Appendix G

Air Quality

G.0 Air Quality

Impacts to air quality would result from construction activities. Operation of the Effluent Interceptor (EI) and Lake Conveyance System (LCS) would not result in impacts to air quality.

Construction of the EI and LCS would require the following actions or activities:

- Installation of erosion controls, clearing and staging area preparation;
- Excavation and placement of pipeline;
- Backfilling, compaction and grading of disturbed soils over installed pipeline;
- Construction and installation of manways;
- Grading and paving of "chat" trails;
- Shaft excavation;
- Tunnel excavation;
- Tunnel lining and grouting;
- Shaft lining and backfill;
- Dredging of sediments from Lake Mead;
- Fusing of the High-density Polyethylene (HDPE) pipe;
- Construction of ancillary facilities and structures; and
- Ongoing final grading and re-vegetation of disturbed soils as projects are completed.

In order to assess potential impacts to air resources from construction activities, the magnitude of the air pollutants emitted during the different construction segments were estimated. This included an estimation of fugitive dust emissions from soil disturbances and criteria pollutants emissions from construction equipment exhaust.

G.1 Fugitive Dust Emissions

Fugitive dust is produced from soil disturbances, materials handling, transfer and storage, and vehicle traffic at the construction sites. Fugitive dust emissions from soil disturbances and movement of construction equipment are estimated using the amount of soil to be disturbed and emission factors based on Section 13.2.3 of AP-42 (EPA 1995a). For this analysis, fugitive dust emissions are those emissions that would be generated from construction activities during a one-month period. This time period was selected because Clark County regulations for active construction sites require stabilization of disturbed soils within one month.

The majority of particles generated from the mechanical disturbance of soil are coarse particles, typically ranging from 10 to 1,000 microns (μm) in aerodynamic diameter. Ground-level emissions of mechanically generated particles are likely to be removed close to the source due to gravitational settling and impaction on nearby obstacles (Countess 2001). A study (Chow et al. 1999) found that up to one-half the mass of dust generated from construction activities does not attain an elevation above 6.6 ft (2 meter [m]).

A particle would be removed from the ambient air by gravitational settling if the time it takes the particle to settle to the ground is less than the time it takes the volume of air containing the particle to leave the site. The time it takes for a particle to settle to the ground due to gravity is called the gravitational settling time. The gravitational settling time can be estimated from the terminal velocity of the particle and the elevation at which the particle is released. The time for the volume of air that contains the particle to leave the site can be determined from the wind speed and the distance to the boundary of the property.

At a temperature of 80 degree Fahrenheit (ºF) (27 degree Celsius [ºC]), a soil particle with an aerodynamic diameter of 10 µm has a terminal velocity of 0.0116 feet per second (0.004 m/second). When this particle is released at a height of 6.6 ft (2 m), it takes 564 seconds for the particle to reach the ground. During this same amount of time, using the average daytime wind speed for the Las Vegas area (3.85 mile per hour [mph] [6196 m/hour]), if the particle encounters no obstacles, it would travel approximately 3,185 ft (971 m) horizontally in the direction the wind blows. A particle with an aerodynamic diameter of 15 µm would reach the ground in about 251 seconds.

Because gravitational settling and obstacles would be present to reduce the travel of coarse-sized particles (>10 µm) from the site, impacts to air resources would focus on fugitive dusts with an aerodynamic diameter less than 10 µm. These particles are more likely to become entrained in the ambient air.

Fugitive dust emissions are estimated for dust generated by construction activities that is classified as particulate matter less than 10 µm in diameter (PM_{10}). Fugitive dust emissions have been estimated for the case where no controls are used to reduce formation of dust and for the case where construction activities are conducted in compliance with Clark County air quality regulations. To estimate uncontrolled PM_{10} emissions from earth disturbances, an emission factor of 0.42 tons PM_{10} per acre per month is used. This value comes from the PM_{10} State Implementation Plan for Clark County (Clark County 2001). Fugitive dust emissions for each segment of the EI and the LCS alternatives are provided in Table G.1-1.

G.2 Construction Equipment Exhaust Emission Factors

To estimate exhaust emissions from construction equipment, the emission standards (40 CFR 89.112) promulgated for non-road equipment diesel engines were used for most criteria pollutants. Sulfur dioxide (SO_2) emissions from non-road diesel engines are not regulated as an emission standard, rather the sulfur content of diesel fuel is regulated.

Sulfur dioxide emissions are directly proportional to the sulfur content of the fuel. A maximum fuel sulfur content of 500 parts per million (ppm)[1] by weight and brake-specific fuel consumption of 0.325 lb-fuel per horsepower (hp) -hour was used to estimate SO_2. The brake-specific fuel consumption is the amount of fuel consumed by the engine to produce the rated horsepower for a period of one hour.

[1] Current regulatory standard for diesel fuel.

Table G.1-1. Fugitive Dust (PM_{10}) Emissions from Construction Activities.

Source	Construction Disturbance[1] (ft^2)	Uncontrolled PM_{10} Emissions[2] (tons)	Uncontrolled PM_{10} Emissions[3] (tons/year)	PM_{10} Emissions after Controls[4] (tons)	PM_{10} Emissions after Controls[3] (tons/year)
EI-Alignment A 28 mos.)[5]					
Reach 1	1,245,625	12.0	-----	6.0	-----
Reach 2	1,290,000	12.4	-----	6.2	-----
Reach 3	161,172	1.6	-----	0.8	-----
COH Forcemain	434,625	4.2	-----	2.1	-----
AWT Pipeline	6,050	0.1	-----	0.0	-----
CCWRD Conn.	10,425	0.1	-----	0.1	-----
EI Terminus	1,021	0.0	-----	0.0	-----
Total		30.4	13.0	15.2	6.5
EI-Alignment B (28 mos.)					
Reach 1	1,245,625	12.0	-----	6.0	-----
Reach 2	1,314,565	12.7	-----	6.3	-----
Reach 3	161,172	1.6	-----	0.8	-----
South lateral	737,645	7.1	-----	3.6	-----
AWT Pipeline	6,050	0.1	-----	0.0	-----
CCWRD Conn.	10,425	0.1	-----	0.1	-----
EI Terminus	377,500	3.6	-----	1.8	-----
Total		37.2	15.9	18.6	8.0
Boulder Islands North LCS					
NRMT3-West Tunnel (35 mos.)	450,000	4.3	1.5	2.2	0.7
NRMT3-East Tunnel (67 mos.)	450,000	4.3	0. 8	2.2	0.4
BINDP (15 mos.)	363,000	3.5	1.8	3.5	1.8
HPRS	43,560	0.4	0.2	0.4	0.2
Total		12.5	3.5	8.3	3.1
Boulder Islands South LCS					
SRMT3-West Tunnel (35 mos.)	450,000	4.3	1.5	2.2	0.7
SRMT3-East Tunnel (67 mos.)	450,000	4.3	0.8	2.2	0.4
BISOP (8 mos.)	440,000	4.2	4.2	2.1	2.1
BISDP (15 mos.)	126,500.0	1.2	0.6	1.2	0.6
Total		14.0	7.1	7.7	3.8

Las Vegas Bay LCS					
LVBT1 (39 mos.)	450,000	4.3	1.3	2.2	0.7
LVBT2 (64 mos.)	456,000	4.4	0.8	2.2	0.4
Las Vegas Bay Diffuser (6 mos.)	360,000	3.5	3.5	1.7	1.7
Total		12.2	5.6	6.1	2.8

Notes:
1. Soil disturbed is from cut-and-cover construction, staging areas, chat trail construction and tunnel retrieval and working shafts.
2. Fugitive dust emissions reported only for dust with an aerodynamic diameter less than or equal to ≤ 10 µm. Uncontrolled PM_{10} emissions from earth disturbances were calculated using an emission factor of 0.42 tons PM_{10} per acre (i.e. 3,148,917.5 ft^2 ÷ 4,3560 [ft^2 per acre] = 72.3 acres x 0.42 [tons per acre] = 30.36 tons). The value of 0.42 tons PM_{10} per acre comes from the PM_{10} State Implementation Plan (SIP) for Clark County (Clark County 2001).
3. Emissions per year were calculated by dividing total emissions (tons) by number of construction months and then multiplying by 12 months. (i.e. 30.36 tons ÷ 28 months = 1.08428 tons per month x 12 months = 13.01 tons per year)
4. Controls include those required in the Clark County SIP for construction activities (Clark County 2001). Controlled PM_{10} emissions were calculated using an emission factor of 0.21 tons PM_{10} per acre.
5. The number of months (mos.) for construction is indicated in parenthesis.

SO_2 emission factor =
(500 lb-S/1000000 lb-fuel) x (0.325 lb-fuel/hp-hr) x (1 mole-S/32 lb-S) x
(1 mole-SO_2/1 mole-S) x (64 lb-SO_2/1 mole-SO_2) x 453.6 grams/lb
SO_2 emission factor = 0.147 grams/hp-hr

Emission factors for other criteria pollutants are listed in Table G.2-1. The emission factors are given in grams of pollutant per horsepower-hour.

Table G.2-1 Construction Equipment Emission Factors.

Rated Power (hp)	Model Year Standard	NO_x + VOC (g/hr)	CO (g/hr)	PM_{10} (g/hr)
100 < size ≤ 175	2003	4.9	3.7	0.22
175 < size ≤ 300	2003	4.9	2.6	0.15
300 < size ≤ 600	2001	4.8	2.6	0.15
600 < size ≤ 750	2002	4.8	2.6	0.15
100 < size ≤ 175	2007	3.0	3.7	0.22
175 < size ≤ 300	2006	3.0	2.6	0.15
300 < size ≤ 600	2006	3.0	2.6	0.15
600 < size ≤ 750	2006	3.0	2.6	0.15

G.3 On-road Diesel Vehicle Emission Factors

Emissions of nitrogen dioxide (NO_x) and PM_{10} from on-road vehicles such as haul trucks and water trucks that are present at the construction sites were estimated using 2004 calendar year emission standards codified in 40 CFR Part 86. The SO_2 emission factor was calculated in the same manner as non-road engines, but a sulfur content of 15 ppm in fuel was used. This is because the sulfur content of diesel fuel used in on-road engines cannot exceed 15 ppm after 2006. Engine emissions testing data[2] was used to determine an average emission factor for CO emissions from on-road engines. This same data was used to determine an average brake-specific horsepower for estimating the SO_2 emission factor. Emission factors for on-road engines are listed in Table G.3-1.

G.4 Construction Equipment for Cut-and-Cover Activities

The equipment listed in Table G.4-1 was assumed to be part of daily operations at each construction site for cut-and-cover construction associated with installation of the pipeline. The hourly exhaust pollutant emissions provided in the table assume that the equipment is operating continuously during the hour.

Table G.3-1 On-road Diesel Emission Factors.

Pollutant	Emission Factor (g/hp-hr)
PM_{10}	0.1000
NO_x + VOC	2.5000
CO	0.3450
SO_2	0.0050

Table G.4-1 Cut-and-Cover Construction Equipment and Hourly Pollutant Emissions.

Equipment	Size (hp)	Number Per Day	CO (g/hr)	SO_2 (g/hr)	NO_x +VOC (g/hr)	PM_{10} (g/hr)
Backhoe/Front-end Loader	115	1	425.5	16.9	563.5	25.3
D-6 Dozer	175	1	455.0	25.7	857.5	38.5
Compactor	250	1	650.0	36.8	1,225.0	37.5
Grader	175	1	455.0	25.7	857.5	38.5
65-ton Crane	250	1	650.0	36.8	1,225.0	37.5
Haul Trucks	350	54	845.6	12.3	6,125.0	245.0
Water Truck	350	1	120.8	1.8	875.0	35.0

[2] Information provided by Mack Trucks Inc. to the Maryland Department of the Environment, March 2004. Data for model year 2004 engines whose size ranges from 350 to 460 hp.

G.5 Construction Equipment for Tunneling

The equipment listed in Table G.5-1 would be used in different phases of tunnel construction. The maximum daily number of each type of equipment is presented in the table. Hourly emissions from construction equipment, assuming continuous operation is also presented.

Table G.5-1 Tunneling Construction Equipment and Hourly Pollutant Emissions.

Equipment	Size (hp)	Number Per Day	CO (g/hr)	SO_2 (g/hr)	NO_x + VOC (g/hr)	PM_{10} (g/hr)
Bulldozer	175	1	425.5	16.9	563.5	25.3
Grader	175	1	425.5	16.9	563.5	25.3
65-ton Crane	250	1	650.0	36.8	1,225.0	37.5
Delivery/Haul Trucks	350	70	1,087.0	15.8	7,875.0	315.0
Water Truck	350	1	120.8	1.8	875.0	35.0
Tunnel Boring Machine	--	--	--	--	--	--

G.6 Construction Equipment for Fabrication of Sub-aqueous Diffuser Sections

The diffuser sections for the LCS would require dredging of sediments from Lake Mead, fusing HDPE pipeline, laying the pipeline in Lake Mead, and covering the pipeline so it remains in place. Barges would be used to hold equipment used for the dredging and pipe installation. A clamshell dredge mounted on a crane would be used to remove sediments from Lake Mead. Another crane would be used to load the dredged material into haul trucks for disposal. A small tugboat or workboat would be available as needed to move the barges. Equipment and hourly emissions of criteria pollutants are given in Table G.6-1.

Table G.6-1 Diffuser Construction Equipment and Hourly Pollutant Emissions.

Equipment	Size (hp)	Number Per Day	CO Emissions (g/hr)	SO_2 Emissions (g/hr)	NO_x + VOC Emissions (g/hr)	PM_{10} Emissions (g/hr)
65-ton Crane	250	1	650.0	36.8	1225.0	37.5
75-ton Crane	350	1	910.0	51.5	1680.0	52.5
Backhoe/Front-end Loader	175	1	425.5	16.9	563.5	25.3
Grader	195	1	507.0	28.7	955.5	29.3
Haul Trucks	350	30	483.2	7.0	3500.0	140.0

G.7 Estimation of Emissions

Although a variety of construction equipment is needed for construction of the EI and LCS alternatives, not all construction activities occur simultaneously. To determine impacts to air resources, the first step was to determine what 12-month sequence of construction activities resulted in the maximum number of construction equipment used on the site. This was determined from the proposed construction schedule and sequencing of construction activities. The *RSMeans Heavy Construction Cost Data* manual (Reed Construction Data 2003) was used to determine the type and size equipment used for the various construction activities, as well as the daily construction progress. The daily construction progress estimate was used for the determination of the number of material delivery trucks and haul trucks needed to support the construction activities.

In addition, for all construction activities, a maximum of three diesel support vehicles and three gasoline-fueled support vehicles are assumed to operate continuously throughout the day. Based on these estimates, the worst-case 12-month construction period emissions were determined, assuming an 8-hour day, 6 days per week. These estimates are provided in Tables G.7-1 through G.7-5 for EI-Alignment A, EI-Alignment B, Boulder Island North LCS, Boulder Islands South LCS, and Las Vegas Bay LCS.

Table G.7-1. EI- Alignment A Maximum Daily Construction Equipment Exhaust Pollutant Emissions.

Equipment	Maximum on site per hour	CO emissions (g/hr)	NO_x + VOC emissions (g/hr)	PM_{10} emissions (g/hr)	SO_2 emissions (g/hr)
65-ton Crane	3	1,950	3,675	112.5	110.4
Front-end loader	3	1,277	1,691	75.9	50.7
Grader	3	1,365	2,573	115.5	77.1
Dozers	3	1,365	2,573	115.5	86.1
Water Trucks	2	242	1,750	70	3.5
Haul Trucks for excavated materials	4	483	3,500	140	7
Haul Trucks for fill material	2	242	1,750	70	3.5
Pipe delivery trucks	1	121	875	35	1.8
Support vehicles – diesel	3	362	2,625	105	10.5
Support vehicles – gasoline	3	375	45	9	5.3
Total Hourly Emissions (g/hr)	--	**7,781.1**	**21,056.0**	**848.4**	**355.8**
Total Daily Emissions (lb/day)	--	**137.3**	**371.4**	**15.0**	**6.3**
12-month emissions (tons)	--	**21.4**	**57.9**	**2.3**	**1.0**

Table G.7-2 EI-Alignment B Maximum Daily Construction Equipment Exhaust Pollutant Emissions.

Equipment	Maximum On Site Per Hour	CO Emissions (g/hr)	NO_x + VOC Emissions (g/hr)	PM_{10} Emissions (g/hr)	SO_2 Emissions (g/hr)
65-ton Crane	4	2,600.00	4,900.00	150.00	147.20
Front-end Loader	4	1,702.00	2,254.00	101.20	67.60
Grader	4	1,820.00	3,430.00	154.00	102.80
Dozers	4	1,820.00	3,430.00	154.00	114.80
Water Trucks	3	362.40	2,625.00	105.00	5.30
Haul Trucks for Excavated materials	5	604.00	4,375.00	175.00	8.80
Haul Trucks for Fill Material	2	241.60	1,750.00	70.00	3.50
Pipe Delivery Trucks	1	120.80	875.00	35.00	1.80
Support Vehicles – Diesel	3	362.40	2,625.00	105.00	10.50
Support Vehicles – Gasoline	3	375.00	45.00	9.00	5.30
Total Hourly Emissions (g/hr)	--	10,008.20	26,309.00	1,058.20	467.40
Total Daily Emissions (lb/day)	--	176.51	464.00	18.66	8.24
12-month Emissions (tons)	--	27.54	72.38	2.91	1.29

Table G.7-3. Boulder Islands North LCS - Maximum Daily Construction Equipment Exhaust Pollutant Emissions.

Equipment	Maximum on site per hour	CO emissions (g/hr)	NO_x + VOC emissions (g/hr)	PM_{10} emissions (g/hr)	SO_2 emissions (g/hr)
Projected use for 12-month period					
Cranes	5	3,250	6,125	188	184
Pipe delivery trucks	5	604	4,375	175	9
Grout/Lining Trucks	12	1,450	10,500	420	21
Support trucks - diesel	3	362	2,625	105	11
Support trucks - gasoline	3	375	45	9	5
Projected use for 6-month period					
Cranes at 65 tons	2	1,300	2,450	75	74
Cranes at 75 tons	1	910	1,680	53	52
Pipe delivery trucks	5	604	4,375	175	9
Bulldozer	2	910	1,715	77	57
Scraper or Grader	1	455	858	39	29

Table G.7-3. Boulder Islands North LCS - Maximum Daily Construction Equipment Exhaust Pollutant Emissions (continued).

Equipment	Maximum on site per hour	CO emissions (g/hr)	NO_x + VOC emissions (g/hr)	PM_{10} emissions (g/hr)	SO_2 emissions (g/hr)
Water truck	1	121	875	35	2
Haul trucks	7	846	6,125	245	12
Support trucks – diesel	2	242	1,750	70	7
Support trucks – gasoline	2	250	30	6	4
Tug boat	1	--	--	--	--
Maximum Hourly Emissions (g/hr)	--	**11,678**	**43,527.5**	**1,671**	**474**
Maximum Daily Emissions (lb/day)	--	**206.0**	**767.8**	**29.5**	**8.4**
Rolling 12-month emissions (tons)	--	**32.1**	**119.8**	**4.6**	**1.3**

Table G.7-4 Boulder Islands South LCS - Maximum Daily Construction Equipment Exhaust Pollutant Emissions.

Equipment	Maximum on site per hour	CO emissions (g/hr)	NO_x + VOC emissions (g/hr)	PM_{10} emissions (g/hr)	SO_2 emissions (g/hr)
Projected use for 12-month period					
Cranes	6	3,900	7,350	225	221
Pipe delivery trucks	6	725	5,250	210	11
Grout/Lining trucks	14	1,691	12,250	490	25
Support trucks – diesel	3	362	2,625	105	11
Support trucks - gasoline	3	375	45	9	5
Projected use for 6-month period					
Cranes at 65 tons	2	1,300	2,450	75	74
Cranes at 75 tons	1	910	1,680	53	52
Pipe delivery trucks	6	725	5,250	210	11
Bulldozer	2	910	1,715	77	57
Scraper or grader	1	455	858	39	29
Water truck	1	121	875	35	2
Haul trucks	8	966	7,000	280	14
Support trucks – diesel	2	242	1,750	70	7
Support trucks – gasoline	2	250	30	6	4
Tug boat	1	--	--	--	--
Maximum Hourly Emissions (g/hr)		**12,932**	**49,127.5**	**1,883**	**519.5**
Maximum Daily Emissions (lb/day)		**228.1**	**866.6**	**33.2**	**9.2**
Rolling 12-month emissions (tons)		**35.6**	**135.2**	**5.2**	**1.4**

Table G.7-5 Las Vegas Bay LCS - Maximum Daily Construction Equipment Pollutant Emissions.

Equipment	Maximum on site per hour	CO emissions (g/hr)	NO_x + VOC emissions (g/hr)	PM_{10} emissions (g/hr)	SO_2 emissions (g/hr)
Projected use for 12-month period					
Cranes	5	3,250	6,125	188	184
Pipe delivery trucks	5	604	4,375	175	9
Grout/Lining Trucks	12	1,450	10,500	420	21
Support trucks - diesel	3	362	2,625	105	11
Support trucks - gasoline	3	375	45	9	5
Projected use for 6-month period					
Cranes at 65 tons	2	1,300	2,450	75	74
Cranes at 75 tons	1	910	1,680	53	52
Pipe delivery trucks	5	604	4,375	175	9
Bulldozer	2	910	1,715	77	57
Haul trucks	4	483	3,500	140	7
Tug boat	1	--	--	--	--
Maximum Hourly Emissions (g/hr)	--	**10,248**	**37,390**	**1,416**	**427.6**
Maximum Daily Emissions (lb/day)	--	**180.8**	**659.6**	**25.0**	**7.6**
Rolling 12-month emissions (tons)	--	**28.2**	**102.9**	**3.9**	**1.2**

The information in Tables G.7-1 through G.7-5 was combined with Table G.1-1 to determine the worst-case, 12-month emission rates. Also determined are the combined emissions, should construction of the EI and LCS segments occur concurrently. The maximum, worst-case emissions are then compared to major source threshold levels for the air shed in which the construction would occur.

Major source threshold levels serve to define regulatory obligations and are threshold levels below which no adverse impact to air quality is expected. Air emissions from new stationary sources whose potential emissions are below threshold levels are presumed not to cause or contribute to an exceedance of the ambient air quality standards. Maximum, worst-case emissions are provided in Table G.7-6 along with major source threshold values for the Las Vegas Valley and Black Mountain airsheds (Figure 3.7-1).

Potential emissions of CO, PM_{10}, and SO_2 are below their respective threshold level for any individual or combined construction activities, no matter where the construction would occur. Therefore, emissions of these pollutants from construction activities are not likely to cause or contribute to an exceedance of the ambient air quality standards.

Table G.7-6 Worst-case 12-Month Potential Emissions from Construction Activities.

Construction Segment	CO emissions (ton/yr)	NO_x +VOC emissions (ton/yr)	PM_{10} emissions (ton/yr)	SO_2 emissions (ton/yr)
EI-Alignment A	21.4	57.9	2.3	1.0
EI-Alignment B	27.5	72.4	2.9	1.3
Boulder Island North LCS	32.1	119.8	4.6	1.3
Boulder Island South LCS	35.6	135.2	5.2	1.4
Las Vegas Bay LCS	28.2	102.9	3.9	1.2
EI-Alignment A & Boulder Island North LCS	53.6	177.7	6.9	2.3
EI-Alignment B & Boulder Island South LCS	63.1	207.6	8.1	2.7
EI-Alignment B and Las Vegas Bay LCS	55.7	175.3	6.8	2.5
Major Source Threshold Las Vegas Valley Airshed	70	50	70	100
Major Source Threshold Black Mountain Airshed	100	100	100	100
Major Source Threshold Conformity Determinations	70	100	70	100

Emissions of nitrogen oxides, however, are above the nonattainment area major source threshold and the attainment area major source threshold for construction for all scenarios. An area is classified as "attainment" for a pollutant if the concentration of the pollutant measured at official monitoring stations is equal to or below the NAAQS set for that pollutant.

Projects located on federal lands in nonattainment areas are subject to the conformity regulations if the potential pollutant emissions from both direct and indirect sources are above threshold levels. If the projected annual emissions from the proposed project exceed the major source threshold, a conformity determination is required. A conformity determination is completed by the federal agency that is sponsoring the project.

Pollutants subject to the conformity requirements include CO, PM_{10}, NO_x, and VOCs for projects located in the Las Vegas Valley airshed. The emissions from the EI segment for these pollutants are below the major source conformity levels; the emissions from the combined construction of the EI and LCS are above the conformity levels.

G.8 Estimation of Impacts

To determine if construction emissions of NO_x could cause an exceedance of the short-term National Ambient Air Quality Standards (NAAQS), a simple screen model (EPA SCREEN3 1995b) was executed to determine the maximum 1-hour concentration of each pollutant emitted from each source. Screening models incorporate assumptions that are overly conservative in order to provide assurance that the maximum concentration of the pollutant would not be under estimated. Assumptions used to execute the model include:

- Exhaust emissions from construction equipment and other mobile sources are modeled as point sources;
- Construction activities occur during daylight hours only;
- All construction equipment is active at the same time, maximizing worst-case hourly emissions;
- Exhaust diameter of 0.3 ft (0.1 m);
- Exhaust gas temperature of 450 K (350 ºF) ;
- Exhaust flow rate estimated from fuel usage and air/fuel ratio of 27:8; and
- No building downwash.

Assumptions inherent to the model include:

- Steady-state emissions of the pollutant;
- Gaussian dispersion of the pollutants; and
- No deposition or reactive gases.

The model was executed in order to obtain the hourly concentration of various pollutants at the edge of the construction ROWs, at the edges of staging areas, and at distances of approximately 500 ft (152 m), 1,000 (305 m), and 2,000 ft (610 m) from the construction sites. These values are provided in Table G.8-1.

Once the 1-hour maximum concentrations were determined for each pollutant, these values were converted into either a 3-hour, 8-hour, 24-hour, or annual averaging value in order to compare the impact of the project plus the existing background concentration to their respective NAAQS. Data is not presented for PM_{10}, because values at monitoring stations already exceed the NAAQS. Data are provided in Table G.8-2 for the maximum concentration that occurs at the edge of the ROW or staging area.

Predicted concentrations of CO and SO_2 plus background concentrations are well below the primary standards. This was expected, because the annual mass emission of these compounds was below the major source threshold. Emissions that are below major source threshold levels are presumed not to cause or contribute to a violation of the NAAQS. Since PM_{10} emissions are

well below major source threshold levels, these emissions are assumed not to cause or contribute to existing violations.

Predicted emissions of NO_x + volatile organic carbons (VOC), however are above the ambient air quality standard for NO_2. The estimate of an annual concentration based on the 1-hour maximum is overly conservative as it is based on continuous emissions occurring every hour of the day, 365 days per year. Further, nitrogen oxides emitted from construction equipment are reactive gases, which are likely to undergo chemical reactions as they disperse in the atmosphere. The SCREEN3 model used for this initial impact assessment does not account for removal of components due to atmospheric reactions.

Only about 4 percent of the NO_x + VOC emissions are attributed to VOC. The largest contributor to emissions is from delivery/haul truck traffic. Hourly emissions are based on calendar year 2004 diesel engine standards.

Table G.8-1 Short-term Modeled Pollutant Concentrations (µg/m3).

Construction Segment	Pollutant	Concentration at edge of ROW or staging area[1]	Concentration at 500 ft	Concentration at 1,000 ft	Concentration at 2,000 ft
EI-Alignment A	CO	420.0 (115)	381.5	201.8	129.6
	SO_2	19.9 (115)	18.5	9.2	6.2
	NO_x + VOC	1,052.4 (115)	906.8	501.8	319.1
	PM_{10}	43.3 (115)	37.2	20.2	13.0
EI-Alignment B	CO	547.0 (115)	496.7	261.3	168.2
	SO_2	26.2 (115)	24.4	12.1	8.2
	NO_x + VOC	1,344.3 (115)	1,151.5	631.7	403.5
	PM_{10}	55.3 (115)	47.3	25.3	16.4
Boulder Islands North LCS	CO	627.4 (295)	547.1	369.7	204.5
	SO_2	22.2 (295)	19.7	13.3	7.2
	NO_x + VOC	2,776.3 (295)	2,381.7	1,567.1	900.9
	PM_{10}	110.0 (295)	94.1	61.8	35.5
Boulder Islands South LCS	CO	646.0 (295)	562.9	380.0	210.5
	SO_2	22.4 (295)	19.9	13.5	7.3
	NO_x + VOC	2,911.0 (295)	2,495.9	1,641.3	944.4
	PM_{10}	115.3 (295)	98.7	64.8	37.2
Las Vegas Bay LCS	CO	622.5 (295)	554.7	376.7	219.4
	SO_2	23.4 (295)	21.4	14.8	8.6
	NO_x + VOC	2,367.3 (295)	2,057.2	1,368.0	799.6
	PM_{10}	90.1 (295)	77.9	51.6	30.2

Note:

[1] Shortest distance to ROW or staging was used (distance in parenthesis).

Table G.8-2 Modeled Maximum Impacts from Construction Equipment Exhausts (year 2004 Diesel Engines at Edge of ROW).

Construction Segment	Pollutant & Averaging Time	Maximum Construction Impacts[1]	Background Concentration	Total Impact	Primary Standard
EI-Alignment A	1-hour CO	0.4	7.2	7.6	35.0
	8-hour CO	0.3	3.0	3.259	9.0
	3-hour SO_2	0.02	0.05[2]	0.05	.50
	24-hour SO_2	0.00	0.01	0.01	.14
	Annual NO_x + VOC	0.040	0.027	0.067	0.053
EI-Alignment B	1-hour CO	0.5	7.2	7.7	35.0
	8-hour CO	0.3	3.0	3.3	9.0
	3-hour SO_2	0.01	0.05[2]	0.05	.50
	24-hour SO_2	0.00	0.01	0.01	.14
	Annual NO_x + VOC	0.057	0.027	0.084	0.053
Boulder Islands North LCS	1-hour CO	0.4	7.2	7.6	35.0
	8-hour CO	0.3	3.0	3.3	9.0
	3-hour SO_2	0.01	0.05	0.05	0.50
	24-hour SO_2	0.00	0.01	0.01	0.14
	Annual NO_x + VOC	0.100	0.027	0.127	0.053
Boulder Islands South LCS	1-hour CO	0.4	7.2	7.6	35.0
	8-hour CO	0.3	3.0	3.3	9.0
	3-hour SO_2	0.01	0.05	0.05	0.50
	24-hour SO_2	0.00	0.01	0.01	0.14
	Annual NO_x + VOC	0.100	0.027	0.127	0.053
Las Vegas Bay LCS	1-hour CO	0.4	7.2	7.6	35.0
	8-hour CO	0.3	3.0	3.3	9.0
	3-hour SO_2	0.01	0.05	0.05	0.50
	24-hour SO_2	0.00	0.01	0.01	0.14
	Annual NO_x + VOC	0.100	0.027	0.127	0.053

Notes:

[1] Values converted to ppm in order to compare to air quality standards.

[2] No monitored value reported. Estimate derived from 24-hour value.

Table G.8-3 provides concentrations plus background levels at a distance of 2,000 ft (610 m) from the source.

Table G.8-3 Modeled Impacts from Construction Equipment Exhausts (year 2004 Diesel Engines at 2,000 ft [610 m])

Construction Segment	Pollutant & Averaging Time	Maximum Construction Impacts[1]	Background Concentration	Total Impact	Primary Standard
EI-Alignment A	1-hour CO	0.1	7.2	7.3	35.0
	8-hour CO	0.1	3.0	3.1	9.0
	3-hour SO2	0.00	0.052	0.05	.50
	24-hour SO2	0.00	0.016	0.01	.14
	Annual NOx + VOC	0.010	0.027	0.037	0.053
EI-Alignment B	1-hour CO	0.1	7.2	7.3	35.0
	8-hour CO	0.1	3.0	3.1	9.0
	3-hour SO2	0.00	0.052	0.048	.50
	24-hour SO2	0.001	0.016	0.007	.14
	Annual NOx + VOC	0.020	0.027	0.047	0.053
Boulder Islands North LCS	1-hour CO	0.1	7.2	7.3	35.0
	8-hour CO	0.1	3.0	3.1	9.0
	3-hour SO2	0.00	0.052	0.05	.50
	24-hour SO2	0.00	0.02	0.01	.14
	Annual NOx + VOC	0.030	0.027	0.057	0.053
Boulder Islands South LCS	1-hour CO	0.1	7.2	7.3	35.0
	8-hour CO	0.1	3.0	3.1	9.0
	3-hour SO2	0.00	0.052	0.05	.50
	24-hour SO2	0.00	0.02	0.01	.14
	Annual NOx + VOC	0.030	0.027	0.057	0.053
Las Vegas Bay LCS	1-hour CO	0.1	7.2	7.3	35.0
	8-hour CO	0.1	3.0	3.1	9.0
	3-hour SO2	0.00	0.052	0.05	.50
	24-hour SO2	0.00	0.02	0.01	.14
	Annual NOx + VOC	0.030	0.027	0.057	0.053

Notes:

[1] Values converted to ppm in order to compare to air quality standards.

[2] No monitored value reported. Estimate derived from 24-hour value.

New diesel engine emission standards have been promulgated for calendar year 2007 models. These standards result in a significant decrease in NO_x and PM_{10} emissions. Table G.8-4 shows the predicted concentrations from the SCREEN Model for PM_{10} and NO_x, assuming that the diesel engines meet 2007 standards.

Table G.8-4 Modeled Impacts from Construction Equipment Exhausts (year 2007 Engines at 2,000 ft [610 m]).

Construction Segment	Pollutant & Averaging Time	Construction Impacts	Background Concentration	Total Impact	Primary Standard
EI-Alignment A	Annual NO_x + VOC (ppm)	0.009	0.027	0.036	0.053
	24-hr PM_{10} ($\mu g/m^3$)	3	--	--	150
EI-Alignment B	Annual NO_x + VOC (ppm)	0.011	0.027	0.038	0.053
	24-hr PM_{10} ($\mu g/m^3$)	4	--	--	150
Boulder Islands North LCS	Annual NO_x + VOC (ppm)	0.012	0.027	0.039	0.053
	24-hr PM_{10} ($\mu g/m^3$)	3	--	--	150
Boulder Islands South LCS	Annual NO_x + VOC (ppm)	0.011	0.027	0.038	0.053
	24-hr PM_{10} ($\mu g/m^3$)	3	--	--	150
Las Vegas Bay LCS	Annual NO_x + VOC (ppm)	0.011	0.027	0.038	0.053
	24-hr PM_{10} ($\mu g/m^3$)	3	--	--	150

Because of the large distance separating the EI and LCS segments, the SCREEN3 Model cannot be used to estimate the combined impacts of concurrent construction of the EI and LCS. Pollutant concentrations are proportional to the distance from the source. As a result it is unlikely that concurrent construction would cause or contribute to an exceedance of the NAAQS.