Appendix K

GREENHOUSE GASES INVENTORY

Inventory of Greenhouse Gas Emissions Boca Quarry Project

Truckee, California

May 04, 2012

Prepared For:

Teichert Aggregates, Inc.
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Sacramento, CA 95864

Prepared By:
Air Permitting Specialists
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Wilton, CA 95693

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1. INTRODUCTION

Air Permitting Specialists (APS) staff have completed our analysis of potential greenhouse gas (GHG) emissions associated with the proposed Boca Quarry project located in Eastern Nevada County, California. The quarry has 17 millions tons of aggregate that may be mined over 30 years. Annual production rates will vary depending on market conditions and is expected to range between 300,000 tons per year to a maximum of 1 million tons per year. The project would operate a maximum of 180 days per year. Under maximum production, the aggregate reserves would be exhausted in approximately 17 years.

The release of GHG emissions from anthropogenic sources is believed to increase the global temperature by changing the radiative transfer properties of the atmosphere. GHG emissions consist primarily of carbon dioxide (CO_2) with trace amount of methane (CH_4) and nitrous oxide (N_2O). For diesel combustion, the primary fuel that will be used, methane and nitrous oxide will contribute less than 0.5 percent to the overall GHG budget at Boca Quarry. Collectively, the total emissions of CO_2, CH_4 and N_2O, are reported in terms of carbon dioxide equivalents or CO_2(e).

While this report focuses on GHG emissions from the Boca Quarry in Eastern Nevada County, the scale of emissions and their impacts are global. GHG emissions from this project need to be viewed in the context of worldwide GHG emissions; not just emissions in Nevada County or in California. This is because greenhouse gases are dispersed and well mixed in the atmosphere and have an average lifetime of many years. Hence the impacts may not be known for 10 to 50 years after the release of GHG.

The process of mining, producing and delivering aggregate to the local markets would release GHG emissions from stationary and mobile sources.

The objectives of this report are to:

1. Identify sources of greenhouse gas emissions

2. Quantify the annual emission rates of GHG emissions

The expansion of Boca Quarry is necessitated by the demand for aggregate in Nevada County such as, from road construction, repaving of Interstate 80 and general public and private road construction and maintenance. This demand will not change if this project is approved or denied.

As a result, the No Project Alternative would not lead to zero emissions or lower emissions because aggregate production would be shifted to other, more distant, sources. According to a recent study[1] on the environmental costs associated with delivery of aggregate, it is estimated that transportation costs will exceed production costs if travel distances exceed about 20 miles. Therefore, local sources of aggregate are preferred.

The dynamics of the marketplace and transportation costs would determine which sources of aggregate would serve the local market. Regardless of the sources of aggregate, GHG emissions would be released in the process of meeting the local demand for aggregate.

This report does not assess the significance of any impacts associated with GHG emissions from Boca Quarry. This determination is deferred to the County of Nevada, that serves as the Lead Agency.

[1] Peter Berck, "A Note on Environmental Costs of Aggregate", Working Paper No. 994, Dept. of Agriculture and Resource Economics Policy, University of California, Berkeley, CA January 2005.

2. SOURCES OF GREENHOUSE GAS EMISSIONS

The process of mining the rock and producing aggregate involves the following key steps:

1. Extraction of rock using blasting and excavation of loosened rock
2. Transport of the rock to crushing and screening area
3. Crushing and screening of rock to produce aggregate

A list of equipment, the horsepower (hp) and daily usage is provided below.

Equipment	No	HP	Max Hrs/Day
Dozer	1	410	10
Excavator	1	473	10
Front End Loader WA 500	1	522	10
Front End Loader WA 600	1	527	10
Electric Generator	1	1372	10

In addition to this equipment, off-site trucks are used to transport the rock to the processing area and employee travel to/from work. Rock crushers and screens used to process the rock will be electrically powered, and therefore would not directly emit greenhouse gases.

The finished aggregate will be transported to various projects in Nevada County and other nearby counties. The truck used to haul the finished product will carry an average of 18 tons of aggregate. Therefore, the maximum 1 million tons or rock that may be produced annually translates into:

$$\frac{(1{,}000{,}000 \text{ tons/yr})}{(18 \text{ tons/truck trip})} = 55{,}556 \text{ truck trips/yr}$$

Since the production would occur over 180 days, this equates to:

$$\frac{(55{,}556 \text{ truck trips/yr})}{(180 \text{ days/yr})} = 309 \text{ trips/day}$$

Note that this represents an average estimate of trucks over the duration of the project and differs from peak hourly and daily traffic estimates presented in the traffic studies.

Other (indirect) sources of GHG emissions are electricity generation at other (off-site) locations and removal of vegetation from the sate. Electricity generation would release GHG emissions from combustion of fossil fuels at power generation plants in Nevada.

As part of the project, 110 acres will be cleared of existing vegetation. This area represents the difference in vegetation removal between existing conditions (40 acres) and what would occur with completion of the project (150 acres). The vegetation absorbs CO_2 from the atmosphere (carbon fixation), and its removal is assumed to be equivalent to releasing CO_2 into the atmosphere. As part of the reclamation, the vegetation will be re-grown and the carbon fixation will be restored. However, over the short-term, there would be a loss in carbon fixation and no credit for vegetation re-growth is assumed.

3. CALCULATION OF EMISSIONS

This section describes the calculation methods and procedures used to determine emissions from the various sources identified in the previous section.

Emissions from On-Site Equipment and Blasting

Direct emissions occur from blasting of rock and transporting the rock to the processing area where the rock is crushed and screened. The process involves loading of rock on to off-road trucks and transferring it to the crushing/screening area. A list of equipment, their horsepower and annual usage was provided in Section 2. The emission factors and capacity factors are based on data from URBEMIS[2] model, Appendix I.

Emissions from blasting assume 1 blast per day. Two hundred and fifty pounds of ammonium nitrate and fuel oil mixture (ANFO) is used per blast. The emission factor[3] is based on AP-42 for No. 2 diesel fuel combustion. A diesel fuel/ANFO ratio of 9% was used assuming diesel fuel bulk density of 7.4 lbs/gallon. This equates to 544 lbs of CO_2 emissions/ton of ANFO.

Emissions from On-Road and Off-Road Trucks and Vehicles

Emissions from heavy duty trucks and employee travel were estimated using the EMFAC 2007 emissions model[4]. The emissions are based on 2005 to 2011 vehicle mix. Separate emissions, in grams/mile, were estimated for heavy duty and light duty vehicles. The CO_2 emissions are 1,559 grams/mile and 282 grams/mile for heavy duty and light duty vehicles respectively. A copy of the EMFAC model output is attached.

Emissions from Electricity Usage

Emissions[5] from electricity usage are estimated to be 0.859 lbs CO_2/kwh or 0.863 lbs CO_2(e)/kwh and is based on total electrical output and total emissions for 2007 at the NWPP subregion that serves Northern Nevada. The project would use 240,000 kilowatt hour (kwh) of electricity per month or 1.44 megawatts hours (mwh) over 6 months annually.

Emissions from Vegetation Removal and Site Clearing

Site clearing of 110 acres of predominantly bitterbrush vegetation is assumed to be equivalent to releasing 2.1 metric tons of CO_2 per acre. This absorption factor is typical for

[2] URBEMIS 2007 Appendix I, URBEMIS User's Guide, Version 9.2

[3] EPA 2010 "Compilation of Emission Factors for Fuel Combustion, Section 1.3, Table 1.312. Available at: www.epa.gov/ttn/chief

[4] EMFAC 2007 Emissions Model available from California Air Resources Board. Available at: http://www.arb.ca.gov/msei/onroad/downloads/docs/user_guide_emfac2007.pdf

[5] eGrid 2010 Version 1.0 for WECC Northwest Grid Sub-Region. Available at: http://epa.gov/statelocalclimate/documents/pdf/background_paper_3-31-2011.pdf

pine/bitterbrush[6]. As noted previously, the vegetation will be eventually reestablished, however, over the short-term, there would be a loss in CO_2 absorption.

[6] Waring, R. H., B. Law, and B. Bond. 1999. *NPP Temperate Forest: OTTER Project Sites, Oregon, U.S. A., 1989-1991.* Data set. Available on-line [http://www.daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A.

4. ESTIMATE OF GHG EMISSIONS

4.1 Summary of Emissions

The overall project emissions are summarized below. Tables 1 to 7 present detailed emissions calculations. The emissions are based on 180 operating days per year producing a maximum of 1 million tons of aggregate per year.

Source	$CO_2(e)$ tons/yr	% of Total
Transport Trucks	3,829	64.2%
On-Site Equipment	1,192	20.0%
Electricity Use	621.05	10.4%
Removal of Vegetation	257.5	4.3%
On-Site Truck Movement	51.2	0.9%
Employee Travel	11.8	0.2%
Blasting	1.8	0.03%
TOTAL	***5,960***	***100%***

4.2 Estimate of Avoided Emissions

As noted earlier, the need for sources of aggregate is based on the overall demand for aggregate. This demand is based on, in part, the population, need for additional roads and the need for repaving existing roads, especially, I-80. Such projects would still be completed regardless if the Boca Quarry project is approved or denied. If the Boca project were not proposed, then the local demand for aggregate, such as road construction projects, would be met from other regional sources.

The nearest source for aggregate is in the Reno/Sparks area. This is approximately 40 miles (one-way, 80 miles round trip) from the Boca Quarry location. This means that a single 18 ton truck load of aggregate delivered from Reno would add an additional 80 miles of truck travel.

The additional truck travel would release GHG emissions as follows:

GHG emissions per truck trip = 80 miles/trip x 1,536 grams/mile x (1/454 grams/lb) = 274.7 lbs/trip

GHG emissions (based on 309 trips/day) = 274.7 lbs/trip x 309 trips/day = 84,790.5 lbs/day (42.2 tons/day)

Since the quarry would operate for up to 180 days/year, these daily emissions equate to 7,631 tons/year. These emissions are in addition to emissions that would be released from the mining and production of aggregate at an alternate location.

Table 1
Summary of GHG Emissions

Source	CO_2 *tons/yr*	CH_4 *tons/yr*	N_2O *tons/yr*	Total $CO_2(e)$ *tons/yr*	% of Total
Trucks Transporting Aggregate	3,816	0.16	0.031	3,829	64.3%
On-Site Equipment	1,184	0.05	0.010	1,188	19.9%
Electricity Use	617.8	0.0118	0.0098	621.05	10.4%
Removal of Vegetation	256.7	0.01	0.002	257.5	4.3%
On-Site Truck Movement	51.0	0.0021	0.00042	51.2	0.9%
Employee Travel	11.7	0.0005	0.00010	11.8	0.20%
Blasting	1.77	0.0001	0.00001	1.8	0.03%
TOTAL	***5,938***	***0.230***	***0.053***	***5,960***	100%

Notes

1. Calculations of CO_2 emissions for each category of sources is presented in Tables 2-6.

2. Emissions of CH_4 and N_2O are based on diesel fuel combustion except electricity usage which is reported in the 2010 eGrid database for WECC Northwest Grid Subregion. Available at: http://epa.gov/statelocalclimate/documents/pdf/background_paper_3-31-2011.pdf

Table 2
On-Site Emissions from Equipment and Blasting

Equipment	No.	HP	Annual Max Hrs	Capacity Factor	Usage Factor	Carbon Dioxide (CO_2) Emission Factor *(g/hp-hr)*	*(lbs/hr)*	*(tons/yr)*
On-Site Equipment								
Dozer	1	410	3,600	0.65	90%	335.6	197	319.1
Excavator	1	473	2,700	0.65	90%	324.2	198	240.1
Front End Loader WA 500	1	522	1,350	0.65	95%	307.2	218	139.8
Front End Loader WA 600	1	527	1,350	0.65	65%	307.2	151	66.1
Electric Generator	1	1372	1,800	0.65	75%	420.9	620	418.6
Totals							1,383	1,184

CALCULATIONS

$$\text{Max Hourly CO2 Emissions (lbs/hr)} = \frac{\text{Emission Factor (g/hp-hr) x HP x Capacity Factor}}{\text{454 grams/hr}}$$

$$\text{Annual CO2 Emissions (lbs/year)} = \frac{\text{Emissions (lbs/hr) x Annual Hrs x Usage Factor}}{\text{2000 lbs/ton}}$$

Emission Factors from URBEMIS 2007 User's Guide Version 9.2, Appendix I, pages I-27 to I-30.

Emissions from Blasting		
Max. Number of Blasts/Day	1	
Max. No. of Blasts/week	2	
No. of Blasts/year	52	
Amount of ANFO/Blast	250	lbs/blast
CO2 Emission Factor	544	lbs CO2 /ton ANFO
	0.272	lbs CO2 /lb ANFO
Emissions/blast	68.0	lbs CO2 / day
Annual Emissions	3,536	lbs/yr
	1.77	tons/yr

Table 3
Emissions from On-Site Truck Movement and Idling

Source of Emissions	Average Trips/Day	Annual Trips/Yr	Round Trip Length *(mile)*	Annual Miles	Emission Factor *(g/mile)*	CO_2 *(lbs/yr)*	CO_2 *(tons/yr)*
On-Site Mining Trucks *(Heavy Duty, 20 mph)*	139	25,000	0.9	22,500	2,009.4	99,584	49.8
Water Truck *(Medium Duty, 20 mph)*	5	900	0.9	810	774.1	1,381	0.69
Service Truck *(Medium Duty, 20 mph)*	4	720	0.9	648	774.1	1,105	0.55
				TOTALS		102,069	51.03

Operating Days/Year 180 days/yr

CALCULATIONS

Annual CO2 Emissions (lbs/year) = $\frac{\text{Emission Factor (g/mile) x Annual Miles}}{\text{454 grams/lb}}$

Annual CO2 Emissions (tons/yr) = $\frac{\text{Annual Pounds}}{\text{2000 lbs/ton}}$

On-Site Truck Idling

Number of Trucks/Day	309		
Idle Time/Truck	5	min	
Emission Factor (EF)	5,860.4	grams CO2/Idle Hour for HD Trucks	
Emissions/Day	332.0	lbs/day	$\frac{\text{(\# trucks/day x 5 min/truck x EF)}}{\text{60 min/hr x 454 grams/lb}}$
Annual Emissions	29.9	tons/yr	(lbs/day x 180 days/2000)

Table 4
Estimate of Off-Site Mobile Emissions

Breakdown of Daily Traffic	Average Trips/Day	Annual Trips/Yr	Round Trip Length *(mile)*	Annual Miles Travelled	Emission Factor *(g/mile)*	CO_2 *(lbs/day)*	CO_2 *(tons/yr)*
Employee/Visitor Vehicles *Light Duty Vehicles*	10	1,800	21	37,800	282.052	130	11.7
Haul Trucks *Heavy Duty Vehicles*	309	55,556	40	2,222,222	1,559.0	42,395	3,815.6
				TOTALS		42,526	3,827
Operating Days/Year	180						

CALCULATIONS

Annual Miles Travelled = Annual Trips x Trip Length (miles/round Trip)

$$\text{Daily CO2 Emissions (lbs/day)} = \frac{\text{No. Trips/day x Round Trip Length (mile) x Emission Factor (gram/mile)}}{\text{454 grams/lb}}$$

$$\text{Annual (tons/yr)} = \frac{\text{Annual Miles Travelled x Emission Factor (g/mile)}}{\text{454 grams/lb x 2000 lbs/ton}}$$

Table 5
Estimate of Avoided Haul Truck Emissions
(from Reno)

Breakdown of Daily Traffic	Average Trips/Day	Annual Trips/Yr	Round Trip Length *(mile)*	Annual Miles	Emission Factor *(gram/mile)*	CO_2 *(lbs/day)*	CO_2 *(tons/yr)*
Haul Trucks *Heavy Duty Vehicles*	309	55,556	80	4,444,444	1,559.04	84,791	7,631
				TOTALS		84,791	7,631
Operating Days/Year	180						

CALCULATIONS

Daily (lbs/day) = $\frac{\text{Peak Trips/day x Round Trip Length x Emissions/Mile}}{\text{454 grams/lb}}$

Annual (tons/yr) = $\frac{\text{Annual Miles /yr x Emission Factor (gram/mile)}}{\text{454 grams/lb x 2000 lbs/ton}}$

Table 6
Estimate of GHG Emissions from Electricity Usage
(Based on 1,440,000 KWH Consumption per Year)

	Global Warming Potential *GWP*	Emission Factor *lbs/kwh*	*lbs*	*tons*	CO2(e) *tons*
CO_2	1	0.85800	1,235,520	617.8	617.8
CH_4	21	0.0000163	24	0.0118	0.247
N_2O	310	0.0000136	20	0.0098	3.04
				617.78	621.05

CO_2 (e) tons = lbs x GWP/2000

Emission Factors based on 2007 eGrid Data. See Attachment 2.
Available at:
http://epa.gov/statelocalclimate/documents/pdf/background_paper_3-31-2011.pdf

Table 7
Evaluation of GHG Emissions in Terms of CO2 Equivalents (CO_2(e)) from Diesel Combustion

Basis: 1 mmbtu of Diesel				
Pollutant	Emission Factor *(kg/mmbtu)*	Global Warming Potential (GWP)	*kg*	*kg CO2(e)*
CO2	73.1	1	73.1	73.1
CH4	0.003	21	0.003	0.063
N2O	0.0006	310	0.0006	0.186
	Totals		73.1	*73.3*
	kg CH4/kg CO2	4.10E-05		
	kg N2O/kg CO2	8.21E-06		
	Overall Ratio CO2(e)/CO2	1.0034		

Notes

CO2 (e) - carbon dioxide equivalents

kg CO2 (e) = kg x GWP

Emission factors from Appendix A, Subchapter 10 (Climate Change), Article 2, Sections 951000 to 95133, California Code of Regulations (CCR) Title 17. Excerpts attached.

ATTACHMENTS

ATTACHMENT 1

Copy of EMFAC 2007 Model Output for Nevada County
Average On-Road and Idling Emissions
for 2005 to 2011 Model Years

Title : BOCA Quarry 2005 to 2011 Average EFs
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2012/04/29 06:09:30
Scen Year: 2011 -- All model years in the range 2005 to 2011 selected
Season : Annual
Area : Nevada

Year: 2011 -- Model Years 2005 to 2011 Inclusive -- Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average Nevada County Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 60F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0.000	0.000	7.019	7.169	0.000	0.000	1.815
10	0.021	0.029	0.062	1.419	0.049	3.809	0.262
20	0.010	0.014	0.035	0.408	0.026	2.568	0.115
30	0.006	0.009	0.023	0.309	0.017	2.115	0.089
35	0.005	0.007	0.020	0.269	0.014	2.069	0.083
45	0.004	0.006	0.016	0.210	0.011	2.303	0.081
55	0.005	0.006	0.015	0.176	0.010	3.121	0.096
65	0.006	0.008	0.017	0.167	0.011	5.129	0.142

Pollutant Name: Carbon Monoxide Temperature: 60F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0.000	0.000	42.656	41.499	0.000	0.000	10.818
10	0.650	0.887	1.048	3.764	1.336	23.875	1.656
20	0.545	0.744	0.787	1.597	0.651	19.069	1.191
30	0.462	0.630	0.635	1.361	0.402	17.971	1.047
35	0.427	0.582	0.581	1.310	0.345	18.615	1.018
45	0.368	0.502	0.501	1.313	0.303	23.043	1.056
55	0.320	0.437	0.452	1.443	0.335	35.199	1.298
65	0.282	0.384	0.434	1.715	0.469	67.350	2.023

Pollutant Name: Oxides of Nitrogen Temperature: 60F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0.000	0.000	9.618	107.781	0.000	0.000	12.648
10	0.053	0.078	0.576	10.969	0.536	1.181	1.301
20	0.043	0.063	0.454	6.895	0.415	1.167	0.850
30	0.037	0.054	0.406	5.643	0.379	1.192	0.708
35	0.035	0.051	0.402	5.192	0.381	1.216	0.659
45	0.033	0.048	0.431	4.639	0.421	1.286	0.606
55	0.033	0.049	0.524	4.563	0.527	1.385	0.615
65	0.036	0.052	0.727	5.008	0.776	1.520	0.698

Pollutant Name: Carbon Dioxide Temperature: 60F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0.000	0.000	1797.658	5860.407	0.000	0.000	882.338
10	707.466	897.343	1259.237	2866.869	1877.953	215.735	1079.446
20	451.668	572.891	774.083	2009.375	1374.152	164.298	703.839
30	334.623	424.433	568.540	1776.354	1181.835	139.064	550.988
35	304.550	386.288	517.877	1692.770	1137.413	133.279	509.601
45	282.052	357.752	481.438	1586.230	1107.576	133.599	474.406
55	303.126	384.483	519.111	1559.043	1143.747	152.151	495.177
65	378.043	479.506	653.443	1614.420	1273.279	200.088	584.436

Pollutant Name: Sulfur Dioxide Temperature: 60F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0.000	0.000	0.018	0.056	0.000	0.000	0.009
10	0.007	0.009	0.012	0.027	0.018	0.003	0.010
20	0.004	0.006	0.007	0.019	0.013	0.002	0.007
30	0.003	0.004	0.005	0.017	0.011	0.002	0.005
35	0.003	0.004	0.005	0.016	0.011	0.002	0.005
45	0.003	0.003	0.005	0.015	0.011	0.002	0.005
55	0.003	0.004	0.005	0.015	0.011	0.002	0.005
65	0.004	0.005	0.006	0.015	0.012	0.003	0.006

Pollutant Name: PM10 Temperature: 60F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL

ATTACHMENT 2

Emission Factors for CH_4 and N_2O for Global Warming Potential and for Diesel Combustion

Source: CCR Subchapter 10, Article 2 Sections 95100 to 95133, Appendix A

Emissions of CO_2, CH_4 and N_2O for Electricity Production for the Northwest Grid Sub-Region

Source: eGrid Version 1.1 Created May 20 2011

3. Global Warming Potentials

According to the Intergovernmental Panel on Climate Change (IPCC), the global warming potential (GWP) of a greenhouse gas is defined as the ratio of the time-integrated radiative forcing from the instantaneous release of 1 kilogram (kg) of a trace substance relative to that of 1 kg of a reference gas. The reference gas used is CO_2. The values given below are those reported in the IPCC Second Assessment Report (IPCC 1996). These values are used to be consistent with other statewide and national Greenhouse Gas (GHG) inventories. Operators must use these values when converting emissions of greenhouse gases to carbon dioxide equivalent values (CO_2e) for purposes of estimating *de minimis* or other emissions as specified in this article.

Table 2. Global Warming Potentials (100-Year Time Horizon)

Gas	GWP
CO_2	1
CH_4*	21
N_2O	310
HFC-23	11,700
HFC-32	650
HFC-125	2,800
HFC-134a	1,300
HFC-143a	3,800
HFC-152a	140
HFC-227ea	2,900
HFC-236fa	6,300
HFC-4310mee	1,300
CF_4	6,500
C_2F_6	9,200
C_4F_{10}	7,000
C_6F_{14}	7,400
SF_6	23,900

* The CH_4 GWP includes the direct effects and those indirect effects due to the production of tropospheric ozone and stratospheric water vapor. The indirect effect due to the production of CO_2 is not included.

Source: IPCC Climate Change 1995: The Science of Climate Change. (1996) Intergovernmental Panel on Climate Change, J.T. Houghton, L.G. Meira Filho, B.A. Callander, N. Harris, A. Kattenberg, and K. Maskell, eds. Cambridge University Press. Cambridge, U.K.

5. Emission Factors

When working with the following emission factor tables the molar mass ratio of carbon dioxide to carbon (CO_2/C) is assumed to be 3.664. Complete oxidation is assumed for all fuels (oxidation factor = 1).

(a) Default Carbon Content, Heat Content, and Carbon Dioxide Emission Factors for Stationary Combustion

The default heat contents specified in Table 4 are provided for use with sections 95125(a) and (b) of the regulation.

The default carbon dioxide emission factors from stationary combustion on a heat content basis (kg CO_2 / MMBtu) specified in Table 4 and Table 5 are provided for use with sections 95125(a), (c) and (h) of the regulation.

Table 4. Default Carbon Content, Heat Content, and Carbon Dioxide Emission Factors from Stationary Combustion by Fuel Type

Fuel Type	Default Carbon Content	Default Heat Content	Default CO_2 Emission Factor	Default CO_2 Emission Factor
Coal and Coke	**kg C / MMBtu**	**MMBtu / Short Ton**	**kg CO_2 / Short Ton**	**kg CO_2 / MMBtu**
Anthracite	28.26	25.09	2,597.94	103.54
Bituminous	25.49	24.93	2,328.35	93.40
Sub-bituminous	26.48	17.25	1,673.64	97.02
Lignite	26.30	14.21	1,369.32	96.36
Unspecified (Residential/Commercial)	26.00	22.24	2,118.67	95.26
Unspecified (Industrial Coking)	25.56	26.28	2,461.17	93.65
Unspecified (Other Industrial)	25.63	22.18	2,082.89	93.91
Unspecified (Electric Power)	25.76	19.97	1,884.86	94.38
Coke	27.85	24.80	2,530.65	102.04
Natural Gas (By Heat Content)	**kg C / MMBtu**	**Btu / Standard cubic foot**	**kg CO_2 / Standard cubic ft.**	**kg CO_2 / MMBtu**
975 to 1,000 Btu / Standard cubic foot	14.73	n/a	n/a	53.97
1000 to 1,025 Btu / Std cubic foot	14.43	n/a	n/a	52.87
1025 to 1,050 Btu / Std cubic foot	14.47	n/a	n/a	53.02
1050 to 1,075 Btu / Std cubic foot	14.58	n/a	n/a	53.42
1075 to 1,100 Btu / Std cubic foot	14.65	n/a	n/a	53.68
Greater than 1,100 Btu / Std cubic foot	14.92	n/a	n/a	54.67
Unspecified (Weighted U.S. Average)	14.47	1,027	0.0544	53.02

Table 4. Default Carbon Content, Heat Content, and Carbon Dioxide Emission Factors from Stationary Combustion by Fuel Type (continued)

Petroleum Products	kg C / MMBtu	MMBtu / Barrel	kg CO_2 / gallon	kg CO_2 / MMBtu
Asphalt & Road Oil	20.62	6.636	11.94	75.55
Aviation Gasoline	18.87	5.048	8.31	69.14
Distillate Fuel Oil (#1, 2 & 4)	19.95	5.825	10.14	73.10
Jet Fuel	19.33	5.670	9.56	70.83
Kerosene	19.72	5.670	9.75	72.25
LPG (energy use)	17.19	3.861	5.79	62.98
Propane	17.20	3.824	5.74	63.02
Ethane	16.25	2.916	4.13	59.54
Isobutane	17.75	4.162	6.44	65.04
n-Butane	17.72	4.328	6.69	64.93
Lubricants	20.24	6.065	10.71	74.16
Motor Gasoline	19.33	5.218	8.80	70.83
Residual Fuel Oil (#5 & 6)	21.49	6.287	11.79	78.74
Crude Oil	20.33	5.800	10.29	74.49
Naphtha (<401 deg. F)	18.14	5.248	8.30	66.46
Natural Gasoline	18.24	4.620	7.35	66.83
Other Oil (>401 deg. F)	19.95	5.825	10.14	73.10
Pentanes Plus	18.24	4.620	7.35	66.83
Petrochemical Feedstocks	19.37	5.428	9.17	70.97
Petroleum Coke	27.85	6.024	14.64	102.04
Still Gas	17.51	6.000	9.17	64.16
Special Naphtha	19.86	5.248	9.09	72.77
Unfinished Oils	20.33	5.825	10.33	74.49
Waxes	19.81	5.537	9.57	72.58
Other Solid Fuels	**kg C / MMBtu**	**MMBtu / Short Ton**	**kg CO_2 / Short Ton**	**kg CO_2 / MMBtu**
Biomass Derived Fuels (Solid). Wood and Wood Waste (12% moisture content) or other solid biomass-derived fuels	25.60	15.38	1,442.62	93.80
Municipal Solid Waste (MSW)	24.74	8.7	788.7	90.65
Biomass-derived Fuels (Gas)	**kg C / MMBtu**	**Btu / Standard cubic foot**	**kg CO_2 / Standard cubic ft.**	**kg CO_2 / MMBtu**
Biogas*	28.4	Varies	Varies	104.06

Note: Heat content factors are based on higher heating values (HHV).
* The emission factors for biogas include both the CO_2 from combustion and the pass-through CO_2, which are assumed to be in equal proportions.

Source: U.S. EPA, *Inventory of Greenhouse Gas Emissions and Sinks: 1990-2005* (2007), Annex 2.1, Tables A-28, A-31, A-32, A-35, and A-36, except: Heat Content factors for Unspecified Coal (by sector), Coke, Naphtha (<401 deg. F), and Other Oil (>401 deg. F) (from U.S. Energy Information Administration, *Annual Energy Review 2005* (2006), Tables A-1, A-4, and A-5); Heat Content factors for Coal (by type) and LPG and all factors for Wood and Wood Waste, Landfill Gas, and Wastewater Treatment Biogas (from EPA Climate Leaders, Stationary Combustion Guidance (2004), Tables B-1 and B-2). MSW from Energy Information Administration, http://www.eia.doe/gov/oiaf/1605/factors.html and from California Air Resources Board, MSW California Air Resources Board, 2008.

(b) Methane and Nitrous Oxide Emission Factors for Stationary Combustion

The default methane and nitrous oxide emission factors for stationary combustion in Table 6 are provided for use with section 95125(b) of the regulation. For readability, these emission factors are provided in units of grams/MMBtu, but should be converted to kg/MMBtu (i.e., divided by 1000) when using them in the equations in section 95125(b).

Table 6. Default CH_4 and N_2O Emission Factors from Stationary Combustion by Fuel Type

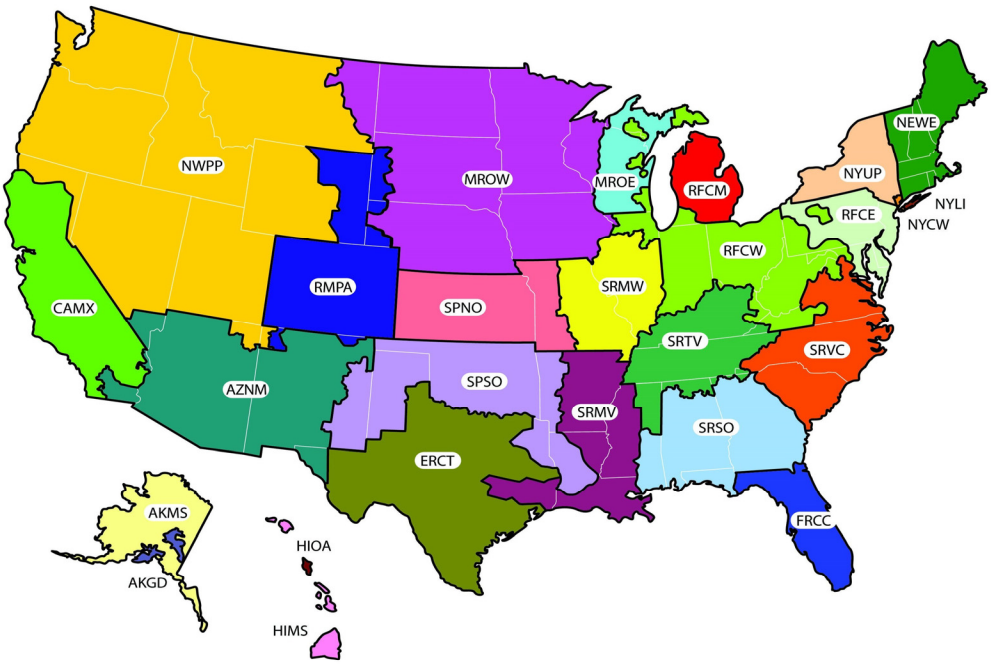
Fuel Type	Default CH_4 Emission Factor (g CH_4/ MMBtu)	Default N_2O Emission Factor (g N_2O / MMBtu)
Asphalt	3.0	0.6
Aviation Gasoline	3.0	0.6
Coal	10.0	1.5
Crude Oil	3.0	0.6
Derived Gases (low Btu gases)	0.3	0.1
Digester Gas	0.9	0.1
Distillate	3.0	0.6
Gasoline	3.0	0.6
Jet Fuel	3.0	0.6
Kerosene	3.0	0.6
Landfill Gas	0.9	0.1
LPG	1.0	0.1
Lubricants	3.0	0.6
MSW	30.0	4.0
Naphtha	3.0	0.6
Natural Gas	0.9	0.1
Natural Gas Liquids	3.0	0.6
Other Biomass	30.0	4.0
Petroleum Coke	3.0	0.6
Propane	1.0	0.1
Refinery Gas	0.9	0.1
Residual Fuel Oil	3.0	0.6
Tires	3.0	0.6
Waste Oil	30.0	4.0
Waxes	3.0	0.6
Wood (Dry)	30.0	4.0

Notes: Heat content factors are based on higher heating values (HHV). Values were converted from LHV to HHV assuming that LHV are 5 percent lower than HHV for solid and liquid fuels and 10 percent lower for gaseous fuels. Those employing this table are assumed to fall under the IPCC definitions of the "Energy Industry" or "Manufacturing Industries and Construction". In all fuels except for coal the values for these two categories are identical. For coal combustion, those who fall within the IPCC "Energy Industry" category may employ a value of 1 g of CH_4/MMBtu.

Source: Intergovernmental Panel on Climate Change, *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (2006), Volume 2, Tables 2.2, 2.3, and 2.4.

Year 2007 eGRID Subregion Emissions - Greenhouse Gases

eGRID subregion acronym	eGRID subregion name	Carbon dioxide (CO_2)		Methane (CH_4)		Nitrous oxide (N_2O)		Carbon dioxide equivalent (CO_2e)	
		Emissions (tons)	Total output emission rate (lb/MWh)	Emissions (lbs)	Total output emission rate (lb/GWh)	Emissions (lbs)	Total output emission rate (lb/GWh)	Emissions (tons)	Total output emission rate (lb/MWh)
AKGD	ASCC Alaska Grid	3,504,228.2	1,284.72	147,873.9	27.11	40,577.9	7.44	3,512,070.5	1,287.60
AKMS	ASCC Miscellaneous	365,943.1	535.73	30,937.2	22.65	6,113.6	4.48	367,215.5	537.59
AZNM	WECC Southwest	113,156,262.7	1,252.61	3,396,786.6	18.80	2,993,639.1	16.57	113,655,943.1	1,258.14
CAMX	WECC California	75,000,483.2	681.01	6,231,629.5	28.29	1,372,599.9	6.23	75,278,668.3	683.53
ERCT	ERCOT All	214,038,968.6	1,252.57	6,068,633.9	17.76	4,781,591.7	13.99	214,843,836.0	1,257.28
FRCC	FRCC All	133,272,674.4	1,220.11	8,999,083.8	41.19	3,332,553.5	15.25	133,883,710.5	1,225.70
HIMS	HICC Miscellaneous	2,150,675.8	1,343.82	432,588.6	135.15	69,488.1	21.71	2,165,988.7	1,353.39
HIOA	HICC Oahu	6,752,509.4	1,620.76	758,650.8	91.05	174,049.2	20.89	6,787,452.8	1,629.15
MROE	MRO East	25,034,396.5	1,692.32	851,783.6	28.79	859,415.2	29.05	25,176,549.6	1,701.93
MROW	MRO West	160,080,984.1	1,722.67	5,383,698.4	28.97	5,425,784.9	29.19	160,978,509.6	1,732.33
NEWE	NPCC New England	54,841,847.2	827.95	10,198,269.4	76.98	2,013,707.0	15.20	55,261,053.6	834.28
NWPP	WECC Northwest	115,898,956.2	858.79	4,410,057.5	16.34	3,682,826.8	13.64	116,516,100.0	863.36
NYCW	NPCC NYC/Westchester	15,514,550.1	704.80	1,154,394.0	26.22	147,480.7	3.35	15,549,530.7	706.39
NYLI	NPCC Long Island	9,201,030.7	1,418.74	1,173,906.8	90.50	169,932.2	13.10	9,239,696.2	1,424.70
NYUP	NPCC Upstate NY	31,665,404.6	683.27	1,614,017.9	17.41	917,461.3	9.90	31,824,558.3	686.71
RFCE	RFC East	143,582,646.4	1,059.32	7,427,798.2	27.40	4,616,541.5	17.03	144,376,202.2	1,065.17
RFCM	RFC Michigan	78,181,546.8	1,651.11	3,083,000.4	32.55	2,631,774.1	27.79	78,621,843.3	1,660.41
RFCW	RFC West	495,807,207.6	1,551.52	11,741,028.7	18.37	16,569,716.6	25.93	498,498,794.4	1,559.94
RMPA	WECC Rockies	61,510,428.0	1,906.06	1,524,891.5	23.63	1,864,622.6	28.89	61,815,455.9	1,915.52
SPNO	SPP North	62,905,859.2	1,798.71	1,484,086.0	21.22	2,042,414.2	29.20	63,238,016.3	1,808.20
SPSO	SPP South	115,289,602.0	1,624.03	3,481,416.3	24.52	3,182,725.9	22.42	115,819,479.4	1,631.49
SRMV	SERC Mississippi Valley	82,644,797.0	1,004.10	3,587,999.4	21.80	1,834,731.1	11.15	82,966,854.3	1,008.01
SRMW	SERC Midwest	123,933,747.9	1,779.27	2,865,634.9	20.57	4,123,975.9	29.60	124,603,053.4	1,788.88
SRSO	SERC South	205,339,150.2	1,495.47	6,492,056.4	23.64	6,748,353.3	24.57	206,453,311.5	1,503.59
SRTV	SERC Tennessee Valley	184,884,320.9	1,540.85	4,769,477.1	19.87	6,114,686.2	25.48	185,882,176.7	1,549.17
SRVC	SERC Virginia/Carolina	175,693,242.5	1,118.41	6,992,327.3	22.26	5,993,080.8	19.08	176,695,589.5	1,124.79
U.S.		**2,690,251,463.1**	**1,293.05**	**104,302,028.0**	**25.07**	**81,709,843.6**	**19.64**	**2,704,011,660.1**	**1,299.66**



This is a representational map; many of the boundaries shown on this map are approximate because they are based on companies, not on strictly geographical boundaries.