel consumption emission factors appear in U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors," passim. For the specific figures, see footnote 6.

12. Related studies also provided comparison methodologies and figures: U.S. Department of the Interior, "Final Environmental Impact Statement: Eastern Powder River Coal (Wyoming)," March 28, 1979; U.S. Department of the Interior, and Montana Department of State Lands, "Final Environmental Impact Statement: Northern Powder River Basin Coal, Montana," 1979.

13. At the recommendation of the Montana State Air Quality Bureau, a 120-square-mile area around Colstrip was classified by EPA as not meeting primary ambient air quality standards for total suspended particulates (TSP). The designation of "Nonattainment" was based on particulate samples collected within the town of Colstrip, and on Western Energy Company's Rosebud Mine. However, other particulate matter data gathered to the east of Colstrip (where the alternate spur of the Tongue River Railroad's Colstrip Alternative would be built) showed no violations.

In December, 1979, Western Energy Company petitioned against the designation on the grounds that the data used as a basis for designation was not representative of air quality in the region. The petition argued that the hi-vol samplers used to determine compliance were unduly influenced by localized particulate emissions from unpaved roads, temporary construction, and nearby furnace flues in Colstrip. The petition requested that the Nonattainment Area be redesignated Attainment, or that the Nonattainment boundaries be redefined. The Montana Attorney General's office concluded that the Montana Department of Health and Environmental Science did not have to act on the petition, and to this date no redesignation has been made.

Regardless of the controversy, though, the major issue is whether or not operation of the railroad would constitute an infraction of air quality regulations. The U.S. Environmental Protection Agency's Emission Offset Interpretative Ruling (U.S. Environmental Protection Agency, Appendix S, 44 F.R. §3282), which is the applicable regulation in the absence of Montana laws, states that:

> Secondary emissions need not be considered in determining whether the emission rates ... [required for review of air quality impact] would be exceeded....

and

> "Secondary emission" means emissions which would occur as a result of the construction or operation of a major stationary source or major modification, but do not come from the major stationary source or major modification itself. For the purpose of this Ruling, secondary emissions must be specific, well defined, quantifiable, and impact the same general area as the stationary source or modification which causes the secondary emissions. Secondary emissions may include, but are not limited to: (i) Emissions from ships or trains coming to or from the new or modified stationary source.

Consequently, under current regulations, operation of the Colstrip spur would not be considered in reviewing major stationary sources, nor would the railroad itself be deemed a major stationary source.

The EPA's Offset Ruling also exempts sources from review if the source would not cause an exceedance of 5 ug/m^3 TSP for 24 hours, or 1 ug/m^3 TSP for the annual average concentration (significance levels). Since the extremely conservative modeling effort in this analysis predicts a peak 24-hour impact of 5.4 ug/m^3 for a 24-hour interval, it is highly likely that a less conservative modeling effort would predict concentrations below the significance levels.

A6.0 NOISE IMPACTS

A6.1 PROPOSED ACTION

The construction and the operation of the proposed railroad would affect ambient noise levels in the immediate vicinity of the right-of-way. The noise impacts from construction would be short term, whereas those impacts from the operation of the railroad would rise incrementally through the life of the project. In addition, downline corridors may be affected by the increased train traffic resulting from the operation of the proposed Tongue River Railroad Company railroad.

A6.1.1 Construction

The use of heavy machinery for the construction of the proposed rail line would cause temporary increases in noise levels along the right-of-way. The decibel readings on the "A" scale (dBA) during construction would average, at a distance 500 feet from the centerline, between 62 and 74 dBA, and, at 2,000 feet, between 54 and 67 dBA. At times, decibel readings could reach 85 dBA within 50 feet of the centerline.[1]

These increases in noise levels might cause temporary aggravation in the communities of Miles City and Ashland. Three residences in the Ashland area would fall within the maximum 500-foot decibel contour line with the Ashland SE Alignment. With the Ashland NW Alignment, 17 residences in the Ashland area would be located within the 500-foot decibel contour line. Twenty rural residences would be within the maximum 500-foot contour line along the remainder of the proposed line.

Two mitigating factors for the construction-related noise impacts exist: (1) that heavy equipment be dispersed along the right-of-way, thus limiting machinery concentrations that may produce high noise levels; (2) that construction normally be avoided during evening hours or on weekends, when people usually are more sensitive to noise disruption.

A6.1.2 Operation and Maintenance

The operation of the proposed TRRC railroad is expected to cause greater long term noise impacts than would the construction-related activities. Consequently, the highest anticipated number of trains per day--25 trains in 2011, under the high production scenario--was applied to calculate the increased noise levels.

A L_{eq} notation is a measure of the average sound level experienced at a specific location during a 24-hour period.[2] L_{eq}s were determined for both rural areas and urban areas along the route of the proposed railroad.

A6.1.2.1 Rural Areas

Currently existing noise levels were determined for rural areas by field investigation. Noise decibel readings were recorded at selected points along the Tongue River Road. These readings established an average rural L_{eq} of between 20 and 40 dBA. However, decibel readings were found to rise as high as 75 dBA adjacent to operating farm machinery.

Using the following equation, the L_{eq} for the proposed railroad was calculated:

$$L_{eq} = 10 \log[[(479,175)(ADTT)(L)]/[MPH]+[(ADTT)(CARS)(MPH^2)]]-2.35$$

In this equation:

ADTT = average daily train traffic, in trains
L = number of locomotives
CARS = number of cars
MPH = average train speed, in miles per hour

Assuming a train speed of 45 miles per hour (mph), the L_{eq} for TRRC trains at 100 feet from the centerline would be 63.5 dBA along the Burlington Northern line under the high coal production scenario. Along the TRRC line, the estimate would be 64.0 dBA. The incremental noise levels in rural areas could rise 23.5 dBA by the year 2011, because of the operation of the proposed railroad.

An additional calculation was performed to assess the potential noise impacts from the operation of the TRRC railroad. This calculation measures the possible L_{dn} levels along the rail line. The notation L_{dn}, like L_{eq}, measures the average sound level experienced at a specific location during a 24-hour period. L_{dn}s differ from L_{eq}s, however, in that the former weighs night-time noise more heavily (+10 dBA) than daytime noise to recognize a person's increased sensitivity to night-time noise. For noise distributed evenly through the daytime and night-time, the proposed railroad's L_{dn} measurement is approximately 6.4 dBA higher than is the L_{eq} measurement. The estimated L_{dn} for the railroad, at 100 feet from the centerline under the high coal production scenario, is 70.4 dBA in the year 2011.

The L_{eq} and L_{dn} estimates for the proposed rail line may exaggerate the potential noise impact to rural areas. For, decibel readings decrease considerably as the distance increases from the rail line. Thus, the establishment of L_{dn} contour lines was used to assess the noise impact to sensitive receptors--which, in rural areas, principally would be ranch homes. The Environmental Protection Agency (EPA) has ascertained that an L_{dn} level of 55 dBA or less must be maintained to prevent individuals from being influenced by the adverse effects of noise.[3] The EPA also determined that an L_{dn} level of 70 dBA would produce a hearing loss after prolonged exposure, i.e., 40 years.

To address these threshold levels, L_{dn} contour lines for 55 dBA and for 70 dBA were established for the proposed rail line. The residences currently located within those contour lines were ascertained from interviews with persons living along the proposed rail line's route, and from U.S. Geological Survey (USGS) quadrangle maps. The 55-dBA contour line for the proposed rail line is approximately 3,470 feet from the centerline; the 70-dBA contour line is about 110 feet from that line (see Table A6-1). The USGS maps reveal that, with the Ashland SE Alignment, 95 rural residences would fall within the 55-L_{dn} contour line, and 6 rural residences would fall within the 70-L_{dn} contour line (140 feet). Under the Ashland NW Alignment, 99 rural residences would be located within the 55-L_{dn} contour, and 5 rural residences would be located within the 70-L_{dn} contour.

TABLE A6-1

PROJECTED NOISE LEVELS ALONG THE TRRC RAIL LINE
PROPOSED ACTION/HIGH COAL PRODUCTION SCENARIO, 2011

NOISE LEVEL MEASURE	AMOUNT
70-dBA Contour	110 feet[a]
55-dBA Contour	3,470 feet[a]
L_{dn} (100 feet)[a]	70.4 dBA
L_{eq} (100 feet)[a]	64.0 dBA

[a] Distance from track centerline

A6.1.2.2 Urban Areas

The communities of Miles City, Forsyth, and Ashland were defined as urban areas for the purposes of assessing noise impacts. Miles City and Forsyth currently experience train traffic on the Burlington Northern rail line, while Ashland currently is exposed to no rail traffic.

The analysis of the noise impacts upon Miles City and Forsyth first defined the existing L_{eq} levels associated with BN trains. It then estimated the incremental L_{eq}s caused by the additional TRRC trains, under the high coal production scenario (2011). The L_{eq} equation presented in section A6.1.2.1 was employed to calculate the L_{eq} levels for the BN and the TRRC. The final L_{eq}s were estimated using the following equation:

$$\text{Final } L_{eq} = L_1 + 10 \log [(1+10)[L_1 - L_2](110)]$$

In this equation:

$L_1 = L_{eq}$ without TRRC trains, and
$L_2 = L_{eq}$ for TRRC trains only

Table A6-2 presents the results of this analysis. The calculations indicate that the L_{eq} increment attributable to the TRRC trains exceeds 4 decibels only on the abandoned Milwaukee Road (MR) line in Miles City, on which no current rail traffic exists. All other rail line segments show an incremental L_{eq} of 3 decibels or less.

TABLE A6-2

INCREMENTAL L_{eqs} ATTRIBUTABLE TO BN TRAFFIC AND TRRC TRAINS IN URBAN AREAS: PROPOSED ACTION (dBA)

	SCENARIO	NON-TRRC TRAINS	TRRC TRAINS	FINAL L_{eq}	ΔL_{eq}
Miles City					
Abandoned MR Line	Low	--	62.6	62.6	62.6
	Medium	--	63.2	63.2	63.2
	High	--	63.8	63.8	63.8
BN East	Low	61.3	60.1	63.8	2.5
	Medium	61.3	60.8	64.1	2.8
	High	61.3	61.3	64.3	3.0
BN West	Low	61.3	56.8	62.6	1.3
	Medium	61.3	57.4	62.8	1.5
	High	61.3	58.0	63.0	1.7
Forsyth	Low	65.0	60.9	66.4	1.4
	Medium	65.0	61.5	66.6	1.6
	High	65.0	62.1	66.8	1.8

The 70-dBA contour lines for L_{dn} levels in Miles City do not extend beyond the established abandoned Milwaukee Road right-of-way. The TRRC trains would expose no sensitive receptors to this level of noise. The 55-dBA contour lines are presented in Table A6-3. Approximately 0.5 square mile of Miles City is located inside this contour line. Two schools, a park, and some Miles City residences appear within this zone, and they may experience some noise interference. Table A6-4 presents data regarding pertinent human responses to various sound levels.

The 55-dBA contour in the Ashland area was considered to run parallel to the rail line at a distance of 4,370 feet. Included in this area is the Tranel Subdivision, the St. Labre Mission, St. Joseph's Village, Ashland Elementary School, and the Ashland townsite.

TABLE A6-3

DOWNLINE IMPACT OF TRAIN TRAFFIC, 55-dBA AND 70-dBA Ldn CONTOURS
PROPOSED ACTION/MEDIUM PRODUCTION SCENARIO, 2011

SEGMENT	TOTAL NO. OF TRAINS	55-dBA CONTOUR[a] FINAL L_{dn}	55 dBA CONTOUR WITHOUT TRRC TRAINS	DIFFERENCE	70-dBA CONTOUR FINAL L_{dn}	70-dBA CONTOUR WITHOUT TRRC TRAINS	DIFFERENCE
WEST							
Miles City/Livingston	37	1,792	1,561	231	240	195	45
Livingston/Helena	54	2,291	1,995	296	347	282	65
Helena/Missoula	58	2,399	2,122	277	372	309	63
Missoula/Sandpoint	41	1,905	1,685	220	263	219	44
Sandpoint/Spokane	75	2,840	2,671	169	479	437	42
EAST							
Miles City/Terry	48	2,122	1,660	462	309	214	95
Terry/Casselton	48	2,122	1,660	462	309	214	95
Casselton/Staples	65	2,712	2,399	313	444	369	75
Staples/Superior	14	971	678	293	96	57	39
Staples/Twin Cities	57	2,372	2,090	282	366	302	64
Casselton/Twin Cities	21	1,240	1,113	127	138	117	21
Terry/Twin Cities	11	794	404	390	71	26	45

[a] Contours in feet from track centerline

TABLE A6-4

SOUND LEVELS AND HUMAN RESPONSE

CAUSE	NOISE LEVEL (dBA)	RESPONSE	HEARING EFFECTS	CONVERSATIONAL RELATIONSHIPS
Carrier deck jet operation	140			
	130	Limit amplified speech		
Jet takeoff (200 ft) Discotheque Auto horn (3 ft)	120	Maximum vocal effort		
Riveting machine	110		Contribution to hearing impairment begins	
Jet takeoff (2,000 ft) Garbage truck	100			Shouting in ear
New York subway station		Very annoying		
Heavy truck (50 ft)	90			Shouting at 2 ft
Pneumatic drill (50 feet)	80	Annoying		Very loud conversation, 2 ft
Alarm clock Freight train (50 ft) Freeway traffic (50 ft)	70	Telephone use difficult Intrusive		Loud conversation, 2 ft Loud conversation, 4 ft
Air conditioning unit (20 ft)	60			Normal conversation
Light auto traffic (100 ft)	50	Quiet		
Living room				
Bedroom	40			
Library				
Soft whisper (15 feet)	30	Very quiet		
Broadcasting studio	20			
	10	Just audible		
	0	Threshold of hearing		

Roughly 206 residences in the Ashland area would be within the 55-L_{dn} contour of the Ashland SE Alignment. With the NW Alignment, 217 Ashland area residences would be within the 55-L_{dn} contour. These areas and residences might experience some degree of interference with outside activities as a result of train operations. No residences in the Ashland area would fall within the 70-L_{dn} contour with construction of the Ashland SE Alignment. Four residences would fall within the 70-L_{dn} contour with the Ashland NW Alignment.

A6.1.3 Downline Operations

The potential downline noise impacts were determined by the same type of analysis as is described in section A6.1.2. The L_{eq} levels were calculated using the applicable equation (see section A6.1.2.1). The existing L_{eqs} for representative downline segments are presented in Table A6-5. The L_{eq} levels expected for the TRRC trains in 2011, under the high coal production scenario, are shown in Table A6-6.

TABLE A6-5

L_{eq}--EXISTING TRAFFIC BY DOWNLINE SEGMENT (dBA)

		MILES PER HOUR						
SEGMENT	TRAINS/DAY	5	20	25	30	35	40	45
WEST								
Miles City/ Livingston	10	63.5	59.0	59.2	59.6	60.3	61.0	61.7
Livingston/Helena	11	63.9	59.4	59.6	60.0	60.7	61.4	62.1
Helena/Missoula	14	64.8	60.4	60.6	60.8	61.7	62.4	63.1
Missoula/Sandpoint	10	63.5	59.0	59.2	59.6	60.3	61.0	61.7
Sandpoint/Spokane	41	69.6	65.1	65.3	65.7	65.9	67.1	67.8
EAST								
Miles City/Terry	16	65.5	61.0	61.2	61.6	62.3	63.0	63.7
Terry/Casselton	17	65.8	61.3	61.4	61.7	62.5	63.2	64.0
Casselton/Staples	30	68.2	63.8	63.9	64.4	65.0	65.7	66.5
Staples/Superior	4	59.5	55.0	55.2	55.6	56.3	57.0	57.7
Staples/Twin Cities	30	68.2	63.8	63.9	64.4	65.0	65.7	66.5
Casselton/ Twin Cities	10	63.5	59.0	59.2	59.6	60.3	61.0	61.7
Terry/Twin Cities[a]	41	59.5	55.0	55.2	55.6	56.3	57.0	57.7

[a] BN/South Dakota line

Table A6-7 depicts the incremental L_{eq} for each rail line segment. The addition of TRRC trains does not add more than four decibels to the L_{eq} measure for any downline segment except for the Terry to Twin

TABLE A6-6

L_{eq}--PROJECTED NON-TRRC TRAFFIC BY DOWNLINE SEGMENT[a]
(dBA)

SEGMENT	YEAR 2011 TRAINS/DAY	MILES PER HOUR 5	20	25	30	35	40	45
WEST								
Miles City/ Livingston	30	68.2	63.8	63.9	64.4	65.0	65.7	66.5
Livingston/Helena	44	69.9	65.4	65.6	66.1	66.7	67.4	68.1
Helena/Missoula	48	70.3	65.8	66.0	66.4	67.1	67.8	68.5
Missoula/Sandpoint	34	68.8	64.3	64.5	64.9	65.6	66.3	67.0
Sandpoint/Spokane	68	71.8	67.3	67.5	67.9	68.6	69.3	70.0
EAST								
Miles City/Terry	33	68.6	64.2	64.3	64.8	65.5	66.2	66.9
Terry/Casselton	33	68.6	64.2	64.3	64.8	65.5	66.2	66.9
Casselton/Staples	53	70.7	66.2	66.4	66.9	67.5	68.2	69.0
Staples/Superior	8	62.1	57.7	57.9	58.3	59.0	59.7	60.4
Staples/Twin Cities	51	70.5	65.9	66.2	66.7	67.3	68.0	68.8
Casselton/ Twin Cities	18	66.0	61.6	61.7	62.2	62.8	63.5	64.3
Terry/Twin Cities[c]	4	59.5	55.0	55.2	55.6	56.3	57.0	57.7

a Assumes a unit train of 4 locomotives pulling 105 cars
b 2011 trains = total projected trains less projected TRRC trains
c Assumes little or no growth on this line

Cities segment. If TRRC trains were routed on the BN South Dakota line, the addition of these trains to the existing traffic would raise the L_{eq} measure by 4.4 decibels at 100 feet distance from the centerline. TRRC trains would not cause the 65-decibel ICC-mandated threshold to be exceeded in any segment where the L_{eq} was not already in excess of 65 dBA.

Because the addition of TRRC trains would increase the L_{eq} measure by more than 4 decibels along the Milwaukee Line, an examination of the effect of TRRC trains on sensitive receptors along this line was made. This examination was made on a sample basis. That is, the 70-L_{dn} and the 55-L_{dn} noise contours for sample downline communities located along the Milwaukee Line were calculated and the sensitive receptors in these communities which fall within the contours were counted. The sample communities examined include Appleton, South Dakota; Millbank, South Dakota; and Waubay, South Dakota. The review revealed that no sensitive receptors would fall within the 70-L_{dn} contour because that contour would be located entirely within the rail-

TABLE A6-7

FINAL L_{eq} BY DOWNLINE SEGMENT
PROPOSED ACTION/MEDIUM COAL PRODUCTION SCENARIO, 2011
(dBA)

SEGMENT	ASSUMING PROJECTED LEVELS OF NON-TRRC TRAFFIC				ASSUMING EXISTING LEVELS OF NON-TRRC TRAFFIC			
	NON-TRRC	TRRC	FINAL L_{eq}[a]	ΔL_{eq}	NON-TRRC	TRRC	FINAL L_{eq}	ΔL_{eq}
WEST								
Miles City/ Livingston	66.5	60.2	67.4	.9	61.7	60.2	64.0	2.3
Livingston/Helena	68.1	61.7	69.0	.9	63.1	61.7	65.4	2.3
Helena/Missoula	68.5	61.7	69.3	.8	66.6	61.7	67.8	1.2
Missoula/Sandpoint	67.0	60.2	67.8	.8	61.7	60.2	63.8	2.1
Sandpoint/Spokane	70.0	60.2	70.4	.4	67.8	60.2	68.5	.7
EAST								
Miles City/Terry	66.9	63.5	68.5	1.6	63.7	63.5	66.6	2.9
Terry/Casselton	66.9	63.5	68.5	1.6	64.0	63.5	66.8	2.8
Casselton/Staples	69.0	62.5	69.8	.8	66.5	62.5	67.9	1.4
Staples/Superior	60.4	59.6	63.1	2.7	57.7	59.5	61.7	2.2
Staples/Twin Cities	68.8	59.5	69.3	.5	66.5	59.5	67.3	.8
Casselton/ Twin Cities	64.3	56.5	65.0	.7	61.7	56.5	62.8	1.1
Terry/Twin Cities	57.7	60.2	62.1	4.4	57.7	60.2	62.1	4.4

[a] Final L_{eq}s computed at 45 mph--highest operating speed and maximum noise level for running trains

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road right-of-way, even with the addition of TRRC trains. In the area between the 70-L_{dn} and the 55-L_{dn} contours, however, an increase in sensitive receptors was found. In Appleton, a community of 1,800 people located adjacent to the rail line, no schools, hospitals, libraries, or churches would fall within this area, with or without TRRC trains. The number of residences falling within the 55-L_{dn} contour could increase from 60 without TRRC trains, to 170 with TRRC trains. Similarly, in Waubay, a community split by the rail line, with a population of 700 persons, only the number of residences which would fall within the 55-L_{dn} contour would increase with the addition of TRRC trains. The increase would be from about 30 to about 100 residences. In Millbank, also a community which is divided by the rail line (population 4,200), two churches and one hospital, as well as many residences, would fall within the 55-L_{dn} contour attributable to TRRC trains. Without TRRC trains, one church and residences would fall within the 55-L_{dn} contour.

The noise effect of TRRC trains within other downline corridor segments does not exceed the ICC threshold as shown above. However, to develop a better understanding of the noise effect of TRRC trains on other downline segments, three representative communities located on the downline corridor expected to experience the largest increment in L_{dn} contours (Glendive to Casselton) were selected for detailed analysis. These communities are Tappan, Belfield, and Jamestown, North Dakota. It was found that no sensitive receptors would fall within the incremental 70-L_{dn} contour associated with the addition of TRRC trains. When considering the 55-L_{dn} contour, an increase in sensitive receptors was found. In Tappan, a few residences would be located within the 55-L_{dn} contour. In Belfield, the addition of TRRC trains would add 2 churches and approximately 70 houses to the area within the 55-L_{dn} contour. Without TRRC trains, 5 churches, 4 schools and approximately 230 residences would fall within that contour. In Jamestown, three churches and two schools as well as residences and places of employment would be located within the 55-L_{dn} contour attributable to TRRC trains. Without TRRC trains, sensitive receptors at Jamestown are expected to include five churches, one hospital, and four schools.

The exposure of sensitive receptors under the low and high coal production scenarios would differ only marginally from that estimated for the medium coal production scenario.

A6.1.4 Related Actions

The effects of mine development on ambient noise levels in the project area are functions of the noise associated with running operations and of the noise associated with increased highway traffic. The assessment of noise levels for the related actions relied upon the results of preceding noise impact analyses.[4]

A6.1.4.1 Impacts Associated with Mining Operations

The effects of noise associated with mining are confined generally to the mining area and to the immediately adjacent area, which is rural. Noise impacts would exert little influence elsewhere.[5] The mine that is located closest to a community is one situated approximately 5 miles northeast of Ashland. The other mines are sited from 5 to 10 miles from Ashland. Because of these distances, Ashland would not experience disruptive noise impacts produced by the mining operations.

A6.1.4.2 Impacts Associated with Highway Traffic

Some highways in the project area would experience significant increases in traffic as a result of related action operations. The areas projected to receive the largest changes in traffic volume are located in and around Ashland. The average daily traffic through Ashland may increase from approximately 900 vehicles currently to 1,500 by 1991 and 3,500 by 2011. Over 50 percent of this traffic represents miners' work trips, and this travel would be concentrated during work shift changes. Other project area roads that are projected to experience significant average daily traffic increases include: FAS 447, Ashland to Mine Site #4; FAS 484, U.S. 212 to Mine Sites #2 and #3; FAS 566, Ashland to the Montco Mine. The 55-L_{dn} noise contours associated with the projected traffic volumes range from 500 to 1,000 feet from the railroad's centerline.

A6.2 TONGUE RIVER ROAD ALTERNATIVE

The Tongue River Road alternative route follows the same transportation corridor as does the proposed rail line. Thus, the potential noise impacts for the two routes would be very similar. Construction noise impacts would be the same as those discussed for the proposed rail line in the Ashland area. Along the remainder of the route, 25 rural residences would fall within the maximum 500-foot decibel contour line.

During operation of the railroad, under the high coal production scenario in 2011, the L_{dn} level would reach 71.0 dBA, and the 55-dBA and the 70-dBA contour lines would average 3,980 feet and 125 feet, respectively, from the centerline (see Table A6-8). When the 55- and 70-L_{dn} contours were considered along with the USGS quadrangle maps, 90 rural residences were located within the 55-L_{dn} contour, and 7 rural residences were located within the 70-L_{dn} contour, with the Ashland SE Alignment. When the Ashland NW Alignment was considered, 94 rural residences were within the 55-L_{dn} contour, and 6 rural residences were within the 70-L_{dn} contour. Because the Tongue River Road alternative route would involve the same alignments near Ashland, the noise impacts to the Ashland area described for the proposed rail line can be applied to the alternative.

TABLE A6-8

PROJECTED NOISE LEVELS ALONG THE TRRC RAIL LINE
TONGUE RIVER ROAD ALTERNATIVE/HIGH PRODUCTION SCENARIO, 2011

NOISE LEVEL MEASURE	AMOUNT
70-dBA Contour	125 feet[a]
55-dBA Contour	3,980 feet[a]
L_{dn} (100 feet)[a]	71.0 dBA
L_{eq} (100 feet)[a]	64.6 dBA

[a] Distance from track centerline

A6.3 MOON CREEK ALTERNATIVE

The Moon Creek alternative route does not follow the same transportation corridor as the proposed rail line for its entire length, but the noise impacts that would result from the construction, operation, and maintenance would be similar. Construction noise impacts would be the same as those discussed for the proposed rail line in the Ashland area. Along the remainder of the route, 21 rural residences would fall within the maximum 500-foot decibel contour line.

Under the high coal production scenario in 2011, the L_{dn} level would reach 71.4 dBA, and the 55-dBA and the 70-dBA contour lines would average 4,370 feet and 140 feet, respectively, from the centerline (see Table A6-9). When the 55- and 70-L_{dn} contours were considered along with the USGS quadrangle maps, 89 rural residences were located within the 55-L_{dn} contour and 7 rural residences were within the 70-L_{dn} contour including the Ashland SE Alignment. When the Ashland NW Alignment was considered, 93 rural residences were within the 55-L_{dn} contour and 6 rural residences were within the 70-L_{dn} contour. Because the Moon Creek alternative route would involve the same alignments near Ashland, the noise impacts to the Ashland area described for the proposed rail line can be applied to the alternative.

TABLE A6-9

PROJECTED NOISE LEVELS ALONG THE TRRC RAIL LINE
MOON CREEK ALTERNATIVE/HIGH PRODUCTION SCENARIO, 2011

NOISE-LEVEL MEASURE	AMOUNT
70-dBA Contour	140 feet[a]
55-dBA Contour	4,370 feet[a]
L_{dn} (100 feet)[a]	71.4 dBA
L_{eq} (100 feet)[a]	65.0 dBA

[a] Distance from track centerline

A6.4 COLSTRIP ALTERNATIVE

A6.4.1 Construction

The noise impacts generated by the construction of the Colstrip alternative route are similar to those impacts described for the proposed rail line. Impacts in the Ashland areas would be the same as those discussed for the proposed rail line. Along the remainder of the route, 17 rural residences would fall within the maximum 500-foot decibel contour line.

A6.4.2 Operation and Maintenance

The method developed to assess the noise impacts for the proposed rail line's operation and maintenance activities also was used to assess the noise impacts for the Colstrip alternative route. Colstrip itself was included in this evaluation, as were Miles City and Forsyth.

A6.4.2.1 Rural Areas

The finding for the rural portions of the proposed railroad--that the addition of the TRRC trains would add no more than 4 decibels to the L_{eq} measure--applies to the rural portions of every rail line route except the Colstrip alternative route. The addition of the TRRC trains to the Burlington Northern line in the rural area between Colstrip and Nichols would increase the existing L_{eq} measures there by more than 4 decibels. However, the final L_{eq} for this segment would not exceed 65 decibels under any scenario.[6]

Once the 55-L_{dn} and 70-L_{dn} contour lines were plotted on the USGS quadrangle maps, 55 rural residences were located within the 55-L_{dn} contour, and 5 rural residences were located in the 70-L_{dn} contour with the Ashland SE Alignment. Should the Ashland NW Alignment be included, 59 rural residences would be located in the 55-L_{dn} contour, and 4 rural residences would be located in the 70-L_{dn} contour (see Table A6-10).

TABLE A6-10

PROJECTED NOISE LEVELS FOR RURAL AREAS ALONG THE TRRC RAIL LINE
COLSTRIP ALTERNATIVE/HIGH PRODUCTION SCENARIO, 2011

NOISE LEVEL MEASURE	AMOUNT
70 dBA Contour	115 feet[a]
55 dBA Contour	3,550 feet[a]
L_{dn} (100 feet)[a]	70.5 dBA
L_{eq} (100 feet)[a]	64.1 dBA

[a] Distance from the centerline

A6.4.2.2 Urban Areas

The analysis for the Colstrip alternative route's urban areas reveals that the TRRC trains would add little to those noise levels currently experienced along the Burlington Northern mainline in Forsyth or Miles City. However, Colstrip route calculations indicate that the L_{eq} increment attributable to the TRRC trains would exceed 4 decibels (see Table A6-11). The 70-dBA contour would not extend beyond the existing railroad right-of-way in Colstrip. The TRRC trains would expose no sensitive receptors to this level of noise. In Colstrip, the addition of the TRRC trains would double the distance between the rail line and the 55-dBA contour. Within the incremental contour are located two churches, a library, and many residences. Any outdoor activities related to these sensitive receptors thus would experience noise interference.[7]

TABLE A6-11

INCREMENTAL L_{eq}s ATTRIBUTABLE TO TRRC TRAINS IN URBAN AREAS[a]
COLSTRIP ALTERNATIVE

	SCENARIO	NON-TRRC TRAINS	TRRC TRAINS	Final L_{eq}	ΔL_{eq}
Colstrip	Low	62.7	58.9	64.2	5.3
	Medium	63.3	58.9	64.6	5.7
	High	63.8	58.9	65.0	6.1

Train operations using the Colstrip alternative route would be confined to the Burlington Northern mainline and, therefore, would not increase noise impacts along the abandoned Milwaukee Road line in Miles City. In regard to the Ashland area, the noise impacts described for the proposed railroad would be the same for the Colstrip alternative route.

A6.5. FOOTNOTES

1. These noise levels assume that, on a 1-mile segment, there will be 13 scrapers, 7 bulldozers, 4 graders, 4 rollers, 4 trucks, 1 backhoe, and a vibrating tampen. All would be operating at full load with no attenuation assumed. Interstate Commerce Commission, Draft Environmental Impact Statement, Somerset Railroad Corporation, Construction and Operation of a Line of Railroad in Niagara County, New York. Washington, DC, September 5, 1980, pp. IV-40 through IV-50.

2. L_{eq}s were computed first for non-TRRC trains projected to operate on existing rail lines, and then for total trains with TRRC trains added. Calculation of the L_{eq} for non-TRRC trains and the final L_{eq} (for total trains) provided the data needed to determine whether the ICC thresholds (+4 decibels or a total of 65 decibels) may be exceeded with the addition of TRRC trains.

3. This basic formula was supplied by the ICC. The formula was revised to account for 53-foot versus 50-foot cars and a single event dBA reading for an SD-40-2 locomotive at throttle position 8. These two minor changes better reflect equipment expected to be used for TRRC trains.

4. U.S. Environmental Protection Agency, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, Washington, DC, 1974. (An L_{dn} of 65 dBA currently is being considered by EPA to replace the 55-L_{dn}. See "Noise Emission Standards for Transportation Equipment Interstate Rail Carriers," Federal Register, Volume 45, No. 191, September 30, 1980, pp. 64876-64877.

5. This formula also was supplied by the ICC. See Interstate Commerce Commission, "Detailed Outline--Tongue River Railroad EIS," Washington, DC, December 8, 1980, Appendix D; and Paul Mushovic, Energy and Environment Branch, Interstate Commerce Commission, Washington, DC, July, 1981.

6. U.S. Department of the Interior, Geological Survey, Colstrip Project EIS (Draft), Volume 1, Washington, DC, pp. 2.2-2.4; U.S. Department of the Interior, Bureau of Land Management, Draft Environmental Impact Statement--Coal, Cheyenne, Wyoming, January, 1981, p. 62.

7. Ibid.

A7.0 SAFETY IMPACTS

A7.1 PROPOSED ACTION

A7.1.1 Construction

During the construction of the proposed rail line, safety impacts in the project area would be minimal. Most of the applicable safety issues would concern the operation of heavy equipment by various contractors. Construction activities would exert a negligible impact on study area safety outside the TRRC work force itself.

A7.1.2 Operation and Maintenance

The impacts to safety resulting from railroad operation along the route of the proposed rail line include the potential for vehicle collisions at at-grade crossings and the potential for derailments. The possibility that train operations might produce trackside fires has have been discussed in that section addressing land use impacts (see section A1.1.2).

A7.1.2.1 Grade-crossing Accidents

Grade-crossing accidents were projected for each set of crossings within the project area by coal production scenario (see section A3.1.2 for a description of these sets of crossings). The potential accidents that can be attributed to the Tongue River Railroad Company trains and to other trains were distinguished by using a method developed as part of the National Cooperative Highway Research Program.[1] The equation used in this calculation is:

$$EA = (A)(B)(ADTT)$$

In this equation, pertinent representations include:

EA = expected annual accidents at a crossing
A = an emperically derived factor, associating traffic volumes with accident frequency
B = an emperically derived factor, representing the relative effectiveness of various types of crossing-warning devices
ADTT = average daily train traffic

Table A7-1 presents the A and B factors used in this equation and illustrates the calculation procedure. The data that must be used in this equation include the estimates of daily traffic at each crossing, the estimates of daily train traffic, and the warning device employed at each crossing.[2] Thus accidents estimated for a set of representative crossings, through the project lifetime, can be predicted and aggregated to produce a regional total.

TABLE A7-1

PROCEDURE USED TO ESTIMATE ACCIDENTS ATTRIBUTABLE TO TRRC TRAINS

EXPECTED ACCIDENTS PER YEAR = A x B x TRAINS PER DAY

VEHICLES PER DAY	A FACTOR
250	.000347
500	.000694
1000	.001377
2000	.002627
3000	.003981
4000	.005208
*5000	.006516
6000	.007720
7000	009005
8000	.010278
9000	.011435
10000	.012674
12000	.015012
14000	.017315
16000	.019549
18000	.021736
20000	.023877
25000	.029051
30000	.034757

*EXAMPLE:

ASSUME: Urban Area
Crossbuck Protection
5000 Vehicles Per Day
5 Trains Per Day

EXPECTED ACCIDENTS (EA):

EA = .006516 x 3.06 x 5

EA = 0.100

EA = 1 accident every ten years

B FACTOR COMPONENTS
(B FACTOR = BASIC VALUE + ADJUSTMENTS[a])

BASIC VALUES:

A.	Crossbucks, highway volume less than 500 per day	3.89
B.	Crossbucks, urban	3.06
C.	Crossbucks, rural	3.03
D.	Stop signs, highway volume less than 500 per day	4.51
E.	Stop signs	1.15
F.	Wigwags	0.61
G.	Flashing lights, urban	0.32
H.	Flashing lights, rural	0.53
I.	Gates, urban	0.32
J.	Gates, rural	0.19

[a] Adjustment equals zero if protection type is other than stop sign with volume less than 500 or wigwag.

The accident estimates projected for the proposed railroad are presented in Table A7-2. Eight accidents involving the TRRC trains are expected between 1987 and 2011, under the medium coal production scenario. This figure represents a 41-percent increase over the baseline case. These eight accidents translate into 0.008 accidents per crossing/year, or an average increase of one accident per crossing in a 125-year period. The low production scenario would result in approximately 23 percent fewer accidents, and the high coal production scenario would generate about 30 percent more accidents. Table A7-3 presents estimates of the losses associated with these accidents (i.e., property damages, injuries, and fatalities).

TABLE A7-2

PROJECTED ACCIDENT RATES IN THE PROJECT AREA, 1987-2011
PROPOSED ACTION/MEDIUM PRODUCTION SCENARIO

YEAR	NON-TRRC	TRRC	TOTAL	PERCENTAGE INCREASE ATTRIBUTABLE TO TRRC TRAIN
1986/87	0.55	0.04	0.59	7
1991	0.62	0.08	0.70	12
1996	0.72	0.21	0.93	29
2001	0.75	0.36	1.11	48
2006	0.77	0.46	1.23	60
2011	0.87	0.56	1.43	64
CUMULATIVE TOTAL[a]	18.56	7.65	26.21	41

[a] Cumulative total includes all years 1987-2011

TABLE A7-3

PROJECTED GRADE-CROSSING ACCIDENTS AND ACCIDENT OUTCOMES
WITHIN THE PROJECT AREA: PROPOSED ACTION

ALTERNATIVE	EXPECTED ACCIDENTS	PROPERTY DAMAGE	INJURIES	FATALITIES
Non-TRRC	18.6	$23,000	3	2
Proposed Action				
Low Scenario	5.9	$ 7,500	1	1
Medium Scenario	7.6	$ 9,500	1	1
High Scenario	10.0	$12,500	2	1
Totals (Medium Scenario)				
Proposed Action	26.2	$32,500	4	3

Should the Ashland NW Alignment be included, a slight increase in the projected accident rates might be anticipated. The increase, which would not alter substantially the eight accidents projected over the 1983 to 2011 period, would be due to an at-grade crossing in the Ashland area.

Mitigative Measures

The most effective approaches to mitigating vehicle collisions at a railroad crossing are to upgrade the crossing's warning devices or to construct a grade-separated crossing. The Montana Department of Highways criteria governing grade-crossing improvements were used to assess whether the upgrading of crossings within the project area may be warranted, given the addition of the TRRC trains. The crossing improvements indicated by the analysis are presented in Tables A3-6 and A3-21, which can be found in sections A3.1.2 and A3.1.3, respectively. Approximately 45 percent of the crossings affected by TRRC trains may warrant upgrading, if the proposed rail line were constructed.[3]

A7.1.2.2 Derailments

The estimate of derailments within the project area involving TRRC-originated trains was based upon the average derailment rates experienced on the Burlington Northern system in recent years. The number of BN derailments in 1978 and 1979 was divided by the millions of train-miles operated on the entire system to derive a factor for projected TRRC train-miles. BN data also were used to estimate the property loss per accident.[4] National rates for the period 1978-1979 became the basis to establish injuries and fatalities.[5] The following factors are used in the analysis:

(1) 9 derailments per 1 million train-miles
(2) $40,000 in property damage per derailment
(3) 0.060 injuries per derailment
(4) 0.003 fatalities per derailment

These factors probably result in overestimating the number of derailments that may occur within the study area. The derailment rates are based upon regional and national incidents, which appear to occur most frequently on rail lines of lesser quality than those lines on which the TRRC trains would operate.[6] To use these derailment rates, an estimate of train-miles within the study area for the proposed railroad, by scenario, is required. Those estimates are presented in Table A7-4.

The number of TRRC train derailments and losses projected to occur within the project area appears in Table A7-5. A derailment is defined as occurring when one or more cars leave the tracks. The data indicate that, under the medium coal production scenario, derailments would increase from approximately one in 1991 to eight in 2011. The cumulative derailment total would slightly exceed 100, 70 percent of

TABLE A7-4

PROJECTED TRAIN-MILES WITHIN THE PROJECT AREA
PROPOSED ACTION/MEDIUM PRODUCTION SCENARIO

YEAR	ADTT[a]	AVERAGE DISTANCE TRAVELED WITHIN THE STUDY AREA[b]	ESTIMATED TRAIN-MILES[c] (millions)
1987/87	1	115	.040
1991	3	115	.120
1996	8	115	.322
2001	14	115	.564
2006	18	115	.724
2011	22	115	.886
CUMULATIVE TOTALS BY SCENARIO, 1987-2011			
Low Scenario		115	9.861
Medium Scenario		115	11.956
High Scenario		115	15.698

[a] See Table A3-9.
[b] Includes mileage on the TRRC line and on BN mainlines within the study area; the Tongue River Road alternative route differs insignificantly
[c] (Average daily trains) x (miles) x (350 operating days per year)

which would occur on the TRRC rail line. The remainder would occur on the Burlington Northern or the Milwaukee Road mainlines in the project area. The data also reveal that the number of injuries would remain small and that fatalities essentially would be nonexistent. The derailment losses would be incurred predominantly by the railroad companies and by railroad employees.[7]

The potential for train derailments in the Ashland area would increase with the Ashland NW Alignment. Although the absolute number of derailments would not increase along this route, the proximity of the rail line to Ashland would increase the possibility that derailments could occur in that community.

A decrease of 18 percent in the derailment total would be experienced for the proposed railroad under the low coal production scenario. An increase of 30 percent would occur under the high coal production scenario for the proposed railroad.

TABLE A7-5

PROJECTED TRRC TRAIN DERAILMENTS WITHIN THE PROJECT AREA
PROPOSED ACTION/MEDIUM PRODUCTION SCENARIO, 1987-2011

YEAR	MILLIONS OF TRAIN-MILES[a]	ESTIMATED DERAILMENT STATISTICS[b] DERAILMENTS	DAMAGE	INJURIES	FATALITIES
1986/87	.040	--[c]	--	--	--
1991	.120	1	$ 40,000	--	--
1996	.322	3	$ 120,000	--	--
2001	.564	5	$ 200,000	--	--
2006	.724	6	$ 240,000	--	--
2011	.886	8	$ 320,000	--	--
CUMULATIVE TOTALS[d]	11.956	108	$4,320,000	6	--

[a] See table A7-4

[b] Derailment factors: 9 derailments per million train-miles; $40,000 property damage per derailment; 0.060 injuries per derailment; 0.003 fatalities per derailment

[c] No entry indicates that the estimated value is less than 1

[d] Includes all years 1987-2011

A7.1.3 Downline Impacts

A7.1.3.1 Grade-crossing Accidents

The assessment of the possible downline train-crossing accidents involved a two-step approach:

(1) Historical accident rates--per million train-miles--were calculated for the several downline segments[8]

(2) TRRC-related accidents were estimated by multiplying the historical accident rates by the projected number of TRRC train-miles downline

To simplify the calculation of the estimated accidents associated with TRRC trains, weighted average rates were determined for the entire downline area. That is, the accident rates for each rail line segment and for each accident category--property damage, injuries, and fatalities--were weighted by the projected distribution of TRRC train miles on each downline segment.[9] Thus composite downline rates for accidents, property damage, injuries, and fatalities were established.

These composite rates, when multiplied by the total TRRC train-miles downline from the project area, were used to calculate the potential number of downline accidents involving TRRC trains, both annually and cumulatively (1987-2011).

Table A7-6 presents the estimates of grade-crossing accidents. More than 1,500 downline grade crossings exist. The projected accidents at these crossings would increase from 2 in 1986/1987 to 43 in 2011. The accidents associated with TRRC trains, under the medium coal production scenario, indicate a rate of 0.014 accidents per crossing during each year of the analysis period. This rate equals an average increase of one accident per crossing during a 70-year period, although this rate is slightly higher in communities and somewhat lower in rural areas, given the relative traffic volumes using these crossings.

TABLE A7-6

EXPECTED TRRC-RELATED GRADE-CROSSING ACCIDENTS DOWNLINE[a]
PROPOSED ACTION/MEDIUM PRODUCTION SCENARIO, 1987-2011

		EXPECTED ACCIDENTS BY CATEGORY			
YEAR	TRRC MILLION TRAIN-MILES	TOTAL ACCIDENTS	NUMBER OF FATALITIES	NUMBER OF INJURIES	PROPERTY DAMAGE
1986/87	0.3	2	--	--	$ 2,475
1991	1.0	7	1	1	$ 8,252
1996	2.5	17	2	3	$ 20,630
2001	4.2	28	4	4	$ 34,660
2006	5.2	35	4	5	$ 42,910
2011	6.4	43	7	7	$ 52,810
CUMULATIVE TOTAL BY SCENARIO					
Low	72.7	483	62	75	$599,920
Medium	88.6	589	75	91	$731,130
High	116.8	777	99	120	$963,830

[a] The derivation of the factors used to estimate accidents involved historic downline accident rates by segment, as presented in the Technical Report on Transportation Impacts, pp. 37-40. These factors, expressed in occurrences per million train-miles, are: 6.65 accidents; $8,252 in property damage; 1.03 injuries; 0.85 fatalities

Since most downline communities are small and have three to five separate track crossings, the average community might experience an increase of less than one grade-crossing accident during the analysis period. Table A7-6 also presents cumulative accident statistics for the high, medium, and low coal production scenarios. The high production scenario would result in 32 percent more accidents than would the medium production scenario; the low production scenario would create 18 percent fewer accidents than would the medium production scenario.

The accident rates for the TRRC trains are low in comparison to national rates. The TRRC accident rate of 6.65 per million train-miles is less than 0.50 percent of the national rate for the period from 1976 to 1980. This low figure can be attributed to two factors: the superior grade-crossing protection devices that have been installed along the lines that would be traveled by TRRC trains; the rural character of the downline corridors that would be used by the TRRC trains.

A7.1.3.2 Derailments

The estimate of the downline derailments involving TRRC-originated trains is based upon the same information detailed in section A7.1.2.2. Table A7-7 presents the estimated downline occurrence of TRRC train derailments, under the medium coal production scenario. In 1986/1987, three projected derailments would occur. By 2011, this figure would rise to 58 downline derailments involving TRRC trains. The cumulative number of derailments for the analysis period is estimated at 797. This total represents a derailment rate of 30 per year--or 0.4 percent of the national derailment total for 1979--and a rate of 0.04 derailments per downline mile per year. Under the high production scenario, the number of derailments would range approximately 32 percent higher than for the medium production scenario. Under the low production scenario, the number of derailments would be reduced to a figure 18 percent lower than for the medium production scenario.

These estimates may exaggerate substantially the number of downline TRRC train derailments that likely would occur. For most of the distance to their ultimate destinations, the TRRC trains would be routed on Burlington Northern mainlines, and derailments on these lines have proven substantially fewer than on other lines.

A7.1.4 Related Actions

Both grade-crossing accidents and derailments are functions of the estimated total TRRC train-miles and of the increased primary and secondary highway traffic. These latter factors, in turn, are determined by the total coal production from the Montco Mine and from the other potential mines in the TRRC service area. The high coal production scenario has been used to determine "worst case" safety impacts. Therefore, to the extent that mine production varies from this scenario, safety impacts would be affected.

TABLE A7-7

PROJECTED TRRC DERAILMENTS DOWNLINE[a]
PROPOSED ACTION/MEDIUM PRODUCTION SCENARIO, 1987-2011

YEAR	MILLIONS OF TRAIN-MILES	NUMBER OF DERAILMENTS	NUMBER OF FATALITIES	NUMBER OF INJURIES	PROPERTY DAMAGE
1986/87	0.3	3	--	--	$ 120,000
1991	1.0	9	--	--	$ 360,000
1996	2.5	22	--	1	$ 880,000
2001	4.2	38	--	2	$ 1,520,000
2006	5.2	47	--	3	$ 1,880,000
2011	6.4	58	--	3	$ 2,320,000
CUMULATIVE TOTALS BY SCENARIO:					
Low	72.7	654	2	39	$26,160,000
Medium	88.6	797	2	48	$31,880,000
High	116.8	1,051	3	63	$42,040,000

[a] Derailment factors: 9.0 derailments/million train-miles
0.060 injuries per derailment
0.003 fatalities per derailment
$40,000 in property damage per derailment

A7.2 TONGUE RIVER ROAD ALTERNATIVE

The Tongue River Road alternative route is similar to the proposed rail line in terms of both coal production and train movements. Potential grade-crossing accidents and train derailments would occur at approximately the same rates for trains operating on the Tongue River Road alternative route as for the proposed railroad. Table A7-8 provides crossing accident projections for the route. Mitigative measures, such as crossing improvements, similarly are applicable to this alternative alignment.

TABLE A7-8

PROJECTED GRADE-CROSSING ACCIDENTS AND ACCIDENT OUTCOMES[a]
WITHIN THE PROJECT AREA
TONGUE RIVER ROAD ALTERNATIVE/MEDIUM PRODUCTION SCENARIO

EXPECTED ACCIDENTS	PROPERTY DAMAGE	INJURIES	FATALITIES
8.2	$10,250.00	1	1

[a] Does not include non-TRRC traffic; see Table A7-3

A7.3 MOON CREEK ALTERNATIVE

The Moon Creek alternative route is similar to the proposed rail line in terms of both coal production and train movements. The potential grade-crossing accidents and train derailments that could occur for trains operating on the Moon Creek alternative route differ very little from that discussed for the proposed railroad. Table A7-9 provides crossing accident projections for the route. Mitigative measures discussed for the proposed railroad similarly are applicable to the Moon Creek alternative route.

TABLE A7-9

PROJECTED GRADE CROSSING ACCIDENTS AND ACCIDENT OUTCOMES[a]
WITHIN THE PROJECT AREA
MOON CREEK ALTERNATIVE/MEDIUM PRODUCTION SCENARIO

EXPECTED ACCIDENTS	PROPERTY DAMAGE	INJURIES	FATALITIES
7.5	$9,375	1	1

[a] Does not include non-TRRC traffic; see Table A7-3

A7.4 COLSTRIP ALTERNATIVE

A7.4.1 Construction

The construction of a rail line along the route of the Colstrip alternative would exert a negligible effect on study area safety.

A7.4.2 Operation and Maintenance

A7.4.2.1 Grade-crossing Accidents

The method used to project the potential grade-crossing accidents for the proposed railroad also was used to project the accidents for trains operating on the Colstrip alternative route. Table A7-10 presents the number of accidents and the associated property damages, injuries, and fatalities for the Colstrip alternative route. Since the alignments near Ashland are the same for all the alternatives, the impact of grade-crossing accidents associated with the Colstrip route would be the same as that for the proposed rail line.

Mitigative Measures

The discussion of the mitigation for vehicle collisions at crossings on the proposed rail line applies directly to the mitigation for vehicle collisions at crossings on the Colstrip alternative route.

TABLE A7-10

PROJECTED GRADE-CROSSING ACCIDENTS AND ACCIDENT OUTCOMES[a]
WITHIN THE PROJECT AREA
COLSTRIP ALTERNATIVE/MEDIUM PRODUCTION SCENARIO

EXPECTED ACCIDENTS	PROPERTY DAMAGE	INJURIES	FATALITIES
5.7	$7,000	1	1

[a] Does not include non-TRRC traffic; see Table A7-3.

The crossing improvements needed to mitigate this impact are presented in Tables A3-6 and A3-21. Should the Colstrip alternative route be selected, fewer crossings would require upgrading.

A7.4.2.2 Derailments

To calculate the potential number of derailments involving TRRC trains on the Colstrip alternative route, the same procedure defined for the proposed rail line was used. Derailments on the Colstrip alternative route would range 15 percent higher than on the proposed railroad. Although the Colstrip alternative route involves fewer miles of new rail construction than does the proposed rail line, the overall distance traveled within the project area by the TRRC trains would be longer--135 miles versus 115 miles, respectively. Tables A7-11 and A7-12 provide the projected train miles and derailments within the project area. The impact of derailments in the Ashland area with the Ashland NW Alignment would be the same as that described for the proposed railroad.

A7.4.3 Downline Impacts

The downline corridors for the Colstrip alternative route are the same as those corridors for the proposed railroad. Therefore, the safety impacts would be the same for both routes.

A7.4.4 Related Actions

The Colstrip alternative route would serve the same potential coal mines as would the proposed railroad. Therefore, the safety impacts would be the same for both routes.

TABLE A7-11

PROJECTED TRAIN MILES WITHIN THE PROJECT AREA
COLSTRIP ALTERNATIVE/MEDIUM PRODUCTION SCENARIO, 1987-2011

YEAR	ADDT[a]	AVERAGE DISTANCE TRAVELLED WITHIN THE STUDY AREA	ESTIMATED TRAIN-MILES[b] (Millions)
1986/87	1	135	.047
1991	3	135	.141
1996	8	135	.378
2001	14	135	.662
2006	18	135	.850
2011	22	135	1.040
CUMULATIVE TOTAL, 1987-2011			
Low Scenario		135	11.576
Medium Scenario		135	14.175
High Scenario		135	18.428

a See Table A3-9
b (Average daily trains) x (miles) x (350 operating days per year)

TABLE A7-12

PROJECTED TRRC TRAIN DERAILMENTS WITHIN THE PROJECT AREA[a]
COLSTRIP ALTERNATIVE/MEDIUM PRODUCTION SCENARIO, 1987-2011

		ESTIMATED DERAILMENT STATISTICS[b]			
YEAR	MILLIONS OF TRAIN-MILES	DERAILMENTS	NUMBER OF FATALITIES	NUMBER OF INJURIES	PROPERTY DAMAGE
1986/87	.047	--	--	--	$ --
1991	.141	1	--	--	$ 40,000
1996	.378	3	--	--	$ 120,000
2001	.662	6	--	--	$ 240,000
2006	.850	7	--	--	$ 280,000
2011	1.040	9	--	--	$ 360,000
CUMULATIVE TOTAL[c]	14.175	127	$5,080,000	7	$5,080,000

a Derailment factors: 9 derailments per million train-miles; $40,000 property damage per derailment; 0.060 injuries per derailment; 0.003 fatalities per derailment.
b No entry means that the estimated value is less than 1.
c Includes all years 1987-2011.

A7.5 FOOTNOTES

1. Highway Research Board, National Research Council, National Academy of Sciences, Factors Influencing Safety at Highway/Rail Grade Crossings, National Cooperative Highway Research Program Report No. 50, Washington, DC, 1968, pp. 59-62.

2. Information pertaining to crossing identification, warning devise, and Average Daily Highway Traffic (ADHT) was provided by the Montana Department of Highways, Planning and Research Bureau, Helena, MT., February, 1981.

3. Montana Department of Highways, Planning and Research Bureau, Helena, MT., March 11, 1981. In applying the criteria, crossing improvements that might be warranted in the baseline case (non-TRRC trains without the TRRC rail line and related actions) were estimated. The TRRC trains then were added to other trains and the criteria were reapplied to determine the additional crossing improvements attributable to TRRC trains.

4. U.S. Department of Transportation, Accident/Incident Bulletin No. 147, October 1979, pp. 91, 9:; No. 148, July 1980, pp. 59-60. Washington, DC.

5. Ibid., No. 147, pp. 37-38; No. 148, pp. 28-29.

6. IntraSearch, Billings, Montana, June 10, 1981; Handy Railroad Atlas of the United States, Rand McNally & Company, New York, 1978, p. 29.

7. This expectation is based on historical derailment experience. For example, in 1979, of the eight persons killed as a result of derailments nationwide, seven were railroad employees and the eighth was an individual trespassing on railroad property. U.S. Department of Transportation, Accident/Incident Bulletin No. 148, p. 26.

8. U.S. Department of Transportation, Federal Railroad Administration, Railroad Accident/Incident Reporting System (RAIRS), 1978, 1979, and 1980; U.S. Department of Transportation, Federal Railroad Administration, Rail/Highway Crossing Accident/Incident and Inventory Bulletin, No. 2, Calendar Year 1979, September 1980, p. A-2.

9. Since the Milwaukee Road route has exhibited a higher historical accident rate than the Burlington Northern route, the BN South Dakota line (old Milwaukee Road) routing scenario for TRRC trains was used to determine segment weights.

10. For example, in 1979 the frequency of derailments nation-wide by track class was as follows:

Track Class	Derailments (1979) Number	Percentage
Unknown	305	4.1
1	3,814	51.0
2	1,426	19.1
3	1,163	15.5
4	684	9.1
5	88	1.2
6	2	< 0.1
Total:	7,482	100.0

The data reveal that about 26 percent of all derailments in 1979 occurred on Track Class 3 and above. These are mainlines and major branch lines, the types of lines over which TRRC trains are most likely to be routed. U.S. Department of Transportation, Accident/Incident Bulletin No. 148, pp. 22, 26. Washington, DC.

A8.0 SOILS AND GEOLOGY

A8.1 PROPOSED ACTION

A8.1.1 Construction

Construction of the proposed rail line including the Ashland SE Alignment or the Ashland NW Alignment could impact the soils along the affected right-of-way by increasing the potential for slumping in otherwise stable soils, by causing an increase in the amount of soil lost due to wind and water erosion, and by reducing soil productivity as a result of horizon mixing and soil compaction. Data from published and unpublished Soil Conservation Service soil surveys of Rosebud, Custer, and Powder River Counties, USDA handbooks, and previous environmental assessments were used to identify possible impacts. This information was supplemented by a field inventory which employed spot sampling of the routes of the proposed rail line and alternatives. All soils data were transferred to 7.5-minute plan and profile maps of the alignments.

Construction also could impact paleontological resources through direct destruction of exposed and buried fossils and fossil sites within the right-of-way.

A8.1.1.1 Potential for Soil Slumping and Sliding

Slumps, defined as "the downward slipping of a coherent body of rock or regolith along a curved surface of rupture," may occur along the steep cuts excavated for the railroad.[1] Slumps can be a hazard with any soil depending on the decreasing stability and the increasing factors promoting soil movement. For example, a cut may be excavated into a hillside and left to remain steep. The natural angle of the slope, which may be at some stage of equilibrium at or less than its angle of repose, has been eliminated. "Angle of repose" refers to the steepest angle, measured from the horizontal, at which a material remains stable. A condition may then exist whereby the slope is greater than the angle of repose for that specific soil and substrate (geologic) material.

Slumping or mass wasting may occur immediately or after additional weakening or geologic conditions trigger a movement. A series of rain storms or a heavy rainfall can add weight to the already strained slope. Liquification--the changing of a granular soil from a reasonably firm state to an almost liquid condition--can occur, with the saturated soil acting as a lubricant on which a massive part of the slope can slide. When the weight is great enough, the lubricating plane slick enough, or a combination of these factors surpass the limits of cohesion, the soil will slump or slide.

Some soils slump more readily than others depending on their physical and chemical properties, as well as their substrate characteristics. An example of a substrate condition conducive to slumping is a soil found on an impermeable shale, slate, or clay layer. This layer acts as a glide plane upon which the soil materials slide after excess water has overcome the adhesion between the soil and the impermeable layer.

Sodium dominance (sodic and/or alkaline condition) in some clay minerals may cause dispersion of the clays, resulting in an impermeable clay layer. These types of clays also become greasy when wetted and serve as a lubricated base for the soils to move upon.

In eastern Montana, conditions exist that may lead to increased slumping or other mass wasting under conditions of disturbance. The area is underlain by shale and sandstone layers which have been folded and/or uplifted, forming slopes which may become saturated with water during certain times of the year. This may result in slumping of soils if they are disturbed.

The route of the proposed rail line with the Ashland SE Alignment includes approximately 27.5 miles of right-of-way that have the potential for mass soil movement or slumping. Should the rail line include the Ashland NW Alignment, the total affected mileage would be 25.8. The exact nature of these soils and whether or not they actually would slump can only be determined from detailed, on-site testing.

In addition to possible slumping in the affected right-of-way, soil movement also may be a problem in borrow areas. Construction of the right-of-way will increase the demand for sub-ballast material. Three to four borrow areas, each 4-5 acres in size, may be needed for acquisition of sub-ballast fill. With the Ashland NW Alignment, additional borrow material would be required. The Ashland NW Alignment has no cut equivalent to the cut on the Ashland SE Alignment that would provide the necessary sub-ballast material. Slumping at newly developed borrow areas may be a problem if reclamation is not accomplished immediately.

A8.1.1.2 Soil Loss

Soil loss induced by wind and water erosion greatly increases when vegetative cover is removed, soil horizons are disturbed and/or mixed, slopes are long and steep, and the soil surface is level or smooth. The most severe short term erosion would occur during the construction period, when the right-of-way would be devoid of vegetation. The amount of soil removed by wind and water erosion during and after construction depends on the reclamation practices introduced from the start of the project and the time required for stable vegetation to establish itself.

Water Erosion

The potential impacts of soil loss due to water erosion along the proposed rail line were determined by calculating projected soil loss and applying those figures to data regarding the ability of specific soils along the route to tolerate soil loss. Soil loss is determined by using the U.S. Department of Agriculture's (USDA) Universal Soil Loss Equation (USLE). Gross erosion estimates are then compared with maximum soil loss tolerance figures developed by the USDA.[2] The USLE computes the average annual soil loss in tons per acre by multiplying together a variety of factors. An explanation of these factors and the values assigned to each as used in the analysis are presented below.

"R", the rainfall factor in the USLE, may be determined by the following relationship:[3]

$$R = EI/100$$

where E = storm energy in foot-tons per acre-inch
I = maximum 30 minute rainfall intensity in inches per hour

Several publications are available showing mean annual R factors for the state of Montana.[4] Reported values range from an R factor of 20 to 30 for the area to be affected by the TRRC railroad. A mid-range value of 25 was used for computations described herein.

The K factor, or soil erodibility factor, applies to the capacity of a particular soil to erode under fallow conditions. The K factor has been estimated for numerous soils on the basis of percent silt and fine sands, percent sand, percent organic material, soil structure, and permeability. Nearly all soils will fall within a range of from 0.1 to 0.7.[5] Sandy soils usually have a low K factor (0.02 to 0.05), very fine sands and silts have a high K factor ranging from 0.3 to 0.7, and the K factor is low for clay soils (0.1 to 0.3). Soil conditions are somewhat variable in the vicinity of the proposed rail line, but are dominated by those with a moderate erodibility (0.25 to 0.35). Therefore, a uniform K factor of 0.32 was employed in the analysis.

The cover and management factor (C) in the USLE measures the combined effect of all the inter-related cover and management variables. The most critical time for soil erosion is during the construction period, before the construction area is stabilized with vegetation. During this period the C factor is taken to be 1.0, or the maximum value.

The support practice factor (P) in the USLE is used to show the effects of specific soil loss prevention practices. These support practices, which are generally used in agricultural applications, include contouring and similar measures. Since these agricultural practices generally are not employed in railroad construction, the P factor was taken as 1.0 (maximum value) for this analysis.

The length and steepness of the land slope have major impacts on the rate of soil erosion during a rainfall event. For field application the slope length (L) and slope steepness (S) have been combined into a single topographic factor. Slope length is the distance from the point of origin of overland flow to the point where the slope gradient decreases enough that deposition begins. A weighted average LS factor for each option and alternative was developed using slope, affected area, and weighted average depth of cut and fill calculations for the various alignments. The top of the roadbed (approximately 28 feet in width), which would be level and would be largely covered with course material as ballast and sub-ballast, was not included in the affected areas in soil loss calculations.

Using the information presented above, the gross erosion per unit area is reduced to a constant LS factor: A-RKLSCP. Gross erosion calculations for the proposed rail line are presented in Table A8-1. The lower figures for the Ashland NW Alignment reflect the fact that this route requires smaller cuts and disturbs slightly less area.

TABLE A8-1

ESTIMATED GROSS WATER EROSION: PROPOSED ACTION

FACTOR	ASHLAND SE ALIGNMENT	ASHLAND NW ALIGNMENT
Affected Area (acres)[a]	1,104	1,076
Slope Length (feet)[b]	40.61	31.76
LS Factor[c]	7.64	6.59
Gross Erosion:		
tons/acres	61.1	52.7
tons/year	67,500	56,700

[a] Affected area for each action was provided by IntraSearch. Area is adjusted to eliminate the level top of the roadway, which was not included in soil loss calculations.

[b] Slope length was computed by using IntraSearch cut and fill data and by assuming a slope of 2H:1V

[c] LS factors for USLE were computed from the formula:

$$LS = (\text{slope length}/75)^{0.6}(\text{slope}/9)^{1.4}$$

See U.S. Department of Agriculture, Predicting Rainfall Losses: A Guide to Conservation Planning. Handbook No. 537, by W.H. Wischmeier and D.D. Smith (Washington, DC: U.S. Government Printing Office, 1978).

The maximum soil loss tolerance, which includes soil loss by erosion, varies from soil to soil depending on "favorable rooting depth." Favorable rooting depth can refer to soils immediately above bedrock or those that are conducive to root penetration. It does not apply to soils or regolith that prohibit root penetration because of adverse physical or chemical properties. The maximum soil loss tolerance for a given soil is expressed in tons/year/acre. For example, a soil with a favorable rooting depth above 80 inches can withstand a soil loss of 10 tons/acre/year, whereas a soil with a favorable rooting depth of 10-20 inches can tolerate only a loss of 2 tons/acre/year.[6]

Table A8-2 was developed by correlating the favorable rooting depth (in inches) and the maximum soil loss tolerance for varying slope lengths. The maximum allowable slope (in percent) for each rooting depth and slope length was then calculated. For example, the maximum allowable slope for a soil with a favorable rooting depth of 10-20 inches on a 40-foot slope is only 3.0 percent.

TABLE A8-2

MAXIMUM SOIL LOSS TOLERENCE AND MAXIMUM ALLOWABLE SLOPE BY ROOTING DEPTH[a]

		MAXIMUM ALLOWABLE SLOPE (%)		
FAVORABLE ROOTING DEPTH (inches)	MAXIMUM SOIL LOSS TOLERANCE[b]	40-ft SLOPE	100-ft SLOPE	500-ft SLOPE
10-20	2	3.0	2.3	1.1
20-40	4	6.0	4.3	2.8
40-60	6	8.2	6.0	3.7
60-80	8	10.1	7.5	4.4
80+	10	11.0	8.0	4.6

[a] U.S. Department of Agriculture, Soil Survey Manual, U.S. Department of Agriculture Handbook No. 18 (Washington D.C.: U.S. Government Printing Office, 1954)

[b] Tons per acre per year

Fifty percent slopes, ranging from 10 to 131 feet in length, are common along the proposed rail line right-of-way. As illustrated in Table A8-2, these slopes could be subject to high erosion rates. The USLE indicates that approximately 67,500 tons of soil per year would be lost along the proposed rail line, with the Ashland SE Alignment, if no mitigation procedures are initiated. About 56,700 tons of soil per year would be lost along the route if the Ashland NW Alignment were included. These figures can be considered a maximum, or "worst case" condition.

The primary means for soil stabilization is re-establishment of natural (vegetation) or artificial (mulch) ground surface cover. Table A8-3 presents the amount of cover and alternative soil stabilizing techniques which would be necessary to prevent soil loss from exceeding the maximum. The "C" value, or management factor, includes ground cover re-establishment. The "P" value is the support practice value, which includes stabilizing practices such as terracing and con-

TABLE A8-3

SLOPE LENGTH AS IT RELATES TO GROUND COVER (C--THE COVER AND MANAGEMENT FACTOR) WITH THE SUPPORT PRACTICE (P) FACTOR HELD CONSTANT IN ORDER TO HOLD SOIL LOSS TO 2 TONS PER ACRE PER YEAR[a]

50% SLOPE LENGTH (IN FEET)	SUPPORT PRACTICE VALUE (P)	COVER AND MANAGEMENT FACTOR (C)	APPROXIMATE % COVER	
			GRASS	FORBS
20	0.9	0.03	65	80
30	0.9	0.025	68	89
40	0.9	0.022	78	90
50	0.9	0.019	75	91
60	0.9	0.017	77	92
70	0.9	0.015	78	93
80	0.9	0.014	79	94
90	0.9	0.014	79	94
100	0.9	0.013	80	94
130	0.9	0.012	82	95

a See U.S. Department of Agriculture, Predicting Rainfall Losses: A Guide to Conservation Planning. Handbook No. 537, by W.H. Wischmeier and D.D. Smith ((Washington, DC: U.S. Government Printing Office, 1978).

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touring. As can be seen from Table A8-3, a considerable amount of ground cover (vegetative or artificial) will be needed to keep soil loss on 50 percent slopes from exceeding the maximum soil loss tolerance. The TRRC plans to revegetate, monitor, and maintain the slopes immediately after completion of construction of the rail line. Successful revegetation should reduce soil loss through water erosion.

Wind Erosion

Soil loss from wind erosion, like soil loss from water erosion, should not exceed the maximum soil loss tolerances given for favorable rooting depths listed in Table A8-2. Wind erosion, as defined by Chepil and Woodruff, is determined by the velocity of wind, the length of exposed field in the path of prevailing winds, and the quantity of soil particles below 0.84 mm in diameter.[7] Soil particles are effectively transported by wind as velocity approaches 12 mph. This results in soil particle lift and saltation.[8]

The amount of wind erosion that may occur to a barren, fine sandy loam soil surface in Rosebud County exposed for 100 feet would be approximately 29 tons/acre/year. For 500 feet of the same exposed soil, erosion potentials could escalate to over 50 tons/acre/year. In Custer County, 25 tons of soil per acre/year could be moved over a 100-foot stretch of exposed soil and 45 tons per acre/year could be eroded on a 500-foot strip of soil. The differences between counties in tons of erosion for the same length of exposed soil are due to the variation in wind speeds through these areas.[9]

Using these estimates, the potential gross wind erosion for the proposed rail line with the Ashland SE Alignment is approximately 25,604 tons/year.[10] For the proposed rail line assuming the Ashland NW Alignment, the potential gross wind erosion would be 23,414 tons per year. This figure assumes a barren but roughened surface along the right-of-way. Soils exhibiting sandy loams and clay and silty clays with unstable clod structure--those subject to contraction and swelling, by freezing and thawing, and wetting and drying--were used as representative soils along the right-of-way.

Prevention of wind erosion depends upon the amount of soil moisture, roughness, and vegetation (including wind barriers and immediate ground cover) present in a given soil. Along the entire route, common reclamation techniques such as mulching, roughening the soil, soil moistening and, eventually, wind barriers and vegetative cover can reduce the effects of wind erosion by as much as 80 to 95 percent. Table A8-4 indicates the effectiveness of vegetative cover in reducing wind erosion. For example, in Powder River County, a stretch of exposed soil 500 feet in length with 1,250 pounds of residue (small flat grain straw) per acre, is likely to lose 5.2 tons of soil to wind erosion per year. The same length of soil with 1,500 pounds of residue/acre would lose only 2.1 tons/acre/year. Given these figures, it appears that the most effective mitigation plan would involve immediate re-establishment of vegetation in areas impacted by construction. The right-of-way should be monitored for revegetation success, and replanted when necessary.

A8.1.1.3 Saline and Sodic Soils

Limitations to chemical and physical potentials of the soil are encountered when saline and/or sodic conditions are present. These limitations affect both the engineering and vegetation bearing capabilities of the soil.

A saline soil contains soluble salts in such quantities that they interfere with the growth of most crop plants. These soils occur in low moisture regimes, such as eastern Montana, and are caused by a lack of precipitation required to leach soluble salts through the soil profile. The excess salts in the topsoil upset the equilibrium normally found by a plant root; therefore, water uptake is hindered, creating stress for the plant.

A sodic soil is one that contains sufficient exchangeable sodium to interfere with the growth of most crop plants, either with or without appreciable quantities of soluble salts. A sodic condition adds a dimension to the salt problem by causing the soil clay particles to disperse, rendering the soil almost impermeable. The impermeable soil inhibits water infiltration, promoting runoff and decreasing the

TABLE A8-4

POUNDS OF RESIDUE PER ACRE
VERSUS TONS OF EROSION PER ACRE PER YEAR

COUNTY	LENGTH OF EXPOSED SOIL (feet)	TONS OF EROSION PER ACRE PER YEAR
Powder River County		
1,500 lbs of residue/acre	100	0.3
	200	1.0
	300	1.8
	400	2.0
	500	2.1
	1,000	3.0
	3,000	3.9
	6,000	4.0
1,250 lbs of residue/acre	100	1.0
	200	2.9
	300	4.0
	400	4.8
	500	5.2
	1,000	7.0
	3,000	9.5
	6,000	10.0
Custer County		
1,500 lbs of residue/acre	100	0.1
	200	1.5
	300	2.0
	400	3.0
	500	3.3
	1,000	4.5
	3,000	6.0
	6,000	6.0
1,250 lbs of residue/acre	100	1.0
	200	4.0
	300	6.0
	400	7.0
	500	8.0
	1,000	11.0
	3,000	12.5
	6,000	12.5

TABLE A8-4. POUNDS OF RESIDUE v. TONS OF EROSION (continued)

COUNTY	LENGTH OF EXPOSED SOIL (IN FEET)	TONS OF EROSION PER ACRE PER YEAR
Rosebud County		
1,750 lbs of residue/acre	100	.1
	200	.5
	300	1.0
	400	1.5
	500	1.8
	1,000	2.0
	3,000	3.0
	6,000	3.8
1,500 lbs of residue/acre	100	.5
	200	2.0
	300	3.0
	400	3.8
	500	4.0
	1,000	5.9
	3,000	8.0
	6,000	9.5

amount of water available to the plant. Approximately 13 acres of saline soil, 60 acres of sodic soil, and 27 acres of saline-sodic soil would be affected by the proposed rail line with the Ashland SE Alignment (Table A8-5). Assuming the Ashland NW Alignment, about 9 acres of saline soil and 60 acres of sodic soil would be affected. Twenty-three acres of saline-sodic soils also would be impacted.

TABLE A8-5

ESTIMATED ACRES OF SALINE AND/OR SODIC SOILS
PROPOSED ACTION

SOIL TYPE	ASHLAND SE ALIGNMENT	ASHLAND NW ALIGNMENT
Saline	13 acres	9 acres
Sodic	60	60
Saline-Sodic	27	23
TOTAL	100 acres	92 acres

Wherever possible, impact to these soils should be avoided. Where these soils are impacted by erosion, compaction, and soil horizon mixing, reclamation would be more difficult than on nonsaline and nonsodic soils. Saline soils would require more maintenance and care than more productive soils to insure plant cover. If supplemental programs (i.e., remulching, reseeding) are not instituted, these soils will exist as erosional hazards for many years.[12] Where possible, saline or sodic soils should be buried and more desirable topsoil left on top.

A8.1.1.4 Soil Horizon Mixing and Compaction

Horizon Mixing

Eastern Montana is composed predominantly of soils with limited horizon or structural development. This is particularly true in the area proposed for railroad construction. The soils under a normally shallow and somewhat fertile A horizon (topsoil) can be characteristically similar to the unfertile parent material. During cut and fill work along the right-of-way, soil horizons would be disturbed. In general, the deeper the cut, the greater the fill and impact.

Low areas to be filled will have their surface horizons buried. The embankments left by the cuts will display subsurface horizons, that lack organic matter, plant residues, and micro-organisms available at the surface. Nonproductive subsurface soils exposed as a result of cut and fill work could impede the revegetation process, thereby increasing the potential for erosion.

Horizon mixing may increase the pH level of the soil. This usually indicates that undesirable salts and/or sodium is present at the surface. A reduction in soil productivity could result because healthy plant growth under such conditions necessitates increased water requirements. Sodic conditions inhibit good infiltration and drainage, often resulting in increased runoff and erosion.

Horizon mixing also could destroy the natural lines of breakage or structure of the soil. These lines, which are usually vertical, are the main avenues by which rooting and percolation take place. Once destroyed, it may take years of development to replace soil structure.

The impacts of soil mixing may be mitigated partially by avoiding the placement of predominantly sandy or clayey soils on the surface, particularly if they are of a saline and/or sodic nature. The Montana Department of State Lands provides guidelines for special handling to assure the availability of adequate topsoil for reclamation of mined lands. These procedures could be helpful in this case.

Soil Compaction

The use of construction machinery would compact some soils. Compaction is the result of an increase in density of soil as a result of applied loads or pressure. It is a function of mechanically applied forces and the water content of the soil. The force required to compact a soil to a given density decreases exponentially with the moisture content. Soil density increases exponentially with the amount of force applied.[13]

The worst effects of compaction occur when the soil is near its plastic limit. Once beyond the plastic limit, soil compaction begins to decrease, giving way to a more liquid action that often results in sinking and the formation of ruts.

Research indicates that six passes over the same spot (four passes with a track-type tractor and two with a pneumatic tire) can cause enough compaction to slow the water infiltration rate from 3.1 inches per hour to 0.8 inches per hour.[14] This is a 74-percent decrease in infiltration, due primarily to a 62-percent reduction in aeration porosity in the upper 5 to 6 inches of surface soil. Large pores were affected to a depth of 20 inches.

Decreased infiltration rates could cause more surface runoff and erosion and could reduce the soil moisture-holding capacity with a corresponding loss of plant production. Lowered plant production would make revegetation efforts more difficult. Reconditioning of compacted soils is a difficult operation due to the large, hard, compacted clumps produced after plowing. Breaking up of these clumps is necessary for root penetration.

Compaction of soils is unavoidable. However, a fair amount of impact can be avoided by timing construction to avoid periods when soil is moist.

A8.1.1.5 Impact to Paleontologic Resources

Construction of the proposed rail line could impact paleontologic resources by direct destruction of exposed and/or buried fossils and fossil sites. The excavation of borrow pit areas associated with construction also may affect fossil sites.

Impact of this kind may be mitigated through in-field location of fossil sites prior to construction. Fossils uncovered by borrowing gravel and/or fill material for the railroad bed will not be adversely affected if they are collected.

A8.1.2 Operation and Maintenance

Impact to soils from operation and maintenance of the proposed railroad would be less than those created during construction. The greatest impact would be an increase in wind and water erosion until the re-establishment of vegetation along the right-of-way. In addition, during operation of the railroad, erosion could be caused by reduction in vegetative cover due to: (1) controlling noxious vegetation along the right-of-way; (2) hydrocarbon spills; (3) grass fires ignited by maintenance crews and equipment. Soil productivity may be affected if soil sterilants applied to the right-of-way to control vegetation alter the chemical properties of the soil. Lowered productivity would affect revegetation efforts and ultimately the rate of soil loss due to wind and water erosion.

A8.1.2.1 Impact to Paleontologic Resources

The operation and maintenance of the proposed railroad should not directly affect paleontologic resources. However, some sites may be indirectly impacted as a result of changing land use patterns. Previously remote areas may be made more accessible, thereby exposing sites to vehicular impact and to collection activities by private individuals.

A8.1.3 Related Actions

The Tongue River Railroad has the potential to serve several new coal mines in the project area. Approximately 25,889 acres would be disturbed over the next 26 years at the low coal production scenario, 29,999 acres at the medium scenario, and 31,349 acres at the high scenario. Topsoil placement and revegetation normally follows mining by 2 to 5 years, thus the total unrevegetated area at any one time can be calculated by totaling the acreage for the previous 2 to 5 years. As a "worst case," 4,320 acres would be unrevegetated in the year 2011 with the high scenario, assuming revegetation lags 5 years behind mining.

Soils in the coal fields near Ashland and Otter Creek have been analyzed and studied by the Soil Conservation Service, the Office of Surface Mining, the Montana Department of State Lands, the Bureau of Land Management, and Bureau of Reclamation. The area represents new development and these tracts include Southwest Otter Creek, Northwest Otter Creek, Ashland (Decker/Birney), Ashland (Coalwood), Coal Creek, and Cook Mountain. All tracts lie in close proximity to Ashland. Soils data on these areas can be applied to the five mines included in the related actions.

The soils in the area are genetically similar to the soils along the Tongue River in the project area. They are light brown or reddish brown in color, influenced by carbonates from the lack of leaching, shallow near areas of sandstone and shale outcrops, and rolling to steep in the uplands, although the relief differences are not as severe as mountainous zones. Organic matter and fertility content are generally considered low. There are areas that display saline, sodic, and saline-sodic conditions. These undesirable traits exist on the surface as well as in the overburden.

Erosion, except in the Northwest Otter Creek Unit, does not seem to be a severe problem. However, the majority of soils in the area have poor reconstruction suitability ratings; therefore, intensive and costly surfacing techniques would have to be employed for proper soils stabilization. Poor and unsuitable plant growth ratings encompass a large portion of each area; therefore again, intensive and costly revegetation techniques will have to be applied.

For purposes of this analysis, it is assumed that sufficient unaffected soils or overburden cover the area to provide adequate surface soil for reclamation. Regardless of this assumption, numerous regulatory safeguards exist to ensure that successful reclamation will occur.

Existing federal and state surface-mining regulations require that the soils and overburden in these areas be surveyed and analyzed in sufficient detail to predict how much soil can be salvaged for reclamation. A reclamation plan must be approved by the Montana Department of State Lands, and a site specific environmental impact statement prepared on each mine prior to the issuance of a permit.

A8.1.3.1 Impact to Paleontologic Resources

Development of five coal mines in the area served by the Tongue River Railroad could impact paleontologic resources by direct destruction of exposed and buried fossil sites. This type of impact could be mitigated through predevelopment literature reviews and in-field surveys designed to locate specific sites. Also, collection of fossils would mitigate adverse affect to sites uncovered during development.

A8.2 TONGUE RIVER ROAD ALTERNATIVE

A8.2.1 Construction

Construction of the Tongue River Road alternative would disturb study area soils in much the same way as would the proposed rail line. Soil slumping, wind and water erosion, mixing of horizons, and compaction would be potential problems. Destruction of paleontologic sites also could be a problem.

A8.2.1.1 Potential for Soil Slumping and Sliding

The explanation and mitigative measures presented for the proposed rail line in section A8.1.1.1 are applicable for the Tongue River Road alternative. Approximately 27.3 miles of right-of-way could be subject to soil slumping and sliding.

A8.2.1.2 Soil Loss

Soil loss due to water erosion is estimated to be 71,200 tons/year for the Tongue River Road alternative with the Ashland SE Alignment, and 60,400 tons/year with the Ashland NW Alignment (see Table 8-6). Wind erosion could remove as much as 24,925 tons/year of soil with the Ashland SE Alignment and 22,735 tons/year with the Ashland NW Alignment. As with the proposed route, these are maximum amounts and could be reduced by applying appropriate mitigative measures (see section A8.1.1.2 and Table A8-2).

TABLE A8-6

ESTIMATED GROSS EROSION: TONGUE RIVER ROAD ALTERNATIVE

FACTOR	ASHLAND SE ALIGNMENT	ASHLAND NW ALIGNMENT
Affected Area (acres)[a]	1,185	1,157
Slope Length (feet)[b]	39.54	30.69
LS Factor[c]	7.51	6.46
Gross Erosion:		
Tons/acre	60.1	51.7
Tons/year	71,200	60,400

[a] Affected area for each action was provided by Intrasearch. Area is adjusted to eliminate the level top of the roadway, which was not included in soil loss calculations.

[b] Slope length was computed by using Intrasearch cut-and-fill data and by assuming a slope of 2H:1V.

[c] LS factors for USLE were computed from the formula:

$$LS = (\text{slope length}/75)^{0.6}(\text{slope}/9)^{1.4}$$

See U.S. Department of Agriculture, Predicting Rainfall Losses: A Guide to Conservation Planning. Handbook No. 537, by W.H. Wischmeier and D.D. Smith (Washington, DC: U.S. Government Printing Office, 1978).

A8.2.1.3 Saline and Sodic Soils

The Tongue River Road alternative would affect roughly 15 acres of saline soil, 59 acres of sodic soils, and 45 acres of saline-sodic soils including the Ashland SE Alignment (see Table A8-7). With the Ashland NW Alignment, the figures would be 11 saline, 59 sodic, and 41 saline-sodic.

TABLE A8-7

ESTIMATED ACRES OF SALINE AND/OR SODIC SOILS
TONGUE RIVER ROAD ALTERNATIVE

SOIL TYPE	ASHLAND SE ALIGNMENT	ASHLAND NW ALIGNMENT
Saline	15 acres	11 acres
Sodic	59	59
Saline-Sodic	45	41
TOTAL	119 acres	111 acres

A8.2.1.4 Soil Horizon Mixing and Compaction

Impacts of mixing and compaction of soils along the Tongue River Road alternative would be similar to those described for the proposed rail line. Mitigative measures could similarly be applied for this alternative.

A8.2.2 Operation and Maintenance

Impacts and mitigative measures associated with operation and maintenance of the Tongue River Road alternative would be the same as those described for the proposed rail line.

A8.2.3 Related Actions

Impacts and mitigation measures associated with related actions of the Tongue River Road alternative would be the same as those discussed for the proposed railroad.

A8.3 MOON CREEK ALTERNATIVE

A8.3.1 Construction

Construction of the Moon Creek alternative would disturb study area soils in much the same way as would the proposed rail line. Soil slumping, wind and water erosion, mixing of horizons, and compaction would be potential problems. Destruction of paleontologic sites also could be a problem.

A8.3.1.1 Potential for Soil Slumping and Sliding

The explanation and mitigative measures presented for the proposed action in section A8.1.1.1 are applicable for the Moon Creek alternative. Approximately 27.8 miles of right-of-way could be subject to soil slumping and sliding.

A8.3.1.2 Soil Loss

Soil loss due to water erosion is estimated to be 72,100 tons/year for the Moon Creek alternative route including the Ashland SE Alignment, and 61,300 with the Ashland NW Alignment (see Table A8-8). Wind erosion could remove as much as 25,556 tons/year of soil with the Ashland SE Alignment, and 23,368 tons/year with the Ashland NW Alignment. As with the route of the proposed rail line, these are maximum amounts and could be reduced by applying appropriate mitigative measures (see section A8.1.1.2 and Table A8-2).

TABLE A8-8

ESTIMATED GROSS EROSION: MOON CREEK ALTERNATIVE[a]

FACTOR	ASHLAND SE ALIGNMENT	ASHLAND NW ALIGNMENT
Affected Area (acres)[a]	1,146	1,118
Slope Length (feet)[b]	42.67	33.82
LS Factor[c]	7.86	6.81
Gross Erosion:		
Tons/acre	62.9	54.5
Tons/year	72,100	61,300

a Affected area for each action was provided by Intrasearch. Area is adjusted to eliminate the level top of the roadway, which was not included in soil-loss calculations.

b Slope length was computed by using Intrasearch cut-and-fill data and by assuming a slope of 2H:1V.

c LS factors for USLE were computed from the formula:

$$LS = (\text{slope length}/75)^{0.6}(\text{slope}/9)^{1.4}$$

See U.S. Department of Agriculture, Predicting Rainfall Losses: A Guide to Conservation Planning. Handbook No. 537, by W.H. Wischmeier and D.D. Smith (Washington, DC: U.S. Government Printing Office, 1978).

A8.3.1.3 Saline and Sodic Soils

The Moon Creek alternative route with the Ashland SE Alignment would affect roughly 9 acres of saline soil, 28 acres of sodic soils, and 9 acres of saline-sodic soils (see Table A8-9). With the Ashland NW Alignment, these figures would be 5 saline, 28 sodic, and 5 saline-sodic.

TABLE A8-9

ESTIMATED ACRES OF SALINE AND/OR SODIC SOILS
MOON CREEK ALTERNATIVE

SOIL TYPE	ASHLAND SE ALIGNMENT	ASHLAND NW ALIGNMENT
Saline	9 acres	5 acres
Sodic	28	28
Saline-Sodic	9	5
TOTAL	46 acres	38 acres

A8.3.1.4 Soil Horizon Mixing and Compaction

Impacts of mixing and compaction of soils along the Moon Creek alternative would be similar to those described for the proposed rail line. Mitigative measures could similarly be applied to this alternative.

A8.3.1.5 Impacts to Paleontologic Resources

Impacts and mitigative measures associated with paleontologic resources along the Moon Creek alternative would be similar to those described for the proposed rail line.

A8.3.2 Operation and Maintenance

Impacts and mitigative measures associated with operation and maintenance of the Moon Creek alternative would be the same as those described for the proposed railroad.

A8.3.3 Related Actions

Impacts and mitigation measures associated with related actions of the Moon Creek alternative would be the same as those discussed for the proposed railroad.

A8.4 COLSTRIP ALTERNATIVE

A8.4.1 Construction

Construction of the Colstrip alternative would disturb study area soils in much the same way as does the proposed rail line. Soil slumping, wind and water erosion, mixing of horizons, and compaction would be potential problems.

Impacts to paleontologic resources resulting from the construction of the Colstrip alternative could occur in two ways: (1) destruction of exposed and/or buried fossils and fossil sites; (2) disturbance of the type section of the Tongue River Member of the Fort Union Formation.

A8.4.1.1 Potential for Soil Slumping and Sliding

The explanation and mitigative measures presented in section A8.1.1.1 are applicable for the Colstrip alternative. Approximately 15.6 miles of right-of-way could be subject to soil slumping and sliding.

A8.4.1.2 Soil Loss

Soil loss due to water erosion including the Ashland SE Alignment is estimated to be 34,600 tons/year for the Colstrip alternative. With the Ashland NW Alignment, soil loss would be 23,800 tons/year (see Table A8-10). Wind erosion could remove as much as 18,773 tons/year of soil with the Ashland SE Alignment, and 16,583 tons/year with the Ashland NW Alignment. As with the proposed route, these are maximum amounts and could be reduced by applying appropriate mitigative measures (see section A8.1.1.2 and Table A8-2).

TABLE A8-10

ESTIMATED GROSS EROSION: COLSTRIP ALTERNATIVE

FACTOR	ASHLAND SE ALIGNMENT	ASHLAND NW ALIGNMENT
Affected Area (acres)[a]	624	596
Slope Length (feet)[b]	34.57	25.72
LS Factor[c]	6.93	5.88
Gross Erosion:		
Tons/acre	55.4	47.0
Tons/year	34,600	23,800

a Affected area for each action was provided by Intrasearch. Area is adjusted to eliminate the level top of the roadway, which was not included in soil-loss calculations.

b Slope length was computed by using IntraSearch cut and fill data and by assuming a slope of 2H:1V.

c LS factors for USLE were computed from the formula:

$$LS = (\text{slope length}/75)^{0.6}(\text{slope}/9)^{1.4}$$

See U.S. Department of Agriculture, Predicting Rainfall Losses: A Guide to Conservation Planning. Handbook No. 537, by W.H. Wischmeier and D.D. Smith ((Washington, DC: U.S. Government Printing Office, 1978).

A8.4.1.3 Saline and Sodic Soils

The Colstrip alternative with the Ashland SE Alignment would affect roughly 8 acres of saline soil, 17 acres of sodic soils, and 8 acres of saline-sodic soils. With the Ashland NW Alignment, these figures would be 4 saline, 17 sodic, and 4 saline-sodic (Table A8-11).

A8.4.1.4 Soil Horizon Mixing and Compaction

Impacts from mixing and compaction of soils along the Colstrip alternative would be similar to those described for the proposed rail line. Mitigative measures could similarly be applied to this alternative.

TABLE A8-11

ESTIMATED ACRES OF SALINE AND/OR SODIC SOILS
COLSTRIP ALTERNATIVE

SOIL TYPE	ASHLAND SE ALIGNMENT	ASHLAND NW ALIGNMENT
Saline	8 acres	4 acres
Sodic	17	17
Saline-Sodic	8	4
TOTAL	33 acres	25 acres

A8.4.1.5 Impact to Paleontologic Resources

The construction of the Colstrip alternative right-of-way could impact paleontological resources by direct destruction of exposed and/or buried fossils. Additionally, this alternative is located near the type section of the Tongue River Member of the Fort Union Formation that is located on the high drainage divide between Rosebud Creek and the Tongue River, south of Miles City near Brandenburg, Montana. This type of section is considered more important for paleontological resources than the other areas in the project area. Mitigation of adverse affect to fossil sites impacted during the construction would be accomplished in the same manner as described for the proposed rail line.

A8.4.2 Operation and Maintenance

Impacts and mitigative measures associated with operation and maintenance of the Colstrip alternative route would be the same as those described for the proposed railroad.

A8.4.3 Related Actions

Impacts and mitigation measures associated with related actions of the Colstrip alternative route would be the same as those described for the proposed railroad.

A8.5 FOOTNOTES

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