



AIR SCIENCES INC.

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TECHNICAL MEMORANDUM

AIR QUALITY ANALYSIS OF THE NEVADA GOLD MINES ORE TRANSPORTATION PROJECT

PREPARED FOR: Steve Schoen and Kim Wolf, Nevada Gold Mines LLC

PREPARED BY: Gwen Barthel and Elizabeth Huelson, Air Sciences Inc.

PROJECT NO.: 59-70-9A

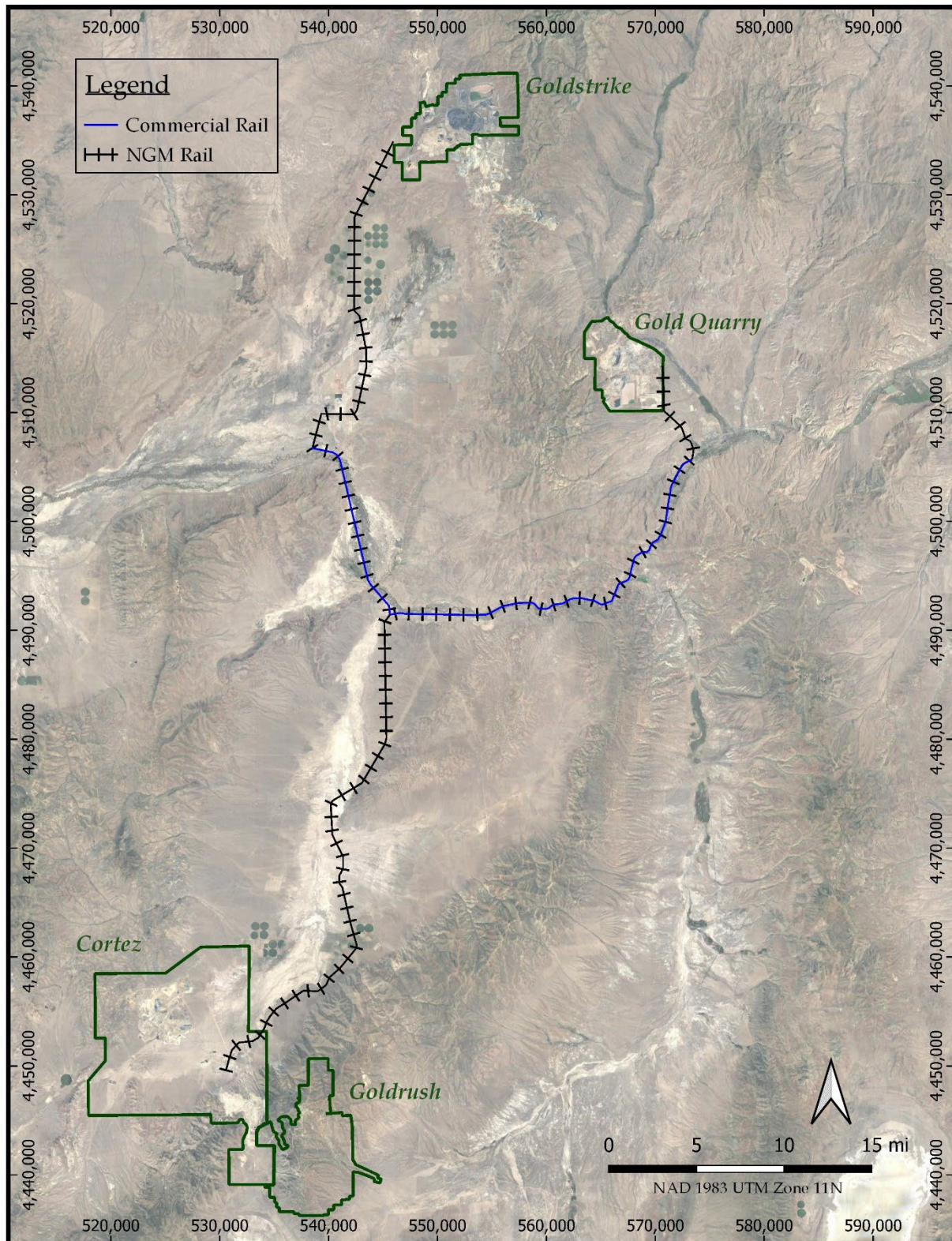
DATE: April 18, 2022

1.0 Introduction

Nevada Gold Mines LLC (NGM) is evaluating the construction and operation of a rail system to transport ore from the Cortez Mining District to the NGM Carlin facilities for processing. For this Reasonably Foreseeable Future Action using best currently available information, this memorandum provides an assessment of the air quality impacts associated with transporting up to 4,600,000 tons per year of ore by rail to either Gold Quarry or Goldstrike for processing.

The conceptual rail routes from the Cortez facility to Gold Quarry and Goldstrike are shown in Figure 1.

Figure 1. Conceptual Rail Routes



2.0 Material Transfer Emissions

Particulate emissions will be generated at the rail loading station at Cortez and also at the unloading stations at Gold Quarry and Goldstrike. At Cortez, stockpiled ore will be transferred from reclaim feeders to a reclaim conveyor and on to a rail loading conveyor. Once the ore arrives at either Gold Quarry or Goldstrike it will be unloaded by belly dump through a hopper to an unloading feeder and then moved along a series of conveyors to be stockpiled near the processing facilities. The particulate emissions from these material transfers at each location are presented in Table 1.

Table 1. Emissions from Ore Transfers

Source	PM₁₀ (ton/yr)	PM_{2.5} (ton/yr)
Ore Loading at Cortez	4.43	0.67
Ore Unloading at Gold Quarry	12.02	1.82
Ore Unloading at Goldstrike	14.55	2.20

Detailed emission calculations are provided in Appendix A. Material transfer emissions were calculated using the emission factors from AP-42, Table 11.19.2-2.

3.0 Rail Transport Emissions

Ore that is transported by rail from Cortez to Gold Quarry will travel approximately 60 miles and ore transported to Goldstrike will travel approximately 63 miles. The routes will be a combination of private rail constructed by NGM and Union Pacific Railroad lines. The potential emissions resulting from rail transport are presented in Table 2.

Table 2. Emissions from Ore Transport by Rail

Destination	PM₁₀ (ton/yr)	PM_{2.5} (ton/yr)	CO (ton/yr)	NO_x (ton/yr)	SO₂ (ton/yr)	VOC (ton/yr)	GHG (ton/yr)
Gold Quarry	17.75	3.80	19.57	71.76	0.062	3.91	6,778
Goldstrike	20.33	4.23	20.33	74.55	0.064	4.07	7,042

Detailed emission calculations are provided in Appendix A. Train transport emissions were estimated using the emission standards for locomotives (40 CFR §1033.101 Table 1) and the average freight rail fuel efficiency in 2018 as reported by the Association of American Railroads (AAR 2019).

The use of rail to transport ore from the Cortez facility to either Gold Quarry or Goldstrike results in lower criteria pollutant and greenhouse gas emissions compared to the use of trucks as summarized in the NEPA Air Quality Impact Analysis Report for the Goldrush Mine (Air Sciences 2020). In particular, greenhouse gas emissions drop from 26,741 tons per year to 6,778 tons per year for transport to Gold Quarry, and from 35,057 tons per year to 7,042 tons per year for transport to Goldstrike.

4.0 References

- AAR. 2019. "The environmental Benefits of Moving Freight by Rail." American Association of Railroads, July. Accessed April 9, 2020. <https://www.aar.org/wp-content/uploads/2018/07/AAR-Environmental-Benefits-Moving-Freight-by-Rail.pdf>.
- Air Sciences. 2020. "NEPA Air Quality Impact Analysis Report, Goldrush Mine." Prepared for Nevada Gold Mines LLC, Prepared by Air Sciences Inc., March.
- EPA. n.d. "AP-42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources." <http://www3.epa.gov/ttn/chief/ap42/index.html>.

Appendix A - Emission Calculations

Air Sciences Inc.

AIR EMISSION CALCULATIONS

PROJECT TITLE:

Goldrush

BY:

G. Barthel

PROJECT NO:

59-70-9A

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SUBJECT:

Rail Transport to NGM Carlin

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Rail Transport Emissions Summary

Gold Quarry

	PM10_TPY	PM2.5_TPY	CO_TPY	NOX_TPY	SO2_TPY	VOC_TPY	CO2e_mt
Location of Activity	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	CO2e ton/yr
Material Load	4.43	0.67	-	-	-	-	-
Rail to Gold Quarry	1.30	1.30	19.57	71.76	0.062	3.91	6,778
Material Unload at Gold Quarry	12.02	1.82	-	-	-	-	-
Total Emissions - Transport to Gold Quarry	17.75	3.80	19.57	71.76	0.062	3.91	6,778
	chk	chk	chk	chk	chk	chk	chk

Goldstrike

	PM10	PM2.5	CO	NOX	SO2	VOC	CO2e
Location of Activity	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	CO2e ton/yr
Material Load	4.43	0.67	-	-	-	-	-
Rail to Goldstrike	1.36	1.36	20.33	74.55	0.064	4.07	7,042
Material Unload at Goldstrike	14.55	2.20	-	-	-	-	-
Total Emissions - Transport to Goldstrike	20.33	4.23	20.33	74.55	0.064	4.07	7,042
	chk	chk	chk	chk	chk	chk	chk

Air Sciences Inc. AIR EMISSION CALCULATIONS	PROJECT TITLE: Goldrush		BY: G. Barthel	
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Material Unload/Load - Gold Quarry

Activity Information

Ore Transported by Rail

4,600,000 ton/yr

(NGM 2022)

Description	Control	Ctrl Eff	Emission Factor (lb/ton) ⁽¹⁾			Annual Emissions (ton)		
			PM	PM10	PM2.5	PM	PM10	PM2.5
Apron Reclaim Feeders Transfer to Reclaim Conveyor	enclosure	50%	0.003	0.0011	0.0002	3.5	1.3	0.2
Reclaim Conveyor Transfer to Rail Loading Conveyor	none	0%	0.003	0.0011	0.0002	6.9	2.5	0.4
Rail Loading Conveyor Transfer to Rail Car	water sprays	75%	0.003	0.0011	0.0002	1.7	0.6	0.1
Rail Car Transfer to Unloading Hopper	enclosure	50%	0.003	0.0011	0.0002	3.5	1.3	0.2
Unloading Hopper Transfer to Unloading Feeder	enclosure	50%	0.003	0.0011	0.0002	3.5	1.3	0.2
Unloading Feeder Transfer to Ore Collection Conveyor	enclosure	50%	0.003	0.0011	0.0002	3.5	1.3	0.2
Ore Collection Conveyor Transfer to Overland Conveyor	water sprays	75%	0.003	0.0011	0.0002	1.7	0.6	0.1
Overland Conveyor #1 Transfer to Overland Conveyor #	none	0%	0.003	0.0011	0.0002	6.9	2.5	0.4
Overland Conveyor #2 Transfer to Radial Stacking Conv	none	0%	0.003	0.0011	0.0002	6.9	2.5	0.4
Radial Stacking Conveyor to Stockpile	none	0%	0.003	0.0011	0.0002	6.9	2.5	0.4
Total						44.9	16.4	2.5

⁽¹⁾ AP-42, Table 11.19.2-2, conveyor transfer point, unctrl; PM2.5=PM10*0.053/0.35

Conversion Factors

2,000 lb/ton

0.35 PM10

0.053 PM2.5

AP-42, Chapter 13.2.4 Particle Size Fractions

AP-42, Chapter 13.2.4 Particle Size Fractions

Air Sciences Inc.

AIR EMISSION CALCULATIONS

PROJECT TITLE:
Goldrush

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Rail Transport to NGM Carlin

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Rail Hauling to Gold Quarry

Activity Information

Operating schedule

Ore Transported to Gold Quarry

Distance traveled on train

Rail fuel factor

Total diesel fuel consumption

365 day/yr

4,600,000 ton/yr

97,940 meters60.9 miles

473 ton-miles/gal diesel (AAR 2019)

591,846 gal/yr82,858 MMBtu/yr11,836,927 bhp-hr/yr

4,600,000 ton ore

yr

60.9 miles

gal diesel

473 ton-miles

=

591,846 gal diesel

yr

591,846 gal diesel

yr

140,000 Btu

gal diesel

1 bhp-hr

7,000 Btu

=

11,836,927 bhp-hr

yr

Line-Haul Locomotive Emission Standards

Year

PM

CO

NOX

VOC

g/bhp-hr

g/bhp-hr

g/bhp-hr

g/bhp-hr

1973-1992

0.22

5.0

8.0

1.0

1993-2004

0.22

2.2

7.4

0.55

2005-2011

0.1

1.5

5.5

0.3

2012-2014

0.1

1.5

5.5

0.3

2015 or later

0.03

1.5

1.3

0.14

Assume 2005 or newer

(NGM 2022)

(40 CFR § 1033.101 Table 1)

Diesel CO2e Emission Factors:

73.96 kg CO2/MMBtu

3.0E-03 kg CH4/MMBtu

6.0E-04 kg N2O/MMBtu

40 CFR Part 98, Table C-1 to Subpart C Fuel Oil No.2

40 CFR Part 98, Table C-2 to Subpart C Petroleum

40 CFR Part 98, Table C-2 to Subpart C Petroleum

Diesel CO2e Emissions

Greenhouse Gas

Emissions

Global Warming

CO2e

ton/yr

ton/yr

Potential(1)

ton/yr

CO2

6,755

1

6,755

CH4

0.27

25

6.85

N2O

0.05

298

16.33

Total CO2e

6,778

(1) 40 CFR 98, Table A-1

Total Rail Emissions

PM

PM10(1)

PM2.5(1)

CO

NOX

SO2(2)

VOC

CO2e

ton/yr

ton/yr

ton/yr

ton/yr

ton/yr

ton/yr

ton/yr

ton/yr

1.30

1.30

1.30

19.6

71.8

0.062

3.9

6,778

(1) PM=PM10=PM2.5

(2) SO2 calculated by mass balance based on 15 ppm S in locomotive diesel

591,846 gal diesel

yr

15 parts S

1.00E+06 parts

6.943 lb

gal diesel

ton

2,000 lb

64.064 M.W. SO2

32.065 M.W. S

=

0.062 ton SO2

yr

Conversion Factors

453.592 g/lb

2,000 lb/ton

907.184 kg/ton

1609.34 m/mi

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Material Unload/Load - Goldstrike

Activity Information

Ore Transported by Rail 4,600,000 ton/yr

Description	Control	Ctrl Eff	Emission Factor (lb/ton) ⁽¹⁾			Annual Emissions (ton)		
			PM	PM10	PM2.5	PM	PM10	PM2.5
Apron Reclaim Feeders Transfer to Reclaim Conveyor	enclosure	50%	0.003	0.0011	0.0002	3.5	1.3	0.2
Reclaim Conveyor Transfer to Rail Loading Conveyor	none	0%	0.003	0.0011	0.0002	6.9	2.5	0.4
Rail Loading Conveyor Transfer to Rail Car	water sprays	75%	0.003	0.0011	0.0002	1.7	0.6	0.1
Rail Car Transfer to Unloading Hopper	enclosure	50%	0.003	0.0011	0.0002	3.5	1.3	0.2
Unloading Hopper Transfer to Unloading Feeder	enclosure	50%	0.003	0.0011	0.0002	3.5	1.3	0.2
Unloading Feeder Transfer to Ore Collection Conveyor	enclosure	50%	0.003	0.0011	0.0002	3.5	1.3	0.2
Ore Collection Conveyor Transfer to Overland Conveyor #1	water sprays	75%	0.003	0.0011	0.0002	1.7	0.6	0.1
Overland Conveyor #1 Transfer to Overland Conveyor #2	none	0%	0.003	0.0011	0.0002	6.9	2.5	0.4
Overland Conveyor #2 Transfer to Overland Conveyor #3	none	0%	0.003	0.0011	0.0002	6.9	2.5	0.4
Overland Conveyor #3 Transfer to Radial Stacking Conveyor	none	0%	0.003	0.0011	0.0002	6.9	2.5	0.4
Radial Stacking Conveyor to Stockpile	none	0%	0.003	0.0011	0.0002	6.9	2.5	0.4
Total						51.8	19.0	2.9

(1) AP-42, Table 11.19.2-2, conveyor transfer point, unctrl; PM2.5=PM10*0.053/0.35

Conversion Factors

2,000 lb/ton

0.35 PM10

0.05 PM2.5

AP-42, Chapter 13.2.4 Particle Size Fractions

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G. Barthel

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Rail Hauling to Goldstrike

Activity Information

Operating schedule365 day/yr

Ore Transported to Goldstrike4,600,000 ton/yr

Distance traveled on train101,748 meters63.2 milesGIS

Rail fuel factor473 ton-miles/gal diesel(AAR 2019)

Total diesel fuel consumption614,858 gal/yr86,080 MMBtu/yr12,297,158 bhp-hr/yr

4,600,000 ton ore

yr

63.2 miles

gal diesel

473 ton-miles

=

614,858 gal diesel

yr

614,858 gal diesel

yr

140,000 Btu

gal diesel

1 bhp-hr

7,000 Btu

=

12,297,158 bhp-hr

yr

Line-Haul Locomotive Emission Standards

Year	PM	CO	NOX	VOC
	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr
1973-1992	0.22	5.0	8.0	1.0
1993-2004	0.22	2.2	7.4	0.55
2005-2011	0.1	1.5	5.5	0.3
2012-2014	0.1	1.5	5.5	0.3
2015 or later	0.03	1.5	1.3	0.14

Assume 2005 or newer

(NGM 2022)

(40 CFR § 1033.101 Table 1)

Diesel CO2e Emission Factors:

73.96 kg CO2/MMBtu

3.0E-03 kg CH4/MMBtu

6.0E-04 kg N2O/MMBtu

40 CFR Part 98, Table C-1 to Subpart C Fuel Oil No.2

40 CFR Part 98, Table C-2 to Subpart C Petroleum

40 CFR Part 98, Table C-2 to Subpart C Petroleum

Diesel CO2e Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential ⁽¹⁾	CO2e ton/yr
CO2	7,018	1	7,018
CH4	0.28	25	7.12
N2O	0.06	298	16.97
Total CO2e			7,042

(1) 40 CFR 98, Table A-1

Total Rail Emissions

PM	PM10 ⁽¹⁾	PM2.5 ⁽¹⁾	CO	NOX	SO2 ⁽²⁾	VOC	CO2e
ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr
1.36	1.36	1.36	20.3	74.6	0.064	4.1	7,042

(1) PM=PM10=PM2.5

(2) SO2 calculated by mass balance based on 15 ppm S in locomotive diesel

614,858 gal diesel

yr

15 parts S

1.00E+06 parts

6.943 lb

gal diesel

ton

2,000 lb

64.064 M.W. SO2

32.065 M.W. S

=

0.064 ton SO2

yr

Conversion Factors

453.592 g/lb

2000 lb/ton

907.184 kg/ton

1609.34 m/mi