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Nevada Rail Partners	T13/EIS Interface - *Air Quality Emission Factors and Socioeconomic Input, Mina Rail Corridor* - Rev 00 8n RFP Reference Exhibit D-2.13c.2	April 20, 2007	07-00041

Section I. Submittal Information (includes above information)

Submittal Description and Revision Summary for Entire Submittal:

This document provides requested air quality and socioeconomic data for the Mina Rail Corridor. Results are based on conceptual design data for the proposed alignment, and on comments to the draft (Rev. 0A) provided by BSC. Conceptual-level estimates are provided for fugitive dust emissions for construction activities including earthwork, track construction, facilities construction, access road, quarries, and water well construction, quarry operations, and storage piles. Estimates of equipment operating hours are also provided. Socioeconomic data, including fuel use, employment, and appropriate cost data are also included.

Special Instructions:

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Section II. Data File Information (Add lines below if needed for additional files. Indicate "Last item" or "End of list" on last line used.)

Filename	Rev.	File Size	Description (File description and revision summary for file)	Application and Version/ Add-in or Extension and Version
T13_Cover_20April2007.ppt	00	699 KB	Report cover for the *Air Quality Emission Factors and Socioeconomic Input, Mina Rail Corridor* – Rev. 00	Microsoft Powerpoint 2003
T13_MRC_AirQuality_Rev00_FINAL_20Apr07.doc	00	4,859 KB	Main text with all imbedded graphics and appendices – *Air Quality Emission Factors and Socioeconomic Input, Mina Rail Corridor* – Rev. 00 NRP-R-SYSW-EI-0003-00	Microsoft Word 2003
T13_MRC_AirQuality_Rev00_FINAL_20Apr07.pdf	00	1,535 KB	Scanned version of the complete document with all imbedded graphics and appendices – *Air Quality Emission Factors and Socioeconomic Input, Mina Rail Corridor* – Rev. 00 NRP-R-SYSW-EI-0003-00	Adobe Acrobat 7.0 Standard Version
T13_MRC_AirQuality_Rev00_FINALreadonly_20Apr07.doc	00	4,859 KB	Main text (Read Only) with all graphics and appendices – *Air Quality Emission Factors and Socioeconomic Input, Mina Rail Corridor* – Rev. 00 NRP-R-SYSW-EI-0003-00	Microsoft Word 2003
T13_MRC_AirQuality_Rev00_FINALredlines_20Apr07.pdf	00	1,180 KB	Scanned redline version of the complete document with all imbedded graphics and appendices – *Air Quality Emission Factors and Socioeconomic Input, Mina Rail Corridor* - Rev 00 NRP-R-SYSW-EI-0003-00	Adobe Acrobat 7.0 Standard Version
T13_AirQuality_MRC_App_D_16_apr_07.xls	00	140 KB	Air quality report supporting tables	Microsoft Excel 2003
T13_MRC_AQ_App_A&B_Revised_10_may_07.xls	00	808 KB	Errata Sheet for Appedix A&B	Microsoft Excel 2003
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Air Quality Emission Factors and Socioeconomic Input Mina Rail Corridor

Task 13: EIS Interface Support

Rev. 00

Document No. NRP-R-SYSW-EI-0003-00

prepared by:

prepared for:

Nevada Rail Line Conceptual Design

Subcontract NN-HC4-00239

April 20, 2007

Air Quality Emission Factors and Socioeconomic Input Mina Rail Corridor

Task 13: EIS Interface Support

Rev. 00

Document No. NRP-R-SYSW-EI-0003-00

Nevada Rail Line Conceptual Design
Subcontract NN-HC4-00239
20 April 2007

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Appendix A – Analysis Assumptions

Appendix B – Air Emissions Analysis for Construction Activities

Appendix C – Air Emissions Analysis for Operational Activities

Appendix D – Modeling Inputs Requested for Socioeconomic Modeling

List of Acronyms

BC	Bonnie Claire
CARB	California Air Resources Board
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CRC	Caliente Rail Corridor
CS	Common Segment
DOE	U.S. Department of Energy
EOL	end-of-line
EPA	U.S. Environmental Protection Agency
g	grams
hp	horsepower
MCS	Mina Common Segment
MN	Mina Segment
MOW	maintenance-of-way
MRC	Mina Rail Corridor
m/s	meters per second
m^2	square meters
NRL	Nevada Rail Line
NRP	Nevada Rail Partners
OV	Oasis Valley
PM	particulate matter
RA EIS	Rail Alignment Environmental Impact Statement
Repository	Yucca Mountain Geologic Repository
ROW	right-of-way
S	Schurz Segment
TCC	Train Control Center
UPRR	Union Pacific Railroad
VMT	vehicle miles traveled
VOC	volatile organic compounds
WRAP	Western Regional Air Partnership
yd^3	cubic yards

1.1 PURPOSE

The project addressed in this report is the Nevada Rail Line (NRL), which would connect the existing national rail system with the U.S. Department of Energy's (DOE's) potential Yucca Mountain Geologic Repository (Repository). The site would be the nation's first geological repository designed to store and dispose of spent nuclear fuel and high-level radioactive waste. The NRL would provide a means of transporting the waste by rail to the Repository as well as transporting construction materials by rail to support Repository operations. Two potential corridors between the existing national rail system and the Repository have been evaluated: 1) the Caliente Rail Corridor (CRC), beginning near Caliente, Nevada, and 2) the Mina Rail Corridor (MRC), beginning near Fort Churchill (see Figure 1-A).

This report describes the air quality emission factors and socioeconomic input for the MRC. The proposed NRL may potentially affect the air quality and socioeconomic resources of the region encompassing Lyon, Mineral, Esmeralda, and Nye counties. These effects will be quantified and evaluated by the *Rail Alignment Environmental Impact Statement* (RA EIS) Contractor. For this to occur, however, data regarding construction equipment, workers, and methods are required. Therefore, the objectives of this report are:

- To describe the techniques, methods, and equipment used for construction and operation of the MRC in terms that can be used by the RA EIS Contractor to estimate the total air emissions and subsequent impacts to the local and regional environment.
- To describe the construction and operational data requested by the RA EIS Contractor for use in subsequent economic impact modeling.

1.2 CONTENTS

This report addresses three principal elements:

1. Framework for Analysis – Construction and subsequent operation of the rail line will require the efforts of hundreds of workers, support personnel, vehicles, and equipment. These activities may affect the region's air quality and socioeconomic resources. At this time, the construction plan and the operation and maintenance plan are only conceptually defined; therefore, it is necessary to make several basic assumptions regarding construction and operation to serve as a framework for the air quality and socioeconomic analysis. These assumptions are discussed in Section 2.0 of this report.

2. Air Emissions – Section 3.0 of this report describes the methodologies and refers to the sources used to calculate air emissions. This report provides estimates of the numbers and types of equipment needed for construction and operation, the duration of operations, and the horsepower associated with the various equipment types. Numeric results of the calculations of construction-related air quality emissions are presented in Appendix A; numeric results for operational air emissions are shown in Appendix B.

3. Socioeconomic Factors – Section 4.0 of this report discusses the preparation of input data for the socioeconomic impact analysis to be conducted by the RA EIS Contractor. The analysis requires input from the engineering team regarding the number of construction personnel, construction camp locations, and other factors. It also requires operational data in terms of the personnel needed to operate the railroad and its facilities.

These elements are necessary to determine the magnitude of the potential effects of the MRC on the air quality and socioeconomic resources of the region. Subsequent sections of this report further describe these elements.

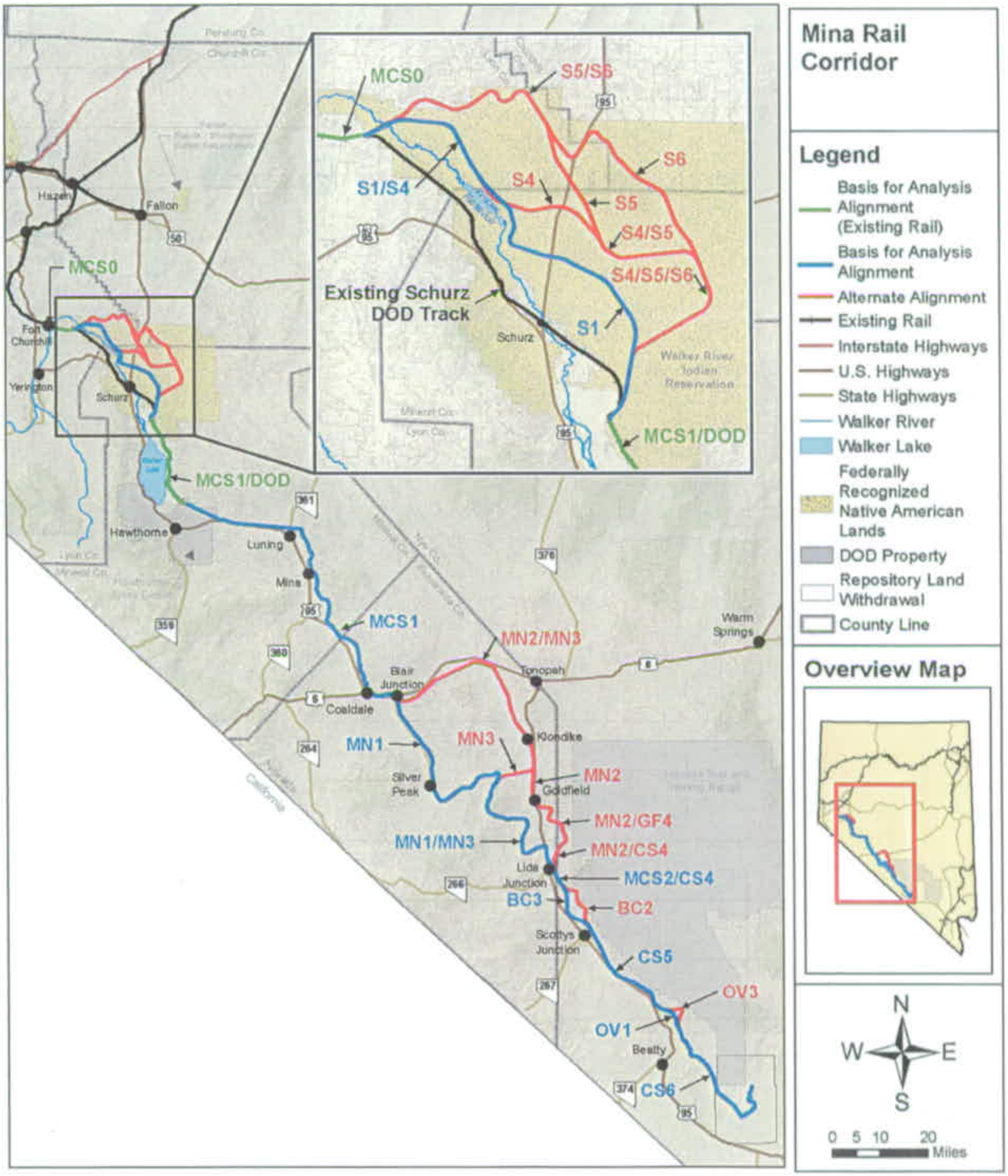

Figure 1-A. Mina Rail Corridor

The body of this report documents the assumptions and methodologies used to perform the air emissions calculations and the socioeconomic analysis. The data are presented in the following appendices:

- Appendix A – Analysis Assumptions
- Appendix B – Air Emissions Analysis for Construction Activities
- Appendix C – Air Emissions Analysis for Operational Activities
- Appendix D – Modeling Inputs Requested for Socioeconomic Modeling

This report is not a stand-alone document. Sections that overlap with or duplicate information contained in *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a) reference the location of the data in the CRC document.

This report is one of several prepared to support and provide initial input to the first draft of the RA EIS. The other reports are as follows:

- *Alignment Development Report, Mina Rail Corridor* (NRP 2007b)
- *Comparative Cost Estimates, Mina Rail Corridor* (NRP 2007c)
- *Construction Plan, Mina Rail Corridor* (NRP 2007d)
- *Facilities—Design Analysis Report, Mina Rail Corridor* (NRP 2007f)
- *Operations and Maintenance Report, Mina Rail Corridor* (NRP 2007g)
- *Route Sections and Structures Report, Caliente Rail Corridor* (NRP 2007h)

Each report covers a specific topic for a specific purpose. Accordingly, each report utilizes data from various sources in varying levels of detail and precision as appropriate, as well as in different contexts. Although the reports are consistent in overall conceptual design, numerical values for certain parameters may vary from one report to another. This variation is due to the conceptual nature of the reports and their distinct areas of focus; it should not be considered an abnormal situation or an indication of error.

2.1 FRAMEWORK FOR ANALYSIS

Estimating fugitive dust and exhaust emissions from construction and operating equipment requires information about the proposed construction process. For example, the number and operating hours of various types of equipment are dependent on the construction duration. These factors are also dependent on the estimated volumes of cut and fill along the engineered alignment segments. Schedule and construction philosophy (for example, the number of headings in which construction occurs) will influence the size of crews and their location along the alignment.

Although the methods of constructing the NRL are still evolving, several assumptions made for the purposes of this report establish a general framework for construction of the proposed rail line. These assumptions are grouped into three categories:

- Schedule
- Construction
- Alignment

The individual assumptions made for the air quality and socioeconomic modeling inputs analyses are listed on the analysis spreadsheets and are summarized in Appendix A. These assumptions are intended to represent a typical construction concept and not necessarily the preferred methods or process for NRL. Those decisions will be made in later project development phases.

Further information on the assumptions is presented in Sections 2.2, 2.3, and 2.4 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).

Supporting data for the analyses described in this report have been obtained from other NRP reports. These reports include:

- *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a)
- *Alignment Development Report, Mina Rail Corridor* (NRP 2007b)
- *Comparative Cost Estimates, Mina Rail Corridor* (NRP 2007c)
- *Construction Plan, Mina Rail Corridor* (NRP 2007d)
- *Facilities–Design Analysis Report, Mina Rail Corridor* (NRP 2007f)
- *Operations and Maintenance Report, Mina Rail Corridor* (NRP 2007g)

2.2 SCHEDULE ASSUMPTIONS

Assumptions regarding the sequence, duration, and schedule for the MRC air quality evaluation are similar to those made for the CRC. Refer to Section 2.2 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).

2.3 CONSTRUCTION ASSUMPTIONS

Materials – Refer to Section 2.3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).

Site Grading – Site grading and drainage construction would occur on multiple headings; track construction would occur on one heading, starting at the town of Hawthorne, Nevada. Earthwork quantities and surface areas have been computed based on information provided from *Comparative Cost Estimates, Mina Rail Corridor* (NRP 2007c).

Access Roads – Refer to Section 2.3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).

Construction Camps – For purposes of the air quality analysis, the following has been assumed:

- The disturbed area for each camp is approximately 25 acres. Construction of each camp would require approximately six months for site clearing, installation of utilities and services (including water and sewer systems, and a fueling station), and for erection of offices, supporting facilities, and living quarters. Site grading would be minimal, and camps have been located to be within or immediately adjacent to the proposed right-of-way (ROW).
- The existing road system would be used to provide access from the camps to a paved highway; less than 1 mile of new road would be needed to complete access to the camps. Roads used for camp access would be upgraded to a gravel surface to minimize fugitive dust.
- After completion of the construction activities, the construction camps would be dismantled and the land reclaimed. Reclamation methods are described in *Construction Plan, Mina Rail Corridor* (NRP 2007d).
- For purposes of the air quality analysis, it has been assumed that 10 sites would be constructed; locations of these sites are provided in *Construction Plan, Mina Rail Corridor* (NRP 2007d). Of these, it should be assumed that only six camps would be operating concurrently, and only 10 would be used in any given year. It has been assumed that over a four-year period, the annual employment would be as high as approximately 2,160 persons.

Refer to Section 2.3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a) for additional information.

Quarries – Rock quarries would be developed at approved locations within or near the ROW for production of ballast materials needed for track construction. It is anticipated that two quarries, chosen from among five potential locations, would be developed. Locations of the potential quarries for the MRC are specified in *Construction Plan, Mina Rail Corridor* (NRP 2007d). Section 2.3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a) provides additional information regarding the assumptions made for purposes of the air emissions analysis.

Wells – Water for construction activities would be provided from approximately 84 new wells installed for this project as specified in the *Construction Plan, Mina Rail Corridor* (NRP 2007d). The wells would be spaced along the alignment and, for the most part, within the proposed ROW. There would be approximately fifteen wells outside of the ROW along the basis for analysis alignment (see Section 2.4 below). New access roads may be required to construct and operate these wells. With respect to air quality emissions from well construction, critical assumptions include:

- The surface area that would be disturbed for each well is approximately 1.4 acres. Construction of each well would require up to four weeks.
- The estimated well depths would range from 200 to 2,000 feet. For this analysis, it has been assumed that the average depth is 400 feet and that the drilling rate is 20 feet per day.

2.4 ALIGNMENT ASSUMPTIONS

The MRC segments composing the alignment used as the basis for analysis[1] are listed in Table 2-1 and are shown in Figure 2-A. The fugitive dust and exhaust emission factors for the construction of these segments have been evaluated and are presented in Appendix B. This report also includes consideration of alternate alignment segments. Engineering characteristics of these alternate segments are described in the *Alignment Development Report, Mina Rail Corridor* (NRP 2007b). Earthwork volumes for these alternate segments are presented in Appendix B, along with sufficient information for others to calculate the emissions in the event that it becomes necessary to compare the air quality effects of one segment to another.

Table 2-1. MRC Engineered Alignment Segments Used in Air Emissions Analysis

Segment	Length (miles)
S1	31.9
MCS1	72.2
MN1	39.6
MN1/MN3	33.5
MCS2/CS4	2.1
BC3	12.3
CS5	24.9
OV1	6.1
CS6	31.8
Total	254.4

Source: NRP 2007b.

Data are also presented for the MN2 and MN3 alignments as well as the alternates for the Bonnie Claire and Oasis Valley segments. The MN2 alignment includes segments MN2/MN3, MN2, MN2/GF4, and MN2/CS4. The MN3 alignment includes segments MN2/MN3, MN3, and MN1/MN3. Data are presented in Appendix B by individual segment and collectively, where appropriate.

[1] Throughout this and other NRP reports, the phrase "basis for analysis" is used to provide a frame of reference for NRP's evaluations of the alignment's construction engineering and operational characteristics. Except for the *Operations and Maintenance Report, Mina Rail Corridor* (NRP 2007g), NRP reports provide data for all alignment segments so that consideration of other alternate alignment segment combinations can be accomplished.

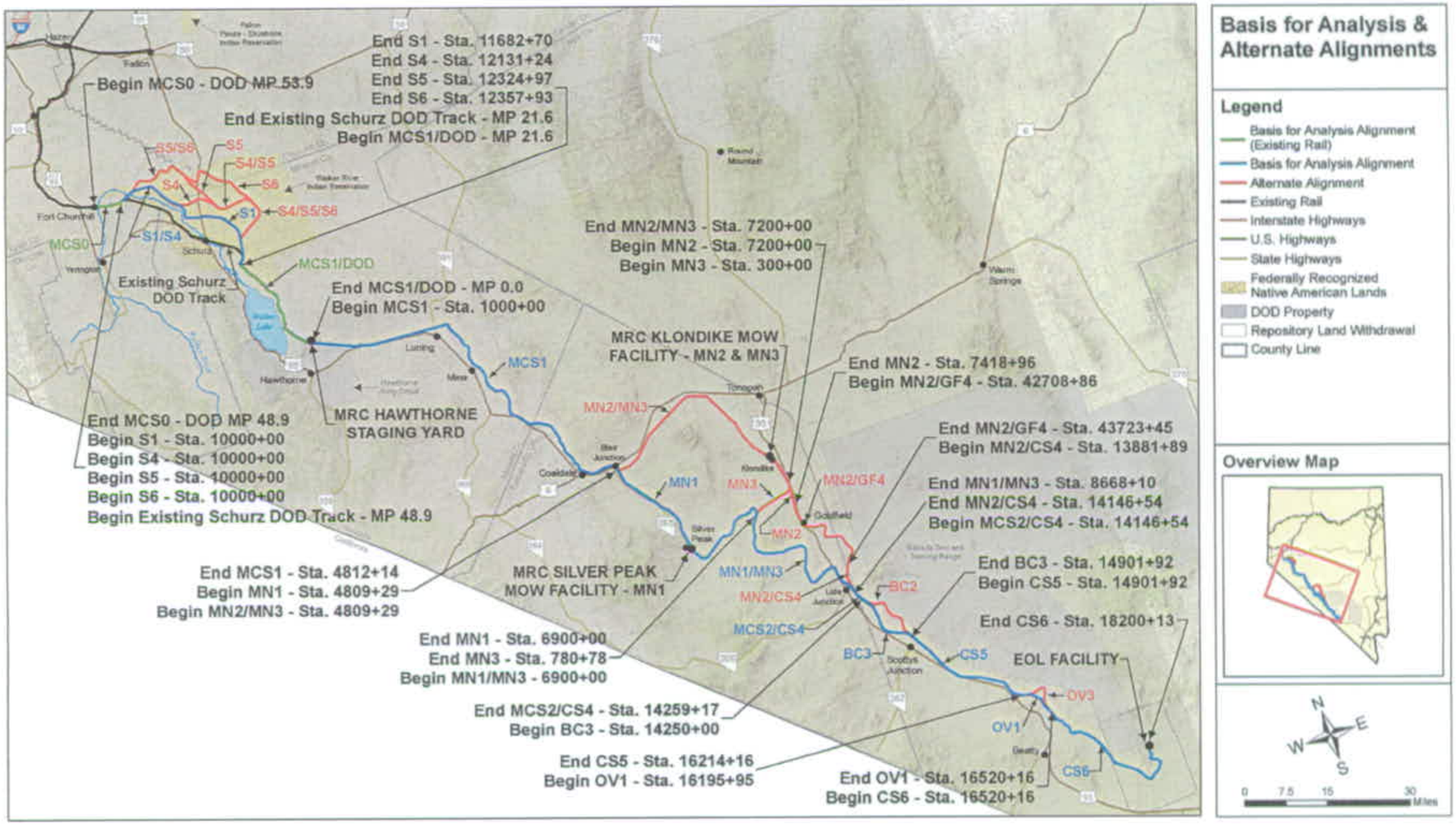

Figure 2-A. MRC Basis for Analysis

3.1 CONSTRUCTION

Refer to Section 3.1 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).

3.1.1 Fugitive Dust

As in *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a), fugitive dust is reported in three forms:

- Particulate matter with an aerodynamic diameter smaller than 100 microns (PM)
- Particulate matter with an aerodynamic diameter of less than or equal to 10 microns (PM_{10})
- Particulate matter with an aerodynamic diameter of less than 2.5 microns ($PM_{2.5}$)

The methodologies for estimating fugitive dust emissions are based on the use of established emission factors for similar activities (Western Regional Air Partnership [WRAP] 2004 and U.S. Environmental Protection Agency [EPA] various updates). Since publication of the Caliente reports, some emission factors in the WRAP and EPA sources have changed. These changes are small and have little effect on the results of total dust emissions. For purposes of maintaining consistency with the Caliente documents, emission factors have been left at their former values.

Specific references and assumptions used in the development of the emission estimates are shown in the tables in Appendix A. The analytical basis sheets in Appendix A provide a summary of the assumed numeric values of various parameters used in the emissions analysis, such as total yards of excavation, miles of new access road, and duration of construction activities. All of the emissions calculations refer to the analytical basis for assigned project values. Appendix B provides results of fugitive dust calculations.

3.1.2 Exhaust Emissions

Refer to Section 3.1.2 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).

3.1.3 Methodologies for Construction Emissions

The computations for fugitive dust and engine exhaust sources during construction are presented in Appendix B. The basis of these computations is presented below in Tables 3-1 and 3-2 for fugitive dust and exhaust, respectively, for each table in Appendix B.

Table 3-1. Explanation of Appendix B Data Sheets for Fugitive Dust Emissions

Appendix B Sheet Name	Basis of Computation
Earthwork Basis	Refer to Table 3-3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Track and Bridge Construction – Dust	Refer to Table 3-3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Construction Features	The fugitive dust emissions due to construction of the camps, quarries, and wells as well as construction of the access roads to these features are based on the surface area and duration of earthwork activities associated with construction of the sites. • Camps – Computations present emissions for the bounding condition of 10 open camps. The schedule assumes that the camps would be constructed within the first six months following notice to proceed. • Quarries – Two quarries would be developed for the project. Excavated quarry materials would be delivered to a loading facility adjacent to the track via conveyors. • Wells – The majority of the 84 wells needed for the project would be developed within the 1,000-foot ROW. Surface disturbances and fugitive dust emissions are presented for all wells. Approximately nine of the wells may required new or improved access roads; disturbance and fugitive dust emissions are presented for these also.
Facilities	The fugitive dust emissions due to construction of the facilities are based on the surface area and duration of earthwork activities associated with construction of each facility. The estimates of surface areas and earthwork disturbance activities are used in conjunction with the emission factor to estimate the fugitive dust emissions. For purposes of estimating annual emissions, the following is assumed: • The MRC would not require a separate Union Pacific Railroad (UPRR) interchange facility. Two tracks in the Hawthorne staging yard would be allotted for interchange movements. The interchange tracks would be constructed during the same time period as the staging yard. • Construction of the Hawthorne staging yard would require 12 months to complete. • Construction of the maintenance-of-way (MOW) facility would require 12 months to complete. • Construction of the end-of-line (EOL) facility would require about 20 months to complete.
Access Roads	Refer to Table 3-3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Unpaved Roads	Refer to Table 3-3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Batch Plants	Refer to Table 3-3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Materials Storage and Stockpiles	Refer to Table 3-3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Quarry	Refer to Table 3-3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Rock Excavation	Refer to Table 3-3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).

Table 3-2. Explanation of Appendix B Data Sheets for Construction Exhausts

Appendix B Sheet Name	Basis of Computation
Track and Bridge	The typical motorized construction equipment used for similar construction projects is shown, along with horsepower and operating hours. Annual operating hours are estimated as a linear distribution of hours throughout the anticipated total construction duration. Construction equipment operating hours were estimated for the CRC according to an estimated number of crews and pieces of equipment. Although shorter, the MRC has nearly the same volume of fill (25,642,000 cubic yards [yd^3]) as the CRC has in cut (27,020,000 yd^3). As these two volumes are nearly equal (a ratio of 0.95), the construction equipment operating hours for the MRC are assumed to be the same as those for the CRC.
Construction Features	Refer to Table 3-4 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Facilities	Refer to Table 3-4 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Access Roads	Refer to Table 3-4 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Batch Plants	Refer to Table 3-4 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).
Signals and Communications	Refer to Table 3-4 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).

3.2 OPERATION

Refer to Section 3.2 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a). Appendix C of this MRC document presents emissions data for the MRC.

4.1 RA EIS TEAM DATA REQUESTS

Construction and operation of the NRL would require a large force of construction personnel that could induce economic or social impacts to the region. The RA EIS Contractor will use an economic-demographic forecasting model known as Policy Insight®, developed by Regional Economic Models, Inc., to provide employment, real disposable income, and gross regional product data for Lyon, Mineral, Esmeralda, Nye, and Clark counties. The Policy Insight® model used in these determinations is an eight-region model. Six of the regions are Lyon, Mineral, Esmeralda, Nye, Clark, and Lincoln counties. The seventh region is the combination of Washoe County and Carson City. The eighth region is an aggregation of the other counties in Nevada.

The Policy Insight® model, in use since 1980, generates year-by-year estimates of the total regional effects of any specific policy initiative, such as the MRC. The model has the following features:

- It is calibrated to local conditions using a relatively large amount of local data.
- It combines several different kinds of analytical tools (including economic base, input-output, and econometric models).
- It allows users to manipulate an unusually large number of input variables and gives forecasts for an unusually large number of output variables.
- It allows users to generate forecasts for any combination of future years, providing special flexibility in analyzing the timing of economic impacts.
- It accounts for business cycles.

The Policy Insight® model is very data intensive; that is, as noted above, it requires a relatively large amount of local data to produce feasible results. As with the air emissions data requests, many of the data requested for Policy Insight® modeling pertained to specific construction activities. Section 2.0 of this report notes that the methods of constructing the MRC are still evolving; therefore, several assumptions have been made for the purposes of this report to establish a general framework for construction of the proposed rail line and to serve as a basis for the input data provided to the RA EIS Contractor. These assumptions are outlined in Appendix A. In general, data requirements covered the following topics:

- Size and composition of the workforce for construction of the track, drainage, and major bridge structures, including construction camps, batch plants, and ballast sites
- Construction of supporting facilities at the staging yard, MOW, and EOL at the Repository
- Operation of the rail line, including crew size and support requirements
- Operation of the supporting facilities, including workforce size and composition
- Locomotive fuel consumption for Repository construction and operation, and for spent nuclear fuel shipments

4.2 RA EIS INPUTS

Refer to Section 4.2 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a). Appendix D of this MRC document presents data for socioeconomic evaluations of the MRC.

4.3 EFFECTS OF EXPANDED SCHEDULE

Refer to Section 4.3 of *Air Quality Emission Factors and Socioeconomic Input, Caliente Rail Corridor* (NRP 2007a).

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Appendix A
Analysis Assumptions

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ASSUMPTIONS FOR FUGITIVE DUST AND EXHAUST AIR EMISSIONS DURING CONSTRUCTION

EARTHWORK BASIS	
(1)	All values are based on output from InRoads analyses of alignment dated January 2006. Alignment segments listed as the basis for analysis are defined in *Alignment Development Report, Mina Rail Corridor* (NRP 2007b).
(2)	Surface area disturbed data from InRoads were adjusted to account for disturbances resulting from construction of alignment access roads, and to allow for contingencies (20%).
(3)	The effective disturbed surface area adds a 50% factor to the portion of the segment assumed to be rugged terrain, to account for the expected increase in construction time associated with this type of terrain.
(4)	Volumes of different types of materials based on geologic mapping as provided by Shannon & Wilson, Inc. (2007)
TRACK AND BRIDGE CONSTRUCTION – FUGITIVE DUST	
(1)	Analysis includes fugitive dust emanating from surface area disturbances and placement of embankment, track, and alignment access roads. Results are tabulated for alluvial and rock excavations, and for anticipated borrow and waste.
(2)	PM_{10} emission factor reference was taken from WRAP *Fugitive Dust Handbook*, Chapter 3, Construction and Demolition, Table 3-2, Recommended PM_{10} Emission Factors for Construction Operations, Level 1 (November 15, 2004) for "worst-case conditions" due to the "active large-scale earth moving operations." These factors were based on a work schedule of 168 hours per month and were therefore adjusted to account for a 260-hour-per-month work schedule.
(3)	AP-42, Section 13.2.3 was utilized for the PM general construction emission factor due to the absence of a similar factor in WRAP *Fugitive Dust Handbook*.
(4)	For both on-site and off-site cut and fill emissions, WRAP does not provide a PM emission factor. Therefore, the PM emission factor for this project is assumed to be the WRAP PM_{10} factor multiplied by 1.85 to provide a PM:PM_{10} ratio similar to that for other construction activities utilizing a general construction PM_{10} factor (that is, track construction, bridge construction, facilities construction, and access road construction).
(5)	$PM_{2.5}$ is assumed to be 20.8% of PM_{10} per ratio for construction dust published by the California Air Resources Board (CARB, June 30, 1989).
(6)	Assumes disturbed areas associated with track sidings and bridge construction are included in the surface area of the alignment.
(7)	Assumes that potential wind erosion associated with the track construction phase is accounted for by applying the emission factor to the entire time (effective duration) the segment is exposed.
(8)	Emissions of fugitive dust from construction of signals and communication equipment are included herein, as the construction of said equipment is assumed to occur within the ROW.
CONSTRUCTION FEATURES – FUGITIVE DUST	
(1)	Analysis includes fugitive dust emanating from construction of camps, quarries, and wells, and the access roads leading to these features.
(2)	PM_{10} emission factor reference was taken from WRAP *Fugitive Dust Handbook*, Chapter 3, Construction and Demolition, Table 3-2, Recommended PM_{10} Emission Factors for Construction Operations, Level 1 (November 15, 2004). These factors were based on a work schedule of 168 hours per month and were therefore adjusted to account for a 260-hour-per-month work schedule.
(3)	AP-42, Section 13.2.3 was utilized for the PM general construction emission factor due to the absence of a similar factor in WRAP *Fugitive Dust Handbook*.

ASSUMPTIONS FOR FUGITIVE DUST AND EXHAUST AIR EMISSIONS DURING CONSTRUCTION

(4)	$PM_{2.5}$ is assumed to be 20.8% of PM_{10} per ratio for construction dust published by CARB (June 30, 1989).
(5)	Construction camps are assumed to be sited on flat terrain. Therefore, general construction emissions are assumed to account for site grading emissions. Earth-moving activities are assumed to be negligible.
FACILITY CONSTRUCTION – FUGITIVE DUST	
(1)	Analysis includes fugitive dust emanating from construction of the Hawthorne staging yard, the MOW facility, and the EOL facility.
(2)	PM_{10} emission factor reference was taken from WRAP *Fugitive Dust Handbook*, Chapter 3, Construction and Demolition, Table 3-2, Recommended PM_{10} Emission Factors for Construction Operations, Level 1 (November 15, 2004). These factors were based on a work schedule of 168 hours per month and were therefore adjusted to account for a 260-hour-per-month work schedule.
(3)	AP-42, Section 13.2.3 was utilized for the PM general construction emission factor due to the absence of a similar factor in WRAP *Fugitive Dust Handbook*.
(4)	$PM_{2.5}$ is assumed to be 20.8% of PM_{10} per ratio for construction dust published by CARB (June 30, 1989).
(5)	Earthwork quantities for facilities are taken from *Comparative Cost Estimates, Mina Rail Corridor* (NRP 2007c).
ACCESS ROAD CONSTRUCTION – FUGITIVE DUST	
(1)	Analysis includes fugitive dust emanating from construction of permanent access roads to the Hawthorne staging yard, the MOW facility, and the EOL facility.
(2)	PM_{10} emission factor reference was taken from WRAP *Fugitive Dust Handbook*, Chapter 3, Section 3.2.4 (November 15, 2004). These factors were based on a work schedule of 168 hours per month and were therefore adjusted to account for a 260-hour-per-month work schedule.
(3)	AP-42, Section 13.2.3 was utilized for the PM General Construction emission factor due to the absence of a similar factor in WRAP *Fugitive Dust Handbook*.
(4)	$PM_{2.5}$ is assumed to be 20.8% of PM_{10} per ratio for construction dust published by CARB (June 30, 1989).
(5)	Assumes all roads meet the criteria of WRAP, Table 3-3, Conversion of Road Miles to Acres Disturbed, Group 4.
CONSTRUCTION TRAFFIC ON UNPAVED ROADS – FUGITIVE DUST	
(1)	Silt content was taken from the Industrial Unpaved Roads section of AP-42, Table 13.2.2-1 for a typical surface material.
(2)	Wet days per year is expressed as the mean number of days per year with at least 0.01 inch of precipitation, taken from AP-42, Figure 13.2.2-1 for southwestern Nevada.
(3)	Total operating hours, provided by the NRP construction team, were used to estimate total vehicle miles traveled (VMT) by assuming an average vehicle speed.
(4)	A batch plant was assumed to be located at the Beatty Wash Bridge. Haul distances for delivery of raw materials to the batch plants are assumed to be 15 miles for each plant; the distance from plant to bridge was assumed to be 1 mile.
(5)	Truck travel for fuel and maintenance trucks is assumed to be included within data listed for grading and track operations within this same tab.
(6)	Vehicles are assumed to be traveling on a constructed gravel road.
(7)	Emissions of fugitive dust from paved roads are assumed to be insignificant.

ASSUMPTIONS FOR FUGITIVE DUST AND EXHAUST AIR EMISSIONS DURING CONSTRUCTION

BATCH PLANT OPERATIONS – FUGITIVE DUST	
(1)	Emission factor reference was taken from AP-42, Table 11.12-3 (October 2001).
(2)	$PM_{2.5}$ is assumed to be equal to PM_{10} because AP-42 does not provide an emission factor for $PM_{2.5}$ for the listed processes.
(3)	Concrete volume of 49,502 cubic meters was taken from the Morrison-Knudsen estimate (1997), and converted to cubic yards by multiplying by 1.31.
(4)	Analysis assumes one (1) plant, located at the Beatty Wash Bridge site.
(5)	Truck mix concrete is assumed for conservative emission factors.
(6)	Wind erosion of storage piles is not included within this tab.
TRACK AND BRIDGE CONSTRUCTION STORAGE PILES – FUGITIVE DUST	
(1)	See notes within tab.
BATCH PLANTS, FINE MATERIALS STORAGE PILES – FUGITIVE DUST	
(1)	See notes within tab.
BATCH PLANTS, COARSE MATERIALS STORAGE PILES – FUGITIVE DUST	
(1)	See notes within tab.
QUARRY OPERATIONS – FUGITIVE DUST	
(1)	Emission factor reference was taken from AP-42, Table 11.19.2-2 (August 2004).
(2)	The total project subballast and ballast is assumed to be processed at the quarries established for the project. Volumes were adjusted to account for swell factors. Shannon & Wilson, Inc. (2005) estimate that approximately 4,600 tons of material would be excavated to produce 3,400 tons of usable material.
(3)	All rock excavation is assumed to be performed by wet drilling. AP-42 does not provide emission factors for rock blasting.
(4)	The AP-42 emission factor for tertiary crushing applies to all crushing operations (primary, secondary, and tertiary) because AP-42 does not provide emission factors for primary and secondary crushing. No emissions for fines crushing are included.
(5)	For sources listed in AP-42 which do not explicitly express PM factors, the PM emission factor for this project is assumed to be the AP-42 PM_{10} factor multiplied by 1.85. This will provide a similar PM:PM_{10} ratio as for other construction activities accounted for in this project where a documented PM factor is not available. $PM_{2.5}$ emissions are assumed to equal PM_{10}.
(6)	Six conveyor transfer points are assumed in the process.
(7)	Truck loading emission factor is assumed to equal the truck unloading emission factor from AP-42 because no truck loading factor is provided.

ASSUMPTIONS FOR FUGITIVE DUST AND EXHAUST AIR EMISSIONS DURING CONSTRUCTION

TRACK AND BRIDGE CONSTRUCTION – EXHAUST	
(1)	Hours of operation are based on an assumed construction equipment consist. Five (5) consists would be used for site grading; one (1) would be used for track construction. Consists are listed later in this appendix.
(2)	Hours of operation are assumed to be those for common terrain, adjusted by the terrain factor. A factor of 50% was then added to the hours for each equipment type to account for the increase in construction time associated with rugged terrain.
(3)	Hours of operation were based on the estimated number of pieces of equipment type, used by five (5) crews for 3,000 hours per year.
(4)	Duration of construction activities would be 24 months for grading and 26 months for track laying.
(5)	If no specific piece of equipment was referenced, the horsepower represents typical equipment listed by these manufacturers that is similar to the equipment listed for this project, and is identified as such by the word "generally." These references are intended to be representative, not indicative of actual equipment.
CONSTRUCTION FEATURES – EXHAUST	
(1)	Duration of construction is specified within the Analytical Basis, shown later in this appendix.
(2)	If no specific piece of equipment was referenced, the horsepower represents typical equipment listed by these manufacturers that is similar to the equipment listed for this project, and is identified as such by the word "generally." These references are intended to be representative, not indicative of actual equipment.
(3)	Generators pumping water wells were given an estimated horsepower (hp) of 150 hp, assuming 90% efficiency.
FACILITIES CONSTRUCTION – EXHAUST	
(1)	Duration of construction is specified within the Analytical Basis, shown later in this appendix.
(2)	If no specific piece of equipment was referenced, the horsepower represents typical equipment listed by these manufacturers that is similar to the equipment listed for this project, and is identified as such by the word "generally." These references are intended to be representative, not indicative of actual equipment.
ACCESS ROAD CONSTRUCTION – EXHAUST	
(1)	Analysis covers exhaust emissions for construction of access roads to camps, quarries, and wells, as well as permanent access roads to facilities.
(2)	If no specific piece of equipment was referenced, the horsepower represents typical equipment listed by these manufacturers that is similar to the equipment listed for this project, and is identified as such by the word "generally." These references are intended to be representative, not indicative of actual equipment.
BATCH PLANT OPERATIONS – EXHAUST	
(1)	If no specific piece of equipment was referenced, the horsepower represents typical equipment listed by these manufacturers that is similar to the equipment listed for this project, and is identified as such by the word "generally." These references are intended to be representative, not indicative of actual equipment.
SIGNALS AND COMMUNICATIONS CONSTRUCTION – EXHAUST	
(1)	Assumes a construction period of 1.5 years, to occur over the final year and a half of the project.
(2)	If no specific piece of equipment was referenced, the horsepower represents typical equipment listed by these manufacturers that is similar to the equipment listed for this project, and is identified as such by the word "generally." These references are intended to be representative, not indicative of actual equipment.

ASSUMED NUMERICAL VALUES FOR GENERAL PARAMETERS AFFECTING AIR QUALITY

Parameter	Value	Notes		
Duration of construction				
Track grading	24	months		
Camp, quarry, well, and facility access roads	6	months		
Water Wells				
Total number of wells	84	Source: *Construction Plan, Mina Rail Corridor* (NRP 2007d; 4-3)		
Number of well sites outside of ROW	20	Source: *Construction Plan, Mina Rail Corridor* (NRP 2007d; 4-4)		
Surface area disturbed per well (acres)	1.43	Basis – 250-foot square plot		
Quarry Construction				
Number of quarries	2	Several quarries were studied; two would be developed.		
Surface area disturbed per quarry (acres)	120	Information provided by Shannon & Wilson, Inc.(2005)		
Access Road Lengths	**Existing (mi)**	**New (mi)**	**Contingency**	**Total (mi)**
Alignment access road	0	510	102	612
Camps	18	0	4	22
Quarries	11	9	4	23
Wells	14	2	3	19
Access Road Disturbed Area & Earthwork	**Surface Area Disturbed (acres)**		**Earthwork (yd^3)**	
Alignment access road		4,940	9,862,000	
Camps		320	77,000	
Quarries		650	116,000	
Wells		360	85,000	
Excavation				
Alluvial (yd^3)	8,975,000			
Rippable (yd^3)	5,496,000			
Drill & blast (yd^3)	3,005,000			
Embankment Fill				
Fill (yd^3)	25,754,000			
Borrow (yd^3)	17,967,000			
Track Installation				
Subballast (tons)	2,400,000	Source: *Construction Plan, Mina Rail Corridor* (NRP 2007d; 3-1)		
Ballast (tons)	2,800,000	Source: *Construction Plan, Mina Rail Corridor* (NRP 2007d; 3-1)		
Trackage (track feet)		Does not include sidings or yards.		
Mainline	1,343,462			
Sidings	85,000	Source: *Comparative Cost Estimates, Mina Rail Corridor* (NRP 2007c; 5-1)		
Yards	121,540	Source: *Comparative Cost Estimates, Mina Rail Corridor* (NRP 2007c; Section 4.0)		
Track welding	2,035	field welds	36,634	plant welds
Structures				
Bridge construction	2	Jackson Wash and Beatty Wash		
Batch plant	1	Mobile; initially located at Beatty Wash		

ASSUMED NUMERICAL VALUES FOR GENERAL PARAMETERS AFFECTING AIR QUALITY

Facilities	Disturbed Area (acres)	Duration of Construction Activity (months)			
		Grading	Trackwork	Structures	Total
Hawthorne staging yard*	50	6	6	6	12
MOW facility*	15	6	6	6	12
EOL yard*	100	8	12	12	20
Totals	165				

Note: Trackwork and structures constructed concurrently.

LENGTH AND DISTURBED AREA FOR ACCESS ROADS TO CONSTRUCTION FEATURES

Access Road Destination	Existing Roads (mi)	New Roads (mi)	Disturbed Area (acres)		
			Site	Road	Total
Alignment Access Road	0.00	510	0	4,940	4,940
East Railroad Springs Road	3.40	0.00	0.00	12	12
Construction Camp 9A	0.00	0.00	25	0	25
Construction Camp 10	1.39	0.00	25	5	30
Construction Camp 11	2.67	0.00	25	10	35
Construction Camp 12	12.30	0.30	25	45	70
Construction Camp 13A	0.80	0.00	25	3	28
Construction Camp 14	0.00	0.00	25	0	25
Construction Camp 15	0.90	0.00	25	3	28
Construction Camp 16	0.00	0.00	25	0	25
Construction Camp 17	0.00	0.00	25	0	25
Construction Camp 18A	0.00	0.00	25	0	25
Garfield Hills Quarry	2.00	1.90	120	31	151
Gabbs Range Quarry	2.00	0.50	120	58	178
North Clayton Quarry	3.60	1.90	120	39	159
Malpais Mesa South Quarry	3.30	4.20	120	44	164
Well 13	2.30	0.00	1.43	23	24
Well 14	4.10	1.00	1.43	50	51
Well 15	0.80	0.00	1.43	8	9
Well 16	1.20	0.00	1.43	12	13
Well 17	2.20	0.00	1.43	22	23
Well 18	0.00	1.50	1.43	15	16
Well 19	3.60	0.00	1.43	35	36
Well 20	3.20	0.00	1.43	32	33
Well 21	3.10	0.00	1.43	31	32
SUMMARY Alignment	0.00	510.00			4,940
Camps	18.06	0.30	← Units in miles		320
Quarries	5.30	6.10		Units in acres →	650
Wells	20.50	2.50			290

Note: Only the quantities required for the Garfield Hills and Malpais Mesa South quarries are included in the summary totals.

ESTIMATED EARTHWORK FOR ACCESS ROADS TO CONSTRUCTION FEATURES

Access Road Destination	Estimated Earthwork (yd^3)	
	Calculated	Rounded
Alignment Access Road		9,862,000
Construction Camp 9A	0	0
Construction Camp 10	5,874	6,000
Construction Camp 11	11,270	11,000
Construction Camp 12	53,222	53,000
Construction Camp 13A	3,379	3,000
Construction Camp 14	0	0
Construction Camp 15	3,802	4,000
Construction Camp 16	0	0
Construction Camp 17	0	0
Construction Camp 18A	0	0
Garfield Hills Quarry	24,499	24,000
Gabbs Range Quarry	12,672	12,000
North Clayton Quarry	31,258	31,000
Malpais Mesa South Quarry	49,421	49,000
Well 13	8,501	9,000
Well 14	18,850	19,000
Well 15	2,957	3,000
Well 16	4,435	4,000
Well 17	8,131	8,000
Well 18	5,544	6,000
Well 19	13,306	13,000
Well 20	11,827	12,000
Well 21	11,458	11,000

	EARTHWORK SUMMARY	Alignment	9,862,000
	(Units in cubic yards)	Camp roads	77,000
		Quarry roads	73,000
		Well roads	85,000

ESTIMATED CONSTRUCTION EQUIPMENT CONSISTS, SITE GRADING

Equipment Type	Number of pieces		Annual Operating Hours	Duration of grading	Total Hours
	Pieces	Crews			
Two-ton Flatbed Truck	2	5	30,000	2	60,000
Tractor-trailer (flatbed, belly dump)	4	5	60,000	2	120,000
Caterpillar D400 Rock Truck	20	5	300,000	2	600,000
Water Truck – 4,000 gallons (gal)	10	5	150,000	2	300,000
Fuel/service truck	3	5	45,000	2	90,000
Pickup	30	5	450,000	2	900,000
Caterpillar 966 Loader	5	5	75,000	2	150,000
Caterpillar 140 Blade	10	5	150,000	2	300,000
CP 563E Padfoot Drum Compactor – (84")	2	5	30,000	2	60,000
CP 563E Smooth Drum Compactor – (84")	2	5	30,000	2	60,000
Caterpillar 815 Compactor	5	5	75,000	2	150,000
Caterpillar D6 Dozer	10	5	150,000	2	300,000
Caterpillar D9 Dozer	15	5	225,000	2	450,000
Caterpillar D10 Dozer	15	5	225,000	2	450,000
Komatsu PC 300 Excavator	2	5	30,000	2	60,000
Komatsu PC 400 Excavator	5	5	75,000	2	150,000
Caterpillar 615 Scraper	2	5	30,000	2	60,000
Caterpillar 631 Scraper	18	5	270,000	2	540,000
Air compressor (250 cubic feet per minute [cfm])	5	5	75,000	2	150,000
Jumping Jack compactor	10	5	150,000	2	300,000
TOTAL	175		2,625,000		5,250,000

Notes: 1) Annual hours used in estimating exhaust emissions from track and bridge construction equipment.
2) Annual hours assumed to be 3,000 hours per year.
3) Duration of grading is in years.

CONSTRUCTION TRAIN OPERATING HOURS

Train Type	Cars per Train	Trains per Day	Trains per Month	S1 Speed	MCS1/ MN1 Speed	MCS2 Speed	Total Time (months)	Total Trains
Concrete Ties – L*	12	1	20	15			4	80
Concrete Ties – E*	12	1	20	15			4	80
Rail – 80' – L	8	1	8	15			2	16
Rail – 80' – E	8	1	8	15			2	16
Rail – Weld – L	17	1	8	15			2	16
Rail – Weld – E	17	1	8	15			2	16
Ballast – L	20	8	80	15			3	240
Ballast – E	20	8	80	15			3	240
Construction Materials – L	10	1	8	15			2	16
Construction Materials – E	10	1	8	15			2	16
Concrete Ties – L	12	1	20		15		9	180
Concrete Ties – E	12	1	20		15		9	180
Rail – 80' – L	8	1	8		15		9	72
Rail – 80' – E	8	1	8		15		9	72
Rail – Weld – L	17	1	8		15		9	72
Rail – Weld – E	17	1	8		15		9	72
Ballast – Load	20	8	80		15		9	720
Ballast – E	20	8	80		15		9	720
Construction Materials – L	10	1	8		15		9	72
Construction Materials – E	10	1	8		15		9	72
Concrete Ties – L	12	1	20		40	15	5	100
Concrete Ties – E	12	1	20		40	15	5	100
Rail – 80' – L	8	1	8		40	15	5	40
Rail – 80' – E	8	1	8		40	15	5	40
Rail – Weld – L	17	1	8		40	15	5	40
Rail – Weld – E	17	1	8		40	15	5	40
Ballast – L	20	8	80		40	15	13	1040
Ballast – E	20	8	80		40	15	13	1040
Construction Materials – L	10	1	8		40	15	5	40
Construction Materials – E	10	1	8		40	15	5	40

*L = Loaded; E = Empty

SUMMARY – OPERATING HOURS				Locomotive Operating Hours
Cargo	No. of Locomotives	Months of Operation	Days per month	
Concrete Ties	3	26	21	20,000
Rail	3	26	21	20,000
Rail – Welded	6	26	21	39,000
Ballast	6	26	21	39,000
Construction Materials	6	26	21	39,000
Totals	**24**			**157,000**

Notes 1) Locomotive operating hours assumed to be 12 hours/day.
2) Ballast, welded rail, and construction materials train locomotives assumed to be 4,000 hp units.
3) Tie and rail trains assumed to be 3,000 hp units.
4) Trains are separated for S1, MCS1/MN1, and MCS2 to reflect schedule considerations.

TRACK CONSTRUCTION EQUIPMENT OPERATING HOURS

Equipment Type	Machines per Day	Machine-Months	S1 Speed	MCS1/ MN1 Speed	MCS2 Speed	Total Time (months)	Total Moves
Track Tamper	8	168	15			4	672
Ballast Regulator	4	84	15			4	336
Tie Handler	2	42	15			4	168
Rail Clip Applicator	2	42	15			4	168
Ballast Consolidator	4	84	15			4	336
Track Tamper	8	168		15		9	1,512
Ballast Regulator	4	84		15		9	756
Tie Handler	2	42		15		9	378
Rail Clip Applicator	2	42		15		9	378
Ballast Consolidator	4	84		15		9	756
Track Tamper	8	168			15	13	2,184
Ballast Regulator	4	84			15	13	1,092
Tie Handler	2	42			15	13	546
Rail Clip Applicator	2	42			15	13	546
Ballast Consolidator	4	84			15	13	1,092

Operating Hours – Mainline Track Construction Equipment

Track Equipment	Pieces of Equipment	Months of Operation	Days per month	Operating Hours
Speedswing	4	26	21	26,000
Track Tamper	8	26	21	52,000
Ballast Regulator	4	26	21	26,000
Tie Handler	2	26	21	13,000
Rail Clip Applicator	2	26	21	13,000
Ballast Consolidator	4	26	21	26,000
			Total	156,000

Operating Equipment - Existing DOD Track Rehabilitation and Upgrade

Track Equipment	Pieces of Equipment	Months of Operation	Days per month	Operating Hours
Speedswing	1	3	21	1,000
Track Tamper	1	2	21	1,000
Ballast Regulator	1	2	21	1,000
Tie Handler	1	2	21	1,000
Rail Clip Applicator	1	2	21	1,000
Ballast Consolidator	1	2	21	1,000
			Total	6,000

Notes: 1) Operating hours assumed to be 12 hours of operation per day.
2) Trains are separated for S1, MCS1/MN1, and MCS2 to reflect schedule considerations.
3) Speedswing is not included in rail operations table because it can be road or rail mounted. All other track equipment (e.g., tamper, ballast regulator) is rail mounted.

Appendix B
Air Emissions Analysis for Construction Activities

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SUMMARY OF FUGITIVE DUST EMISSIONS BY SOURCE

Source of Emissions	Annual Emissions (tons/year)			Percent of Total
	PM	PM_{10}	$PM_{2.5}$	
Track and bridge construction				
Surface area disturbance	21,000	11,400	2,400	26%
Alluvial excavation	1,100	600	100	1%
Rock excavation	0	0	0	0%
Off-site borrow	4,700	2,600	500	6%
Construction features	9,600	5,100	1,100	12%
Facilities construction	2,000	1,200	400	2%
Access roads	300	200	0	0%
Unpaved roads	43,000	12,000	2,000	52%
Track storage piles	500	500	100	1%
Batch plant	0	0	0	0%
Coarse stockpiles	0	0	0	0%
Fines stockpiles	0	0	0	0%
Quarries	100	100	100	0%
Totals	**82,300**	**33,700**	**6,700**	

Note: All values rounded to nearest 100 tons. Values showing "zero" emissions actually have emissions, but the emissions are less than 50 tons per year. See individual sheets for amounts less than 50 tons.

DISTURBED AREAS FOR BASIS FOR ANALYSIS AND ALTERNATE SEGMENTS

	Segment	Length (feet)	Length (mi)	ROW Area (acres)	Disturbed Area (acres) Earthwork	Access Roads	Contingency	Total
Basis for Analysis	MCS0	-- Existing DOD track --			10	10	20	40
	S1	168,270	31.9	1,550	310	620	190	1,120
	MCS1/DOD	-- Existing DOD track --			10	10	20	40
	MCS1	381,214	72.2	8,750	640	1,400	410	2,450
	MN1	209,071	39.6	4,800	450	770	240	1,460
	MN1/MN3	176,810	33.5	4,060	350	650	200	1,200
	MCS2/CS4	11,263	2.1	260	20	40	10	70
	BC3	65,192	12.3	1,500	140	240	80	460
	CS5	131,224	24.9	3,010	160	480	130	770
	OV1	32,421	6.1	740	80	120	40	240
	CS6	167,997	31.8	3,860	480	620	220	1,320
	Totals	**1,343,462**	**254.4**	**28,530**	**2,650**	**4,960**	**1,560**	**9,170**
Alternate Alignment Segments	S4	213,124	40.4	4,890	460	780	250	1,490
	S5	232,497	44.0	5,340	570	850	280	1,700
	S6	235,793	44.7	5,410	450	870	260	1,580
	MN2/MN3	239,071	45.3	5,490	310	880	240	1,430
	MN2	21,896	4.1	500	30	80	20	130
	MN3	48,078	9.1	1,100	90	180	50	320
	MN2/GF4	101,459	19.2	2,330	190	370	110	670
	MN2/CS4	26,465	5.0	610	50	100	30	180
	BC2	66,224	12.5	1,520	150	240	80	470
	OV3	46,377	8.8	1,060	100	170	50	320
Mina Alternates	MN1	385,881	73.1	8,860	800	1,420	440	2,660
	MN2	388,891	73.6	8,930	580	1,430	400	2,410
	MN3	463,959	87.9	10,650	750	1,710	490	2,950

Notes: 1) Source: InRoads output, various dates, 2007.
2) InRoads area rounded to nearest 10 acres of value shown on InRoads results.
3) ROW area based on 1,000-foot ROW width.
4) Additions to disturbed area account for alignment access roads on both sides of alignment (160 feet).
5) Contingency adds 20% to sum of InRoads and Additions columns.
6) Mina Alternates present the totals for all segments which comprise the alternative alignment. MN1 is part of the basis for analysis alignment.

CALCULATIONS FOR ALIGNMENT ACCESS ROAD EXCAVATION AND TERRAIN SCALING FACTOR

	Alignment Road Excavation			Terrain Scaling Factor			
	Segment	Length (feet)	Excavation (yd^3)	Common	Rugged	Actual Disturbed Area (acres)	Effective Disturbed Area (acres)
Basis for Analysis	MCS0	-- Existing DOD track --		100%	0%	40	40
	S1	168,270	1,235,000	100%	0%	1,120	1,120
	MCS1/DOD	-- Existing DOD track --		100%	0%	40	40
	MCS1	381,214	2,798,000	100%	0%	2,450	2,450
	MN1	209,071	1,535,000	95%	5%	1,460	1,500
	MN1/MN3	176,810	1,298,000	95%	5%	1,200	1,230
	MCS2/CS4	11,263	83,000	100%	0%	70	70
	BC3	65,192	479,000	90%	10%	460	480
	CS5	131,224	963,000	100%	0%	770	770
	OV1	32,421	238,000	100%	0%	240	240
	CS6	167,997	1,233,000	40%	60%	1,320	1,720
	Totals	**1,343,462**	**9,862,000**			**9,130**	**9,620**
Alternate Alignment Segments	S4	213,124	1,564,000	95%	5%	1,490	1,530
	S5	232,497	1,707,000	95%	5%	1,700	1,740
	S6	235,793	1,731,000	85%	15%	1,580	1,700
	MN2/MN3	239,071	1,755,000	100%	0%	1,430	1,430
	MN2	21,896	161,000	100%	0%	130	130
	MN3	48,078	353,000	100%	0%	320	320
	MN2/GF4	101,459	745,000	70%	30%	670	770
	MN2/CS4	26,465	194,000	100%	0%	180	180
	BC2	66,224	486,000	100%	0%	470	470
	OV3	46,377	340,000	100%	0%	320	320

Notes: 1) Common and rugged terrain values taken from Alignment Earthwork tab, rounded to nearest 5 percent.

2) Disturbed area includes acreages for earthwork, alignment roads, and contingencies.

3) Effective disturbed area = Actual Disturbed area x (% common + (1.5 x % rugged))

4) Terrain Scaling Factor (T.S.F.) =

$$\frac{\text{[Sum of Effective Disturbed Area - Sum of Actual Disturbed Area]}}{\text{Sum of Actual Disturbed Area}} = \mathbf{0.054}$$

CUT AND FILL MATERIALS, WITH BORROW AND WASTE COMPUTATIONS

	Segment	INROADS CUT				INROADS FILL	Additional Material Needed	
		Alluvial	Rippable	Drill and Blast	Total	Embankment	Borrow	Waste
Basis for Analysis	MCS0	0	0	0	0	56,000	75,000	0
	S1	975,000	553,000	104,000	1,632,000	2,013,000	687,000	0
	MCS0/DOD	0	0	0	0	56,000	75,000	0
	MCS1	464,000	118,000	333,000	915,000	6,738,000	7,785,000	0
	MN1	847,000	2,053,000	57,000	2,957,000	7,886,000	6,424,000	0
	MN1/MN3	655,000	1,821,000	848,000	3,324,000	2,063,000	0	1,746,000
	MCS2/CS4	0	0	0	0	134,000	179,000	0
	BC3	167,000	57,000	82,000	306,000	921,000	837,000	0
	CS5	304,000	282,000	0	586,000	1,320,000	1,023,000	0
	OV1	58,000	8,000	0	66,000	715,000	882,000	0
	CS6	5,505,000	604,000	1,581,000	7,690,000	3,852,000	0	3,724,000
	Totals	**8,975,000**	**5,496,000**	**3,005,000**	**17,476,000**	**25,754,000**	**17,967,000**	**5,470,000**
Alternate Alignment Segments	S4	3,876,000	643,000	51,000	4,570,000	5,660,000	2,599,000	0
	S5	3,452,000	1,670,000	3,229,000	8,351,000	6,345,000	0	2,934,000
	S6	3,117,000	1,288,000	1,907,000	6,312,000	8,961,000	3,678,000	0
	MN2/MN3	635,000	207,000	0	842,000	2,354,000	2,759,000	0
	MN2	0	14,000	0	14,000	244,000	303,000	0
	MN3	108,000	500,000	0	608,000	612,000	0	59,000
	MN2/GF4	136,000	77,000	1,682,000	1,895,000	3,170,000	1,096,000	0
	MN2/CS4	304,000	0	0	304,000	128,000	0	133,000
	BC2	30,000	0	568,000	598,000	1,235,000	670,000	0
	OV3	156,000	0	0	156,000	1,339,000	1,629,000	0
Mina Alternates	MN1	1,502,000	3,874,000	905,000	6,281,000	9,949,000	6,424,000	1,746,000
	MN2	1,075,000	298,000	1,682,000	3,055,000	5,896,000	4,158,000	133,000
	MN3	1,398,000	2,528,000	848,000	4,774,000	5,029,000	2,759,000	1,805,000

Notes:
1) All values in cubic yards, rounded to nearest 1,000.
2) Borrow quantities based on 25% shrinkage for alluvial, 25% swell for drill and blast, and 15% swell for rippable rock excavation.
3) Source: InRoads output and *Comparative Cost Estimate, Mina Rail Corridor* (NRP 2007c).
4) Borrow = $1.25*[V_E - (.75V_A + 1.15V_R + 1.25V_D)]$
V_E= Embankment fill volume; V_A= Alluvial cut volume; V_R= Rippable rock cut volume; V_D= Drill and blast cut volume

ESTIMATED EMISSIONS RESULTING FROM SURFACE AREA DISTURBANCES

Segment		Surface Area (acres)	Effective Surface Area (acres)	Scaling Factor (months)	Effective Scaling Factor (months)	Emission Factor (tons/acre/month)			Emissions (tons/segment)			Annual Emissions (tons/segment)		
						PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Basis for Analysis	MCS0	40	40	0.10	0.10				5	3	1	2	1	0
	S1	1,120	1,120	2.93	2.78				3,740	2,026	421	1,870	1,013	211
	MCS1/DO	40	40	0.10	0.10				5	3	1	2	1	0
	MCS1	2,450	2,450	6.41	6.09				17,896	9,693	2,016	8,948	4,847	1,008
	MN1	1,460	1,500	3.82	3.73				6,529	3,537	736	3,265	1,768	368
	MN1/MN3	1,200	1,230	3.14	3.06	1.2	0.65	0.14	4,400	2,384	496	2,200	1,192	248
	MCS2/CS 4	70	70	0.18	0.17				15	8	2	7	4	1
	BC3	460	480	1.20	1.19				658	357	74	329	178	37
	CS5	770	770	2.02	1.91				1,768	957	199	884	479	100
	OV1	240	240	0.63	0.60				172	93	19	86	47	10
	CS6	1,320	1,720	3.45	4.27				6,769	3,666	763	3,384	1,833	381
	Totals	**9,170**	**9,660**	**24.00**	**24.00**	**Emission Totals**			**42,000**	**23,000**	**4,700**	**21,000**	**11,400**	**2,400**
Alternate Alignment Segments	S4	1,490	1,530	3.90	3.80				6,797	3,682	766	3,398	1,841	383
	S5	1,700	1,740	4.45	4.32				8,819	4,777	994	4,409	2,388	497
	S6	1,580	1,700	4.14	4.22				8,008	4,338	902	4,004	2,169	451
	MN2/MN3	1,430	1,430	3.74	3.55				6,097	3,302	687	3,048	1,651	343
	MN2	130	130	0.34	0.32				50	27	6	25	14	3
	MN3	320	320	0.84	0.80				305	165	34	153	83	17
	MN2/GF4	670	770	1.75	1.91				1,538	833	173	769	417	87
	MN2/CS4	180	180	0.47	0.45				97	52	11	48	26	5
	BC2	470	470	1.23	1.17				659	357	74	329	178	37
	OV3	320	320	0.84	1.80				305	165	34	153	83	17
Mina Alternates	MN1	2,660	2,730	6.96	6.78				10,930	5,920	1,231	5,465	2,960	616
	MN2	2,410	2,510	6.31	6.24				7,782	4,215	877	3,891	2,108	438
	MN3	2,950	2,980	7.72	7.40				10,802	5,851	1,217	5,401	2,926	609

Note: Mina Alternates present the totals for all segments which comprise the alternate alignments. MN1 is part of the basis for analysis.

ESTIMATED EMISSIONS RESULTING FROM ALLUVIAL EXCAVATION

Segment		Length (feet)	Alignment Road Excavation (yd^3)	Track Excavation (yd^3)	Total Excavation (yd^3)	Emission Factor (ton/1,000 yd^3)			Emissions (tons/segment)			Annual Emissions (tons/segment)		
						PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Basis for Analysis	MCS0	-- Existing DOD track --							0	0	0	0	0	0
	S1	168,270	1,235,000	975,000	2,210,000				240	130	30	120	70	20
	MCS1/DO-	-- Existing DOD track --							0	0	0	0	0	0
	MCS1	381,214	2,798,000	464,000	3,262,000				360	190	40	180	100	20
	MN1	209,071	1,535,000	847,000	2,382,000				260	140	30	130	70	20
	MN1/MN3	176,810	1,298,000	655,000	1,953,000	0.109	0.059	0.012	210	120	20	110	60	10
	MCS2/CS4	11,263	83,000	0	83,000				10	5	1	10	0	0
	BC3	65,192	479,000	167,000	646,000				70	40	10	40	20	10
	CS5	131,224	963,000	304,000	1,267,000				140	70	20	70	40	10
	OV1	32,421	238,000	58,000	296,000				30	20	0	20	10	0
	CS6	167,997	1,233,000	5,505,000	6,738,000				730	400	80	370	200	40
	Excavation Totals		**9,862,000**	**8,975,000**	**18,837,000**	**Emission Totals**			**2,050**	**1,120**	**230**	**1,050**	**570**	**130**
Alternate Alignment Segments	S4	213,124	1,564,000	3,876,000	5,440,000				590	320	70	300	160	40
	S5	232,497	1,707,000	3,452,000	5,159,000				560	300	60	280	150	30
	S6	235,793	1,731,000	3,117,000	4,848,000				530	290	60	270	150	30
	MN2/MN3	239,071	1,755,000	635,000	2,390,000				260	140	30	130	70	20
	MN2	21,896	161,000	0	161,000				20	10	0	20	10	0
	MN3	48,078	353,000	108,000	461,000				50	30	10	30	20	10
	MN2/GF4	101,459	745,000	136,000	881,000				100	50	10	50	30	10
	MN2/CS4	26,465	194,000	304,000	498,000				50	30	10	30	20	10
	BC2	66,224	486,000	30,000	516,000				60	30	10	30	20	10
	OV3	46,377	340,000	156,000	496,000				50	30	10	30	20	10

ESTIMATED EMISSIONS RESULTING FROM ALLUVIAL EXCAVATION

Segment		Length (feet)	Alignment Road Excavation (yd^3)	Track Excavation (yd^3)	Total Excavation (yd^3)	Emission Factor (ton/1,000 yd^3)			Emissions (tons/segment)			Annual Emissions (tons/segment)		
						PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Mina Alternates	MN1	385,881	2,833,000	1,502,000	4,335,000				470	260	50	240	130	30
	MN2	388,891	2,855,000	1,075,000	3,930,000				430	230	52	220	130	40
	MN3	463,959	3,406,000	1,398,000	4,804,000				420	290	60	270	150	40

Notes: 1) Excavation rounded to nearest 1,000 yd^3.
2) Emissions rounded to nearest 10 tons.
3) Mina Alternates present the totals for all segments which comprise the alternate alignments. MN1 is part of the basis for analysis.

ESTIMATED EMISSIONS RESULTING FROM ROCK EXCAVATION

Rock Excavation	Total Volume Excavated (yd^3)	Conversion Factor (tons/yd^3)	Total Mass Excavated (tons)	Emission Factors (lb/ton)			Emissions (tons)			Annual Emissions (tons)		
				PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Rippable	5,496,000	1.96	10,772,160	0.00015	0.00008	0.00008	0.8	0.4	0.4	0.4	0.2	0.2
Rippable – Truck Loading				0.00018	0.00010	0.00010	1.0	0.5	0.5	0.5	0.3	0.3
Drill & Blast	3,005,000	1.96	5,889,800	0.00015	0.00008	0.00008	0.4	0.2	0.2	0.22	0.12	0.12
Drill & Blast – Truck Loading				0.00018	0.00010	0.00010	0.5	0.3	0.3	0.27	0.15	0.15
Total Rock Excavation Emissions							**3.00**	**1.00**	**1.00**	**1.00**	**0.75**	**0.75**

Notes: 1) Emission factor reference taken from AP-42, Table 11.19.2-2 (August 2004).
2) No emission factor is available for rippable excavation. Assumes the emissions from rippable excavation are equal to emissions from drill and blast.
3) Assumes that all rock excavation is performed by wet drilling. AP-42 does not provide emission factors for rippable or drilling excavation techniques.
4) For sources listed in AP-42 which do not explicitly express PM factors, the PM emission factor for this project is assumed to be the AP-42 PM_{10} factor multiplied by 1.85 to provide a PM:PM_{10} ratio similar to the ratio for other construction activities accounted for in this project where a documented PM factor is not available. $PM_{2.5}$ emissions are assumed to equal PM_{10}.
5) The truck loading emission factor is assumed to equal the truck unloading emission factor from AP-42 because no truck loading factor is provided.

ESTIMATED EMISSIONS RESULTING FROM BORROW AND WASTE

Segment		Borrow	Waste	Emission Factor (ton/1,000 yd^3)			Emissions (tons/segment)			Annual Emissions (tons/segment)		
		(yd^3)		PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Basis for Analysis	MCS0	75,000	0				30	20	3	15	10	2
	S1	687,000	0				300	200	0	150	100	0
	MCS1/DOD	75,000	0				30	20	3	15	10	2
	MCS1	7,785,000	0				3,200	1,700	400	1,600	850	200
	MN1	6,424,000	0				2,600	1,400	300	1,300	700	150
	MN1/MN3	0	1,746,000	0.41	0.22	0.046	700	400	100	350	200	50
	MCS2/CS4	179,000	0				70	0	0	35	0	0
	BC3	837,000	0				300	200	0	150	100	0
	CS5	1,023,000	0				400	200	0	200	100	0
	OV1	882,000	0				360	200	0	180	100	0
	CS6	0	3,724,000				1,500	800	200	750	400	100
	Borrow/Waste Total	**17,967,000**	**5,470,000**			**Emission Totals**	**9,000**	**5,000**	**1,000**	**4,700**	**2,600**	**500**
Alternate Alignment Segments	S4	2,599,000	0				1,100	600	100	550	300	50
	S5	0	2,934,000				1,200	600	100	600	300	50
	S6	3,678,000	0				1,500	800	200	750	400	100
	MN2/MN3	2,759,000	0				1,100	600	100	550	300	50
	MN2	303,000	0	0.41	0.22	0.046	100	100	0	50	50	0
	MN3	0	59,000				0	0	0	0	0	0
	MN2/GF4	1,096,000	0				400	200	100	200	100	50
	MN2/CS4	0	133,000				100	0	0	50	0	0
	BC2	670,000	0				300	100	0	150	50	0
	OV3	1,629,000	0				700	400	100	350	200	50
Mina Alternates	MN1	6,424,000	1,746,000				3,300	1,800	400	1,650	900	200
	MN2	4,158,000	133,000	0.41	0.22	0.046	1,700	900	200	850	450	100
	MN3	2,759,000	1,805,000				1,900	1,000	200	950	500	100

Note: Mina Alternates present the totals for all segments which comprise the alternative alignment. MN1 is part of the basis for analysis.

ESTIMATED EMISSIONS RESULTING FROM SURFACE AREA DISTURBANCES

Feature	Total Surface Area (acres)	Construction Duration (months)	Emission Factor (tons/acre/month)			Emissions (tons)		
			PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Camps	320	6	1.2	0.65	0.14	2,300	1,200	300
Quarries	650	6	1.2	0.65	0.14	4,700	2,500	500
Wells	360	6	1.2	0.65	0.14	2,600	1,400	300
Fugitive Dust Emissions from Surface Disturbance						9,600	5,100	**1,100**

ESTIMATED EMISSIONS RESULTING FROM ALLUVIAL EXCAVATION

	Total Excavation (yd^3)		Emission Factor (ton/1,000 yd^3)			Emissions (tons)		
			PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Camps	77,000					10	0	1
Quarries	116,000		0.109	0.059	0.012	10	10	1
Wells	85,000					10	5	1
Fugitive Dust Emissions from Earth-Moving Activities						30	15	1
Total Fugitive Dust Emissions from Construction-Related Features						9,600	5,100	**1,100**

Notes: 1) Surface area includes facility and access roads.
2) Excavation rounded to nearest 1,000 yd^3 and includes excavation for access roads.
3) Emissions rounded to nearest 100 tons (surface area disturbances) and 10 tons (alluvial excavation), and 1 ton ($PM_{2.5}$).

ESTIMATED EMISSIONS RESULTING FROM SURFACE AREA DISTURBANCES

Facility	Surface Area (acres)	Earthwork Disturbance Duration (months)	Emission Factor (tons/acre/mo)			Total Emissions (tons)			Annual Emissions (tons)		
			PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Hawthorne Staging Yard	50	12	1.2	0.65	0.14	720	390	80	720	390	80
MOW	15	12	1.2	0.65	0.14	220	120	20	220	120	20
EOL	100	20	1.2	0.65	0.14	1,440	780	160	860	470	100
Total Facilities Construction Emissions due to Surface Disturbance						**1,400**	**780**	**160**	**1,800**	**980**	**200**

Notes: 1) Duration of disturbance includes grading and trackwork.
2) Annual emissions rounded to nearest 10 tons.

ESTIMATED EMISSIONS RESULTING FROM ALLUVIAL EXCAVATION

Facility	Total Excavation (yd^3)		Emission Factor (ton/1,000 yd^3)			Emissions (tons/segment)			Annual Emissions (tons/segment)		
			PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Hawthorne Staging Yard	125,000		0.109	0.059	0.012	10	10	10	10	10	10
MOW	55,000		0.109	0.059	0.012	10	10	10	10	10	10
EOL	3,845,000		0.109	0.059	0.012	420	420	420	210	210	210
Total Facilities Construction Emissions Resulting from Excavation and Earth-moving						**440**	**440**	**440**	**230**	**230**	**230**
Total Estimated Fugitive Dust Emissions Resulting from Construction of Facilities						**1,840**	**1,220**	**600**	**2,030**	**1,210**	**430**

Note: 1) Source: *Comparative Cost Estimates, Mina Rail Corridor* (NRP 2007c; Section 4.0)

BASIS OF EMISSIONS

Facility	Number Constructed	Average Miles Constructed per Facility	Total Miles Constructed	Miles-to-Acres Conversion	Total Earthwork Disturbance Duration (months)
Hawthorne Staging Yard	1	8.0	8.0	12.12	2
MOW	1	1.0	1.0	12.12	1
EOL	1	1.8	1.8	12.12	2

ESTIMATED EMISSIONS RESULTING FROM CONSTRUCTION OF FACILITY ACCESS ROADS

Facility	Emission Factor (tons/acre/month)			Emissions (tons)			Annual Emissions (tons)		
	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Hawthorne Staging Yard	1.2	0.65	0.14	233	126	26	233*	126*	26*
MOW	1.2	0.65	0.14	15	8	2	15*	8*	2*
EOL	1.2	0.65	0.14	52	28	6	52*	28*	6*
Total Access Roads Construction Emissions				**300**	**160**	**34**	**300***	**160***	**34***

*Note:- See construction schedule to determine what year emissions would occur.

Notes: 1) Camp access roads constructed at beginning of project.
2) Hawthorne staging yard access road constructed at beginning of grading for MCS1.
3) MOW access road constructed at beginning of grading for MN1.
4) EOL access road constructed at beginning of grading for Common Segment 6.

Miles-to-acres conversion:		
	100	Assumed roadway width (feet)
	5,280	Feet per mile
	43,560	Square feet per acre
	12.12	Conversion rate – Acres disturbed per mile of roadway

ESTIMATED EMISSIONS RESULTING FROM CONSTRUCTION TRAFFIC ON UNPAVED ROADS

Operation	Vehicle Type	Traffic Data		Trip Description	Assumed Average Trip Length (mi)	Total Trip Distance (Hours*mph)	(W) Vehicle Weight (tons)	E		
		Trips	Hours Plus Contingency					PM Emission Factor (lb/VMT)	PM_{10} Emission Factor (lb/VMT)	$PM_{2.5}$ Emission Factor (lb/VMT)
Grading and Track	Water truck	NA	162,000	along alignment	NA	1,620,000	27.0	9.496	2.713	0.416
	Fuel/service truck	NA	49,000	along alignment	NA	490,000	27.0	9.496	2.713	0.416
	Pickup truck	NA	486,000	along alignment	NA	7,290,000	2.5	3.254	0.930	0.143
Access Roads	Water truck	NA	20,600	along access roads	NA	206,000	27.0	9.496	2.713	0.416
	Pickup trucks	NA	71,300	along access roads	NA	1,070,000	2.5	3.254	0.930	0.143
Batch Plants	Mixers-full	9,300	NA	batch plant to bridge	1	NA	30.0	9.957	2.845	0.436
	Mixers-empty	9,300	NA	bridge to batch plant	1	NA	15.0	7.289	2.083	0.319
	Cement delivery – full	600	NA	highway to batch plant	15	NA	45.0	11.950	3.414	0.524
	Cement delivery – empty	600	NA	batch plant to highway	15	NA	15.0	7.289	2.083	0.319
	Aggregate delivery – full	3,600	NA	highway to batch plant	15	NA	42.5	11.646	3.328	0.510
	Aggregate delivery –empty	3,600	NA	batch plant to highway	15	NA	12.5	6.715	1.919	0.294
Construction Camps	Crew transport bus – full	NA	46,000	camp to alignment	NA	690,000	15.5	7.397	2.113	0.324
	Crew transport bus – empty	NA	46,000	alignment to camp	NA	690,000	13.0	6.834	1.953	0.299
	Water truck	NA	2,600	within camps and to/from well	NA	26,000	27.0	9.496	2.713	0.416
	Fuel/service truck	NA	58,000	within and between camps	NA	580,000	27.0	9.496	2.713	0.416
	Pickup trucks	NA	1,740,000	within and between camps	NA	26,100,000	2.5	3.254	0.930	0.143
Quarries	Trucks	NA	23,000	quarry to alignment	NA	46,000	42.5	11.646	3.328	0.510
	Pickups	NA	70,000	alignment to quarry	NA	1,050,000	12.5	6.715	1.919	0.294
Well Drilling	Pickup trucks	NA	390,000	within and between facilities	NA	5,850,000	2.5	3.254	0.930	0.143
MOW Construction	Water truck	NA	1,600	within and between facilities	NA	16,000	27.0	9.496	2.713	0.416
	Pickups	NA	7,900	within and between facilities	NA	118,500	2.5	3.254	0.930	0.143
EOL Construction	Water truck	NA	4,200	within and between facilities	NA	42,000	27.0	9.496	2.713	0.416
	Pickup trucks	NA	21,100	within and between facilities	NA	316,500	2.5	3.254	0.930	0.143
Hawthorne Staging Yard Construction	Water truck	NA	3,200	within and between facilities	NA	32,000	27.0	9.496	2.713	0.416
	Pickup trucks	NA	15,800	within and between facilities	NA	237,000	2.5	3.254	0.930	0.143
Signals and Communications	Supervisor truck – Signals	NA	5,500	along alignment	NA	83,000	2.5	3.254	0.930	0.143
	Foreman truck – Signals	NA	13,200	along alignment	NA	198,000	2.5	3.254	0.930	0.143
	Crew cab trucks – Signals	NA	13,200	along alignment	NA	198,000	3.0	3.533	1.009	0.155
	Utility line trucks – Signals	NA	13,200	along alignment	NA	198,000	7.5	5.336	1.525	0.234
	Tractor-trailer for transport	NA	2,200	along alignment	NA	33,000	16.5	7.608	2.174	0.333
	Pickup – Communications	NA	2,200	along alignment	NA	33,000	2.5	3.254	0.930	0.143
	Supervisor truck – Comm.	NA	5,500	along alignment	NA	83,000	2.5	3.254	0.930	0.143
	Utility line trucks – Comm.	NA	5,500	along alignment	NA	83,000	7.5	5.336	1.525	0.234
	Crew cab trucks – Comm.	NA	2,200	along alignment	NA	33,000	3.0	3.533	1.009	0.155
	Tractor-trailer for transport	NA	2,200	along alignment	NA	33,000	16.5	7.608	2.174	0.333
Totals			**3,283,200**	hours		**47,445,000**	miles			

Notes: 1) Emission Factor Equations taken from the Industrial Unpaved Roads section of AP-42 (13.2.2, dated December 2003).

2) $E_{PM10}, E_{PM2.5} = k\,(s/12)^{0.9}\,(W/3)^{0.45}\,[(365\text{-}P)/365]$
$E_{PM} = k\,(s/12)^{0.7}\,(W/3)^{0.45}\,[(365\text{-}P)/365]$

Where: k = particle size multiplier
s = silt content of road surface material (%)
W = mean vehicle weight (tons)
P = mean number of days in a year with at least 0.01 inch of precipitation; AP-42, Table 13.2.2-1

3) Signals and communications are installed at staggered levels: signals during the final year of construction and communications at least one year prior to start of grading.

4) NA = not applicable

5) VMT = vehicle miles traveled

ESTIMATED EMISSIONS RESULTING FROM CONSTRUCTION TRAFFIC ON UNPAVED ROADS

Operation	Vehicle Type	Total Emissions (tons)			Annual Emissions (tons)			Assumptions
		PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	
Grading and Track	Water truck	-	-	-	-	-	-	Water truck is self-mitigating; assume 10 mph.
	Fuel/service truck	2,326	665	102	1,163	332	51	Assume 10 mph.
	Pickup truck	11,863	3,389	520	5,931	1,695	260	Assume 15 mph.
Access Roads	Water truck	-	-	-	-	-	-	Water truck is self-mitigating; assume 10 mph; emissions occur only in Year 1.
	Pickup trucks	1,741	497	76	1,741	497	76	Assume 15 mph; emissions occur only in Year 1.
Batch Plants	Mixers – full	46	13	2	23	7	1	7 yd^3 truck, yd^3 from batch plant – fugitive dust
	Mixers – empty	34	10	1	17	5	1	
	Cement delivery – full	54	15	2	27	8	1	550 lb cement/yd^3
	Cement delivery – empty	33	9	1	16	5	1	
	Aggregate delivery – full	314	90	14	157	45	7	3,300 lb aggregate/yd^3 (coarse + fine)
	Aggregate delivery – empty	181	52	8	91	26	4	
Construction Camps	Crew transport bus – full	2,552	729	112	1,276	365	56	Assume 15 mph; load = 25 men @ 200 lb.
	Crew transport bus – empty	2,358	674	103	1,179	337	52	
	Water truck	-	-	-	-	-	-	Water truck is self-mitigating; assume 10 mph; emissions occur only in Year 1.
	Fuel/service truck	2,754	787	121	1,377	393	60	Assume 10 mph.
	Pickup trucks	42,471	12,135	1,861	21,236	6,067	930	Assume 15 mph.
Quarries	Trucks	268	77	12	134	38	6	Assume 2 mph.
	Pickups	3,525	1,007	154	1,763	504	77	Assume 15 mph.
Well Drilling	Pickup trucks	9,519	2,720	417	4,760	1,360	209	Assume 15 mph.
MOW Construction	Water truck	-	-	-	-	-	-	Water truck is self-mitigating; assume 10 mph; emissions occur only in Year 1.
	Pickups	193	55	8	193	55	8	Assume 15 mph; emissions occur only in Year 1.
EOL Construction	Water truck	-	-	-	-	-	-	Water truck is self-mitigating; assume 10 mph; emissions only in Final Year of project.
	Pickup trucks	515	147	23	515	147	23	Assume 15 mph; emissions occur only in Final Year of project.
Hawthorne Staging Yard Construction	Water truck	-	-	-	-	-	-	Water truck is self-mitigating; assume 10 mph; emissions occur only in Year 1.
	Pickup trucks	386	110	17	386	110	17	Assume 15 mph; emissions occur only in Year 1.
Signals and Communications	Supervisor truck – Signals	135	39	6	90	26	4	Half-ton pickup at 15 mph.
	Foreman truck – Signals	322	92	14	215	61	9	Half-ton pickup at 15 mph.
	Crew cab trucks – Signals	350	100	15	233	67	10	One-ton crew cab pickup at 15 mph.
	Utility line trucks – Signals	528	151	23	352	101	15	Assume 15 mph; 6-ton chassis and 1.5-ton boom equipment.
	Tractor-trailer for transport	126	36	5	84	24	4	Assume 15 mph; 12.5-ton tractor-trailer, 8-ton load half-time.
	Pickup – Comm.	54	15	2	36	10	2	Half-ton pickup at 15 mph.
	Supervisor truck – Comm.	135	39	6	90	26	4	Half-ton pickup at 15 mph.
	Utility line trucks – Comm.	221	63	10	148	42	6	Assume 15 mph; 6-ton chassis and 1.5-ton boom equipment.
	Crew cab trucks – Comm.	58	17	3	39	11	2	Assume 15 mph; 12.5-ton tractor-trailer, 8-ton load half-time.
	Tractor-trailer for transport	126	36	5	84	24	4	One-ton crew cab pickup at 15 mph.
	Total Emissions	**83,000**	**24,000**	**4,000**	**43,000**	**12,000**	**2,000**	

Methodology: The methodology for estimating fugitive dust emissions from stockpiles was taken from AP-42, Section 13.2.5. It is assumed that the dust is emitted at the time of each pile disturbance. The PM/PM_{10}/$PM_{2.5}$ emissions for each disturbance are estimated by comparing the friction velocities at different locations on the surface of the pile with the theoretical threshold friction velocities. The calculation of friction velocities utilizes the fastest mile (wind speeds) for each time period between pile disturbances. For each subarea of the pile in which the friction velocity is greater than the threshold velocity, the emissions are estimated based on the calculated erosion potential and surface area of that subarea of the pile.

The methodology has been converted onto this worksheet for use on this project. Actual wind data for Las Vegas are incorporated at the bottom of the sheet. The Storage Pile Contributions section contains one table for each of the wind speed "categories" and calculates the total pounds of PM per disturbance per pile for that wind speed category. The totals from each subarea for each wind speed category are summed at the bottom of the sheet and converted to total tons based on an assumption of the number of piles and disturbances, as noted.

DATA FOR CALCULATIONS

Threshold Friction Velocity (meters/second [m/s])	Total Surface Area of Pile (square meters [m^2])	Surface Wind Speed Factor (Pile B3)	Percent of Pile Area
1.02	3,275	0.2a	3%
		0.2b	25%
		0.6a	28%
		0.6b	26%
		0.9	14%
		1.1	4%

STORAGE PILE CONTRIBUTIONS

WIND DATA BETWEEN 6 A.M. AND 6 P.M., CONVERTED TO 10 METERS

Pile Subarea	Range (mph) 1.79 - 7.23		Max. Speed (mph) 7.23	Max. Speed (m/s) 3.2	% Time at Speed 9.44%
	Surface Wind Speed (U_s)	Friction Velocity U (0.1U_s)	Disturbed Area (m^2)	grams (g)/m^2	Total lb PM/Disturbance per pile at Speed
0.2a	0.65	0.065	< threshold	0.00	0.00
0.2b	0.65	0.065	< threshold	0.00	0.00
0.6a	1.94	0.194	< threshold	0.00	0.00
0.6b	1.94	0.194	< threshold	0.00	0.00
0.9	2.91	0.291	< threshold	0.00	0.00
1.1	3.55	0.355	< threshold	0.00	0.00

Pile Subarea	Range (mph) 7.23 – 12.63		Max. Speed (mph) 12.63	Max. Speed (m/s) 5.6	% Time at Speed 35.96%
	Surface Wind Speed (U_s)	Friction Velocity U (0.1U_s)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	1.13	0.113	< threshold	0.00	0.00
0.2b	1.13	0.113	< threshold	0.00	0.00
0.6a	3.39	0.339	< threshold	0.00	0.00
0.6b	3.39	0.339	< threshold	0.00	0.00
0.9	5.08	0.508	< threshold	0.00	0.00
1.1	6.21	0.621	< threshold	0.00	0.00

Pile Subarea	Range (mph) 12.63 – 19.86		Max. Speed (mph) 19.86	Max. Speed (m/s) 8.9	% Time at Speed 22.90%
	Surface Wind Speed (U_s)	Friction Velocity U (0.1U_s)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	1.78	0.178	< threshold	0.00	0.00
0.2b	1.78	0.178	< threshold	0.00	0.00
0.6a	5.33	0.533	< threshold	0.00	0.00
0.6b	5.33	0.533	< threshold	0.00	0.00
0.9	7.99	0.799	< threshold	0.00	0.00
1.1	9.77	0.977	< threshold	0.00	0.00

STORAGE PILE CONTRIBUTIONS

WIND DATA BETWEEN 6 A.M. AND 6 P.M., CONVERTED TO 10 METERS

Pile Subarea	Range (mph)		Max. Speed (mph)	Max. Speed (m/s)	% Time at Speed
	19.86 – 30.70		30.70	13.7	18.26%
	Surface Wind Speed (U_s)	Friction Velocity U (0.1U_s)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	2.75	0.275	< threshold	0.00	0.00
0.2b	2.75	0.275	< threshold	0.00	0.00
0.6a	8.24	0.824	< threshold	0.00	0.00
0.6b	8.24	0.824	< threshold	0.00	0.00
0.9	12.35	1.235	459	8.07	8.16
1.1	15.10	1.510	131	26.17	7.56

Pile Subarea	Range (mph)		Max. Speed (mph)	Max. Speed (m/s)	% Time at Speed
	30.70 – 37.90		37.90	16.9	7.57%
	Surface Wind Speed (U_s)	Friction Velocity U (0.1U_s)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	3.39	0.339	< threshold	0.00	0.00
0.2b	3.39	0.339	< threshold	0.00	0.00
0.6a	10.17	1.017	< threshold	0.00	0.00
0.6b	10.17	1.017	< threshold	0.00	0.00
0.9	15.25	1.525	459	27.40	27.69
1.1	18.64	1.864	131	62.37	18.01

Pile Subarea	Range (mph)		Max. Speed (mph)	Max. Speed (m/s)	% Time at Speed
	> 37.90		44	19.7	0.00%
	Surface Wind Speed (U_s)	Friction Velocity U (0.1U_s)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	3.93	0.393	< threshold	0.00	0.00
0.2b	3.93	0.393	< threshold	0.00	0.00
0.6a	11.80	1.180	917	5.49	11.11
0.6b	11.80	1.180	852	5.49	10.31
0.9	17.70	1.770	459	51.41	51.96
1.1	21.64	2.164	131	104.46	30.17

Total lb PM/disturbance per pile	9		
Total ton PM/disturbance per pile	0.00		
Total disturbances per pile	650		
Total piles	300		**Annual tons**
Total tons PM		**1,000**	**500**
Total tons PM_{10}		**1,000**	**500**
Total tons $PM_{2.5}$		**200**	**100**

Notes: 1) Pile configuration taken from AP-42, Chapter 13.2.5, Pile B3.

2) PM_{10} multiplier is 0.5 per AP-42, Chapter 13.2.5. $PM_{2.5}$ multiplier is 0.2 per AP-42, Chapter 13.2.5.

3) Threshold friction velocity taken from AP-42, Table 13.2.5-2 for overburden.

4) Assumes one pile per mile of mainline (255 mi) and sidings (45 mi), for a total of 300 piles.

5) Surface area of pile is estimated as 235 feet long x 150 feet wide (for an approximate surface area of 3,275 m^2, or 0.81 acres), and 15 feet high, for an approximate volume of 528,000 cubic feet. The approximate volume is intended to consider scrapers moving dirt across a 1-mile distance, 100 feet wide and 1 foot deep.

6) Caterpillar 631 Scraper capacity is approximately 30 yd^3, per *Caterpillar Performance Handbook*, Edition 26. Therefore, it would take approximately 650 scraper loads (disturbances) to move 528,000 cubic feet.

7) The erosion potential, P, and emissions, E, are calculated as follows:

$$P = 58(u^*-u^*_t)^2 + 25(u^*-u^*_t)$$

$$E = P\ g/m^2 * \text{subarea}\ m^2 * lb/453.6g$$

8) Wind speed breakdown for Las Vegas, 1988 – 1992, between 6 a.m. and 6 p.m. is as follows:

Range of speeds between 6 a.m. and 6 p.m. at 20 feet	0.51 – 2.06	2.06 – 3.60	3.60 – 5.66	5.66 – 8.75	8.75 –10.80	>10.80	**m/s**
	2.06	3.60	5.66	8.75	10.80	10.80	**m/s**
	6.76	11.81	18.57	28.71	35.43	35.43	**mph**

Las Vegas anemometer height = 20 feet (6.1 meters); must be converted to 10 meters.

$$U_{10} = U_{6.1}((\ln(10/0.005)/\ln(6.1/0.005))$$

10 m wind speed	7.23	12.63	19.86	30.70	37.90	>37.90	**mph**
% time within range	9.44%	35.96%	22.90%	18.26%	7.57%	2.81%	96.95%

9) Wind speed for category ">37.90 mph" was assumed to be 44 mph, taken as an average of the highest monthly 3-minute fastest-mile speeds recorded for Las Vegas, 1961 –1990.

ESTIMATED EMISSIONS RESULTING FROM BATCH PLANT OPERATIONS

Batch Plant Equipment	Mixed Concrete (yd^3)	Emission Factors (lb/yd^3)			Emission (tons)			Annual Emission (tons)		
		PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Concrete Volume for Structures	65,000									
Aggregate delivery to ground storage		0.0064	0.0031	0.0031	0.21	0.10	0.10	0.10	0.05	0.05
Sand delivery to ground storage		0.0015	0.0007	0.0007	0.05	0.02	0.02	0.02	0.01	0.01
Aggregate transfer to conveyor		0.0064	0.0031	0.0031	0.21	0.10	0.10	0.10	0.05	0.05
Sand transfer to conveyor		0.0015	0.0007	0.0007	0.05	0.02	0.02	0.02	0.01	0.01
Aggregate transfer to elevated storage		0.0064	0.0031	0.0031	0.21	0.10	0.10	0.10	0.05	0.05
Sand transfer to elevated storage		0.0015	0.0007	0.0007	0.05	0.02	0.02	0.02	0.01	0.01
Cement delivery to silo		0.0002	0.0001	0.0001	0.01	0.00	0.00	0.00	0.00	0.00
Cement supplement delivery to silo		0.0003	0.0002	0.0002	0.01	0.01	0.01	0.00	0.00	0.00
Weigh hopper loading		0.0079	0.0038	0.0038	0.26	0.12	0.12	0.13	0.06	0.06
Truck mix loading		0.1700	0.0420	0.0420	5.53	1.37	1.37	2.76	0.68	0.68
Total Emissions		0.2021	0.0575	0.0575	**7.00**	**2.00**	**2.00**	**3.00**	**1.00**	**1.00**

Methodology: The methodology for estimating fugitive dust emissions from stockpiles was taken from AP-42, Section 13.2.5. It is assumed that the dust is emitted at the time of each pile disturbance. The $PM/PM_{10}/PM_{2.5}$ emissions for each disturbance are estimated by comparing the friction velocities at different locations on the surface of the pile with the theoretical threshold friction velocities. The calculation of friction velocities utilizes the fastest mile (wind speeds) for each time period between pile disturbances. For each subarea of the pile in which the friction velocity is greater than the threshold velocity, the emissions are estimated based on the calculated erosion potential and surface area of that subarea of the pile.

The methodology has been converted onto this worksheet for use on this project. Actual wind data for Las Vegas are incorporated at the bottom of the sheet. The Storage Pile Contributions section contains one table for each of the wind speed "categories" and calculates the total pounds of PM per disturbance per pile for that wind speed category. The totals from each subarea for each wind speed category are summed at the bottom of the sheet and converted to total tons based on an assumption of the number of piles and disturbances, as noted.

DATA FOR CALCULATIONS

Threshold Friction Velocity (m/sec)	Total Surface Area of Pile (m^2)	Surface Wind Speed Factor (Pile A)	Percent of Pile Area
1.33	1,515	0.2a	5%
	16,305	0.2b	35%
	16,305	0.6a	48%
	16,305	NA	0%
	16,305	0.9	12%
	16,305	NA	0%

STORAGE PILE CONTRIBUTIONS

WIND DATA BETWEEN 6 A.M. AND 6 P.M., CONVERTED TO 10 METERS

Pile Subarea	Range (mph) 1.79 – 7.23		Max. Speed (mph) 7.23	Max. Speed (m/s) 3.2	% Time at Speed 9.44%
	Surface Wind Speed (U_s)	Friction Velocity U ($0.1U_s$)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	0.65	0.065	< threshold	0.00	0.00
0.2b	0.65	0.065	< threshold	0.00	0.00
0.6a	1.94	0.194	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
0.9	2.91	0.291	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00

STORAGE PILE CONTRIBUTIONS

WIND DATA BETWEEN 6 A.M. AND 6 P.M., CONVERTED TO 10 METERS

Pile Subarea	Range (mph) 7.23 – 12.63		Max. Speed (mph) 12.63	Max. Speed (m/s) 5.6	% Time at Speed 35.96%
	Surface Wind Speed (U_s)	Friction Velocity U ($0.1U_s$)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per pile at Speed
0.2a	1.13	0.113	< threshold	0.00	0.00
0.2b	1.13	0.113	< threshold	0.00	0.00
0.6a	3.39	0.339	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
0.9	5.08	0.508	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
Pile Subarea	Range (mph) 12.63 – 19.86		Max. Speed (mph) 19.86	Max. Speed (m/s) 8.9	% Time at Speed 22.90%
	Surface Wind Speed (U_s)	Friction Velocity U ($0.1U_s$)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	1.78	0.178	< threshold	0.00	0.00
0.2b	1.78	0.178	< threshold	0.00	0.00
0.6a	5.33	0.533	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
0.9	7.99	0.799	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
Pile Subarea	Range (mph) 19.86 – 30.70		Max. Speed (mph) 30.70	Max. Speed (m/s) 13.7	% Time at Speed 18.26%
	Surface Wind Speed (U_s)	Friction Velocity U ($0.1U_s$)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	2.75	0.275	< threshold	0.00	0.00
0.2b	2.75	0.275	< threshold	0.00	0.00
0.6a	8.24	0.824	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
0.9	12.35	1.235	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00

STORAGE PILE CONTRIBUTIONS

WIND DATA BETWEEN 6 A.M. AND 6 P.M., CONVERTED TO 10 METERS

Pile Subarea	Range (mph) 30.70 – 37.90		Max. Speed (mph) 37.90	Max. Speed (m/s) 16.9	% Time at Speed 7.57%
	Surface Wind Speed (U_s)	Friction Velocity U (0.1U_s)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	3.39	0.339	< threshold	0.00	0.00
0.2b	3.39	0.339	< threshold	0.00	0.00
0.6a	10.17	1.017	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
0.9	15.25	1.525	182	7.07	2.84
NA	0.00	0.000	< threshold	0.00	0.00

Pile Subarea	Range (mph) > 37.90		Max. Speed (mph) 44	Max. Speed (m/s) 19.7	% Time at Speed 0.00%
	Surface Wind Speed (U_s)	Friction Velocity U (0.1U_s)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	3.93	0.393	< threshold	0.00	0.00
0.2b	3.93	0.393	< threshold	0.00	0.00
0.6a	11.80	1.180	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
0.9	17.70	1.770	182	22.25	8.93
NA	0.00	0.000	< threshold	0.00	0.00

Total lb PM/disturbance per pile	0.50	
Total ton PM/disturbance per pile	0.000	
Total disturbances per pile	33,600	
Total piles	1	**Annual tons**
Total tons PM	**10**	**10**
Total tons PM_{10}	**10**	**10**
Total tons $PM_{2.5}$	**0**	**0**

Notes: 1) Pile configuration taken from AP-42, Chapter 13.2.5, Pile A.
2) PM10 multiplier is 0.5 per AP-42, Chapter 13.2.5. PM2.5 multiplier is 0.2 per AP-42, Chapter 13.2.5.
3) Threshold friction velocity taken from AP-42 Table 13.2.5-1 for No. 16 Tyler Sieve opening (2 mm), based on a mid-range of typical fine aggregate used in Portland cement concrete.
4) Number of batch plants specified in Appendix A.
5) Surface area of pile estimated as a 100-foot-diameter conical pile (20 feet high, for an approximate surface area of 1,515 m^2), based on similar previous projects.
6) Assumes 350 working days per year at eight hours per day of batch plant operation, with a disturbance occurring every 10 minutes over the duration of the project.
7) The erosion potential, P, and emissions, E, are calculated as follows:

$$P = 58(u^*-u^*_t)^2 + 25(u^*-u^*_t)$$

$$E = P\ g/m^2 * \text{subarea}\ m^2 * lb/453.6g$$

8) Wind speed breakdown for Las Vegas 1988 – 1992, between 6 a.m. and 6 p.m. is as follows:

Range of speeds between 6 a.m. and 6 p.m. at 20 feet	0.51 – 2.06	2.06 – 3.60	3.60 – 5.66	5.66 – 8.75	8.75 – 10.80	>10.80	**m/s**
	2.06	3.60	5.66	8.75	10.80	10.80	**m/s**
	6.76	11.81	18.57	28.71	35.43	35.43	**mph**

Las Vegas anemometer height = 20 ft (6.1 meters); must be converted to 10 meters.

$$U_{10} = U_{6.1}((\ln(10/0.005)/\ln(6.1/0.005))$$

10 m wind speed	7.23	12.63	19.86	30.70	37.90	>37.90	**mph**
% time within range	9.44%	35.96%	22.90%	18.26%	7.57%	2.81%	96.95%

9) Wind speed for category ">37.90 mph" was assumed to be 44 mph, taken as an average of the highest monthly 3-minute fastest-mile speeds recorded for Las Vegas, 1961 –1990.

Air Emission Estimates for Batch Plants, Fine Materials Storage Piles – Fugitive Dust

Methodology: The methodology for estimating fugitive dust emissions from stockpiles was taken from AP-42, Section 13.2.5. It is assumed that the dust is emitted at the time of each pile disturbance. The PM/PM_{10}/$PM_{2.5}$ emissions for each disturbance are estimated by comparing the friction velocities at different locations on the surface of the pile with the theoretical threshold friction velocities. The calculation of friction velocities utilizes the fastest mile (wind speeds) for each time period between pile disturbances. For each subarea of the pile in which the friction velocity is greater than the threshold velocity, the emissions are estimated based on the calculated erosion potential and surface area of that subarea of the pile.

The methodology has been converted onto this worksheet for use on this project. Actual wind data for Las Vegas are incorporated at the bottom of the sheet. The Storage Pile Contributions section contains one table for each of the wind speed "categories" and calculates the total pounds of PM per disturbance per pile for that wind speed category. The totals from each subarea for each wind speed category are summed at the bottom of the sheet and converted to total tons based on an assumption of the number of piles and disturbances, as noted.

DATA FOR CALCULATIONS

Threshold Friction Velocity (m/sec)	Total Surface Area of Pile (m^2)	Surface Wind Speed Factor (Pile A)	Percent of Pile Area
1.00	1,515	0.2a	5%
	16,305	0.2b	35%
	16,305	0.6a	48%
	16,305	NA	0%
	16,305	0.9	12%
	16,305	NA	0%

STORAGE PILE CONTRIBUTIONS

WIND DATA BETWEEN 6 A.M. AND 6 P.M., CONVERTED TO 10 METERS

Pile Subarea	Range (mph) 1.79 – 7.23		Max. Speed (mph) 7.23	Max. Speed (m/s) 3.2	% Time at Speed 9.44%
	Surface Wind Speed (U_s)	Friction Velocity U ($0.1U_s$)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	0.65	0.065	< threshold	0.00	0.00
0.2b	0.65	0.065	< threshold	0.00	0.00
0.6a	1.94	0.194	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
0.9	2.91	0.291	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00

STORAGE PILE CONTRIBUTIONS

WIND DATA BETWEEN 6 A.M. AND 6 P.M., CONVERTED TO 10 METERS

Pile Subarea	Range (mph)		Max. Speed (mph)	Max. Speed (m/s)	% Time at Speed
	7.23 – 12.63		12.63	5.6	35.96%
	Surface Wind Speed (U_s)	Friction Velocity U ($0.1U_s$)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	1.13	0.113	< threshold	0.00	0.00
0.2b	1.13	0.113	< threshold	0.00	0.00
0.6a	3.39	0.339	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
0.9	5.08	0.508	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
Pile Subarea	Range (mph)		Max. Speed (mph)	Max. Speed (m/s)	% Time at Speed
	12.63 – 19.86		19.86	8.9	22.90%
	Surface Wind Speed (U_s)	Friction Velocity U ($0.1U_s$)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	1.78	0.178	< threshold	0.00	0.00
0.2b	1.78	0.178	< threshold	0.00	0.00
0.6a	5.33	0.533	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
0.9	7.99	0.799	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
Pile Subarea	Range (mph)		Max. Speed (mph)	Max. Speed (m/s)	% Time at Speed
	19.86 – 30.70		30.70	13.7	18.26%
	Surface Wind Speed (U_s)	Friction Velocity U ($0.1U_s$)	Disturbed Area (m^2)	g/m^2	Total lb PM/ Disturbance per Pile at Speed
0.2a	2.75	0.275	< threshold	0.00	0.00
0.2b	2.75	0.275	< threshold	0.00	0.00
0.6a	8.24	0.824	< threshold	0.00	0.00
NA	0.00	0.000	< threshold	0.00	0.00
0.9	12.35	1.235	182	9.10	3.66
NA	0.00	0.000	< threshold	0.00	0.00

STORAGE PILE CONTRIBUTIONS

WIND DATA BETWEEN 6 A.M. AND 6 P.M., CONVERTED TO 10 METERS

Pile Subarea	Range (mph)		Max. Speed (mph)	Max. Speed (m/s)	% Time at Speed
	30.70 - 37.90		37.90	16.9	7.57%
	Surface Wind Speed (U_s)	Friction Velocity U (0.1U_s)	Disturbed Area (m^2)	g/m²	Total lb PM/ Disturbance per Pile at Speed
0.2a	3.39	0.339	< threshold	0.00	0.00
0.2b	3.39	0.339	< threshold	0.00	0.00
0.6a	10.17	1.017	727	0.43	0.69
NA	0.00	0.000	< threshold	0.00	0.00
0.9	15.25	1.525	182	29.09	11.67
NA	0.00	0.000	< threshold	0.00	0.00

Pile Subarea	Range (mph)		Max. Speed (mph)	Max. Speed (m/s)	% Time at Speed
	> 37.90		44	19.7	0.00%
	Surface Wind Speed (U_s)	Friction Velocity U (0.1U_s)	Disturbed Area (m^2)	g/m²	Total lb PM/ Disturbance per Pile at Speed
0.2a	3.93	0.393	< threshold	0.00	0.00
0.2b	3.93	0.393	< threshold	0.00	0.00
0.6a	11.80	1.180	727	6.39	10.24
NA	0.00	0.000	< threshold	0.00	0.00
0.9	17.70	1.770	182	53.67	21.54
NA	0.00	0.000	< threshold	0.00	0.00

Total lb PM/disturbance per pile	2	
Total ton PM/disturbance per pile	0.001	
Total disturbances per pile, assumed over the life of the project	33,600	
Total piles	1	**Annual tons**
Total tons PM	**40**	**20**
Total tons PM_{10}	**20**	**10**
Total tons $PM_{2.5}$	**10**	**10**

Air Emission Estimates for Batch Plants, Fine Materials Storage Piles – Fugitive Dust

Notes: 1) Pile Configuration taken from AP-42, Chapter 13.2.5, Pile A.

2) PM10 multiplier is 0.5 per AP-42, Chapter 13.2.5. PM2.5 multiplier is 0.2 per AP-42, Chapter 13.2.5.

3) Threshold friction velocity taken from AP-42 Table 13.2.5-1 for No. 16 Tyler Sieve opening (2 mm), based on a mid-range of typical fine aggregate used in Portland cement concrete.

4) Number of batch plants specified in Appendix A.

5) Surface area of pile estimated as a 100-foot diameter conical pile (20 feet high, for an approximate surface area of 1,515 m^2), based on similar previous projects.

6) Assumes 350 working days per year at eight hours per day of batch plant operation, with a disturbance occurring every 10 minutes over the duration of the project.

7) The erosion potential, P, and emissions, E, are calculated as follows:

$$P = 58(u^*-u^*_t)^2 + 25(u^*-u^*_t)$$

$$E = P \text{ g/m}^2 * \text{subarea m}^2 * \text{lb/453.6g}$$

8) Wind speed breakdown for Las Vegas 1988 – 1992, between 6 a.m. and 6 p.m. is as follows:

Range of speeds between 6 a.m. and 6 p.m. at 20 feet	0.51 - 2.06	2.06 - 3.60	3.60 - 5.66	5.66 - 8.75	8.75 - 10.80	>10.80	**m/s**
	2.06	3.60	5.66	8.75	10.80	10.80	**m/s**
	6.76	11.81	18.57	28.71	35.43	35.43	**mph**

Las Vegas anemometer height = 20 ft (6.1 meters); must be converted to 10 meters.

$$U_{10} = U_{6.1}((\ln(10/0.005)/\ln(6.1/0.005))$$

10 m wind speed	7.23	12.63	19.86	30.70	37.90	>37.90	**mph**
% time within range	9.44%	35.96%	22.90%	18.26%	7.57%	2.81%	96.95%

9) Wind speed for category ">37.90 mph" was assumed to be 44 mph, taken as an average of the highest monthly 3-minute fastest-mile speeds recorded for Las Vegas, 1961 –1990.

ESTIMATED EMISSIONS RESULTING FROM BALLAST PRODUCTION

Quarry Operation	Total (tons)	Emission Factors (lb/ton)			Emissions (tons)			Annual Emissions (tons)		
		PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
Subballast										
Drilling and Blasting	3,247,000	1.48E-04	8.00E-05	8.00E-05	0.2	0.1	0.1	0.1	0.1	0.1
Truck Loading		0.0002	0.0001	0.0001	0.3	0.2	0.2	0.1	0.1	0.1
Truck Unloading		0.0002	0.0001	0.0001	0.3	0.2	0.2	0.1	0.1	0.1
Primary Crusher		0.0054	0.0024	0.0024	8.8	3.9	3.9	4.4	1.9	1.9
Screening		0.0250	0.0087	0.0087	40.6	14.1	14.1	20.3	7.1	7.1
Secondary Crusher		0.0054	0.0024	0.0024	8.8	3.9	3.9	4.4	1.9	1.9
Screening		0.0250	0.0087	0.0087	40.6	14.1	14.1	20.3	7.1	7.1
Tertiary Crusher		0.0054	0.0024	0.0024	8.8	3.9	3.9	4.4	1.9	1.9
Conveyor Transfer Points (6)		0.0030	0.0011	0.0011	29.2	10.7	10.7	14.6	5.4	5.4
Total Subballast Emissions					**110**	**40**	**40**	**54**	**20**	**20**
Track Ballast										
Drilling and Blasting	3,788,000	1.48E-04	8.00E-05	8.00E-05	0.3	0.2	0.2	0.1	0.1	0.1
Truck Loading		0.0002	0.0001	0.0001	0.3	0.2	0.2	0.2	0.1	0.1
Truck Unloading		0.0002	0.0001	0.0001	0.3	0.2	0.2	0.2	0.1	0.1
Primary Crusher		0.0054	0.0024	0.0024	10.2	4.5	4.5	5.1	2.3	2.3
Screening		0.0250	0.0087	0.0087	47.4	16.5	16.5	23.7	8.2	8.2
Secondary Crusher		0.0054	0.0024	0.0024	10.2	4.5	4.5	5.1	2.3	2.3
Screening		0.0250	0.0087	0.0087	47.4	16.5	16.5	23.7	8.2	8.2
Tertiary Crusher		0.0054	0.0024	0.0024	10.2	4.5	4.5	5.1	2.3	2.3
Conveyor Transfer Point (6)		0.0030	0.0011	0.0011	34.1	12.5	12.5	17.0	6.3	6.3
Total Ballast Emissions					**160**	**60**	**60**	**80**	**30**	**30**

Notes: 1) Subballast emissions occur along the alignment.
2) Ballast emissions occur at the quarries.
3) Total tonnage for ballast and subballast have been adjusted to account for swell factor during quarry operations.

ESTIMATED EQUIPMENT OPERATING HOURS FOR TRACK AND BRIDGE CONSTRUCTION

Track and Bridge Construction Equipment	HP	Original Basis for Hours	Hours Adjusted for Terrain	Notes/Reference/Assumptions
SITE PREPARATION AND GRADING				
Two-ton Flatbed Truck	300	30,000	32,000	Generally www.macktrucks.com
Tractor-trailer (flatbed, belly dump)	300	60,000	65,000	Generally www.macktrucks.com
Caterpillar D400 Rock Truck	405	300,000	324,000	D400E Series II from *Caterpillar Performance Handbook* 33 ed., Chapter 19, Former Models, 2002.
Water Truck – 4,000 gal	300	150,000	162,000	Generally www.macktrucks.com
Fuel/service Truck	300	45,000	49,000	Generally www.macktrucks.com
Pickup	250	450,000	486,000	HP values taken from similar equipment on previous projects
Caterpillar 966 Loader	260	75,000	81,000	www.cat.com, 966G series II Loader
Caterpillar 140 Blade	222	150,000	162,000	www.cat.com, 140 H Global Grader
CP 563E Padfoot Drum Compactor – (84")	150	30,000	32,000	www.cat.com
CP 563E Smooth Drum Compactor – (84")	150	30,000	32,000	www.cat.com
Caterpillar 815 Compactor	254	75,000	81,000	www.cat.com, 815F
Caterpillar D6 Dozer	210	150,000	162,000	www.cat.com, D6R Series II Track-Type Tractor
Caterpillar D9 Dozer	464	225,000	243,000	www.cat.com, D9T Track-Type Tractor
Caterpillar D10 Dozer	646	225,000	243,000	www.cat.com, D10T Track Type Tractor
Komatsu PC 300 Excavator	254	30,000	32,000	www.komatsu.com, PC300LC-7
Komatsu PC 400 Excavator	347	75,000	81,000	www.komatsu.com, PC400LC-6 Excel
Caterpillar 615 Scraper	279	30,000	32,000	http://www.cat.com, 615C Series II
Caterpillar 631 Scraper	519	270,000	292,000	www.cat.com, 631G
Rock Drill	161	35,000	38,000	EPA Publication 460/3-91-02 (21A-2001), "Nonroad Engine and Vehicle Emissions Study (NEVES)", November 1991.

ESTIMATED EQUIPMENT OPERATING HOURS FOR TRACK AND BRIDGE CONSTRUCTION

Track and Bridge Construction Equipment	HP	Original Basis for Hours	Hours Adjusted for Terrain	Notes/Reference/Assumptions
Crawler Crane – 100 ton	350	8,000	9,000	Generally www.manitowoccranegroup.com
Crawler Crane – 150 ton	500	4,000	4,000	Generally www.manitowoccranegroup.com
Air Compressor (250 cfm)*	37	75,000	81,000	HP values taken from similar equipment on previous projects; hours of operation include operation of small air tools.
Jumping Jack Compactor*	161	150,000	162,000	EPA Publication 460/3-91-02 (21A-2001), "NEVES", November 1991.
TRACK INSTALLATION				
Pettibone 360 Speed Swing – Hi-rail	185		26,000	www.pettibone-mi.com/speedswings/ss360m
Kershaw 26-2 Ballast Regulator	161		26,000	EPA Publication 460/3-91-02 (21A-2001), "NEVES", November 1991.
Jackson 6700 Tamper	99		52,000	HP values taken from similar equipment on previous projects
Tie Handler	464		13,000	www.cat.com, D9T Track-Type Tractor
Rail Clip Applicator	210		13,000	www.cat.com, D6R Series II Track-Type Tractor
Ballast Consolidator	464		26,000	www.cat.com, D9T Track-Type Tractor
EMD SD40 Locomotive	3,000		40,000	Build dates 1984 - 1995
EMD SD70MAC Locomotive	4,000		117,000	Build date 1995

Notes: 1) Hours shown for site grading are annual. Total hours listed in Analytical Basis.
2) Hours shown for track installation are total over life of construction (26 months).
3) Two types of locomotives are listed; larger (SD70) would be used for line haul of materials; smaller unit used for short haul.

ESTIMATED EQUIPMENT OPERATING HOURS FOR CAMP, QUARRY, AND WELL CONSTRUCTION

Construction Camp Equipment	HP	Original Basis for Hours	Total Hours Plus Contingency	Yearly Average Operation (hours)	Notes/References/Assumptions
BUILD CAMPS					
Caterpillar 140 Blade	222	2,400	2,600	2,600	www.cat.com, 140H Global Grader; emissions occur only in Year 1.
Tandem Axle Dump Truck	300	4,800	5,300	5,300	Generally, www.macktrucks.com; emissions occur only in Year 1.
Caterpillar 420D Backhoe-loader	93	4,800	5,300	5,300	www.cat.com, 420D IT; emissions occur only in Year 1.
Water Truck – 4,000 gal	300	2,400	2,600	2,600	Generally, www.macktrucks.com; emissions occur only in Year 1.
Pickup Trucks	250	288,000	317,000	317,000	Similar to previous project
OPERATE CAMPS					
Construction Crew Buses	300	42,000	46,000	23,000	Estimate based on CAT and Cummins
Fuel and Maintenance Trucks	300	52,800	58,000	29,000	Generally, www.macktrucks.com
Pickup Trucks	250	1,584,000	1,740,000	870,000	Similar to previous project
BUILD QUARRIES					
Caterpillar 140 Blade	222	480	500	500	www.cat.com, 140H Global Grader; emissions occur only in Year 1.
Tandem Axle Dump Truck	300	1,440	1,600	1,600	Generally, www.macktrucks.com; emissions occur only in Year 1.
Caterpillar 420D Backhoe-loader	93	1,440	1,600	1,600	www.cat.com, 420D IT; emissions occur only in Year 1.
Water Truck – 4,000 gal	300	480	500	500	Generally, www.macktrucks.com; emissions occur only in Year 1.
Pickup Trucks	250	2,400	2,600	2,600	Similar to previous project
OPERATE QUARRIES					
Case CX800 Excavators	486	21,120	23,000	12,000	www.casece.com/products/products
Case 921C Loaders	248	42,240	46,000	23,000	www.casece.com/products/products
Caterpillar D400 Rock Truck	405	21,120	23,000	12,000	D400E Series II from *Caterpillar Performance Handbook* 33 ed., Chapter 19, Former Models, 2002.

ESTIMATED EQUIPMENT OPERATING HOURS FOR CAMP, QUARRY, AND WELL CONSTRUCTION

Construction Camp Equipment	HP	Original Basis for Hours	Total Hours Plus Contingency	Yearly Average Operation (hours)	Notes/References/Assumptions
Crushers and Conveyors	210	31,680	35,000	18,000	Equivalent to www.cat.com, D6R Series II Track-Type Tractor
Pickup Trucks	250	63,360	70,000	35,000	Similar to previous project
BUILD WATER WELLS					
Caterpillar 140 Blade	222	0	0	0	www.cat.com, 140H Global Grader; emissions occur only in Year 1.
Tandem Axle Dump Truck	300	1,680	1,800	1,800	Generally, www.macktrucks.com; emissions occur only in Year 1.
Caterpillar 420D Backhoe-loader	93	1,680	1,800	1,800	www.cat.com, 420D IT; emissions occur only in Year 1.
Water Truck – 4,000 gal	300	0			Generally, www.macktrucks.com; emissions occur only in Year 1.
Drill Rig	250	4,032	4,400	4,400	Generally www.cmeco.com; 24 hours per day
Pickup Trucks	250	16,800	18,000	18,000	Similar to previous project
OPERATE WATER WELLS					
Generator	200	1,060,000	1,170,000	585,000	Estimate based on CAT and Cummins
Pickup Trucks	250	350,000	390,000	195,000	Similar to previous project

Basis of hours – Camps	
Caterpillar 140 Blade	Calculated as 1 blade per camp x 10 camps x 4 weeks of activity x 60 hours per week.
Tandem Axle Dump Truck	Calculated as 2 trucks per camp x 10 camps x 4 weeks of activity x 60 hours per week.
Caterpillar 420D Backhoe-loader	Calculated as 2 loaders per camp x 10 camps x 4 weeks of activity x 60 hours per week.
Water Truck – 4,000 gal	Calculated as 1 water truck per camp x 10 camps x 4 weeks of activity x 60 hours per week.
Pickup Trucks	Calculated as 30 pickups per camp x 10 camps x 16 weeks of activity x 60 hours per week.
Operations	
Construction Crew Buses	Calculated as 4 buses per camp x 10 camps x 2 hrs operation per day x 22 days per month x duration of project.
Fuel and Maintenance Trucks	Calculated as 1 truck per camp x 10 camps x 10 hrs operation per day x 22 days per month x duration of project.
Pickup Trucks	Calculated as 20 trucks per camp x 10 camps x 10 hours per week x 22 days per month x duration of project.

ESTIMATED EQUIPMENT OPERATING HOURS FOR CAMP, QUARRY, AND WELL CONSTRUCTION

Number of Pickup Trucks	1	Camp superintendent	10	Foremen
	3	Staff personnel	5	Construction management personnel
	2	Health and safety	5	Resident field inspectors
	2	Line superintendents	2	DOE resident staff
Basis of hours – Quarries				
Caterpillar 140 Blade	Calculated as 2 quarries x 1 blade x 4 weeks of activity x 60 hours per week.			
Tandem Axle Dump Truck	Calculated as 2 quarries x 3 trucks x 4 weeks of activity x 60 hours per week.			
Caterpillar 420D Backhoe-loader	Calculated as 2 quarries x 3 loaders x 4 weeks of activity x 60 hours per week.			
Water Truck – 4,000 gal	Calculated as 2 quarries x 1 truck x 4 weeks of activity x 60 hours per week.			
Pickup Trucks	Calculated as 5 pickups per quarry x 2 quarries x 4 weeks of activity x 60 hours per week.			
Operations				
Excavators	Calculated as 2 excavators per quarry x 2 quarries x 10 hrs operation per day x 22 days per month x duration of project.			
Loaders	Calculated as 4 loaders per quarry x 2 quarries x 10 hrs operation per day x 22 days per month x duration of project.			
Caterpillar D400 Rock Truck	Calculated as 2 trucks per quarry x 2 quarries x 10 hrs operation per day x 22 days per month x duration of project.			
Crushers and Conveyors	Calculated as 3 crushers per quarry x 2 quarries x 10 hrs operation per day x 22 days per month x duration of project.			
Pickup Trucks	Calculated as 6 trucks per quarry x 2 quarries x 10 hours per day x 22 days per month x duration of project.			
Basis of hours – Wells				
Caterpillar 140 Blade	Not required			
Tandem Axle Dump Truck	Calculated as 1 truck per 10 wells x 84 wells x 2 days of activity x 10 hours per day			
Caterpillar 420D Backhoe-loader	Calculated as 1 loader per 10 wells x 84 wells x 2 days of activity x 10 hours per day			
Water Truck – 4,000 gal	Not required			
Drill Rig	Calculated as 400 feet per well x 84 wells x 12 hours per day per 100 feet			
Pickup Trucks	Calculated as 2 pickups per 10 wells x 84 wells x 10 days of activity x 10 hours per day			
			17	Number of pickups required
Operations				
Generators	Calculated as 84 wells x 24 hours per day x 22 days per month x duration of project			
Pickup Trucks	Calculated as 1 truck per 10 wells x 84 wells x 8 hours per day x 22 days per month x duration of project			

ESTIMATED EQUIPMENT OPERATING HOURS FOR FACILITY CONSTRUCTION

Hawthorne Staging Yard Construction Equipment	HP	No. Req'd	Original Basis for Hours	Hours Plus Contingency	Total Hours of Emissions	Notes/Reference/Assumptions
Grading and site preparation						
Caterpillar 140 Blade	222	2	2,880	3,200	3,200	www.cat.com, 140H Global Grader
Tandem Axle Dump Truck	300	5	7,200	7,900	7,900	Generally www.macktrucks.com
Caterpillar 420D Backhoe-loader	93	4	5,760	6,300	6,300	www.cat.com, 420D IT
CP 563E Smooth Drum Compactor – (84")	150	2	2,880	3,200	3,200	www.cat.com
Caterpillar 615 Scraper	279	3	4,320	4,800	4,800	www.cat.com, 615C
Pickup Truck	250	10	14,400	15,800	15,800	Similar to previous projects
Water Truck – 4,000 gal	300	2	2,880	3,200	3,200	Generally www.macktrucks.com
Trackwork						
Pettibone 441 Speed Swing – Hi-rail	161	2	2,880	3,200	3,200	EPA Publication 460/3-91-02 (21A-2001), "NEVES", November 1991.
Kershaw 26-2 Ballast Regulator	161	2	2,880	3,200	3,200	EPA Publication 460/3-91-02 (21A-2001), "NEVES", November 1991.
Jackson 6700 Tamper	99	2	2,880	3,200	3,200	Similar to previous projects
Hi-rail Dump Truck	400	2	2,880	3,200	3,200	Similar to previous projects
Tractor-trailer (flatbed, belly dump)	300	4	5,760	6,300	6,300	Generally www.macktrucks.com
Structures						
Two-ton Flatbed Truck	300	3	4,320	4,800	4,800	Generally www.macktrucks.com
Tractor-trailer (flatbed)	300	3	4,320	4,800	4,800	Generally www.macktrucks.com
Crane – Burro 45	220	1	1,440	1,600	1,600	Generally www.manitowoccranegroup.com
Air Compressor – Small Air Tools	37	5	7,200	7,900	7,900	Compressor assumed to be similar to that used in track construction.
Caterpillar 420D Backhoe-loader	93	5	7,200	7,900	7,900	www.cat.com, 420D IT

ESTIMATED EQUIPMENT OPERATING HOURS FOR FACILITY CONSTRUCTION

MOW Construction Equipment	HP	No. Req'd	Original Basis for Hours	Hours Plus Contingency	Total Hours of Emissions	Notes/Reference/Assumptions
Grading and Site Preparation						
Caterpillar 140 Blade	222	1	1,440	1,600	1,600	www.cat.com, 140H Global Grader
Tandem Axle Dump Truck	300	3	4,320	4,800	4,800	Generally www.macktrucks.com
Caterpillar 420D Backhoe-loader	93	2	2,880	3,200	3,200	www.cat.com, 420D IT
CP 563E Smooth Drum Compactor – (84")	150	2	2,880	3,200	3,200	www.cat.com
Caterpillar 615 Scraper	279	1	1,440	1,600	1,600	www.cat.com, 615C
Pickup Truck	250	5	7,200	7,900	7,900	Similar to previous projects
Water Truck – 4,000 gal	300	1	1,440	1,600	1,600	Generally www.macktrucks.com
Trackwork						
Pettibone 441 Speed Swing – Hi-rail	161	2	2,880	3,200	3,200	EPA Publication 460/3-91-02 (21A-2001), "NEVES", November 1991.
Kershaw 26-2 Ballast Regulator	161	2	2,880	3,200	3,200	EPA Publication 460/3-91-02 (21A-2001), "NEVES", November 1991.
Jackson 6700 Tamper	99	2	2,880	3,200	3,200	Similar to previous projects
Hi-rail Dump Truck	400	2	2,880	3,200	3,200	Similar to previous projects
Tractor-trailer (flatbed, belly dump)	300	4	5,760	6,300	6,300	Generally www.macktrucks.com
Structures						
Two-ton Flatbed Truck	300	3	4,320	4,800	4,800	Generally www.macktrucks.com
Tractor-trailer (flatbed)	300	3	4,320	4,800	4,800	Generally www.macktrucks.com
Crane – Burro 45	220	1	1,440	1,600	1,600	Generally www.manitowoccranegroup.com
Air Compressor – Small Air Tools	37	5	7,200	7,900	7,900	Compressor assumed to be similar to that used in track construction.
Caterpillar 420D Backhoe-loader	93	5	7,200	7,900	7,900	www.cat.com, 420D IT

ESTIMATED EQUIPMENT OPERATING HOURS FOR FACILITY CONSTRUCTION

EOL Construction Equipment	HP	No. Req'd	Original Basis for Hours	Hours Plus Contingency	Total Hours of Emissions	Notes/Reference/Assumptions
Grading and site preparation						
Caterpillar 140 Blade	222	2	3,840	4,200	4,200	www.cat.com, 140H Global Grader
Tandem Axle Dump Truck	300	5	9,600	10,600	10,600	Generally www.macktrucks.com
Caterpillar 420D Backhoe-loader	93	4	7,680	8,400	8,400	www.cat.com, 420D IT
CP 563E Smooth Drum Compactor – (84")	150	2	3,840	4,200	4,200	www.cat.com
Caterpillar 615 Scraper	279	3	5,760	6,300	6,300	www.cat.com, 615C
Pickup Truck	250	10	19,200	21,100	21,100	Similar to previous projects
Water Truck – 4,000 gal	300	2	3,840	4,200	4,200	Generally www.macktrucks.com
Trackwork						
Pettibone 441 Speed Swing – Hi-rail	161	2	5,760	6,300	6,300	EPA Publication 460/3-91-02 (21A-2001), "NEVES", November 1991.
Kershaw 26-2 Ballast Regulator	161	2	5,760	6,300	6,300	EPA Publication 460/3-91-02 (21A-2001), "NEVES", November 1991.
Jackson 6700 Tamper	99	2	5,760	6,300	6,300	Similar to previous projects
Hi-rail Dump Truck	400	2	5,760	6,300	6,300	Similar to previous projects
Tractor-trailer (flatbed, belly dump)	300	4	11,520	12,700	12,700	Generally www.macktrucks.com
Structures						
Two-ton Flatbed Truck	300	3	8,640	9,500	9,500	Generally www.macktrucks.com
Tractor-trailer (flatbed)	300	3	8,640	9,500	9,500	Generally www.macktrucks.com
Crane – Burro 45	220	1	2,880	3,200	3,200	Generally www.manitowoccranegroup.com
Air Compressor – Small Air Tools	37	5	14,400	15,800	15,800	Compressor assumed to be similar to that used in track construction.
Caterpillar 420D Backhoe-loader	93	5	14,400	15,800	15,800	www.cat.com, 420D IT

BASIS FOR ANALYSIS

Facility Name	Duration of construction activity (months)			Notes
	Grading	Trackwork	Structures	
Hawthorne Staging Yard	6	6	6	Emissions occur in Year 1 of 3-year duration.
MOW	6	6	6	Emissions occur in Year 2 of 3-year duration.
EOL	8	12	12	Emissions occur in Year 3 of 3-year duration.

Note: Original basis of hours calculated as (number of equipment pieces) x (number of months duration of construction activity) x 240 hours per month.

ESTIMATED EQUIPMENT OPERATING HOURS FOR ACCESS ROAD CONSTRUCTION

Access Roads Construction Equipment	HP	Number Required	Original Basis for Hours	Hours Plus Contingency	Yearly Avg Operation	Notes/References/Assumptions
Access Roads – Camps, Quarries and Wells						
Caterpillar 140 Blade	222	9	12,960	14,300	14,300*	www.cat.com, 140H Global Grader
Tandem Axle Dump Truck	300	9	12,960	14,300	14,300*	Generally, www.macktrucks.com
Caterpillar 420D Backhoe-loader	93	9	12,960	14,300	14,300*	www.cat.com, 420D IT
CP 563E Padfoot Drum Compactor – (84")	150	2	2,880	3,200	3,200*	www.cat.com
CP 563E Smooth Drum Compactor – (84")	150	9	12,960	14,300	14,300*	www.cat.com
Caterpillar 615 Scraper	279	3	4,320	4,800	4,800*	www.cat.com, 615C
Pickup Truck	250	20	28,800	31,700	31,700*	Similar to previous project
Water Truck – 4,000 gal	300	8	11,520	12,700	12,700*	Generally, www.macktrucks.com
Access Road – Facilities						
Caterpillar 140 Blade	222	5	7,200	7,900	7,900*	www.cat.com, 140H Global Grader
Tandem Axle Dump Truck	300	12	17,280	19,000	19,000*	Generally, www.macktrucks.com
Caterpillar 420D Backhoe-loader	93	12	17,280	19,000	19,000*	www.cat.com, 420D IT
CP 563E Padfoot Drum Compactor – (84")	150	4	5,760	6,300	6,300*	www.cat.com
CP 563E Smooth Drum Compactor – (84")	150	9	12,960	14,300	14,300*	www.cat.com
Caterpillar 615 Scraper	279	8	11,520	12,700	12,700*	www.cat.com, 615C
Pickup Truck	250	25	36,000	39,600	39,600*	Similar to previous project
Water Truck – 4,000 gal	300	5	7,200	7,900	7,900*	Generally, www.macktrucks.com

* Emissions to occur in Year 1 of construction.

EQUIPMENT REQUIRED FOR CONSTRUCTION

Camps, Quarries, and Wells	Camps	Quarries	Wells	Total	Comments
Caterpillar 140 Blade	5	2	2	9	One consist per 50 mi of road; two consists for camps; one each for wells and quarries; consist includes blade truck, loader, and compactor.
Tandem Axle Dump Truck	5	2	2	9	
Caterpillar 420D Backhoe-loader	5	2	2	9	
CP 563E Padfoot Drum Compactor – (84")	2	0	0	2	
CP 563E Smooth Drum Compactor – (84")	5	2	2	9	
Caterpillar 615 Scraper	2	1	0	3	
Pickup Truck	10	5	5	20	
Water Truck – 4,000 gal	5	2	1	8	
Facilities	**Hawthorne**	**MOW**	**EOL**	**Total**	**Comments**
Caterpillar 140 Blade	2	1	2	5	Assumes one crew; sequence of construction runs from north to south.
Tandem Axle Dump Truck	5	2	5	12	
Caterpillar 420D Backhoe-loader	5	2	5	12	
CP 563E Padfoot Drum Compactor – (84")	2	0	2	4	
CP 563E Smooth Drum Compactor – (84")	5	2	2	9	
Caterpillar 615 Scraper	4	0	4	8	
Pickup Truck	10	5	10	25	
Water Truck – 4,000 gal	2	1	2	5	

ESTIMATED EQUIPMENT OPERATING HOURS FOR BATCH PLANT OPERATIONS

Batch Plant Equipment	HP	Original Basis for Hours	Hours Plus Contingency	Yearly Avg Operation	Notes/Reference/Assumptions
Loaders	260	9,000	9,000	5,000	www.cat.com, 966G-Series II Loader; assumes loaders operate half of the total time the batch plant operates
Cement Mixer	300	1,240	1,400	700	Generally www.macktrucks.com; assumes 15 mph
Cement Delivery	500	1,200	1,300	700	Generally www.macktrucks.com; assumes 15 mph
Aggregate Delivery	500	7,200	7,900	4,000	Generally www.macktrucks.com; assumes 15 mph
Generators (two located at each plant)	200	18,000	19,800	9,900	Assumes 3,000 hour/year operation each based on a 3-year project.

Note: Assumes one batch plant at Beatty Wash Bridge.

ESTIMATED EQUIPMENT OPERATING HOURS FOR SIGNAL AND COMMUNICATIONS CONSTRUCTION

Signals and Communications Construction Equipment	Number of Pieces	HP	Original Basis for Hours	Hours Plus Contingency	Yearly Avg Operation	Notes/References/Assumptions
Signals						
Supervisor half-ton pickups	2	250	5,000	5,500	3,700	Similar to previous projects; emissions occur over the last year and a half of project; emissions shown are Final Year emissions.
Half-ton crew foreman pickups	5	250	12,000	13,200	8,800	"
One-ton crew cab pickups	5	250	12,000	13,200	8,800	"
Utility line trucks	5	300	12,000	13,200	8,800	Generally www.macktrucks.com; emissions occur over the last year and a half of project; emissions shown are Final Year emissions.
20-ton crane	1	332	2,000	2,200	1,500	Generally www.manitowoccranegroup.com; emissions occur over the last year and a half of project; emissions shown are Final Year emissions.
Tractor backhoes	3	93	7,000	7,700	5,100	www.cat.com, 420D IT, assumes backhoe loader; emissions occur over the last year and a half of project; emissions shown are Final Year emissions.
Tractor-trailer combo for transport	1	300	2,000	2,200	1,500	Generally www.macktrucks.com; emissions occur over the last year and a half of project; emissions shown are Final Year emissions.
Communications						
Half-ton pickup	1	250	2,000	2,200	1,500	Similar to previous projects; emissions occur over a year and a half period prior to first year of grading construction; emissions shown are First Year emissions.
Supervisor half-ton pickups	2	250	5,000	5,500	3,700	"
Utility line trucks	2	250	5,000	5,500	3,700	"
Crew cab pickup (1-ton)	1	250	2,000	2,200	1,500	"
Backhoe	1	93	2,000	2,200	1,500	www.cat.com, 420D IT, assumes backhoe loader; emissions occur over a year and a half period prior to first year of grading construction; emissions shown are first Year emissions.
Tractor-trailer combo for transport	1	300	2,000	2,200	1,500	Generally www.macktrucks.com; emissions occur over a year and a half period prior to first year of grading construction; emissions shown are first Year emissions.

Note: Original basis of hours calculated as number of pieces required x 1.5 years x 2,000 hours per year.

Appendix C
Air Emissions Analysis for Operational Activities

Appendix C – Contents

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ASSUMPTIONS FOR AIR EMISSIONS ANALYSIS DURING OPERATIONS

RAIL TRAFFIC

(1) All emission factors other than SO_2, based on Emission Standards found at 40 Code of Federal Regulations 92.8, Table A8-3 – Tier 2 Standards. All locomotives and locomotive engines manufactured after January 1, 2005 must meet the Tier 2 Standards.

(2) SO_2 emission factor estimated using the following: ppmw as (S/1000000) x fuel density (lb/gal) x (1 /HHV diesel) x (1 lb-mol S/32 lb S) x (1 lb mole SO_2/1 lb-mole S) x (64 lb SO_2/1 lb-mole SO_2) x BSFC, where:

ppmw = 15

Fuel density = 7

HHV diesel = 137,000 Btu/gal

BSFC = 6,869 Btu/hp-hr

This yields an SO_2 emission factor of: 0.00001 lb/bhp-hr

0.005 g/bhp-hr

(3) The BSFC was calculated using a factor of 20.24 bhp-hr/gal obtained from Development of Railroad Emission Methodologies, Table 17, prepared for Southeastern Air Resource Managers, Inc., by Sierra Research Inc., June 2004.

(4) The fuel density and HHV were obtained from EPA, *Compilation of Air Pollutant Emission Factors* (AP-42), Appendix A (September 1985).

(5) Line haul train traffic assumes peak of about 20 trains per week, including commercial and DOE traffic.

(6) Switch cycle train traffic assumes one switch engine based at the Hawthorne staging yard, operating 8 hours/day; and two switch engines based at the EOL facility, operating 16 hours/day.

FACILITIES – FUEL TANKS

(1) Assumes diesel (no. 2) fuel oil for all storage.

(2) Net throughput is based on fuel consumption of 200 gal/hr/engine for line haul and switch cycle locomotives. It is assumed that total fuel consumption for locomotives to be distributed from the fuel tank.

(3) A single, 200,000-gal tank is currently anticipated at the EOL facility. Space is provided in the table for the inclusion of additional tanks, if necessary.

(4) Tank dimensions are representative of a 200,000-gal tank but not based on engineered dimensions.

ASSUMPTIONS FOR AIR EMISSIONS ANALYSIS DURING OPERATIONS

FACILITIES – FUEL HANDLING	
(1)	Loading Loss (LL) = 12.46 x [(S x P x M)/T] where, S = Saturation Factor P = True Vapor Pressure M = Molecular Weight of Vapor T = Temperature of Bulk Liquid Loaded (F + 460) Source: EPA, *Compilation of Air Pollutant Emission Factors* (AP-42), Chapter 5.2, Emission Factors for Transportation and Marketing of Petroleum Liquids (January 1995).
(2)	Assumes S factor for splash loading dedicated normal service. AP-42, Table 5.2-1.
(3)	Vapor pressure for distillate fuel oil no. 2 obtained from TANKS 4.0.
(4)	Vapor molecular weight for distillate fuel oil no. 2 obtained from TANKS 4.0.
(5)	Temperature in F of bulk liquid for distillate fuel oil no. 2 is provided by TANKS 4.0 as a function of the specified meteorological data. By default this cell assumes Las Vegas meteorological data will be utilized, but the appropriate value should be determined based on the location of the fuel unloading.
(6)	Fuel is delivered to the site by rail. This rail traffic is included in Line Haul emissions.
(7)	Assumes total amount of fuel consumed by line haul and switch cycle locomotives is unloaded from rail car to storage tank.

FACILITIES – EXHAUST	
(1)	Assumes permanent power supplied to facilities; generators are not required.
(2)	Equipment list represents anticipated vehicles to be based at each facility. It is assumed that roughly one-half of the workforce would be operating a pickup.

Air Emissions During Operations – Rail Traffic

	Line Haul		
Basis for Analysis	Max. bhp-hr per locomotive	4,000	
	Locomotives per train	2	
	Hours per Roundtrip	24	
	Trips per Week	20	
	Hours per Week	960	
	Emission Factors (g/bhp-hr)	Emissions (lb/hr)	Emissions (tons/year)
NO_x	5.5	48.49	1,210.0
PM/PM_{10}	0.2	1.76	44.0
CO	1.5	13.22	330.0
VOC	0.3	2.64	66.0
SO_x	0.005	0.04	1.1
	Switch Cycle		
Basis for Analysis	Max. bhp-hr per locomotive	2,000	
	Locomotives per train	3	
	Hours Per Day	40	
	Days Per Week	5	
	Hours Per Week	600	
	Emission Factors (g/bhp-hr)	Emissions (lb/hr)	Emissions (tons/year)
NO_x	8.100	35.71	557.0
PM/PM_{10}	0.240	1.06	16.5
CO	2.400	10.58	165.0
VOC	0.600	2.64	41.3
SO_x	0.005	0.02	0.3

Note: Number of locomotives assumes one switch engine at the Hawthorne staging yard operating 8 hours per day, and two switch engines at the EOL facility, each operating 10 hours per day.

Air Emissions During Operations – Fuel Tanks

Fuel Storage – TANKS Inputs				
Meteorological Data Used in Emissions Calculations:				
Dimensions/Design	Facility	Hawthorne Staging Yard	MOW	EOL
	Tank Name/Number	T-0001INT	T-0001MOW	T-0001EOL
	Orientation (horizontal/vertical)	Vertical	Vertical	Vertical
	Shell Height (ft)			38.2
	Diameter (ft)			30
	Maximum Liquid Height (ft)			37
	Avg. Liquid Height (ft)			20
	Net Throughput (gal/year)			5.0 MM
	Tank Heated (yes/no)			no
	If yes:			
	Average Liquid Surface Temperature (F)			-
	Minimum Liquid Surface Temperature (F)			-
	Maximum Liquid Surface Temperature (F)			-
	Bulk Liquid Temperature (F)			-
Paint Conditions	Shell Color			white
	Shell Condition (Good/Poor)	Good	Good	Good
	Roof Color/Shade			white
Roof Characteristics	Roof Condition (Good/Poor)	Good	Good	Good
	Roof Type (for example, floating or fixed, external or internal)			external floating
	Roof Height (ft)			38.2
	Radius (ft) (Dome Roof)			NA
Breather Vent Settings	Vacuum Settings (psig)	TANKS default	TANKS default	TANKS default
	Pressure Settings (psig)	TANKS default	TANKS default	TANKS default
Contents		No. 2 fuel oil	No. 2 fuel oil	No. 2 fuel oil

Air Emissions During Operations – Fuel Tanks

Methodology: This methodology for estimating emissions from fuel storage tanks is the use of EPA's TANKS 4.0 program. This program provides emission estimates for standing and working losses based on user-supplied information on the tanks and liquid to be stored. The following table reflects the required user-supplied information in the order requested by the program. The user must specify meteorological data from a location with a similar climate to that of tank location. The TANKS 4.0 program contains data for Las Vegas and Ely, Nevada. This template assumes one tank per facility. Additional columns can be added to account for additional tanks.

Fuel Unloading Parameter	Value
Saturation Factor (S)	1.45
True Vapor Pressure (psia) (P)	0.0088
Molecular Weight of Vapors (lb/lb-mole)	130
Temperature of bulk liquid (T)	527
Loading Loss (L_L) (lb/1,000 gal)	0.04
Fuel Unloaded (1,000 gal per year)	5,000
Total (lb/year)	196

Air Emissions during Operations – Vehicle Exhausts at Facilities

	Equipment Type	Quantity	HP	Annual Hours of Operation
Hawthorne Staging Yard				
Professional	Pickup	4	250	2,000
Labor	Pickup	4	250	4,000
Clerical	Pickup	1	250	500
Maintenance equipment				
Crew-cab pickup		2	400	3,000
Boom truck		2	400	2,000
Utility vehicle		1	250	1,500
MOW Facility (Silver Peak or Klondike)				
Professional	Pickup	5	250	2,500
Labor	Pickup	3	250	3,000
Clerical	Pickup	1	250	500
Maintenance equipment				
Crew-cab pickup	Pickup	2	400	3,000
Boom truck	Pickup	1	250	1,000
Utility vehicle	Pickup	1	250	1,500
EOL Facility				
Professional	Pickup	8	250	4,000
Labor	Pickup	3	250	3,000
Clerical	Pickup	1	250	500
Maintenance equipment				
Crew-cab pickup		1	400	1,000
Boom truck		2	400	1,000
Utility vehicle		1	250	1,000
Total		**43**		**35,000**

Note: Operating equipment is not expected at the Train Control Center (TCC).

Appendix D
Modeling Inputs Requested for Socioeconomic Modeling

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Table D-1. REMI Inputs – Construction of Rail Line

Input Description	Professional	Clerical	Craftsman	Total
CONSTRUCTION CREWS, TOTAL EMPLOYMENT				
Year 1	240	120	1,800	2,160
Year 2	240	120	1,800	2,160
Year 3	240	120	1,800	2,160
Year 4	80	40	630	750
Year 5	60	30	280	370
Total	860	430	6,310	7,600
Construction personnel per camp (approximate; actual numbers may vary)	40	20	300	360

Input Description	Input Value	Units	Notes
Number of camps operational at any given time	6	camps	
Number of workers not in camps	60	persons	(7)
Mineral	40	persons	
Esmeralda	5	persons	
Nye	15	persons	
Construction schedule	56	months	
Average wage rate or total wages ($)			(1)
CONSTRUCTION FEATURES			
BATCH PLANTS	1		(5)
Total number batch plants in each county			
Mineral	0	each	
Esmeralda	0	each	
Nye	1	each	
Schedule for constructing batch plant	2	weeks	
Estimated costs to construct batch plant ($)	$500,000		
Estimated number workers needed to *construct* batch plant	10	persons	
Estimated number of workers needed to *operate* batch plant	5	persons	
CONSTRUCTION CAMPS			(2)
Total number of work camps operational at any given time	6	sites	
Total number of potential construction camp sites	10	sites	

Table D-1. REMI Inputs – Construction of Rail Line

Total number camp sites in each county			
Mineral	4	each	
Esmeralda	3	each	
Nye	3	each	
Schedule for constructing work camp (no. of weeks)	26	weeks	
Schedule for manning work camps (for example, all 6 active at one time)	12	months	
Estimated cost to construct each work camp ($)	$6,300,000		
Estimated cost to operate each work camp ($)	$300,000	month	
Estimated number of workers to construct work camps	60	per camp	
Estimated number of workers to operate work camps	90	per camp	
Minimum estimated camp population	50	per camp	
QUARRY SITES			(3)
Total number ballast areas in each county			
Mineral	1		
Esmeralda	1		
Nye	0		
Schedule for establishing ballast sites	6	months	
Estimated pre production costs for ballast sites ($)			
Mineral	$13,000,000		(4)
Esmeralda	$13,000,000		
Nye	$0		(4)
Estimated operation and maintenance costs for ballast sites ($)			
Mineral	$100,000,000		(4)
Esmeralda	$100,000,000		
Nye	$0		(4)
Estimated number workers needed to *establish* ballast sites	30		
Estimated number of workers needed to *operate* ballast sites	30		
Estimated number of workers needed to *reclaim* ballast sites	30		
WELLS			
Total number of wells in each county			(3)
Lyon	5	each	
Churchill	1	each	
Mineral	15	each	
Esmeralda	21	each	
Nye	43	each	

Table D-1. REMI Inputs – Construction of Rail Line

Estimated cost to drill each well, excluding contingency ($)	$179,000			(4)
Contingency costs for well construction (as % total costs)	25	percent		
Estimated cost to construct each well ($)	$100,000			
Estimated cost to operate each work camp ($)	$300,000	month		
Estimated number of workers to construct wells	70	persons		
Estimated number of workers to operate wells	20	persons		
ROAD IMPROVEMENTS				(6)
Estimated length of upgrades (mi)				
Schedule for upgrades (no. of weeks)				
Estimated length of new road construction (mi)	9	miles		
Schedule for new construction (no. of months)	9	months		

Notes: 1) Average wage rate to be determined by RA EIS contractor.
2) Camp details provided in *Construction Plan, Mina Rail Corridor* (NRP 2007d).
3) Assumes two quarries, one at Garfield Hills and the other at Malpais Mesa South. Cost based on information in *Ballast Sourcing Cost Analysis* (Shannon & Wilson 2005).
4) Source: *Comparative Cost Estimates, Mina Rail Corridor* (NRP 2007c)
5) Assumes one plant at the Beatty Wash Bridge; the facility will be mobile.
6) Road improvements are for construction of new access roads to the Hawthorne staging yard and the MOW facilities.
7) Assumes that the construction personnel who are not in camps are included in the totals shown above; assumes that some camps would not be fully occupied.

Table D-2. REMI Inputs – Construction of Facilities

Input Description	Input Value		Notes
Hawthorne Staging Yard			
Estimated costs to construct facility, excluding contingency ($)	$16,575,000		(1)
Contingency costs for facility construction (as % total costs)	30	percent	
Schedule for constructing (no. of weeks)	52	weeks	(2)
Estimated number workers need to construct facility	110	persons	(3)
MOW (Silver Peak)			
Estimated costs to construct facility, excluding contingency ($)	$11,733,000		(1)
Contingency costs for facility construction (as % total costs)	30	percent	
Schedule for constructing (no. of weeks)	52	weeks	(2)
Estimated number workers need to construct facility	60	persons	(3)
EOL (with Trackage for Cask Maintenance Facility)			
Estimated costs to construct facility, excluding contingency ($)	$51,755,000		(1)
Contingency costs for facility construction (as % total costs)	30	percent	
Schedule for constructing (no. of weeks)	88	weeks	(2)
Estimated number workers need to construct facility	150	persons	(3)

Notes 1) Source: *Comparative Cost Estimates, Mina Rail Corridor* (NRP 2007c). Costs shown do not include construction estimate contingency, costs for engineering design, or related program costs such as land acquisition and program administration).
2) Source: *Facilities–Design Analysis Report, Mina Rail Corridor* (NRP 2007f).
3) Construction crew size is exclusive of other crew needs for track grading, structures, or placement.

Table D-3. REMI Inputs – Operation of Rail Line

Input Description	Input Value		Notes
TRAIN CREW			
Average number of trains per week (2014-2037)	20		(1)
Number of rail crews per week	6	each	
Number of employees in each rail crew	2	persons	
Average annual wage for rail crew employee	$100,000		
Schedule for number of trains per week	2034		(2)
Peak number of trains per week	20		
Per diem spending by train crew			
Standard meal per diem ($)	$30		(3)
Standard lodging per diem ($)	$80		(4)
Number of train trips per crew	10	trips	(5)
Number of overnights per week per train rider			
Number of train-riding workers with contingency			
Number of train-riding workers without contingency			
Weeks per year the trains run	50	weeks	(6)
Costs of operating rail line that are not already included in costs of operating ancillary facility ($)	$1,200,000	annual	(7)
Administrative workers	$150,000		(8)

Notes: 1) Based on peak year.
2) Assume operation of rail line peaks in the year 2034.
3) Value shown is based on an assumed total cost of meals per week.
4) Value shown is based on an assumed total aggregate room nights per trip.
5) Assumes that one trip does not lay over.
6) Assumes no operations during Christmas holiday season.
7) Includes locomotive maintenance, signals and communications maintenance, track renewal, related track and rail line maintenance materials.
8) Includes salary cost for two administrative staff persons to maintain personnel records and related human resources duties.

Table D-4. REMI Inputs – Operation of Facilities

Input Description	Input Value		Notes
Hawthorne Staging Yard			
Total estimated number operations workers (per day)	40		
Professional	4		
Labor	35		
Clerical	1		
Estimated costs to operate facility ($)	$120,000	per year	(1)
Schedule for operations (no. of weeks)			(2)
MOW Facility			
Total estimated number operations workers (per day)	40		
Professional	5		
Labor	30		
Clerical	5		
Estimated costs to operate facility ($)	$120,000	per year	(1)
Schedule for operations (no. of weeks)			(2)
EOL Facility			
Total estimated number operations workers (per day)	40		(3)
Professional	11		
Labor	25		
Clerical	4		
Estimated costs to operate facility ($)	$120,000	per year	(1)
Schedule for operations (no. of weeks)			(2)

Notes: 1) Estimated costs to operate facilities (staging yard, MOW facility, and EOL facility) include costs for yard utilities (sewer, water, power), building maintenance, solid waste disposal, and administrative costs (copy/fax machines, computers, etc.).
2) Schedule of operations for ancillary facilities will be for life of the Repository project.
3) TCC would employ approximately 15 people who could be located at either the Hawthorne staging yard or the EOL facility.

Table D-5a. REMI Inputs – Estimated Gallons of Fuel Consumed by Category by Year for the NRL (1)

Year	Waste Shipments					Repository Shipments		Commercial Shared Use (3)	Road Haul Total	Switching	Total Gallons	
	Commercial SNF	Commercial HLW	DOE SNF	Navy	Other (2)	Repository Construction	Fuel Oil				DOE Only	Including Shared Use
1	24,000	48,000	5,000	3,000	79,000	176,000	31,000	743,000	1,109,000	349,000	715,000	1,458,000
2	65,000	94,000	10,000	3,000	87,000	176,000	62,000	991,000	1,488,000	349,000	846,000	1,837,000
3	70,000	94,000	22,000	3,000	91,000	176,000	62,000	1,239,000	1,757,000	349,000	867,000	2,106,000
4	108,000	94,000	34,000	3,000	99,000	176,000	62,000	1,239,000	1,815,000	349,000	925,000	2,164,000
5	127,000	94,000	43,000	6,000	96,000	176,000	62,000	1,239,000	1,843,000	349,000	953,000	2,192,000
6	147,000	94,000	29,000	10,000	96,000	176,000	62,000	1,239,000	1,853,000	349,000	963,000	2,202,000
7	132,000	94,000	34,000	10,000	96,000	176,000	62,000	1,239,000	1,843,000	349,000	953,000	2,192,000
8	132,000	94,000	34,000	10,000	96,000	176,000	62,000	1,239,000	1,843,000	349,000	953,000	2,192,000
9	125,000	103,000	34,000	10,000	99,000	176,000	62,000	1,239,000	1,848,000	349,000	958,000	2,197,000
10	127,000	106,000	34,000	10,000	103,000	176,000	62,000	1,239,000	1,857,000	349,000	967,000	2,206,000
11	127,000	106,000	34,000	10,000	84,000	176,000	62,000	1,239,000	1,838,000	349,000	948,000	2,187,000
12	130,000	106,000	34,000	10,000	111,000	0	62,000	1,239,000	1,692,000	349,000	802,000	2,041,000
13	139,000	111,000	34,000	10,000	115,000	0	62,000	1,239,000	1,710,000	349,000	820,000	2,059,000
14	137,000	115,000	36,000	10,000	115,000	0	62,000	1,239,000	1,714,000	349,000	824,000	2,063,000
15	132,000	120,000	41,000	10,000	118,000	0	62,000	1,239,000	1,722,000	349,000	832,000	2,071,000
16	137,000	123,000	34,000	10,000	99,000	0	62,000	1,239,000	1,704,000	349,000	814,000	2,053,000
17	135,000	123,000	38,000	10,000	120,000	0	62,000	1,239,000	1,727,000	349,000	837,000	2,076,000
18	147,000	70,000	38,000	10,000	103,000	0	62,000	1,239,000	1,669,000	349,000	779,000	2,018,000
19	142,000	0	38,000	10,000	96,000	0	62,000	1,239,000	1,587,000	349,000	697,000	1,936,000
20	142,000	0	38,000	10,000	96,000	0	62,000	1,239,000	1,587,000	349,000	697,000	1,936,000
21	135,000	0	38,000	10,000	96,000	0	62,000	1,239,000	1,580,000	349,000	690,000	1,929,000
22	135,000	0	38,000	10,000	84,000	0	62,000	1,239,000	1,568,000	349,000	678,000	1,917,000
23	137,000	0	38,000	0	89,000	0	62,000	1,239,000	1,565,000	349,000	675,000	1,914,000
24	94,000	0	41,000	0	70,000	0	62,000	1,239,000	1,506,000	349,000	616,000	1,855,000
25	17,000	0	0	0	22,000	0	62,000	1,239,000	1,340,000	349,000	450,000	1,689,000
26	0	0	0	0	14,000	0	62,000	1,239,000	1,315,000	349,000	425,000	1,664,000
27	0	0	0	0	12,000	0	62,000	1,239,000	1,313,000	349,000	423,000	1,662,000

Table D-5a. REMI Inputs – Estimated Gallons of Fuel Consumed by Category by Year for the NRL (1)

Year	Waste Shipments					Repository Shipments		Commercial Shared Use (3)	Road Haul Total	Switching	Total Gallons	
	Commercial SNF	Commercial HLW	DOE SNF	Navy	Other (2)	Repository Construction	Fuel Oil				DOE Only	Including Shared Use
28	0	0	0	0	12,000	0	62,000	1,239,000	1,313,000	349,000	423,000	1,662,000
29	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
30	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
31	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
32	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
33	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
34	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
35	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
36	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
37	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
38	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
39	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
40	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
41	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
42	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
43	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
44	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
45	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
46	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
47	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
48	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
49	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
50	0	0	0	0	0	0	62,000	1,239,000	1,301,000	174,000	236,000	1,475,000
Total	2,943,000	1,789,000	799,000	188,000	2,398,000	1,936,000	3,069,000	61,206,000	74,328,000	13,600,000	26,722,000	87,928,000

Notes: 1) All values in gallons, rounded to nearest 1,000 gal.
2) Includes site-specific cask and waste packages.
3) Mid-range estimate of commercial shared-use traffic.

Table D-5b. Estimated Annual Fuel Consumption During Construction

Parameter		CRC	MRC
Diesel			
Total Hours during Grading Activities		2,819,000	2,619,000
Average Diesel Fuel Consumption (gal/hr)	(1)	11.0	11.0
Estimated Diesel Fuel Consumption (gal)		31,009,000	28,809,000
Total Diesel Fuel Consumed in Nevada during 2004 (gal)	(2)	478,296,000	478,296,000
NRL Consumption during Construction as a Percentage of Nevada Consumption		6.5%	6.0%
Gasoline			
Total Hours during Grading Activities		3,175,400	2,414,300
Average Diesel Fuel Consumption (gal/hr)		3.0	3.0
Estimated Diesel Fuel Consumption (gal)		11,908,000	9;054,000
Total Diesel Fuel Consumed in Nevada during 2004 (gal)		1,094,058,000	1,094,058,000
NRL Consumption during Construction as a Percentage of Nevada Consumption		1.1%	0.8%

Notes: 1) Source: NRP calculations.
2) Source: http://tonto.eia.doe.gov/state/state_energy_profiles.cfm