



## APPENDIX K

### Air Quality Information



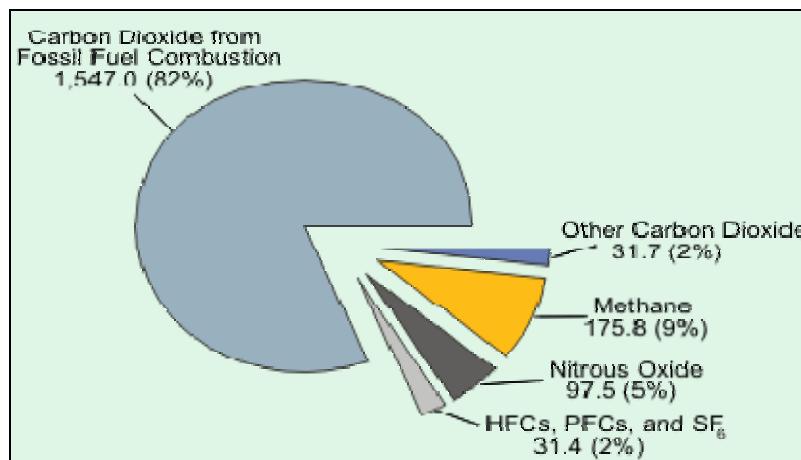


## Greenhouse Gases

In April 2007, the U.S. Supreme Court declared that carbon dioxide ( $\text{CO}_2$ ) and other greenhouse gases are air pollutants under the Clean Air Act (CAA). The Court declared that the U.S. Environmental Protection Agency (USEPA) has the authority to regulate emissions from new cars and trucks under the landmark environment law.

Many chemical compounds found in the Earth's atmosphere act as "greenhouse gases." These gases allow sunlight to enter the atmosphere freely. When sunlight strikes the Earth's surface, some of it is reflected back towards space as infrared radiation (heat). Greenhouse gases absorb this infrared radiation and trap the heat in the atmosphere. Over time, the trapped heat results in the phenomenon of global warming.

Many gases exhibit these "greenhouse" properties. The sources of the majority of greenhouse gases come mostly from natural sources but are also contributed to by human activity and are shown in **Figure K-1**. It is not possible to state that a specific gas causes a certain percentage of the greenhouse effect because the influences of the various gases are not additive.

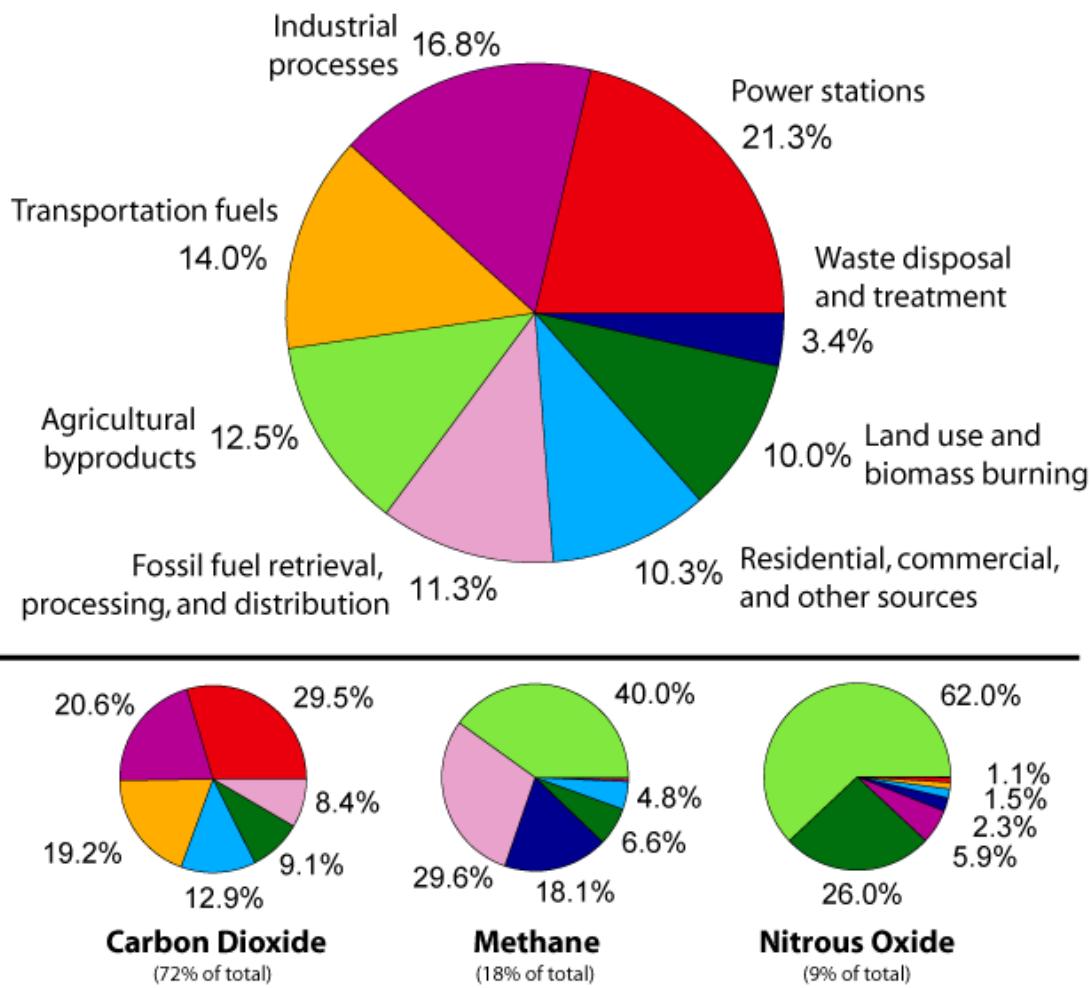


Source: Energy Information Administration 2003

**Figure K-1. Greenhouse Gas Emissions From Burning of Gas (Million Metric Tons of Carbon Equivalent)**

**Figure K-2** displays the annual greenhouse gas emissions by sector in the United States. Most government agencies and military installations are just beginning to establish a baseline for their operations and their impact on the greenhouse effect. Since the USEPA has not promulgated an ambient standard or *de minimis* level for  $\text{CO}_2$  emissions for Federal actions, there is no standard value to compare an action against in terms of meeting or violating the standard. Hence, we shall attempt to establish the effects on air quality as a result of the amount of  $\text{CO}_2$  produced by the Federal action and what could be done to minimize the impact of these emissions.

## Annual Greenhouse Gas Emissions by Sector



Source: Rosmarino 2006

**Figure K-2. Annual Greenhouse Gas Emissions by Sector**

### References

Energy Information Administration. 2003. "Greenhouse Gases, Climate Change, and Energy." EIA Brochure. 2003. Available online: <<http://www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html>>. Last updated April 2, 2004. Accessed November 4, 2007.

Tanyalynnette Rosmarino, Director of Field Engineering, Northeast, BigFix, Inc. 2006. "A Self-Funding Enterprise Solution to Reduce Power Consumption and Carbon Emissions." Slide presentation for the NYS Forum's May Executive Committee Meeting Building an Energy Smart IT Environment. 2006. Available online: <[http://www.nysforum.org/documents/html/2007/execcommittee/may/enterprisepowerconsumptionreduction\\_files/800x600/slide1.html](http://www.nysforum.org/documents/html/2007/execcommittee/may/enterprisepowerconsumptionreduction_files/800x600/slide1.html)>. Accessed November 4, 2007.

<b>Summary</b>	Summarizes total emissions by calendar year.
<b>Combustion</b>	Estimates emissions from non-road equipment exhaust as well as painting.
<b>Fugitive</b>	Estimates fine particulate emissions from earthmoving, vehicle traffic, and windblown dust
<b>Grading</b>	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions
<b>Maintenance Emissions</b>	Estimates the total emissions from future maintenance of fencelines and patrol roads from mowers.
<b>Generator Emissions</b>	Estimates the total emissions from emergency generators to power construction equipment.
<b>AQCR Tier Report</b>	Summarizes total emissions for the Brownsville-Laredo Intradate AQCR Tier Reports for 2001, to be used to compare project to regional emissions.

Air Quality Emissions from Alternative 2, Route A						
	NO <sub>x</sub> (ton)	VOC (ton)	CO (ton)	SO <sub>2</sub> (ton)	PM <sub>10</sub> (ton)	
Construction Combustion	470.443	70.127	549.588	9.409	15.782	
Construction Fugitive Dust	-	-	-	-	-	646.336
Maintenance Emissions	0.042	0.005	0.021	0.010	0.005	662.118
Generator Emissions	22.777	1.859	4.907	1.498	1.601	
TOTAL CY2008	493.263	71.992	554.516	10.917	663.724	

Since future year budgets were not readily available, actual 2001 air emissions inventories for the counties were used as an approximation of the regional inventory. Because the Alternative 2, Route A is several orders of magnitude below significance, the conclusion would be the same, regardless of whether future year budget data set were used.

#### Brownsville-Laredo Intrastate AQCR

Year	Point and Area Sources Combined				
	NO <sub>x</sub> (tpy)	VOC (tpy)	CO (tpy)	SO <sub>2</sub> (tpy)	
2001	44,137	73,577	317,422	2,940	132,788

Source: USEPA-AirData NET Tier Report (<http://www.epa.gov/air/data/geosei.html>). Site visited on 15 October 2007.

#### Determination Significance (Significance Threshold = 10%) for Construction Activities

Point and Area Sources Combined				
NO <sub>x</sub> (tpy)	VOC (tpy)	CO (tpy)	SO <sub>2</sub> (tpy)	PM <sub>10</sub> (tpy)
44,137	73,577	317,422	2,940	132,788
493,263	71,992	554,516	10,917	663,724
1.118%	0.098%	0.175%	0.371%	0.500%

Minimum - 2001  
2008 Emissions  
Alternative 2, Route A %

### **Construction Combustion Emissions for CY 2008**

Combustion Emissions of VOC, NO<sub>x</sub>, SO<sub>2</sub>, CO and PM<sub>10</sub> Due to Construction

Includes:

100% of Construct Pedestrian Fence and Patrol Road

22,134,816 ft<sup>2</sup>

Assumptions:

Total ground disturbance for pedestrian fence and patrol road would be 69.87 miles long by 60 feet wide (22,134,816 ft<sup>2</sup>).

No grading would be required in construction staging areas.

Patrol road would be graded and lined with gravel. No paving would be included in Alternative 2, Route A.

Construction would occur between March and December 2008 for a total of 190 working days.

Total Building Construction Area:	0 ft <sup>2</sup>	(none)
Total Demolished Area:	0 ft <sup>2</sup>	(none)
Total Paved Area:	0 ft <sup>2</sup>	(none)
Total Disturbed Area:	0 ft <sup>2</sup>	(none)
Construction Duration:	22,134,816 ft <sup>2</sup>	
Annual Construction Activity:	1.0 year(s) 190 days/yr	

## Emissions Factors Used for Construction Equipment

Reference: Guide to Air Quality Assessment, SMAQMD, 2004

Emissions factors are taken from Table 3-2. Assumptions regarding the type and number of equipment are from Table 3-1 unless otherwise noted.

Grading	No. Req'd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Equipment						
Bulldozer	1	29.40	3.66	25.09	0.59	1.17
Motor Grader	1	10.22	1.76	14.98	0.20	0.28
Water Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	3	60.51	9.02	70.69	1.21	2.03

Paving	No. Req'd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Equipment						
Paver	1	7.93	1.37	11.62	0.16	0.22
Roller	1	5.01	0.86	7.34	0.10	0.14
Total per 10 acres of activity	2	12.94	2.23	18.96	0.26	0.36

Demolition	No. Req'd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Equipment						
Loader	1	7.86	1.35	11.52	0.16	0.22
Haul Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	2	28.75	4.95	42.14	0.58	0.80

Building Construction	No. Req'd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Stationary						
Generator Set	1	11.83	1.47	10.09	0.24	0.47
Industrial Saw	1	17.02	2.12	14.52	0.34	0.68
Welder	1	4.48	0.56	3.83	0.09	0.18
Mobile (non-road)						
Truck	1	20.89	3.60	30.62	0.84	0.58
Forklift	1	4.57	0.79	6.70	0.18	0.13
Crane	1	8.37	1.44	12.27	0.33	0.23
Total per 10 acres of activity	6	67.16	9.98	78.03	2.02	2.27

Note: Footnotes for tables are on following page

### Architectural Coatings

Equipment	No. Req'd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Air Compressor	1	6.83	0.85	5.82	0.14	0.27
Total per 10 acres of activity	1	6.83	0.85	5.82	0.14	0.27

- a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
- b) The SMAQMD 2004 reference lists emissions factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC.
- c) The SMAQMD 2004 reference does not provide SO<sub>2</sub> emissions factors. For this worksheet, SO<sub>2</sub> emissions have been estimated based on approximate fuel use rate for diesel equipment and the assumption of 500 ppm sulfur diesel fuel. For the average of the equipment fleet, the resulting SO<sub>2</sub> factor was found to be approximately 0.04 times the NOx emissions factor for the mobile equipment (based upon 2002 USAF IERA "Air Emissions Inventory Guidance") and 0.02 times the NOx emissions factor for all other equipment (based on AP-42, Table 3.4-1)
- d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

### PROJECT-SPECIFIC EMISSIONS FACTOR SUMMARY

Source	Equipment Multiplier*	SMAQMD Emissions Factors (lb/day)				
		NO <sub>x</sub>	VOC	CO	SO <sub>2</sub> **	PM <sub>10</sub>
Grading Equipment	51	156814.195	23375.707	183196.091	3136.284	5260.830
Paving Equipment	1	0.000	0.000	0.000	0.000	0.000
Demolition Equipment	1	0.000	0.000	0.000	0.000	0.000
Building Construction	1	0.000	0.000	0.000	0.000	0.000
Air Compressor for Architectural Coating	1	0.000	0.000	0.000	0.000	0.000
Architectural Coating <sup>**</sup>			0.000			

\*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project

\*\*Emissions factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emissions Factor for Grading Equipment NOx = (Total Grading NOx per 10 ac\* ((total disturbed area/43560)/10)) \* (Equipment Multiplier)

### Summary of Input Parameters

	Total Area (ft <sup>2</sup> )	Total Area (acres)	Total Days
Grading:	22,134,816	508.15	6 (from "CY2008 Grading" worksheet)
Paving:	0	0.00	0
Demolition:	0	0.00	0
Building Construction:	0	0.00	0
Architectural Coating	0	0.00	0 (per the SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The "Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

### Total Project Emissions by Activity (lbs)

	NO <sub>x</sub>	VOC	CO	SO <sub>2</sub>	PM <sub>10</sub>
Grading Equipment	940,885.17	140,254.24	1,099,176.55	18,817.70	31,564.98
Paving	-	-	-	-	-
Demolition	-	-	-	-	-
Building Construction	-	-	-	-	-
Architectural Coatings	-	-	-	-	-
<b>Total Emissions (lbs):</b>	<b>940,885.17</b>	<b>140,254.24</b>	<b>1,099,176.55</b>	<b>18,817.70</b>	<b>31,564.98</b>

### Results: Total Project Annual Emissions Rates

	NO <sub>x</sub>	VOC	CO	SO <sub>2</sub>	PM <sub>10</sub>
Total Project Emissions (lbs)	940,885.17	140,254.24	1,099,176.55	18,817.70	31,564.98
Total Project Emissions (tons)	470.44	70.13	549.59	9.41	15.78

### CO2 Emissions

It is assumed that 30 vehicles consisting of bulldozer, grader, forklift, cranes, rollers, and light duty trucks would be used for this project.

It is further assumed that the total approximate average miles per vehicle would be 10 miles

It is assumed that the average vehicle will produce 19.5 pounds of CO2 per gallon of gas used. ([www.eia.doe.gov/oiaf/1605/coefficients](http://www.eia.doe.gov/oiaf/1605/coefficients))

30 vehicles × 10 miles/day/vehicle × 190 days working × 1 gal/10 miles × 19.5 lb co2/gal × ton/2000lb = 55 tons CO2

**Estimate emissions of CO2 for BLAQCR region is 995,000 tons per year**

## **Construction Fugitive Dust Emissions for CY 2008**

Calculation of  $PM_{10}$  Emissions Due to Site Preparation (Uncontrolled).

User Input Parameters / Assumptions	Value	Source / Reference
Acres graded per year:	508.15 acres/yr	(From "CY2008 Combustion" worksheet)
Grading days/yr:	5.59 days/yr	(From "CY2008 Grading worksheet")
Exposed days/yr:	90 assumed days/yr	assumed area is exposed
Grading Hours/day:	8 hr/day	
Soil piles area fraction:	0.10 (assumed fraction of site area covered by soil piles)	
Soil percent silt, s:	8.5 %	(mean silt content; expected range: 0.56 to 23 AP-42 Table 13.2.2-1) ( <a href="http://www.cpc.noaa.gov/products/soilmst/w.shtml">http://www.cpc.noaa.gov/products/soilmst/w.shtml</a> )
Soil percent moisture, M:	85 %	
Annual rainfall days, p:	70 days/yr	rainfall exceeds 0.01 inch/day (AP-42 Fig 13.2.2-1)
Wind speed > 12 mph %, l:	39.5 %	Ave. of wind speed at Brownsville, TX ( <a href="ftp://fp.wcc.nrcs.usda.gov/downloads/climate/windrose/texas/brownsville/">ftp://fp.wcc.nrcs.usda.gov/downloads/climate/windrose/texas/brownsville/</a> )
Fraction of TSP, J:	0.5 per California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993, p. A9-99	
Mean vehicle speed, S:	5 mi/hr	
Dozer path width:	8 ft	(On-site)
Qty construction vehicles:	152.44 vehicles	(From "CY2008 Grading worksheet")
On-site VMT/vehicle/day:	5 mi/veh/day	(Excluding bulldozer VMT during grading)
$PM_{10}$ Adjustment Factor k	1.5 lb/VMT	(AP-42 Table 13.2.2-2 12/03 for $PM_{10}$ for unpaved roads)
$PM_{10}$ Adjustment Factor a	0.9 (dimensionless)	(AP-42 Table 13.2.2-2 12/03 for $PM_{10}$ for unpaved roads)
$PM_{10}$ Adjustment Factor b	0.45 (dimensionless)	(AP-42 Table 13.2.2-2 12/03 for $PM_{10}$ for unpaved roads)
Mean Vehicle Weight, W	40 tons	assumed for aggregate trucks

TSP - Total Suspended Particulate

VMT - Vehicle Miles Traveled

### **Emissions Due to Soil Disturbance Activities**

Operation Parameters (Calculated from User Inputs)	
Grading duration per acre	0.1 hr/acre
Bulldozer mileage per acre	1 VMT/acre
Construction VMT per day	762 VMT/day
Construction VMT per acre	8.4 VMT/acre

(Miles traveled by bulldozer during grading)  
(Travel on unpaved surfaces within site)

### **Equations Used (Corrected for PM<sub>10</sub>)**

Operation	Empirical Equation	Units	AP-42 Section (5th Edition)
Bulldozing	$0.75(s^{1.5})(M^{1.4})$	lbs/hr	Table 11.9-1, Overburden
Grading	$(0.60)(0.051s^{2.0})$	lbs/VMT	Table 11.9-1,
Vehicle Traffic (unpaved roads)	$[(k(s/12)^a)(W/3)^b)] / [(365-P)/365]$	lbs/VMT	Section 13.2.2

Source: Compilation of Air Pollutant Emissions Factors, Vol. I, USEPA AP-42, Section 11.9 dated 10/98 and Section 13.2 dated 12/03

### **Calculation of PM<sub>10</sub> Emissions Factors for Each Operation**

Operation	Emissions Factor (mass/unit)	Operation Parameter	Emissions Factor (lbs/acre)
Bulldozing	0.04 lbs/hr	0.1 hr/acre	0.00 lbs/acre
Grading	0.77 lbs/VMT	1 VMT/acre	0.80 lbs/acre
Vehicle Traffic (unpaved roads)	2.85 lbs/VMT	8.4 VMT/acre	24.00 lbs/acre

### **Emissions Due to Wind Erosion of Soil Piles and Exposed Graded Surface**

Reference: California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993.

$$\text{Soil Piles EF} = 1.7(s/1.5)[(365 - p)/235](l/15)(J) = (s)(365 - p)(l)(J)/(3110.2941), \text{ p. A9-99.}$$

$$\text{Soil Piles EF} = 15.9 \text{ lbs/day/acre covered by soil piles}$$

Consider soil piles area fraction so that EF applies to graded area

Soil piles area fraction: 0.10 (Fraction of site area covered by soil piles)

$$\text{Soil Piles EF} = 1.59 \text{ lbs/day/acre graded}$$

$$\text{Graded Surface EF} = 26.4 \text{ lbs/day/acre (recommended in CEQA Manual, p. A9-93).}$$

### **Calculation of Annual PM<sub>10</sub> Emissions**

Source	Emissions Factor	Graded Acres/yr	Exposed days/yr	Emissions lbs/yr	Emissions tons/yr
Bulldozing	0.00 lbs/acre	508.15	NA	0	0.000
Grading	0.80 lbs/acre	508.15	NA	407	0.203
Vehicle Traffic	24.00 lbs/acre	508.15	NA	12,195	6.098
Erosion of Soil Piles	1.59 lbs/acre/day	508.15	90	72,716	36.358
Erosion of Graded Surface	26.40 lbs/acre/day	508.15	90	1,207,354	603.677
<b>TOTAL</b>				<b>1,292,671</b>	<b>646.34</b>

Soil Disturbance EF: 24.80 lbs/acre

Wind Erosion EF: 27.99 lbs/acre/day

Back calculate to get EF:

$$455.46 \text{ lbs/acre/grading day}$$

## **Construction (Grading) Schedule for CY 2008**

Estimate of time required to grade a specified area.

Input Parameters	
Construction area:	508.15 acres/yr (from 'CY2008 Combustion' Worksheet)
Qty Equipment:	152.44 (calculated based on 3 pieces of equipment for every 10 acres)

### Assumptions.

Terrain is mostly flat.

An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.  
200 hp bulldozers are used for site clearing.

300 hp bulldozers are used for stripping, excavation, and backfill.

Vibratory drum rollers are used for compacting.

Stripping, Excavation, Backfill and Compaction require an average of two passes each.

Excavation and Backfill are assumed to involve only half of the site.

### Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	508.15	63.52
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	508.15	248.43
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	254.07	256.19
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	254.07	105.10
2315 310 5020	Compaction	Vibrating roller, 6" lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	508.15	178.22
<b>TOTAL</b>							<b>851.46</b>	

### Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 851.46  
Qty Equipment: 152.44  
Grading days/yr: 5.59

### Maintenance Activities Emissions for CY 2008

Combustion Emissions of VOC, NO<sub>x</sub>, SO<sub>2</sub>, CO and PM<sub>10</sub> Due to Maintenance Activities

The pedestrian fence line and patrol road would require mowing approximately two times per year to maintain vegetation height and allow enhanced visibility and security.

Assumptions:

- Approximately 508.15 acres of land would be mowed twice per year.
- Two agricultural mowers (40 horsepower) would operate for approximately 14 days.
- Each working day would be 8 hours.
- Agricultural mowers operate at 43% load capacity (17.2 horsepower).

### Emissions Factors Used for Maintenance Equipment

Reference: USAF IERA "Air Emissions Inventory Guidance", July 2001, Table 7-6. Criteria Pollutant Emissions Factors for Nonroad Diesel Engines.

Emissions Factors						
Equipment	Rated Power (hp)	Loading Factor (% of Max Power)	Operating Time (hr/yr)	BSFC (lb/hp-hr)	NO <sub>x</sub> (g/hp-hr)	VOC (g/hp-hr)
Agricultural Mower (Diesel)	40	43	224	0.408	5.0	0.6
BSFC = Brake Specific Fuel Consumption					2.5	1.19

### Results: Total Maintenance Annual Emissions Rates

	NO <sub>x</sub>	VOC	CO	SO <sub>2</sub>	PM <sub>10</sub>
Total Maintenance Emissions (lbs)	84.954	10.195	42.477	20.219	10.195
Total Maintenance Emissions (tons)	0.042	0.005	0.021	0.010	0.005

Example:

Total Maintenance Emissions (lbs of NO<sub>x</sub>) =  
(Rated power output of equipment engine)\*(Loading Factor/100)\*(Operating Time)\*(Number of Equipment)\*(Emissions Factor)\*(Conversion factor)

$$\text{Total Maintenance Emissions (lbs of NO}_x\text{)} = (40 \text{ hp})^*(43/100)^*(224 \text{ hr/yr})^*(2 \text{ Equipment})^*(5.0 \text{ g/hp-hr})^*(0.002205 \text{ lb/g}) = 84.95 \text{ lbs/yr}$$

## Emissions from Diesel Powered Generators for Construction Equipment

Alternative 2, Route A would require six diesel powered generators to power construction equipment. These generators would operate approximately 8 hours per day for 190 working days.

Number of Generators	6
Maximum Hours of Operation	8 hrs/day
Number of Construction Days	190
Total Generator Capacity	75 hp
Hourly Rate	0.5262 MMBtu/hr
Annual Use	4,799 MMBtu/yr

Example:  $1\text{hp}=0.002546966 \text{MMBtu}/\text{Hr}$   
Hourly Rate (MMBtu) =  $(75 \text{ Hp}/0.363)^*(0.00254699 \text{ MMBtu}/\text{hr}) = 0.5262 \text{ MMBtu}/\text{hr}$   
Annual Use (MMBtu) =  $(\text{Number of Generator} * \text{Hours Operation}/\text{Day} * \text{Number of Construction Days}) = (6*8*190*0.5262) = 4,799 \text{ MMBtu}/\text{yr}$

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).

Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>)

### Generator Emissions Factors (Diesel)

NO <sub>x</sub>	4.41 lb/MMBtu
VOC	0.36 lb/MMBtu
CO	0.95 lb/MMBtu
SO <sub>x</sub>	0.29 lb/MMBtu
PM <sub>10</sub>	0.31 lb/MMBtu

### Emissions (Diesel)

NO <sub>x</sub>	10,581 tpy
VOC	0,864 tpy
CO	2,279 tpy
SO <sub>x</sub>	0,696 tpy
PM <sub>10</sub>	0,744 tpy

Example: Total NOx Emissions =  $(\text{Annual MMBtu/year} * (\text{EF})/2000 = (4,799*4.41)/2000 = 10,581 \text{ tpy}$

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>)

## Emissions from Diesel Powered Generators for Portable Lights

To be conservative, it was assumed that up to 30 portable light units would be needed for construction. These portable lights are powered by 6-kilowatt self-contained diesel generators. Portable lights would generally operate continuously every night (approximately 12 hours) 365 days per year.

Number of Generators	30
Maximum Hours of Operation	12 hrs/day
Number of Construction Days	365
Total Generator Capacity	6 hp
Hourly Rate	0.0421 MMBtu/hr
Annual Use	5,531 MMBtu/yr

Example:  $1\text{hp}=0.002546966 \text{MMBtu}/\text{Hr}$   
Hourly Rate (MMBtu) =  $(75 \text{ Hp}/0.363)^*(0.002546699 \text{ MMBtu}/\text{hr}) = 0.5262 \text{ MMBtu}/\text{hr}$   
Annual Use (MMBtu) = (Number of Generator \* Hours Operation/Day \* Number of Construction Days) =  $(6^*\text{8}^*\text{190}^*\text{0.5262}) = 4,799 \text{ MMBtu}/\text{yr}$

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).

Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>)

### Generator Emissions Factors (Diesel)

NO <sub>x</sub>	4.41 lb/MMBtu
VOC	0.36 lb/MMBtu
CO	0.95 lb/MMBtu
SO <sub>x</sub>	0.29 lb/MMBtu
PM <sub>10</sub>	0.31 lb/MMBtu

### Emissions (Diesel)

NO <sub>x</sub>	12,196 tpy
VOC	0.996 tpy
CO	2,627 tpy
SO <sub>x</sub>	0.802 tpy
PM <sub>10</sub>	0.857 tpy

Example: Total NOx Emissions = (Annual MMBtu/year\*(EF)/2000 =  $(5,531^*4.41)/2000 = 12,196 \text{ tpy}$

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>)

### Brownsville-Laredo Intrastate Air Quality Control Region

Row # <u>SORT</u>	State	County	Area Source Emissions						Point Source Emissions				
			CO	NOx	PM10	PM2.5	SO2	VOC	CO	NOx	PM10	PM2.5	SO2
1 TX	Cameron Co	84,539	10,659	36,197	6,679	849	15,988	386	1,169	149	111	136	516
2 TX	Hidalgo Co	145,505	17,041	61,198	11,285	1,161	27,056	4,064	2,697	319	313	41	773
3 TX	Jim Hogg Co	1,621	110	1,229	291	18.5	763	77.3	293	3.32	0.08	50	
4 TX	Starr Co	17,040	2,251	12,645	2,259	141	4,287	433	1,144	0.47	0.42	30.4	215
5 TX	Webb Co	47,946	5,122	9,943	2,380	376	13,764	755	1,128	36.7	35.6	25.2	124
6 TX	Willacy Co	9,021	1,371	9,238	1,777	121	2,753	144	253	1.61	1.61	0.02	49.6
7 TX	Zapata Co	5,466	396	1,828	477	40.1	7,134	425	503	0.18	0.17	0.21	104
<b>Grand Total</b>		<b>311,138</b>	<b>36,950</b>	<b>132,278</b>	<b>25,148</b>	<b>2,707</b>	<b>71,745</b>	<b>6,284</b>	<b>7,187</b>	<b>510</b>	<b>465</b>	<b>233</b>	<b>1,832</b>

SOURCE:

<http://www.epa.gov/air/data/geosel.html>

USEPA - AirData NET Tier Report

\*Net Air pollution sources (area and point) in tons per year (2001)  
Site visited on 15 October 2007.

Brownsville-Laredo Intrastate AQCR (40 CFR 81.135):

In the State of Texas: Cameron County, Hidalgo County, Jim Hogg County, Starr County, Webb County, Willacy County, Zapata County

<b>Summary</b>	Summarizes total emissions by calendar year.
<b>Combustion</b>	Estimates emissions from non-road equipment exhaust as well as painting.
<b>Fugitive</b>	Estimates fine particulate emissions from earthmoving, vehicle traffic, and windblown dust
<b>Grading</b>	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions
<b>Maintenance Emissions</b>	Estimates the total emissions from future maintenance of fencelines and patrol roads from mowers.
<b>Generator Emissions</b>	Estimates the total emissions from emergency generators to power construction equipment.
<b>AQCR Tier Report</b>	Summarizes total emissions for the Brownsville-Laredo Intradate AQCR Tier Reports for 2001, to be used to compare project to regional emissions.

Air Quality Emissions from Alternative 2, Route B						
	NO <sub>x</sub> (ton)	VOC (ton)	CO (ton)	SO <sub>2</sub> (ton)	PM <sub>10</sub> (ton)	
CY2008						
Construction Combustion	470.241	70.097	549.352	9.405	15.776	
Construction Fugitive Dust	-	-	-	-	-	645.982
Maintenance Emissions	0.042	0.005	0.021	0.010	0.005	
Generator Emissions	22.777	1.859	4.907	1.498	1.601	
TOTAL CY2008	493.061	71.961	554.280	10.913	663.364	

Since future year budgets were not readily available, actual 2001 air emissions inventories for the counties were used as an approximation of the regional inventory. Because Alternative 2, Route B is several orders of magnitude below significance, the conclusion would be the same, regardless of whether future year budget data set were used.

#### Brownsville-Laredo Intrastate AQCR

Year	Point and Area Sources Combined				
	NO <sub>x</sub> (tpy)	VOC (tpy)	CO (tpy)	SO <sub>2</sub> (tpy)	
2001	44,137	73,577	317,422	2,940	132,788

Source: USEPA-AirData NET Tier Report (<http://www.epa.gov/air/data/geosei.html>). Site visited on 15 October 2007.

#### Determination Significance (Significance Threshold = 10%) for Construction Activities

	Point and Area Sources Combined				
	NO <sub>x</sub> (tpy)	VOC (tpy)	CO (tpy)	SO <sub>2</sub> (tpy)	
Minimum - 2001	44,137	73,577	317,422	2,940	132,788
2008 Emissions	493.061	71.961	554.280	10.913	663.364
Alternative 2, Route B %	1.117%	0.098%	0.175%	0.371%	0.500%

### **Construction Combustion Emissions for CY 2008**

Combustion Emissions of VOC, NO<sub>x</sub>, SO<sub>2</sub>, CO and PM<sub>10</sub> Due to Construction

Includes:

100% of Construct Pedestrian Fence and Patrol Road                    22,125,312 ft<sup>2</sup>

Assumptions:

Total ground disturbance for pedestrian fence and patrol road would be 69.84 miles long by 60 feet wide (22,125,312 ft<sup>2</sup>).

Alternative 2

Patrol road would be graded and lined with gravel. No paving would be included in Alternative 2, Route B.

Construction would occur between March and December 2008 for a total of 190 working days.

Total Building Construction Area:	0 ft <sup>2</sup>	(none)
Total Demolished Area:	0 ft <sup>2</sup>	(none)
Total Paved Area:	0 ft <sup>2</sup>	(none)
Total Disturbed Area:	22,125,312 ft <sup>2</sup>	(none)
Construction Duration:	1.0 year(s)	
Annual Construction Activity:	190 days/yr	

## Emissions Factors Used for Construction Equipment

Reference: Guide to Air Quality Assessment, SMAQMD, 2004

Emissions factors are taken from Table 3-2. Assumptions regarding the type and number of equipment are from Table 3-1 unless otherwise noted.

### Grading

Equipment	No. Req'd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Bulldozer	1	29.40	3.66	25.09	0.59	1.17
Motor Grader	1	10.22	1.76	14.98	0.20	0.28
Water Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	3	60.51	9.02	70.69	1.21	2.03

### Paving

Equipment	No. Req'd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Paver	1	7.93	1.37	11.62	0.16	0.22
Roller	1	5.01	0.86	7.34	0.10	0.14
Total per 10 acres of activity	2	12.94	2.23	18.96	0.26	0.36

### Demolition

Equipment	No. Req'd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Loader	1	7.86	1.35	11.52	0.16	0.22
Haul Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	2	28.75	4.95	42.14	0.58	0.80

### Building Construction

Equipment <sup>d</sup>	No. Req'd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Stationary						
Generator Set	1	11.83	1.47	10.09	0.24	0.47
Industrial Saw	1	17.02	2.12	14.52	0.34	0.68
Welder	1	4.48	0.56	3.83	0.09	0.18
Mobile (non-road)						
Truck	1	20.89	3.60	30.62	0.84	0.58
Forklift	1	4.57	0.79	6.70	0.18	0.13
Crane	1	8.37	1.44	12.27	0.33	0.23
Total per 10 acres of activity	6	67.16	9.98	78.03	2.02	2.27

Note: Footnotes for tables are on following page

Architectural Coatings		No. Rqd. <sup>a</sup> per 10 acres	VOC <sup>b</sup> (lb/day)	NO <sub>x</sub> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup> (lb/day)	PM <sub>10</sub> (lb/day)
Equipment	Air Compressor	1	6.83	0.85	5.82	0.14	0.27
Total per 10 acres of activity		1	6.83	0.85	5.82	0.14	0.27

- a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
- b) The SMAQMD 2004 reference lists emissions factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC.
- c) The SMAQMD 2004 reference does not provide SO<sub>2</sub> emissions factors. For this worksheet, SO<sub>2</sub> emissions have been estimated based on approximate fuel use rate for diesel equipment and the assumption of 500 ppm sulfur diesel fuel. For the average of the equipment fleet, the resulting SO<sub>2</sub> factor was found to be approximately 0.04 times the NOx emissions factor for the mobile equipment (based upon 2002 USAF IERA "Air Emissions Inventory Guidance") and 0.02 times the NOx emissions factor for all other equipment (based on AP-42, Table 3.4-1)
- d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

## PROJECT-SPECIFIC EMISSIONS FACTOR SUMMARY

Source	Equipment Multiplier*	SMAQMD Emissions Factors (lb/day)				
		NO <sub>x</sub>	VOC	CO	SO <sub>2</sub> <sup>**</sup>	PM <sub>10</sub>
Grading Equipment	51	156746.864	23365.670	183117.432	3134.937	5258.571
Paving Equipment	1	0.000	0.000	0.000	0.000	0.000
Demolition Equipment	1	0.000	0.000	0.000	0.000	0.000
Building Construction	1	0.000	0.000	0.000	0.000	0.000
Air Compressor for Architectural Coating	1	0.000	0.000	0.000	0.000	0.000
Architectural Coating <sup>**</sup>		0.000	0.000	0.000	0.000	0.000

\*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project

\*\*Emissions factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emissions Factor for Grading Equipment NOx = (Total Grading NOx per 10 ac\* ((total disturbed area/43560)/10)) \* (Equipment Multiplier)

### Summary of Input Parameters

	Total Area (ft <sup>2</sup> )	Total Area (acres)	Total Days
Grading:	22,125.312	507.93	6 (from "CY2008 Grading" worksheet)
Paving:	0	0.00	0
Demolition:	0	0.00	0
Building Construction:	0	0.00	0
Architectural Coating	0	0.00	0 (per the SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The "Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

### Total Project Emissions by Activity (lbs)

	NO <sub>x</sub>	VOC	CO	SO <sub>2</sub>	PM <sub>10</sub>
Grading Equipment	940,481.19	140,194.02	1,098,704.59	18,809.62	31,551.43
Paving	-	-	-	-	-
Demolition	-	-	-	-	-
Building Construction	-	-	-	-	-
Architectural Coatings	-	-	-	-	-
<b>Total Emissions (lbs):</b>	<b>940,481.19</b>	<b>140,194.02</b>	<b>1,098,704.59</b>	<b>18,809.62</b>	<b>31,551.43</b>

### Results: Total Project Annual Emissions Rates

	NO <sub>x</sub>	VOC	CO	SO <sub>2</sub>	PM <sub>10</sub>
Total Project Emissions (lbs)	940,481.19	140,194.02	1,098,704.59	18,809.62	31,551.43
Total Project Emissions (tons)	470.24	70.10	549.35	9.40	15.78

CO<sub>2</sub> Emissions

## **Construction Fugitive Dust Emissions for CY 2008**

Calculation of  $PM_{10}$  Emissions Due to Site Preparation (Uncontrolled).

User Input Parameters / Assumptions	Value	Source / Reference
Acres graded per year:	507.93 acres/yr	(From "CY2008 Combustion" worksheet)
Grading days/yr:	5.56 days/yr	(From "CY2008 Grading worksheet")
Exposed days/yr:	90 assumed days/yr	assumed area is exposed
Grading Hours/day:	8 hr/day	
Soil piles area fraction:	0.10 (assumed fraction of site area covered by soil piles)	
Soil percent silt, s:	8.5 % (mean silt content; expected range: 0.56 to 23 AP-42 Table 13.2.2-1)	
Soil percent moisture, M:	85 % ( <a href="http://www.cpc.noaa.gov/products/soilmst/w.shtml">http://www.cpc.noaa.gov/products/soilmst/w.shtml</a> )	
Annual rainfall days, p:	70 days/yr rainfall exceeds 0.01 inch/day (AP-42 Fig 13.2.2-1)	
Wind speed > 12 mph %, l:	39.5 % Ave. of wind speed at Brownsville, TX ( <a href="ftp://fp.wcc.nrcs.usda.gov/downloads/climate/windrose/texas/brownsville/">ftp://fp.wcc.nrcs.usda.gov/downloads/climate/windrose/texas/brownsville/</a> )	
Fraction of TSP, J:	0.5 per California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993, p. A9-99	
Mean vehicle speed, S:	5 mi/hr (On-site)	
Dozer path width:	8 ft	(From "CY2008 Grading worksheet")
Qty construction vehicles:	152.38 vehicles	(Excluding bulldozer VMT during grading)
On-site VMT/vehicle/day:	5 mi/veh/day	(AP-42 Table 13.2.2-2 12/03 for $PM_{10}$ for unpaved roads)
$PM_{10}$ Adjustment Factor k	1.5 lb/VMT	(AP-42 Table 13.2.2-2 12/03 for $PM_{10}$ for unpaved roads)
$PM_{10}$ Adjustment Factor a	0.9 (dimensionless)	(AP-42 Table 13.2.2-2 12/03 for $PM_{10}$ for unpaved roads)
$PM_{10}$ Adjustment Factor b	0.45 (dimensionless)	(AP-42 Table 13.2.2-2 12/03 for $PM_{10}$ for unpaved roads)
Mean Vehicle Weight, W	40 tons	assumed for aggregate trucks

TSP - Total Suspended Particulate  
VMT - Vehicle Miles Traveled

### **Emissions Due to Soil Disturbance Activities**

Operation Parameters (Calculated from User Inputs)	
Grading duration per acre	0.1 hr/acre
Bulldozer mileage per acre	1 VMT/acre
Construction VMT per day	762 VMT/day
Construction VMT per acre	8.3 VMT/acre

### Equations Used (Corrected for PM10)

Operation	Empirical Equation	Units	AP-42 Section (5th Edition)
Bulldozing	$0.75(s^{1.5})(M^{1.4})$	lbs/hr	Table 11.9-1, Overburden
Grading	$(0.60)(0.051)s^{2.0}$	lbs/VMT	Table 11.9-1,
Vehicle Traffic (unpaved roads)	$[(K(s/12)^a)(W/3)^b] / [(365-P)/365]$	lbs/VMT	Section 13.2.2

Source: Compilation of Air Pollutant Emissions Factors, Vol. I, USEPA AP-42, Section 11.9 dated 10/98 and Section 13.2 dated 12/03

### Calculation of PM<sub>10</sub> Emissions Factors for Each Operation

Operation	Emissions Factor (mass/ unit)	Operation Parameter	Emissions Factor (lbs/ acre)
Bulldozing	0.04 lbs/hr	0.1 hr/acre	0.00 lbs/acre
Grading	0.77 lbs/VMT	1 VMT/acre	0.80 lbs/acre
Vehicle Traffic (unpaved roads)	2.85 lbs/VMT	8.3 VMT/acre	23.70 lbs/acre

### **Emissions Due to Wind Erosion of Soil Piles and Exposed Graded Surface**

Reference: California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993.

$$\text{Soil Piles EF} = 1.7(s/1.5)[(365 - p)/235](l/15)(J) = (s)(365 - p)(l)(J)/(3110.2941), \text{ p. A9-99.}$$

$$\text{Soil Piles EF} = 15.9 \text{ lbs/day/acre covered by soil piles}$$

Consider soil piles area fraction so that EF applies to graded area

Soil piles area fraction: 0.10 (Fraction of site area covered by soil piles)

$$\text{Soil Piles EF} = 1.59 \text{ lbs/day/acre graded}$$

$$\text{Graded Surface EF} = 26.4 \text{ lbs/day/acre (recommended in CEQA Manual, p. A9-93).}$$

### **Calculation of Annual PM<sub>10</sub> Emissions**

Source	Emissions Factor	Graded Acres/yr	Exposed days/yr	Emissions lbs/yr	Emissions tons/yr
Bulldozing	0.00 lbs/acre	507.93	NA	0	0.000
Grading	0.80 lbs/acre	507.93	NA	406	0.203
Vehicle Traffic	23.70 lbs/acre	507.93	NA	12,038	6.019
Erosion of Soil Piles	1.59 lbs/acre/day	507.93	90	72,684	36.342
Erosion of Graded Surface	26.40 lbs/acre/day	507.93	90	1,206,835	603.418
<b>TOTAL</b>				<b>1,291,964</b>	<b>645.98</b>

Soil Disturbance EF: 24.50 lbs/acre  
Wind Erosion EF: 27.99 lbs/acre/day

Back calculate to get EF:

$$457.26 \text{ lbs/acre/grading day}$$

## **Construction (Grading) Schedule for CY 2008**

Estimate of time required to grade a specified area.

Input Parameters	
Construction area:	507.93 acres/yr (from 'CY2008 Combustion' Worksheet)
Qty Equipment:	152.38 (calculated based on 3 pieces of equipment for every 10 acres)

### Assumptions.

Terrain is mostly flat.

An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.  
200 hp bulldozers are used for site clearing.

300 hp bulldozers are used for stripping, excavation, and backfill.

Vibratory drum rollers are used for compacting.

Stripping, Excavation, Backfill and Compaction require an average of two passes each.

Excavation and Backfill are assumed to involve only half of the site.

### Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	507.93	63.49
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	507.93	248.32
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	253.96	256.08
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	253.96	105.06
2315 310 5020	Compaction	Vibrating roller, 6" lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	507.93	178.14
<b>TOTAL</b>							<b>851.09</b>	

### Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 851.09  
Qty Equipment: 153.00  
Grading days/yr: 5.56

### Maintenance Activities Emissions for CY 2008

Combustion Emissions of VOC, NO<sub>x</sub>, SO<sub>2</sub>, CO and PM<sub>10</sub> Due to Maintenance Activities

The fenceline and patrol road would require mowing approximately two times per year to maintain vegetation height and allow enhanced visibility and security.

Assumptions:

- Approximately 507.93 acres of land would be mowed twice per year.
- Two agricultural mowers (40 horsepower) would operate for approximately 14 days.
- Each working day would be 8 hours.
- Agricultural mowers operate at 43% load capacity (17.2 horsepower).

### Emissions Factors Used for Maintenance Equipment

Reference: USAF IERA "Air Emissions Inventory Guidance", July 2001, Table 7-6. Criteria Pollutant Emissions Factors for Nonroad Diesel Engines.

Emissions Factors						
Equipment	Rated Power (hp)	Loading Factor (% of Max Power)	Operating Time (hr/yr)	BSFC (lb/hp-hr)	NO <sub>x</sub> (g/hp-hr)	VOC (g/hp-hr)
Agricultural Mower (Diesel)	40	43	224	0.408	5.0	0.6
BSFC = Brake Specific Fuel Consumption					2.5	1.19
					0.6	0.6

### Results: Total Maintenance Annual Emissions Rates

	NO <sub>x</sub>	VOC	CO	SO <sub>2</sub>	PM <sub>10</sub>
Total Maintenance Emissions (lbs)	84.954	10.195	42.477	20.219	10.195
Total Maintenance Emissions (tons)	0.042	0.005	0.021	0.010	0.005

Example:

Total Maintenance Emissions (lbs of NO<sub>x</sub>) =

(Rated power output of equipment engine)\*(Loading Factor/100)\*(Operating Time)\*(Number of Equipment)\*(Emissions Factor)\*(Conversion factor)

Total Maintenance Emissions (lbs of NO<sub>x</sub>) = (40 hp)\*(43/100)\*(224 hr/yr)\*(2 Equipment)\*(5.0 g/hp-hr)\*(0.002205 lb/g) = 84.95 lbs/yr

## Emissions from Diesel Powered Generators for Construction Equipment

Alternative 2, Route B would require six diesel powered generators to power construction equipment. These generators would operate approximately 8 hours per day for 190 working days.

Number of Generators	6
Maximum Hours of Operation	8 hrs/day
Number of Construction Days	190
Total Generator Capacity	75 hp
Hourly Rate	0.5262 MMBtu/hr
Annual Use	4,799 MMBtu/yr

Example:  $1\text{hp}=0.002546966 \text{MMBtu/Hr}$   
Hourly Rate (MMBtu) =  $(75 \text{hp} / 0.363) * (0.002546969 \text{MMBtu/hr}) = 0.5262 \text{ MMBtu/hr}$   
Annual Use (MMBtu) = (Number of Generator \* Hours Operation/Day \* Number of Construction Days) =  $(6 * 8 * 190 * 0.5262) = 4,799 \text{ MMBtu/yr}$

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).  
Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>)

### Generator Emissions Factors (Diesel)

NO <sub>x</sub>	4.41 lb/MMBtu
VOC	0.36 lb/MMBtu
CO	0.95 lb/MMBtu
SO <sub>x</sub>	0.29 lb/MMBtu
PM <sub>10</sub>	0.31 lb/MMBtu

### Emissions (Diesel)

NO <sub>x</sub>	10.581 tpy
VOC	0.864 tpy
CO	2.279 tpy
SO <sub>x</sub>	0.696 tpy
PM <sub>10</sub>	0.744 tpy

Example: Total NOx Emissions = (Annual MMBtu/year \* (EF)/2000 =  $(4,799 * 4.41) / 2000 = 10.581 \text{ tpy}$

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>)

## Emissions from Diesel Powered Generators for Portable Lights

To be conservative, it was assumed that up to 30 portable light units would be needed for construction. These portable lights are powered by 6-kilowatt self-contained diesel generators. Portable lights would generally operate continuously every night (approximately 12 hours) 365 days per year.

Number of Generators	30
Maximum Hours of Operation	12 hrs/day
Number of Construction Days	365
Total Generator Capacity	6 hp
Hourly Rate	0.0421 MMBtu/hr
Annual Use	5,531 MMBtu/yr

Example:  $1\text{hp}=0.002546966 \text{MMBtu/Hr}$   
Hourly Rate (MMBtu) =  $(75 \text{ Hp}/0.363) * (0.002546699 \text{ MMBtu/hr}) = 0.5262 \text{ MMBtu/hr}$   
Annual Use (MMBtu) =  $(\text{Number of Generator} * \text{Hours Operation/Day} * \text{Number of Construction Days}) = (6 * 8 * 190 * 0.5262) = 4,799 \text{ MMBtu/yr}$

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).  
Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/03s03.pdf>)

### Generator Emissions Factors (Diesel)

NO <sub>x</sub>	4.41 lb/MMBtu
VOC	0.36 lb/MMBtu
CO	0.95 lb/MMBtu
SO <sub>x</sub>	0.29 lb/MMBtu
PM <sub>10</sub>	0.31 lb/MMBtu

### Emissions (Diesel)

NO <sub>x</sub>	12.196 tpy
VOC	0.996 tpy
CO	2.627 tpy
SO <sub>x</sub>	0.802 tpy
PM <sub>10</sub>	0.857 tpy

Example: Total NO<sub>x</sub> Emissions =  $(\text{Annual MMBtu/year}^* (\text{EF})/2000 = (5,531 * 4.41)/2000 = 12.196 \text{ tpy}$

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/03s03.pdf>)

### Brownsville-Laredo Intrastate Air Quality Control Region

Row # <u>SORT</u>	State	County	Area Source Emissions						Point Source Emissions				
			CO	NOx	PM10	PM2.5	SO2	VOC	CO	NOx	PM10	PM2.5	SO2
1 TX	Cameron Co	84,539	10,659	36,197	6,679	849	15,988	386	1,169	149	111	136	516
2 TX	Hidalgo Co	145,505	17,041	61,198	11,285	1,161	27,056	4,064	2,697	319	313	41	773
3 TX	Jim Hogg Co	1,621	110	1,229	291	18.5	763	77.3	293	3.32	0.08	50	
4 TX	Starr Co	17,040	2,251	12,645	2,259	141	4,287	433	1,144	0.47	0.42	30.4	215
5 TX	Webb Co	47,946	5,122	9,943	2,380	376	13,764	755	1,128	36.7	35.6	25.2	124
6 TX	Willacy Co	9,021	1,371	9,238	1,777	121	2,753	144	253	1.61	0.61	0.02	49.6
7 TX	Zapata Co	5,466	396	1,828	477	40.1	7,134	425	503	0.18	0.17	0.21	104
<b>Grand Total</b>		<b>311,138</b>	<b>36,950</b>	<b>132,278</b>	<b>25,148</b>	<b>2,707</b>	<b>71,745</b>	<b>6,284</b>	<b>7,187</b>	<b>510</b>	<b>465</b>	<b>233</b>	<b>1,832</b>

SOURCE:

<http://www.epa.gov/air/data/geosel.html>

USEPA - AirData NET Tier Report

\*Net Air pollution sources (area and point) in tons per year (2001)  
Site visited on 15 October 2007.

Brownsville-Laredo Intrastate AQCR (40 CFR 81.135):

In the State of Texas: Cameron County, Hidalgo County, Jim Hogg County, Starr County, Webb County, Willacy County, Zapata County

<b>Summary</b>	Summarizes total emissions by calendar year.
<b>Combustion</b>	Estimates emissions from non-road equipment exhaust as well as painting.
<b>Fugitive</b>	Estimates fine particulate emissions from earthmoving, vehicle traffic, and windblown dust
<b>Grading</b>	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions
<b>Maintenance Emissions</b>	Estimates the total emissions from future maintenance of fencelines and patrol roads from mowers.
<b>Generator Emissions</b>	Estimates the total emissions from emergency generators to power construction equipment.
<b>AQCR Tier Report</b>	Summarizes total emissions for the Brownsville-Laredo Intradate AQCR Tier Reports for 2001, to be used to compare project to regional emissions.

Air Quality Emissions from Alternative 3					
	NO <sub>x</sub> (ton)	VOC (ton)	CO (ton)	SO <sub>2</sub> (ton)	PM <sub>10</sub> (ton)
CY2008					
Construction Combustion	2,927.478	436.388	3,419.987	58.550	98.212
Construction Fugitive Dust	-	-	-	-	1,615.145
Maintenance Emissions	0.127	0.015	0.064	0.030	0.015
Generator Emissions	22.777	1.859	4.907	1.498	1.601
TOTAL CY2008	2,950.383	438.263	3,424.958	60.078	1,714.973

Since future year budgets were not readily available, actual 2001 air emissions inventories for the counties were used as an approximation of the regional inventory. Because Alternative 3 is several orders of magnitude below significance, the conclusion would be the same, regardless of whether future year budget data set were used.

#### Brownsville-Laredo Intrastate AQCR

Point and Area Sources Combined					
Year	NO <sub>x</sub> (tpy)	VOC (tpy)	CO (tpy)	SO <sub>2</sub> (tpy)	PM <sub>10</sub> (tpy)
2001	44,137	73,577	317,422	2,940	132,788

Source: USEPA-AirData NET Tier Report (<http://www.epa.gov/air/data/geosei.html>). Site visited on 15 October 2007.

#### Determination Significance (Significance Threshold = 10%) for Construction Activities

Point and Area Sources Combined					
NO <sub>x</sub> (tpy)	VOC (tpy)	CO (tpy)	SO <sub>2</sub> (tpy)	PM <sub>10</sub> (tpy)	
44,137	73,577	317,422	2,940	132,788	
2,950.383	438.263	3,424.958	60.078	1,714.973	
<b>6.685%</b>	<b>0.596%</b>	<b>1.079%</b>	<b>2.044%</b>	<b>1.292%</b>	

Minimum - 2001  
2008 Emissions  
Alternative 3 %

### **Construction Combustion Emissions for CY 2008**

Combustion Emissions of VOC, NO<sub>x</sub>, SO<sub>2</sub>, CO and PM<sub>10</sub> Due to Construction

Includes:

100% of Construct Pedestrian Fences and Patrol Road

55,313,280 ft<sup>2</sup>

Assumptions:

Total ground disturbance for pedestrian fence and patrol road would be 69.84 miles long by 150 feet wide (55,313,280 ft<sup>2</sup>).

No grading would be required in construction staging areas.

Patrol road would be graded and lined with gravel. No paving would be included in Alternative 3.

Construction would occur between March and December 2008 for a total of 190 working days.

Total Building Construction Area:	0 ft <sup>2</sup>	(none)
Total Demolished Area:	0 ft <sup>2</sup>	(none)
Total Paved Area:	0 ft <sup>2</sup>	(none)
Total Disturbed Area:	55,313,280 ft <sup>2</sup>	(none)
Construction Duration:	1.0 year(s)	
Annual Construction Activity:	190 days/yr	

## Emissions Factors Used for Construction Equipment

Reference: Guide to Air Quality Assessment, SMAQMD, 2004

Emissions factors are taken from Table 3-2. Assumptions regarding the type and number of equipment are from Table 3-1 unless otherwise noted.

### Grading

Equipment	No. Reqd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Bulldozer	1	29.40	3.66	25.09	0.59	1.17
Motor Grader	1	10.22	1.76	14.98	0.20	0.28
Water Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	3	60.51	9.02	70.69	1.21	2.03

### Paving

Equipment	No. Reqd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Paver	1	7.93	1.37	11.62	0.16	0.22
Roller	1	5.01	0.86	7.34	0.10	0.14
Total per 10 acres of activity	2	12.94	2.23	18.96	0.26	0.36

### Demolition

Equipment	No. Reqd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Loader	1	7.86	1.35	11.52	0.16	0.22
Haul Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	2	28.75	4.95	42.14	0.58	0.80

### Building Construction

Equipment <sup>d</sup>	No. Reqd. <sup>a</sup> per 10 acres	NO <sub>x</sub> (lb/day)	VOC <sup>b</sup> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup>	PM <sub>10</sub> (lb/day)
Stationary						
Generator Set	1	11.83	1.47	10.09	0.24	0.47
Industrial Saw	1	17.02	2.12	14.52	0.34	0.68
Welder	1	4.48	0.56	3.83	0.09	0.18
Mobile (non-road)						
Truck	1	20.89	3.60	30.62	0.84	0.58
Forklift	1	4.57	0.79	6.70	0.18	0.13
Crane	1	8.37	1.44	12.27	0.33	0.23
Total per 10 acres of activity	6	67.16	9.98	78.03	2.02	2.27

Note: Footnotes for tables are on following page

Architectural Coatings					
Equipment	No. Rqd. <sup>a</sup> per 10 acres	VOC <sup>b</sup> (lb/day)	NO <sub>x</sub> (lb/day)	CO (lb/day)	SO <sub>2</sub> <sup>c</sup> (lb/day)
Air Compressor	1	6.83	0.85	5.82	0.14
Total per 10 acres of activity	1	6.83	0.85	5.82	0.14

- a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
- b) The SMAQMD 2004 reference lists emissions factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC.
- c) The SMAQMD 2004 reference does not provide SO<sub>2</sub> emissions factors. For this worksheet, SO<sub>2</sub> emissions have been estimated based on approximate fuel use rate for diesel equipment and the assumption of 500 ppm sulfur diesel fuel. For the average of the equipment fleet, the resulting SO<sub>2</sub> factor was found to be approximately 0.04 times the NO<sub>x</sub> emissions factor for the mobile equipment (based upon 2002 USAF IERA "Air Emissions Inventory Guidance") and 0.02 times the NO<sub>x</sub> emissions factor for all other equipment (based on AP-42, Table 3.4-1)
- d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

## PROJECT-SPECIFIC EMISSIONS FACTOR SUMMARY

Source	Equipment Multiplier*	SMAQMD Emissions Factors (lb/day)		
		NO <sub>x</sub>	VOC	CO
Grading Equipment	127	975826.067	145462.752	1139995.780
Paving Equipment	1	0.000	0.000	0.000
Demolition Equipment	1	0.000	0.000	0.000
Building Construction	1	0.000	0.000	0.000
Air Compressor for Architectural Coating	1	0.000	0.000	0.000
Architectural Coating <sup>g</sup> **		0.000	0.000	0.000

\*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project

\*\*Emissions factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emissions Factor for Grading Equipment NO<sub>x</sub> = (Total Grading NO<sub>x</sub> per 10 ac\* ((total disturbed area/43560)/10)) \* (Equipment Multiplier)

### Summary of Input Parameters

	Total Area (ft <sup>2</sup> )	Total Area (acres)	Total Days
Grading:	55,313,280	1,269.82	6 (from "CY2008 Grading" worksheet)
Paving:	0	0.00	0
Demolition:	0	0.00	0
Building Construction:	0	0.00	0 (per the SMAQMD "Air Quality of Thresholds of Significance", 1994)
Architectural Coating	0	0.00	0

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The "Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

### Total Project Emissions by Activity (lbs)

	NO <sub>x</sub>	VOC	CO	SO <sub>2</sub>	PM <sub>10</sub>
Grading Equipment	5,854,956.40	872,776.51	6,839,974.68	117,099.13	196,423.10
Paving	-	-	-	-	-
Demolition	-	-	-	-	-
Building Construction	-	-	-	-	-
Architectural Coatings	-	-	-	-	-
<b>Total Emissions (lbs):</b>	<b>5,854,956.40</b>	<b>872,776.51</b>	<b>6,839,974.68</b>	<b>117,099.13</b>	<b>196,423.10</b>

### Results: Total Project Annual Emissions Rates

	NO <sub>x</sub>	VOC	CO	SO <sub>2</sub>	PM <sub>10</sub>
Total Project Emissions (lbs)	5,854,956.40	872,776.51	6,839,974.68	117,099.13	196,423.10
Total Project Emissions (tons)	2,927.48	436.39	3,419.99	58.55	98.21

### CO2 Emissions

It is assumed that 75 vehicles consisting of bulldozer, grader, forklift, cranes, rollers, and light duty trucks would be used for this project.

It is further assumed that the total approximate average miles per day per vehicle would be 10 miles

It is assumed that the average vehicle will produce 19.5 pounds of CO2 per gallon of gas used. ([www.eia.doe.gov/oiaf/1605/coefficients](http://www.eia.doe.gov/oiaf/1605/coefficients))

75 vehicles × 10 miles/day/vehicle × 190 days working × 1 gal/10 miles × 19.5 lb co2/gal × ton/2000lb = 137.5 tons CO2

Estimate emissions of CO2 for BLIAQCR region is 995,000 tons per year

## Construction Fugitive Dust Emissions for CY 2008

Calculation of  $PM_{10}$  Emissions Due to Site Preparation (Uncontrolled).

User Input Parameters / Assumptions			
Acres graded per year:	1269.82	acres/yr	(From "CY2008 Combustion" worksheet)
Grading days/yr:	5.59	days/yr	(From "CY2008 Grading worksheet")
Exposed days/yr:	90	assumed days/yr	graded area is exposed
Grading Hours/day:	8	hr/day	
Soil piles area fraction:	0.10	(assumed fraction of site area covered by soil piles)	
Soil percent silt, s:	8.5 %	(mean silt content; expected range: 0.56 to 23 AP-42 Table 13.2.2-1)	
Soil percent moisture, M:	85 %	( <a href="http://www.cpc.noaa.gov/products/soilmst/w.shtml">http://www.cpc.noaa.gov/products/soilmst/w.shtml</a> )	
Annual rainfall days, p:	70	days/yr rainfall exceeds 0.01 inch/day (AP-42 Fig 13.2.2-1)	
Wind speed > 12 mph %, l:	39.5 %	Ave. of wind speed at Brownsville, TX ( <a href="ftp://fp.wcc.nrcs.usda.gov/downloads/climate/windrose/texas/brownsville/">ftp://fp.wcc.nrcs.usda.gov/downloads/climate/windrose/texas/brownsville/</a> )	
Fraction of TSP, J:	0.5	per California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993, p. A9-99	
Mean vehicle speed, S:	5 mi/hr	(On-site)	
Dozer path width:	8 ft		
Qty construction vehicles:	380.95 vehicles	(From "CY2008 Grading worksheet")	
On-site VMT/vehicle/day:	5 mi/veh/day	(Excluding bulldozer VMT during grading)	
$PM_{10}$ Adjustment Factor k	1.5 lb/VMT	(AP-42 Table 13.2.2-2 12/03 for $PM_{10}$ for unpaved roads)	
$PM_{10}$ Adjustment Factor a	0.9 (dimensionless)	(AP-42 Table 13.2.2-2 12/03 for $PM_{10}$ for unpaved roads)	
$PM_{10}$ Adjustment Factor b	0.45 (dimensionless)	(AP-42 Table 13.2.2-2 12/03 for $PM_{10}$ for unpaved roads)	
Mean Vehicle Weight, W	40 tons	assumed for aggregate trucks	
TSP - Total Suspended Particulate			
VMT - Vehicle Miles Traveled			

### **Emissions Due to Soil Disturbance Activities**

Operation Parameters (Calculated from User Inputs)	
Grading duration per acre	0 hr/acre
Bulldozer mileage per acre	1 VMT/acre
Construction VMT per day	1905 VMT/day
Construction VMT per acre	8.4 VMT/acre

(Miles traveled by bulldozer during grading)  
(Travel on unpaved surfaces within site)

### Equations Used (Corrected for PM10)

Operation	Empirical Equation	Units	AP-42 Section (5th Edition)
Bulldozing	$0.75(s^{1.5})(M^{1.4})$	lbs/hr	Table 11.9-1, Overburden
Grading	$(0.60)(0.051)s^{2.0}$	lbs/VMT	Table 11.9-1,
Vehicle Traffic (unpaved roads)	$[(K(s/12)^a)(W/3)^b] / [(365-P)/365]$	lbs/VMT	Section 13.2.2

Source: Compilation of Air Pollutant Emissions Factors, Vol. I, USEPA AP-42, Section 11.9 dated 10/98 and Section 13.2 dated 12/03

### Calculation of PM<sub>10</sub> Emissions Factors for Each Operation

Operation	Emissions Factor (mass/ unit)	Operation Parameter	Emissions Factor (lbs/ acre)
Bulldozing	0.04 lbs/hr	0 hr/acre	0.00 lbs/acre
Grading	0.77 lbs/VMT	1 VMT/acre	0.80 lbs/acre
Vehicle Traffic (unpaved roads)	2.85 lbs/VMT	8.4 VMT/acre	24.00 lbs/acre

### **Emissions Due to Wind Erosion of Soil Piles and Exposed Graded Surface**

Reference: California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993.

$$\text{Soil Piles EF} = 1.7(s/1.5)[(365 - p)/235](l/15)(J) = (s)(365 - p)(l)(J)/(3110.2941), \text{ p. A9-99.}$$

$$\text{Soil Piles EF} = 15.9 \text{ lbs/day/acre covered by soil piles}$$

Consider soil piles area fraction so that EF applies to graded area

Soil piles area fraction: 0.10 (Fraction of site area covered by soil piles)

$$\text{Soil Piles EF} = 1.59 \text{ lbs/day/acre graded}$$

$$\text{Graded Surface EF} = 26.4 \text{ lbs/day/acre (recommended in CEQA Manual, p. A9-93).}$$

### **Calculation of Annual PM<sub>10</sub> Emissions**

Source	Emissions Factor	Graded Acres/yr	Exposed days/yr	Emissions lbs/yr	Emissions tons/yr
Bulldozing	0.00 lbs/acre	1269.82	NA	0	0.000
Grading	0.80 lbs/acre	1269.82	NA	1,016	0.508
Vehicle Traffic	24.00 lbs/acre	1269.82	NA	30,476	15.238
Erosion of Soil Piles	1.59 lbs/acre/day	1269.82	90	181,711	90.855
Erosion of Graded Surface	26.40 lbs/acre/day	1269.82	90	3,017,088	1,508.544
<b>TOTAL</b>				<b>3,230,290</b>	<b>1,615.15</b>

Soil Disturbance EF: 24.80 lbs/acre  
Wind Erosion EF: 27.99 lbs/acre/day

Back calculate to get EF:

$$455.46 \text{ lbs/acre/grading day}$$

## **Construction (Grading) Schedule for CY 2008**

Estimate of time required to grade a specified area.

Input Parameters	
Construction area:	1,269.82 acres/yr (from 'CY2008 Combustion' Worksheet)
Qty Equipment:	380.95 (calculated based on 3 pieces of equipment for every 10 acres)

### Assumptions.

Terrain is mostly flat.

An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.  
200 hp bulldozers are used for site clearing.

300 hp bulldozers are used for stripping, excavation, and backfill.

Vibratory drum rollers are used for compacting.

Stripping, Excavation, Backfill and Compaction require an average of two passes each.

Excavation and Backfill are assumed to involve only half of the site.

### Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	1269.82	158.73
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	1269.82	620.80
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	634.91	640.20
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	634.91	262.65
2315 310 5020	Compaction	Vibrating roller, 6" lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	1269.82	445.36
<b>TOTAL</b>							<b>2127.73</b>	

### Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 2127.73  
Qty Equipment: 380.95  
Grading days/yr: 5.59

### Maintenance Activities Emissions for CY 2008

#### Combustion Emissions of VOC, NO<sub>x</sub>, SO<sub>2</sub>, CO and PM<sub>10</sub> Due to Maintenance Activities

The fenceline and patrol road would require mowing approximately two times per year to maintain vegetation height and allow enhanced visibility and security.

Assumptions:

- Approximately 1,269.82 acres of land would be mowed twice per year.
- Six agricultural mowers (40 horsepower) would operate for approximately 14 days.
- Each working day would be 8 hours.
- Agricultural mowers operate at 43% load capacity (17.2 horsepower).

### Emission Factors Used for Maintenance Equipment

Reference: USAF IERA "Air Emissions Inventory Guidance", July 2001, Table 7-6. Criteria Pollutant Emission Factors for Nonroad Diesel Engines.

Emission Factors						
Equipment	Rated Power (hp)	Loading Factor (% of Max Power)	Operating Time (hr/yr)	BSFC (lb/hp-hr)	NO <sub>x</sub> (g/hp-hr)	VOC (g/hp-hr)
Agricultural Mower (Diesel)	40	43	224	0.408	5.0	0.6
BSFC = Brake Specific Fuel Consumption					2.5	1.19

### Results: Total Maintenance Annual Emission Rates

	NO <sub>x</sub>	VOC	CO	SO <sub>2</sub>	PM <sub>10</sub>
Total Maintenance Emissions (lbs)	254.863	30.584	127.431	60.657	30.584
Total Maintenance Emissions (tons)	0.127	0.015	0.064	0.030	0.015

Example:

$$\text{Total Maintenance Emissions (lbs of NO}_x\text{)} = (\text{Rated power output of equipment engine})^*(\text{Loading Factor}/100)^*(\text{Operating Time})^*(\text{Number of Equipment})^*(\text{Emission Factor})^*(\text{Conversion factor})$$

$$\text{Total Maintenance Emissions (lbs of NO}_x\text{)} = (40 \text{ hp})^*(43/100)^*(224 \text{ hr/yr})^*(2 \text{ Equipment})^*(5.0 \text{ g/hp-hr})^*(0.002205 \text{ lb/g}) = 84.95 \text{ lbs/yr}$$

## Emissions from Diesel Powered Generators for Construction Equipment

Alternative 3 would require six diesel powered generators to power construction equipment. These generators would operate approximately 8 hours per day for 190 working days.

Number of Generators	6
Maximum Hours of Operation	8 hrs/day
Number of Construction Days	190
Total Generator Capacity	75 hp
Hourly Rate	0.5262 MMBtu/hr
Annual Use	4,799 MMBtu/yr

Example:  $1\text{hp}=0.002546966 \text{MMBtu}/\text{Hr}$

$$\text{Annual Use (MMBtu)} = (75 \text{ Hp}/0.363) * (0.002546699 \text{ MMBtu}/\text{hr}) = 0.5262 \text{ MMBtu}/\text{hr}$$
$$\text{Annual Use (MMBtu)} = (\text{Number of Generator} * \text{Hours Operation}/\text{Day} * \text{Number of Construction Days}) = (6*8*190*0.5262) = 4,799 \text{ MMBtu/yr}$$

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).

Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>)

Generator Emissions Factors (Diesel)

NO <sub>x</sub>	4.41 lb/MMBtu
VOC	0.36 lb/MMBtu
CO	0.95 lb/MMBtu
SO <sub>x</sub>	0.29 lb/MMBtu
PM <sub>10</sub>	0.31 lb/MMBtu

Emissions (Diesel)

NO <sub>x</sub>	10,581 tpy
VOC	0.864 tpy
CO	2,279 tpy
SO <sub>x</sub>	0.696 tpy
PM <sub>10</sub>	0.744 tpy

Example: Total NOx Emissions = (Annual MMBtu/year)\*(EF)/2000 = (4,799\*4.41)/2000 = 10,581 tpy

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>)

### Emissions from Diesel Powered Generators for Portable Lights

To be conservative, it was assumed that up to 30 portable light units would be needed for construction. These portable lights are powered by 6-kilowatt self-contained diesel generators. Portable lights would generally operate continuously every night (approximately 12 hours) 365 days per year.

Number of Generators	30
Maximum Hours of Operation	12 hrs/day
Number of Construction Days	365
Total Generator Capacity	6 hp
Hourly Rate	0.0421 MMBtu/hr
Annual Use	5,531 MMBtu/yr

Example:  $1\text{hp}=0.002546966 \text{MMBtu/Hr}$   
 $\text{Hourly Rate (MMBtu)} = (75 \text{ Hp}/0.363) * (0.00254699 \text{ MMBtu/hr}) = 0.5262 \text{ MMBtu/hr}$   
 $\text{Annual Use (MMBtu)} = (\text{Number of Generator} * \text{Hours Operation/Day} * \text{Number of Construction Days}) = (6*8*190*0.5262) = 4,799 \text{ MMBtu/yr}$

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).

Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>)

### Generator Emissions Factors (Diesel)

NO <sub>x</sub>	4.41 lb/MMBtu
VOC	0.36 lb/MMBtu
CO	0.95 lb/MMBtu
SO <sub>x</sub>	0.29 lb/MMBtu
PM <sub>10</sub>	0.31 lb/MMBtu

### Emissions (Diesel)

NO <sub>x</sub>	12.196 tpy
VOC	0.996 tpy
CO	2.627 tpy
SO <sub>x</sub>	0.802 tpy
PM <sub>10</sub>	0.857 tpy

Example: Total NOx Emissions = (Annual MMBtu/year)\*(EF)/2000 = (5,531\*4.41)/2000 = 12.196 tpy

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>)

### Brownsville-Laredo Intrastate Air Quality Control Region

Row # <u>SORT</u>	State	County	Area Source Emissions						Point Source Emissions				
			CO	NOx	PM10	PM2.5	SO2	VOC	CO	NOx	PM10	PM2.5	SO2
1 TX	Cameron Co	84,539	10,659	36,197	6,679	849	15,988	386	1,169	149	111	136	516
2 TX	Hidalgo Co	145,505	17,041	61,198	11,285	1,161	27,056	4,064	2,697	319	313	41	773
3 TX	Jim Hogg Co	1,621	110	1,229	291	18.5	763	77.3	293	3.32	3.32	0.08	50
4 TX	Starr Co	17,040	2,251	12,645	2,259	141	4,287	433	1,144	0.47	0.42	30.4	215
5 TX	Webb Co	47,946	5,122	9,943	2,380	376	13,764	755	1,128	36.7	35.6	25.2	124
6 TX	Willacy Co	9,021	1,371	9,238	1,777	121	2,753	144	253	1.61	1.61	0.02	49.6
7 TX	Zapata Co	5,466	396	1,828	477	40.1	7,134	425	503	0.18	0.17	0.21	104
<b>Grand Total</b>		<b>311,138</b>	<b>36,950</b>	<b>132,278</b>	<b>25,148</b>	<b>2,707</b>	<b>71,745</b>	<b>6,284</b>	<b>7,187</b>	<b>510</b>	<b>465</b>	<b>233</b>	<b>1,832</b>

SOURCE:

<http://www.epa.gov/air/data/geosel.html>

USEPA - AirData NET Tier Report

\*Net Air pollution sources (area and point) in tons per year (2001)  
Site visited on 15 October 2007.

Brownsville-Laredo Intrastate AQCR (40 CFR 81.135):

In the State of Texas: Cameron County, Hidalgo County, Jim Hogg County, Starr County, Webb County, Willacy County, Zapata County