

**ASSUMPTIONS,
EMISSION FACTORS,
AND GENERAL TYPES OF EMISSIONS
FOR CONSTRUCTION SCENARIOS**

General Assumptions Used in the Air Quality Analysis

Pipeline Construction

The work area at the trenches will be 55 ft wide including a 6.5 ft. wide trench (Rich Maurer July 5, 1995 memo). The depth of the trench is approximately 7 ft for smaller pipe and 10 ft for larger pipe (based on information in Rich Maurer July 31, 1995 memo).

Headway per day is 100 to 200 ft for larger pipe and 300 to 600 ft for smaller pipe (Rich Maurer July 5, 1995 memo). For Air Quality, used a worst case of 200 ft for larger pipe and 600 ft for smaller pipe.

Size of pipe vary from 8" to 24" for smaller pipe and 30" to 60" for larger pipe (Rich Maurer July 31, 1995). For Air Quality, used a worst case of 24" for smaller pipe and 60" for larger pipe.

There will be four crews working on per day for Alternatives 2 and 3, three for Alternative 4, and one for Alternative 5 (Rich Maurer November 4, 1995 memo). It was assumed that construction would be performed 10 hours per day, 250 days per year.

Each crew will have a staging area of 10 acres (Rich Maurer July 5, 1995 memo).

The capacity of trucks carrying material will be 16 cubic yards (Rich Maurer July 5, 1995 memo).

Based on the size of the pipe and trench the amount of excess material was calculated (See material handling calculation, the amount of trips to dispose of excess material will be 4 per day for smaller pipeline construction and 9 trips per day for larger pipeline construction. It was assumed that there would be 10 additional trips per day to transport supplies.

The average length of disposal truck trips is 3 miles (Rich Maurer July 31, 1995 memo).

There will be 20 people per crew. Each employee will commute an average of 40 miles each way (Rich Maurer July 31, 1995 memo).

Reservoir Construction

Half of the water surface area was used as an estimate of the area that would be disturbed during reservoir construction per Rich Maurer on October 11, 1995. He also mentioned that the water surface area for smaller Tolay would be approximately 700 acres and 150 acres for the Smaller Two Rock reservoir.

Estimates of the amount of material to be imported and the number of truck trips per are given in Rich Maurer October 27, 1995 memo. Each trip distance was specified in the memo.

The staging area will be 15 acres (Rich Maurer July 5, 1995 memo).

Approximately 10 truck trips per day to remove disposal material will be needed. (Rich Maurer July 5, 1995 memo). At most the trip distance will be 15 miles (Rich Maurer July 31, 1995).

Construction headway is about 10,000 cubic yards per day (Rust September, 28 1995 memo).

There will be approximately 100 workmen on the site each day (Rich Maurer July 5, 1995). The average commute to the site will be 40 miles (Rich Maurer July 31, 1995 memo).

The work shift will be 10 hours per day, 6 days per week for 8 months a year (Rust memo September 28, 1995)

Pump Stations

The Geysers Project will require some larger pump stations. One acre will be needed for these stations. All other pump stations will require 1/8 of an acre (Rich Maurer July 31, 1995).

Half the pump stations for each alternative would be created at the same time. The other pump stations would be created one at a time per Rich Maurer on October 10, 1995. It was assumed that grading activities for each station would be on separate days.

It was assumed that there would be not air quality emissions beyond the initial clearing and grading of the pump station area.

Aquifer Storage and Recovery Wells

It was assumed that there would be 7 wells and 27,000 feet of pipeline would be needed (Rich Maurer November 28, 1995). Seven of the wells would be 16 inches wide and 800 feet deep. The other 7 wells would be 14 inches wide and 200 feet deep. The wells would be constructed one at a time. The pipeline diameter would be less than 24 inches and would be constructed by one crew.

Mitigations

It was assumed that watering would reduce dust emissions by 50 percent for material handling, grading, and wind erosion for pipeline and pump station construction.

It was assumed that watering would reduce dust emissions by 50 percent for material handling and grading for the reservoirs. A tackifier would be used to reduce wind erosion emissions by 80 percent.

It was assumed that mitigations would reduce vehicle emissions by 5 percent and equipment emissions by 15% as a conservative estimate.

Project: Santa Rosa Subregional Long-Term Wastewater Project
Subject: Construction - Emission Factors

Prepared By: I. Edmonds
Date Prepared: 11/20/95
Checked By: C. Chapin 11/22/95

Fugitive Dust Emission Factor For Wind Erosion

$$E = kaIKCL'V,$$

where E = Particulate matter wind erosion losses (tons/acre/yr)
k = Particulate size coefficient
a = Portion of total wind erosion that would be suspended
I = soil erodibility (tons/acre/yr)
K = surface roughness factor
C = Climatic factor
L' = field width factor
V = vegetative cover factor

Source: Control of Open Fugitive Sources, Section 7.1.2, EPA 1992

Assumptions

k = 1 for determining total suspended particulates
a = 0.025 per EPA 1992
I = 56 per EPA 1992 Table 7-1
K = 0.8
C = 1 per EPA 1992 Figure 7-4
L' = 0.6 for smaller pipe trench per EPA 1992 Figure 7-5
0.4 for larger pipe trench and 1 acre pump station per EPA 1992 Figure 7-5
0.66 for 10 acre staging area per EPA 1992 Figure 7-5
0.77 for 15 acre staging area per EPA 1992 Figure 7-5
0.35 for 1/8 acre pump station and wells per EPA 1992 Figure 7-5
0.85 for 150 acre area for reservoirs per EPA 1992 Figure 7-5
V = 1 as a worst-case

Calculations

for smaller pipe trench

$$E = \frac{0.672 \text{ (tons/acre/yr)}}{3.7 \text{ (pounds/acre/day)}}$$

for larger pipe trench

$$E = \frac{0.448 \text{ (tons/acre/yr)}}{2.5 \text{ (pounds/acre/day)}}$$

for 10 acre staging area

$$E = \frac{0.7392 \text{ (tons/acre/yr)}}{4.1 \text{ (pounds/acre/day)}}$$

for 15 acre staging area

$$E = \frac{0.8624 \text{ (tons/acre/yr)}}{4.7 \text{ (pounds/acre/day)}}$$

for 1 acre pump stations

$$E = \frac{0.448 \text{ (tons/acre/yr)}}{2.5 \text{ (pounds/acre/day)}}$$

for 1/8 acre pump station and wells

$$E = \frac{0.392 \text{ (tons/acre/yr)}}{2.1 \text{ (pounds/acre/day)}}$$

for 150 acre area for reservoirs

$$E = \frac{0.952 \text{ (tons/acre/yr)}}{5.2 \text{ (pounds/acre/day)}}$$

Project: Santa Rosa Subregional Long-Term Wastewater Project
Subject: Construction - Emission Factors

Prepared By: I. Edmonds
Date Prepared: 11/20/95
Checked By: C. Chapin 11/22/95

Fugitive Dust Emission Factor For Material Handling

$$E = \frac{0.0032(k)(u/5)^{1.3}}{(m/2)^{1.4}}$$

where E= emission factor (pounds/ton of material)
k= particle size coefficient
u= wind speed (mph)
m= moisture content (%)

Source: Control of Open Fugitive Sources, Section 4.1.1, EPA 1992

Assumptions

k= 0.74 for TSP
u= 5.3 mph (BAAQMD 1995)
m= 7.9 default for soil
0.7 default for stone

Calculations

For soil

$$E = 0.00037 \text{ pounds/tons of material handled}$$

For stone

$$E = 0.01111 \text{ pounds/tons of material handled}$$

Fugitive Dust Emission Factor For Grading

5.7 kg/VKT
or

20.2 lbs/MT

Source: Control of Open Fugitive Dust, Section 5.1.1, EPA 1992

Entrained Dust Emission Factor for Vehicle Trips

$$E = 0.0081(s/0.7)^{0.8}$$

where E= emission factor (pounds/VMT)
s= surface silt content
I= total surface dust loading (grains/ft²)

Source: Control of Open Fugitive Dust, Section 2.1.1, EPA 1992

Assumptions

si= 0.92 for streets that are two lane roads with daily traffic of 500-10,000
0.36 for streets that are greater than 4 lanes and daily traffic greater than 10,000

Calculations

E= 0.010 for streets that are two lane roads with daily traffic of 500-10,000
0.005 for streets that are greater than 4 lanes and daily traffic greater than 10,000

0.007 average value assuming half the trip is on 2 lane road and half on 4 lane freeway

Project: Santa Rosa Subregional Long-Term Wastewater Project
Subject: Construction - Emission Factors

Prepared By: I. Edmonds
Date Prepared: 11/20/95
Checked By: C. Chapin 11/22/95

Vehicle Exhaust Emission Factor for Trucks

Carbon Monoxide = 9.13 g/mile
Nitrogen Oxides = 11.48 g/mile
Hydrocarbons = 2.43 g/mile
Particulate Matter = 2.05 g/mile

Calculated by the EMFAC7F emission factor model assuming the year 1996, average temperature of 60 F, hot stabilized, 100 percent heavy-duty diesel trucks, no I/M requirements and a speed of 30 mph

Vehicle Exhaust Emission Factor for Passenger Vehicles

Carbon Monoxide = 2.65 g/mile
Nitrogen Oxides = 0.64 g/mile
Hydrocarbons = 0.28 g/mile
Particulate Matter = 0.01 g/mile

Calculated by the EMFAC7F emission factor model assuming the year 1996, average temperature of 60 F, hot stabilized, 100 percent light-duty auto and truck, I/M requirements and a speed of 45 mph

Drilling of Wells

0.00008 lbs/ton of material removed

Source: Table 11.19.2-2 of AP-42, 5th edition, January 1995

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - Material Handled During Pipeline Construction	Date Prepared:	8/11/95
		Checked By:	C. Chapin 11/22/95

Estimates of Handled Material During Pipeline Construction At One Site

For smaller pipe (24" diameter)

Average Headway (ft/day)	Height of Trench ¹ (ft)	Width of Trench (ft)	Material Excavated Per Day ² (ft3) (yd3)		Backfill Required ³ (yd3)	Excess Material ⁴ (yd3)	Total Material Handled ⁵ (yd3)
600.0	6.67	6.5	26001.3	963.0	893.2	69.8	1926.0

For larger pipe (60" diameter)

Average Headway (ft/day)	Height of Trench ¹ (ft)	Width of Trench (ft)	Material Excavated Per Day ¹ (ft3) (yd3)		Backfill Required ² (yd3)	Excess Material ³ (yd3)	Total Material Handled ⁵ (yd3)
200.0	9.67	6.5	12567.1	465.4	320.0	145.4	930.9

Assumptions:

1. Trenches will have 8" of excavation below the pipe and 4ft over pipe.
2. material excavated = height of trench x width of trench x length
3. Backfill required = material excavated - volume of pipe ($\pi \times \text{radius}^2 \times \text{length}$)
4. Excess material = material excavated-backfill required
5. Total material handled = Material excavated+backfill+excess material

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% USD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 1: ESTIMATED TRAVEL FRACTIONS

	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MED DUTY TRUCKS URBAN BUS			HEAVY DUTY TRUCKS			MCY
	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	ALL
% VMT	2.43	96.92	0.65	1.32	97.77	0.91	2.82	97.18	100.00	28.73	71.27	100.00	100.00
% TRIP	2.43	96.92	0.65	1.32	97.77	0.91	2.82	97.18	100.00	28.73	71.27	100.00	100.00
% VEH	4.79	94.30	0.91	3.11	95.44	1.45	7.65	92.35	100.00	44.17	55.83	100.00	100.00

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: CARBON MONOXIDE

IN GRAMS PER MILE

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH	60
IDLE*	1.25
3	24.99
4	20.77
5	17.59
6	15.14
7	13.22
8	11.70
9	10.47
10	9.47
11	8.64
12	7.95
13	7.37
14	6.88
15	6.46
16	6.09
17	5.78
18	5.50
19	5.25
20	5.03
21	4.83
22	4.65
23	4.48
24	4.33
25	4.18
26	3.99
27	3.93
28	3.81
29	3.70
30	3.59
31	3.49
32	3.40
33	3.31
34	3.22
35	3.14
36	3.07
37	3.00

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: CARBON MONOXIDE

IN GRAMS PER MILE

SPEED	TEMPERATURE IN DEGREES FAHRENHEIT
MPH	60
38	2.93
39	2.88
40	2.82
41	2.77
42	2.73
43	2.70
44	2.67
45	2.65
46	2.64
47	2.64
48	2.64
49	2.66
50	2.69
51	2.73
52	2.79
53	2.86
54	2.95
55	3.07
56	3.21
57	3.40
58	3.63
59	4.26
60	4.97
61	5.79
62	6.76
63	7.93
64	9.38
65	11.23

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: TOTAL ORGANIC GASES IN GRAMS PER MILE
(EXHAUST PLUS RUNNING EVAP.)

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH 60

IDLE* 0.25

3	4.98
4	3.99
5	3.25
6	2.70
7	2.27
8	1.93
9	1.67
10	1.46
11	1.30
12	1.16
13	1.05
14	0.96
15	0.88
16	0.82
17	0.77
18	0.73
19	0.69
20	0.66
21	0.63
22	0.61
23	0.59
24	0.57
25	0.55
26	0.53
27	0.52
28	0.50
29	0.49
30	0.48
31	0.46
32	0.45
33	0.44
34	0.43
35	0.41
36	0.40
37	0.39

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DENPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: TOTAL ORGANIC GASES IN GRAMS PER MILE
(EXHAUST PLUS RUNNING EVAP.)

SPEED	TEMPERATURE IN DEGREES FAHRENHEIT
MPH	60
38	0.38
39	0.37
40	0.36
41	0.35
42	0.34
43	0.33
44	0.32
45	0.31
46	0.31
47	0.30
48	0.30
49	0.30
50	0.29
51	0.29
52	0.30
53	0.30
54	0.30
55	0.31
56	0.32
57	0.33
58	0.35
59	0.40
60	0.45
61	0.52
62	0.61
63	0.72
64	0.88
65	1.10

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: REACTIVE ORGANIC GASES IN GRAMS PER MILE
(EXHAUST PLUS RUNNING EVAP.)

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH 60

IDLE* 0.23

3	4.65
4	3.73
5	3.04
6	2.52
7	2.12
8	1.80
9	1.56
10	1.36
11	1.20
12	1.07
13	0.97
14	0.88
15	0.81
16	0.75
17	0.71
18	0.66
19	0.63
20	0.60
21	0.57
22	0.55
23	0.53
24	0.51
25	0.49
26	0.47
27	0.46
28	0.45
29	0.44
30	0.43
31	0.41
32	0.40
33	0.39
34	0.38
35	0.37
36	0.36
37	0.35

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: REACTIVE ORGANIC GASES IN GRAMS PER MILE
(EXHAUST PLUS RUNNING EVAP.)

SPEED	TEMPERATURE IN DEGREES FAHRENHEIT
MPH	60
38	0.34
39	0.33
40	0.32
41	0.31
42	0.30
43	0.29
44	0.29
45	0.28
46	0.27
47	0.27
48	0.27
49	0.26
50	0.26
51	0.26
52	0.26
53	0.27
54	0.27
55	0.28
56	0.29
57	0.30
58	0.31
59	0.35
60	0.40
61	0.46
62	0.54
63	0.64
64	0.78
65	0.97

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: OXIDES OF NITROGEN

IN GRAMS PER MILE

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH 60

IDLE* 0.07

3	1.32
4	1.19
5	1.10
6	1.03
7	0.97
8	0.92
9	0.88
10	0.84
11	0.80
12	0.77
13	0.74
14	0.71
15	0.69
16	0.66
17	0.64
18	0.62
19	0.60
20	0.58
21	0.57
22	0.55
23	0.54
24	0.53
25	0.52
26	0.51
27	0.51
28	0.50
29	0.50
30	0.50
31	0.50
32	0.50
33	0.50
34	0.51
35	0.51
36	0.52
37	0.53

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: OXIDES OF NITROGEN IN GRAMS PER MILE

SPEED	TEMPERATURE IN DEGREES FAHRENHEIT
MPH	60
38	0.53
39	0.55
40	0.56
41	0.57
42	0.59
43	0.60
44	0.62
45	0.64
46	0.66
47	0.68
48	0.70
49	0.73
50	0.76
51	0.80
52	0.83
53	0.86
54	0.90
55	0.94
56	0.98
57	1.02
58	1.06
59	1.10
60	1.15
61	1.19
62	1.24
63	1.29
64	1.34
65	1.39

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: EXHAUST PARTICULATES IN GRAMS PER MILE

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH 60

IDLE* 0.00

3	0.01
4	0.01
5	0.01
6	0.01
7	0.01
8	0.01
9	0.01
10	0.01
11	0.01
12	0.01
13	0.01
14	0.01
15	0.01
16	0.01
17	0.01
18	0.01
19	0.01
20	0.01
21	0.01
22	0.01
23	0.01
24	0.01
25	0.01
26	0.01
27	0.01
28	0.01
29	0.01
30	0.01
31	0.01
32	0.01
33	0.01
34	0.01
35	0.01
36	0.01
37	0.01

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Passenger Vehicles

YEAR: 1996	DENPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: EXHAUST PARTICULATES IN GRAMS PER MILE

SPEED	TEMPERATURE IN DEGREES FAHRENHEIT
MPH	60
38	0.01
39	0.01
40	0.01
41	0.01
42	0.01
43	0.01
44	0.01
45	0.01
46	0.01
47	0.01
48	0.01
49	0.01
50	0.01
51	0.01
52	0.01
53	0.01
54	0.01
55	0.01
56	0.01
57	0.01
58	0.01
59	0.01
60	0.01
61	0.01
62	0.01
63	0.01
64	0.01
65	0.01

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3

Santa Rosa Passenger Vehicles

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 3: INCREMENTAL HOT START EMISSION RATES IN GRAMS PER TRIP *

AVERAGE SPEED = 25.6 MPH

AVERAGE TRIP LENGTH = 3.59 MILES

TEMPERATURE IN DEGREES FAHRENHEIT

POLLN	60
CO	10.67
TOG	0.99
ROG	0.87
NOX	1.49

TABLE 4: INCREMENTAL COLD START EMISSION RATES IN GRAMS PER TRIP *

AVERAGE SPEED = 25.6 MPH

AVERAGE TRIP LENGTH = 3.59 MILES

TEMPERATURE IN DEGREES FAHRENHEIT

POLLN	60
CO	86.65
TOG	7.69
ROG	6.63
NOX	2.41

* THESE ARE ADDITIONAL TRANSIENT EMISSIONS THAT OCCUR OVER AND ABOVE THE HOT STABILIZED EMISSIONS SHOWN IN TABLE 2.
THE DURATION OF THIS PORTION IS AS DEFINED IN FTP-75.

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3

Santa Rosa Passenger Vehicles

YEAR: 1996	DENPOINT: 10	% COLD STARTS	0.0	% LDA	100.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	0.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 5: TRIP END HOT SOAK EMISSION RATES (TOG OR ROG) IN GRAMS PER TRIP

TEMPERATURE IN DEGREES FAHRENHEIT

60

0.63

TABLE 6: NON TRIP RELATED EMISSIONS

COMPOSITE MULTIDAY DIURNAL EMISSION RATE (TOG OR ROG): 1.05 GRAMS PER VEHICLE DAY

COMPOSITE SINGLE DAY DIURNAL EMISSION RATE (TOG OR ROG): 0.74 GRAMS PER HOUR

COMPOSITE MULTIDAY RESTING LOSS EMISSION RATE (TOG OR ROG): 0.63 GRAMS PER VEHICLE DAY

COMPOSITE SINGLE DAY RESTING LOSS EMISSION RATES (TOG OR ROG) IN GRAMS PER HOUR

TEMPERATURE IN DEGREES FAHRENHEIT

60

0.12

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 1: ESTIMATED TRAVEL FRACTIONS

	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MED DUTY TRUCKS URBAN BUS			HEAVY DUTY TRUCKS			MCY
	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	
% VMT	2.43	96.92	0.65	1.32	97.77	0.91	2.82	97.18	100.00	28.73	71.27	100.00	100.00
% TRIP	2.43	96.92	0.65	1.32	97.77	0.91	2.82	97.18	100.00	28.73	71.27	100.00	100.00
% VEH	4.79	94.30	0.91	3.11	95.44	1.45	7.65	92.35	100.00	44.17	55.83	100.00	100.00

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: CARBON MONOXIDE

IN GRAMS PER MILE

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH 60

IDLE* 2.18

3	43.65
4	40.23
5	37.15
6	34.36
7	31.84
8	29.56
9	27.49
10	25.61
11	23.91
12	22.36
13	20.95
14	19.66
15	18.48
16	17.41
17	16.43
18	15.53
19	14.71
20	13.96
21	13.27
22	12.64
23	12.06
24	11.52
25	11.03
26	10.42
27	10.17
28	9.79
29	9.44
30	9.13
31	8.83
32	8.57
33	8.32
34	8.10
35	7.90
36	7.72
37	7.55

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: CARBON MONOXIDE

IN GRAMS PER MILE

SPEED	TEMPERATURE IN DEGREES FAHRENHEIT
MPH	60
38	7.40
39	7.27
40	7.16
41	7.06
42	6.97
43	6.89
44	6.83
45	6.79
46	6.75
47	6.73
48	6.72
49	6.72
50	6.73
51	6.76
52	6.80
53	6.85
54	6.91
55	6.99
56	7.08
57	7.19
58	7.31
59	7.45
60	7.60
61	7.77
62	7.96
63	8.17
64	8.39
65	8.64

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: TOTAL ORGANIC GASES IN GRAMS PER MILE
(EXHAUST PLUS RUNNING EVAP.)

SPEED	TEMPERATURE IN DEGREES FAHRENHEIT
MPH	
60	
IDLE*	0.37
3	7.41
4	7.04
5	6.69
6	6.36
7	6.06
8	5.77
9	5.50
10	5.25
11	5.02
12	4.80
13	4.59
14	4.40
15	4.21
16	4.04
17	3.88
18	3.73
19	3.59
20	3.46
21	3.33
22	3.21
23	3.10
24	3.00
25	2.90
26	2.76
27	2.72
28	2.64
29	2.56
30	2.49
31	2.42
32	2.35
33	2.29
34	2.23
35	2.18
36	2.13
37	2.08

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: TOTAL ORGANIC GASES IN GRAMS PER MILE
(EXHAUST PLUS RUNNING EVAP.)

SPEED	TEMPERATURE IN DEGREES FAHRENHEIT
MPH	60
38	2.03
39	1.99
40	1.95
41	1.91
42	1.88
43	1.85
44	1.82
45	1.79
46	1.76
47	1.74
48	1.71
49	1.69
50	1.67
51	1.66
52	1.64
53	1.62
54	1.61
55	1.60
56	1.59
57	1.58
58	1.58
59	1.57
60	1.57
61	1.56
62	1.56
63	1.56
64	1.56
65	1.57

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: REACTIVE ORGANIC GASES IN GRAMS PER MILE
(EXHAUST PLUS RUNNING EVAP.)

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH 60

IDLE* 0.36

3	7.23
4	6.87
5	6.53
6	6.21
7	5.91
8	5.63
9	5.37
10	5.12
11	4.89
12	4.68
13	4.48
14	4.29
15	4.11
16	3.95
17	3.79
18	3.64
19	3.50
20	3.37
21	3.25
22	3.14
23	3.03
24	2.93
25	2.83
26	2.70
27	2.65
28	2.57
29	2.50
30	2.43
31	2.36
32	2.29
33	2.23
34	2.18
35	2.13
36	2.08
37	2.03

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: REACTIVE ORGANIC GASES IN GRAMS PER MILE
(EXHAUST PLUS RUNNING EVAP.)

SPEED	TEMPERATURE IN DEGREES FAHRENHEIT
MPH	60
38	1.98
39	1.94
40	1.90
41	1.87
42	1.83
43	1.80
44	1.77
45	1.74
46	1.72
47	1.69
48	1.67
49	1.65
50	1.63
51	1.62
52	1.60
53	1.59
54	1.57
55	1.56
56	1.55
57	1.54
58	1.54
59	1.53
60	1.53
61	1.53
62	1.52
63	1.52
64	1.53
65	1.53

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS 0.0	% LDA 0.0	% LDT 0.0	% MDT 0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS 0.0	% UBD 0.0	% HDG 0.0	% HDD 100.0
SEASON: SUMMER		% HOT STAB 100.0		% MCY 0.0	

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: OXIDES OF NITROGEN

IN GRAMS PER MILE

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH 60

IDLE* 1.11

3	22.30
4	21.36
5	20.49
6	19.68
7	18.93
8	18.24
9	17.59
10	17.00
11	16.44
12	15.93
13	15.46
14	15.02
15	14.61
16	14.24
17	13.89
18	13.57
19	13.28
20	13.01
21	12.77
22	12.55
23	12.35
24	12.17
25	12.01
26	11.69
27	11.75
28	11.64
29	11.56
30	11.48
31	11.43
32	11.39
33	11.37
34	11.37
35	11.38
36	11.41
37	11.45

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: OXIDES OF NITROGEN IN GRAMS PER MILE

SPEED	TEMPERATURE IN DEGREES FAHRENHEIT
MPH	60

38	11.51
39	11.59
40	11.68
41	11.79
42	11.92
43	12.07
44	12.24
45	12.43
46	12.63
47	12.86
48	13.12
49	13.39
50	13.69
51	14.02
52	14.38
53	14.77
54	15.19
55	15.64
56	16.13
57	16.66
58	17.23
59	17.84
60	18.50
61	19.22
62	19.99
63	20.82
64	21.72
65	22.69

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: EXHAUST PARTICULATES IN GRAMS PER MILE

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH 60

IDLE* 0.10

3	2.05
4	2.05
5	2.05
6	2.05
7	2.05
8	2.05
9	2.05
10	2.05
11	2.05
12	2.05
13	2.05
14	2.05
15	2.05
16	2.05
17	2.05
18	2.05
19	2.05
20	2.05
21	2.05
22	2.05
23	2.05
24	2.05
25	2.05
26	2.02
27	2.05
28	2.05
29	2.05
30	2.05
31	2.05
32	2.05
33	2.05
34	2.05
35	2.05
36	2.05
37	2.05

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: EXHAUST PARTICULATES IN GRAMS PER MILE

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH 60

38	2.05
39	2.05
40	2.05
41	2.05
42	2.05
43	2.05
44	2.05
45	2.05
46	2.05
47	2.05
48	2.05
49	2.05
50	2.05
51	2.05
52	2.05
53	2.05
54	2.05
55	2.05
56	2.05
57	2.05
58	2.05
59	2.05
60	2.05
61	2.05
62	2.05
63	2.05
64	2.05
65	2.05

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3

Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 3: INCREMENTAL HOT START EMISSION RATES IN GRAMS PER TRIP *

AVERAGE SPEED = 25.6 MPH

AVERAGE TRIP LENGTH = 3.59 MILES

TEMPERATURE IN DEGREES FAHRENHEIT

POLLN	60
CO	0.00
TOG	0.00
ROG	0.00
NOX	0.00

TABLE 4: INCREMENTAL COLD START EMISSION RATES IN GRAMS PER TRIP *

AVERAGE SPEED = 25.6 MPH

AVERAGE TRIP LENGTH = 3.59 MILES

TEMPERATURE IN DEGREES FAHRENHEIT

POLLN	60
CO	0.00
TOG	0.00
ROG	0.00
NOX	0.00

* THESE ARE ADDITIONAL TRANSIENT EMISSIONS THAT OCCUR OVER AND ABOVE THE HOT STABILIZED EMISSIONS SHOWN IN TABLE 2.
THE DURATION OF THIS PORTION IS AS DEFINED IN FTP-75.

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3

Santa Rosa Trucks

YEAR: 1996	DEWPOINT: 10	% COLD STARTS	0.0	% LDA	0.0	% LDT	0.0	% MDT	0.0
INSPECTION & MAINTENANCE: NO		% HOT STARTS	0.0	% UBD	0.0	% HDG	0.0	% HDD	100.0
SEASON: SUMMER		% HOT STAB	100.0			% MCY	0.0		

TABLE 5: TRIP END HOT SOAK EMISSION RATES (TOG OR ROG) IN GRAMS PER TRIP

TEMPERATURE IN DEGREES FAHRENHEIT

60

0.00

TABLE 6: NON TRIP RELATED EMISSIONS

COMPOSITE MULTIDAY DIURNAL EMISSION RATE (TOG OR ROG): 0.00 GRAMS PER VEHICLE DAY

COMPOSITE SINGLE DAY DIURNAL EMISSION RATE (TOG OR ROG): 0.00 GRAMS PER HOUR

COMPOSITE MULTIDAY RESTING LOSS EMISSION RATE (TOG OR ROG): 0.00 GRAMS PER VEHICLE DAY

COMPOSITE SINGLE DAY RESTING LOSS EMISSION RATES (TOG OR ROG) IN GRAMS PER HOUR

TEMPERATURE IN DEGREES FAHRENHEIT

60

0.00

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - General Pipeline Emissions	Date Prepared:	11/22/95
		Checked By:	C. Chapin 11/22/95

Wind Erosion Over 1 Construction Area for Smaller Pipe

Emission factor = 3.7 pounds/acre/day

area= 600ft*55ft= 33000 ft² acre/43560 ft² = 0.76 acres

Emissions = emission factor * acres = 2.8 pounds/day

Wind Erosion Over 1 Construction Area for Larger Pipe

Emission factor = 2.5 pounds/acre/day

area= 200ft*55ft= 11000 ft² acre/43560 ft² = 0.25 acres

Emissions = emission factor * acres = 0.6 pounds/day

Wind Erosion Over 1 Staging Area

Emission factor = 4.1 pounds/acre/day

area= 5 acres per staging area to be exposed

Emissions = emission factor * acres = 20.5 pounds/day/staging area

Dust Emissions from Truck Travel for 1 Smaller Pipe Construction Area

Emission factor = 0.01 pounds/vehicle miles traveled

Vehicle miles traveled = Number of truck trips * miles traveled
 = 14 trips * 6 miles round trip = 84 VMT

Emissions = emission factor * VMT = 0.8 pounds/day

Dust Emissions from Truck Travel for 1 Larger Pipe Construction Area

Emission factor = 0.01 pounds/vehicle miles traveled

Vehicle miles traveled = Number of truck trips * miles traveled
 = 19 trips * 6 miles round trip = 114 VMT

Emissions = emission factor * VMT = 1.1 pounds/day

Dust Emissions from Travel for 1 Construction Crew

Emission factor = 0.007 pounds/vehicle miles traveled

Vehicle miles traveled = Number of trips * miles traveled
 = 20 trips * 80 miles round trip = 1600 VMT

Emissions = emission factor * VMT = 11.2 pounds/day

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - General Pipeline Emissions	Date Prepared:	11/22/95
		Checked By:	C. Chapin 11/22/95

Exhaust Emissions from Truck Travel for 1 Smaller Pipe Construction Area

Emission factor =	9.13 g/mile	for Carbon Monoxide
	11.48	for Nitrogen Oxides
	2.43	for Hydrocarbons
	2.05	for Particulate Matter
Vehicle miles traveled = Number of trips * miles traveled		
= 14 trips * 6 miles round trip =	84 VMT	
Emissions = emission factor * VMT	766.9 g*.0022lb/g =	1.7 pounds/day for Carbon Monoxide
	984.3	2.1 pounds/day for Nitrogen Oxides
	204.1	0.4 pounds/day for Hydrocarbons
	172.2	0.4 pounds/day for Particulate Matter

Exhaust Emissions from Truck Travel for 1 Larger Pipe Construction Area

Emission factor =	9.13 g/mile	for Carbon Monoxide
	11.48	for Nitrogen Oxides
	2.43	for Hydrocarbons
	2.05	for Particulate Matter
Vehicle miles traveled = Number of trips * miles traveled		
= 19 trips * 6 miles round trip =	114 VMT	
Emissions = emission factor * VMT	1040.8 g*.0022lb/g =	2.3 pounds/day for Carbon Monoxide
	1308.7	2.9 pounds/day for Nitrogen Oxides
	277.0	0.6 pounds/day for Hydrocarbons
	233.7	0.5 pounds/day for Particulate Matter

Exhaust Emissions from 1 Construction Crew

Emission factor =	2.65 g/mile	for Carbon Monoxide
	0.64	for Nitrogen Oxides
	0.28	for Hydrocarbons
	0.01	for Particulate Matter
Vehicle miles traveled = Number of trips * miles traveled		
= 20 trips * 80 miles round trip =	1600 VMT	
Emissions = emission factor * VMT	4240.0 g*.0022lb/g =	9.3 pounds/day for Carbon Monoxide
	1024.0	2.3 pounds/day for Nitrogen Oxides
	448.0	1.0 pounds/day for Hydrocarbons
	18.0	0.0 pounds/day for Particulate Matter

Dust Emissions From Material Handling For 1 Smaller Pipe Construction Area

Emission factor =	0.000373 pounds/tons of material handled
Amount of material handled =	Volume (cubic yards) * Weight (assumed 1.59 tons/cubic yard)
= 1926*1.59 =	3062.34 tons
Emissions = emission factor * amount of material handled =	1.1 pounds/day

Dust Emissions From Material Handling For 1 Larger Pipe Construction Area

Emission factor =	0.000373 pounds/tons of material handled
Amount of material handled =	Volume (cubic yards) * Weight (assumed 1.59 tons/cubic yard)
= 931*1.59 =	1480.29 tons
Emissions = emission factor * amount of material handled =	0.6 pounds/day

Project: Santa Rosa Subregional Long-Term Wastewater Project
Subject: Construction - General Pipeline Emissions

Prepared By: I. Edmonds
Date Prepared: 11/22/95
Checked By: C. Chapin 11/22/95

Dust Emissions From Grading For 1 Smaller Pipe Construction Area

Emission factor = 20.2 pounds/VMT

Amount of VMT = Length of Area * Number of Passes of Grader
= 600 ft * 9 trips (assuming grader can grade 6 ft area with each pass)
= 5400 ft * mile/5280 ft = 1.0 mile

Emissions = emission factor * vehicle mile traveled = 20.7 pounds/day

Dust Emissions From Grading For 1 Larger Pipe Construction Area

Emission factor = 20.2 pounds/VMT

Amount of VMT = Length of Area * Number of Passes of Grader
= 200 ft * 9 trips (assuming grader can grade 6 ft area with each pass)
= 1800 ft * mile/5280 ft = 0.3 mile

Emissions = emission factor * vehicle mile traveled = 6.9 pounds/day

Dust Emissions From Grading For 1 Staging Area

Emission factor = 20.2 pounds/VMT

Amount of VMT = Length of Area * Number of Passes of Grader
= 660 ft * 110 trips (assuming grader can grade 6 ft area with each pass)
= 72600 ft * mile/5280 ft = 13.8 mile

Emissions = emission factor * vehicle mile traveled = 277.8 pounds/day/staging area

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - General Reservoir Emissions	Date Prepared:	11/22/95
		Checked By:	C. Chapin 11/22/95

Wind Erosion Over Reservoir Area

Emission factor = 5.2 pounds/acre/day

Wind Erosion Over Staging Area

Emission factor = 4.7 pounds/acre/day

area = 7.5 acres per staging area will be exposed

Emissions = emission factor * acres = 35.3 pounds/day

Dust Emissions from Truck Travel for Disposal

Emission factor = 0.01 pounds/vehicle miles traveled

Vehicle miles traveled = Number of trips * miles traveled
= 10 trips * 30 miles round trip = 300 VMT

Emissions = emission factor * VMT 3.0 pounds/day

Dust Emissions from Truck Travel for Import Material

Emission factor = 0.01 pounds/vehicle miles traveled

Dust Emissions from Travel for Employees

Emission factor = 0.007 pounds/vehicle miles traveled

Vehicle miles traveled = Number of trips * miles traveled
= 100 trips * 80 miles round trip = 8000 VMT

Emissions = emission factor * VMT 56.0 pounds/day

Exhaust Emissions from Truck Travel for Disposal

Emission factor = 9.13 g/mile for Carbon Monoxide
11.48 for Nitrogen Oxides
2.43 for Hydrocarbons
2.05 for Particulate Matter

Vehicle miles traveled = Number of trips * miles traveled
= 10 trips * 30 miles round trip = 300 VMT

Emissions = emission factor * VMT
2739.0 g * 0.0022lb/g = 6.0 pounds/day for Carbon Monoxide
3444.0 7.6 pounds/day for Nitrogen Oxides
729.0 1.6 pounds/day for Hydrocarbons
615.0 1.4 pounds/day for Particulate Matter

Exhaust Emissions from Truck Travel for Import Materials

Emission factor = 9.13 g/mile for Carbon Monoxide
11.48 for Nitrogen Oxides
2.43 for Hydrocarbons
2.05 for Particulate Matter

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - General Reservoir Emissions	Date Prepared:	11/22/95
		Checked By:	C. Chapin 11/22/95

Exhaust Emissions from Employee Travel

Emission factor =	2.65 g/mile	for Carbon Monoxide
	0.64	for Nitrogen Oxides
	0.28	for Hydrocarbons
	0.01	for Particulate Matter
Vehicle miles traveled = Number of trips * miles traveled		
= 100 trips * 80 miles round trip =	8000 VMT	
Emissions = emission factor * VMT	21200.0 g*0.0022lb/g =	46.6 pounds/day for Carbon Monoxide
	5120.0	11.3 pounds/day for Nitrogen Oxides
	2240.0	4.9 pounds/day for Hydrocarbons
	80.0	0.2 pounds/day for Particulate Matter

Dust Emissions From Material Handling

Emission factor =	0.000373 pounds/tons of material handled
Amount of material handled =	Volume (cubic yards) * Weight (assumed 1.59 tons/cubic yard)
= 10000*1.59	15900 tons
Emissions = emission factor * amount of material handled =	5.9 pounds/day

Dust Emissions From Grading

Emission factor =	20.2 pounds/VMT
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Dust Emissions From Grading For Staging Area

Emission factor =	20.2 pounds/VMT
Amount of VMT =	Length of Area * Number of Passes of Grader
= 808 ft *135 trips (assuming grader can grade 6 ft area with each pass)	
= 109080 ft * mile/5280 ft =	20.7 mile
Emissions = emission factor * vehicle mile traveled =	417.3 pounds/day

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - General Pump Station Emissions	Date Prepared:	8/11/95
		Checked By:	C. Chapin 11/22/95

Wind Erosion Over Larger Pump Station

Emission factor = 2.5 pounds/acre/day

area= 1 acres

Emissions = emission factor * acres = 2.5 pounds/day

Wind Erosion Over Smaller Pump Station

Emission factor = 2.1 pounds/acre/day

area= 0.125 acres

Emissions = emission factor * acres = 0.3 pounds/day

Dust Emissions from Travel for Employees

Emission factor = 0.007 pounds/vehicle miles traveled

Vehicle miles traveled = Number of trips * miles traveled
= 20 trips * 80 miles round trip = 1600 VMT

Emissions = emission factor * VMT = 11.2 pounds/day

Exhaust Emissions from Employee Travel

Emission factor =
2.65 g/mile for Carbon Monoxide
0.64 for Nitrogen Oxides
0.28 for Hydrocarbons
0.01 for Particulate Matter

Vehicle miles traveled = Number of trips * miles traveled
= 20 trips * 80 miles round trip = 1600 VMT

Emissions = emission factor * VMT	4240.0 g * 0.0022lb/g =	9.3 pounds/day for Carbon Monoxide
	1024.0	2.3 pounds/day for Nitrogen Oxides
	448.0	1.0 pounds/day for Hydrocarbons
	16.0	0.0 pounds/day for Particulate Matter

Dust Emissions From Grading for Larger Pump Station

Emission factor = 20.2 pounds/VMT

Amount of VMT = Length of Area * Number of Passes of Grader
= 209 ft * 35 trips (assuming grader can grade 6 ft area with each pass)
= 7315 ft * mile/5280 ft = 1.4 mile

Emissions = emission factor * vehicle mile traveled = 28.0 pounds/day

Dust Emissions From Grading For Smaller Pump Station

Emission factor = 20.2 pounds/VMT

Amount of VMT = Length of Area * Number of Passes of Grader
= 74 ft * 12 trips (assuming grader can grade 6 ft area with each pass)
= 888 ft * mile/5280 ft = 0.2 mile

Emissions = emission factor * vehicle mile traveled = 3.4 pounds/day

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - General ASR Well Emissions	Date Prepared:	11/28/95
		Checked By:	C. Chapin 11/28/95

Wind Erosion Over 1 Construction Area

Emission factor =	2.1 pounds/acre/day	
area=	10ft*10ft=	100 ft ² acre/43560 ft ² = 0.002 acres
Emissions = emission factor * acres =		0.005 pounds/day

Drilling of Wells

Emission factor =	0.00008 lbs/ton of material	
Volume of one area 1 well = $\pi r^2 h$ =	$\pi * .75^2 * 800$ ft =	1413.7 cubic feet or 52.4 cubic yards
assuming 1.59 tons /cubic yard, the amount of material handled =	52.4*1.59 =	83.3 tons
Emissions = emission factor * amount of material		0.007 lbs
Volume of one area 2 well = $\pi r^2 h$ =	$\pi * .75^2 * 200$ ft =	353.4 cubic feet or 13.1 cubic yards
assuming 1.59 tons /cubic yard, the amount of material handled =	13.1*1.59 =	20.8 tons
Emissions = emission factor * amount of material		0.002 lbs

Dust Emissions from Truck Travel for 1 Area 1 Well

Emission factor =	0.01 pounds/vehicle miles traveled	
Vehicle miles traveled = Number of truck trips * miles traveled		
=	5 trips* 6 miles round trip =	30 VMT
Emissions = emission factor * VMT		0.300 pounds/day

Dust Emissions from Truck Travel for 1 Area 2 Well

Emission factor =	0.01 pounds/vehicle miles traveled	
Vehicle miles traveled = Number of truck trips * miles traveled		
=	2 trips* 6 miles round trip =	12 VMT
Emissions = emission factor * VMT		0.120 pounds/day

Dust Emissions from Travel for 1 Construction Crew

Emission factor =	0.007 pounds/vehicle miles traveled	
Vehicle miles traveled = Number of trips * miles traveled		
=	20 trips* 80 miles round trip =	1600 VMT
Emissions = emission factor * VMT		11.2 pounds/day

Exhaust Emissions from Truck Travel for 1 Area 1 Well

Emission factor =	9.13 g/mile	for Carbon Monoxide
	11.48	for Nitrogen Oxides
	2.43	for Hydrocarbons
	2.05	for Particulate Matter
Vehicle miles traveled = Number of trips * miles traveled		
=	5 trips* 6 miles round trip =	30 VMT
Emissions = emission factor * VMT	273.9 g*.0022lb/g =	0.60 pounds/day for Carbon Monoxide
	344.4	0.76 pounds/day for Nitrogen Oxides
	72.9	0.16 pounds/day for Hydrocarbons
	61.5	0.14 pounds/day for Particulate Matter

Project: Santa Rosa Subregional Long-Term Wastewater Project
Subject: Construction - General ASR Well Emissions

Prepared By: I. Edmonds
Date Prepared: 11/28/95
Checked By: C. Chapin 11/28/95

Exhaust Emissions from Truck Travel for 1 Area 2 Well

Emission factor = 9.13 g/mile for Carbon Monoxide
11.48 for Nitrogen Oxides
2.43 for Hydrocarbons
2.05 for Particulate Matter

Vehicle miles traveled = Number of trips * miles traveled
= 2 trips * 6 miles round trip = 12.00 VMT

Emissions = emission factor * VMT
109.6 g * .0022lb/g = 0.24 pounds/day for Carbon Monoxide
137.8 0.30 pounds/day for Nitrogen Oxides
29.2 0.06 pounds/day for Hydrocarbons
24.6 0.05 pounds/day for Particulate Matter

Exhaust Emissions from 1 Construction Crew

Emission factor = 2.65 g/mile for Carbon Monoxide
0.84 for Nitrogen Oxides
0.28 for Hydrocarbons
0.01 for Particulate Matter

Vehicle miles traveled = Number of trips * miles traveled
= 20 trips * 80 miles round trip = 1600.00 VMT

Emissions = emission factor * VMT
4240.0 g * .0022lb/g = 9.33 pounds/day for Carbon Monoxide
1024.0 2.25 pounds/day for Nitrogen Oxides
448.0 0.99 pounds/day for Hydrocarbons
16.0 0.04 pounds/day for Particulate Matter

Dust Emissions From Material Handling For 1 Area 1 Well

Emission factor = 0.000373 pounds/tons of material handled

Amount of material handled = 83.3

Emissions = emission factor * amount of material handled = 0.03 pounds/day

Dust Emissions From Material Handling For 1 Area 2 Well

Emission factor = 0.000373 pounds/tons of material handled

Amount of material handled = 20.8

Emissions = emission factor * amount of material handled = 0.01 pounds/day

Dust Emissions From Grading

Emission factor = 20.2 pounds/VMT

Amount of VMT = Length of Area * Number of Passes of Grader
= 10 ft * 2 trips (assuming grader can grade 6 ft area with each pass)
= 20 ft * mile/5280 ft = 0.0 mile

Emissions = emission factor * vehicle mile traveled = 0.08 pounds/day

Project: Santa Rosa Subregional Long-Term Wastewater Project
Subject: Construction - General Geysers Emissions

Prepared By: I. Edmonds
Date Prepared: 11/29/95
Checked By: C. Chapin 11/29/95

Wind Erosion Over Construction Area

Emission factor = 5.2 pounds/acre/day

Wind Erosion Over Staging Area

Emission factor = 4.7 pounds/acre/day

area = 7.5 acres per staging area will be exposed

Emissions = emission factor * acres = 35.3 pounds/day

Dust Emissions from Truck Travel for Disposal

Emission factor = 0.01 pounds/vehicle miles traveled

Vehicle miles traveled = Number of trips * miles traveled
= 100 trips * 30 miles round trip = 3000 VMT

Emissions = emission factor * VMT = 30.0 pounds/day

Dust Emissions from Truck Travel for Import Material

Emission factor = 0.01 pounds/vehicle miles traveled

Vehicle miles traveled = Number of trips * miles traveled
= 10 trips * 3 miles round trip = 30 VMT

Emissions = emission factor * VMT = 0.3 pounds/day

Dust Emissions from Travel for Employees

Emission factor = 0.007 pounds/vehicle miles traveled

Vehicle miles traveled = Number of trips * miles traveled
= 20 trips * 80 miles round trip = 1600 VMT

Emissions = emission factor * VMT = 11.2 pounds/day

Exhaust Emissions from Truck Travel for Disposal

Emission factor = 9.13 g/mile for Carbon Monoxide
11.48 for Nitrogen Oxides
2.43 for Hydrocarbons
2.05 for Particulate Matter

Vehicle miles traveled = Number of trips * miles traveled
= 100 trips * 30 miles round trip = 3000 VMT

Emissions = emission factor * VMT
27390.0 g * 0.0022lb/g = 60.3 pounds/day for Carbon Monoxide
34440.0 75.8 pounds/day for Nitrogen Oxides
7290.0 16.0 pounds/day for Hydrocarbons
6150.0 13.5 pounds/day for Particulate Matter

Exhaust Emissions from Truck Travel for Import

Emission factor = 9.13 g/mile for Carbon Monoxide
11.48 for Nitrogen Oxides
2.43 for Hydrocarbons
2.05 for Particulate Matter

Vehicle miles traveled = Number of trips * miles traveled
= 10 trips * 3 miles round trip = 30 VMT

Emissions = emission factor * VMT
273.9 g * 0.0022lb/g = 0.6 pounds/day for Carbon Monoxide
344.4 0.8 pounds/day for Nitrogen Oxides
72.9 0.2 pounds/day for Hydrocarbons
61.5 0.1 pounds/day for Particulate Matter

Project: Santa Rosa Subregional Long-Term Wastewater Project
Subject: Construction - General Geysers Emissions

Prepared By: I. Edmonds
Date Prepared: 11/29/95
Checked By: C. Chapin 11/29/95

Exhaust Emissions from Employee Travel

Emission factor = 2.65 g/mile for Carbon Monoxide
0.64 for Nitrogen Oxides
0.28 for Hydrocarbons
0.01 for Particulate Matter

Vehicle miles traveled = Number of trips * miles traveled
= 20 trips * 80 miles round trip = 1600 VMT

Emissions = emission factor * VMT
4240.0 g * 0.0022lb/g = 9.3 pounds/day for Carbon Monoxide
1024.0 2.3 pounds/day for Nitrogen Oxides
448.0 1.0 pounds/day for Hydrocarbons
16.0 0.0 pounds/day for Particulate Matter

Dust Emissions From Material Handling

Emission factor = 0.000373 pounds/tons of material handled

Amount of material handled = Volume (cubic yards) * Weight (assumed 1.59 tons/cubic yard)
= 1500 * 1.59 = 2385 tons

Emissions = emission factor * amount of material handled = 0.9 pounds/day

Dust Emissions From Grading

Emission factor = 20.2 pounds/VMT

Amount of VMT = Length of Area * Number of Passes of Grader
= 195 ft * 33 trips (assuming grader can grade 6 ft area with each pass)
= 6435 ft * mile/5280 ft = 1.2 mile

Emissions = emission factor * vehicle mile traveled = 24.6 pounds/day

Dust Emissions From Grading For Staging Area

Emission factor = 20.2 pounds/VMT

Amount of VMT = Length of Area * Number of Passes of Grader
= 808 ft * 135 trips (assuming grader can grade 6 ft area with each pass)
= 109080 ft * mile/5280 ft = 20.7 mile

Emissions = emission factor * vehicle mile traveled = 417.3 pounds/day

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - Off-Road Equipment Emissions For Each Pipeline Crew	Date Prepared:	11/20/95
		Checked By:	C. Chapin 11/22/95

Off-Road Equipment Types and Usage Hours per Day

Equipment Type	Number of Pieces	Daily Duration (Hours)
Dozer	1	1.5
Excavator	1	0.25
Backhoe	1	1.5
Front End Loader	1	0.9
Water Truck	1	1.3
Crane	1	0.4
Compactor	2	1.5
Paver	1	0.3
Welding Machine	1	0.75
Generator	1	2.05

Source: Rich Maurer memo November 14, 1995 (Number or pieces) and Parsons ES Noise Department (Hours)

Equipment Emission Factors and Horsepower

Equipment Type	Emission Factors (grams/hp-hr)					Horsepower
	HC	CO	NOx	PM	SOx	
Dozer	0.37	2.28	8.15	0.41	0.89	358
Excavator	0.7	5.2	10.75	1.44	0.93	183
Backhoe	1.4	6.8	10.1	1.05	0.85	77
Front End Loader	0.9	2.4	10.3	0.89	0.85	175
Water Truck	0.37	2.28	8.15	0.5	0.89	658
Crane	1.26	4.2	10.3	1.44	0.93	194
Compactor	0.8	3.1	9.3	0.9	0.93	8
Paver	0.6	3.2	10.3	0.9	0.93	91
Welding Machine	1.2	5	8	1	0.93	35
Generator	1.2	5	8	1	0.93	22

Source: Nonroad Engine and Vehicle Emission Study (EPA 1991)

Off Road Equipment Emissions per Day per Pipeline Crew

Equipment Type	Emissions* (pounds/day)				
	HC	CO	NOx	PM	SOx
Dozer	0.43	2.68	9.57	0.48	1.05
Excavator	0.07	0.52	1.08	0.14	0.09
Backhoe	0.36	1.73	2.57	0.27	0.22
Front End Loader	0.31	0.83	3.57	0.24	0.29
Water Truck	0.70	4.29	15.34	0.94	1.67
Crane	0.22	0.72	1.76	0.25	0.16
Compactor	0.04	0.16	0.49	0.05	0.05
Paver	0.04	0.19	0.62	0.05	0.06
Welding Machine	0.07	0.29	0.46	0.06	0.05
Generator	0.12	0.50	0.79	0.10	0.09
Total	2.35	11.91	36.25	2.58	3.73

* Emissions (pounds/day) = Number of pieces x Number of hours x Horsepower x Emission factor x 0.0022 lbs/grams

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - Off- Road Equipment Emissions	Date Prepared:	10/13/95
	Reservoirs for Alt 2A and 2E	Checked By:	C. Chapin 11/22/95

Off-Road Equipment Types and Usage Hours per Day

Equipment Type	Number of Pieces	Daily Duration (Hours)
Dozers	5	10
Scapers	8	10
Backhoes	3	10
Graders	2	10
Water Truck	3	10
Compactors	3	10

Source: Rust memo September 28, 1995

Equipment Emission Factors and Horsepower

Equipment Type	Emission Factors (grams/hp-hr)					Horsepower
	HC	CO	NOx	PM	SOx	
Dozers	0.37	2.28	8.15	0.41	0.89	356
Scrapers	0.5	2.5	8.7	0.79	0.9	311
Backhoes	1.4	6.8	10.1	1.05	0.85	77
Graders	1.1	1.9	9.6	0.63	0.87	172
Water Trucks	0.37	2.28	8.15	0.5	0.89	658
Compactors	0.8	3.1	9.3	0.9	0.93	8

Source: Nonroad Engine and Vehicle Emission Study (EPA 1991)

Off Road Equipment Emissions per Day

Equipment Type	Emissions ^a (pounds/day)				
	HC	CO	NOx	PM	SOx
Dozers	14.49	89.28	319.15	16.06	34.85
Scrapers	27.37	136.84	476.20	43.24	49.26
Backhoes	7.11	34.56	51.33	5.34	4.32
Graders	8.32	14.38	72.65	4.77	6.58
Water Trucks	16.07	99.02	353.94	21.71	38.65
Compactors	0.42	1.64	4.91	0.48	0.49
Total	73.79	375.71	1278.19	91.59	134.16

^a Emissions (pounds/day) = Number of pieces x Number of hours x Horsepower x Emission factor x 0.0022 lbs/grams

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - Off- Road Equipment Emissions	Date Prepared:	10/13/95
	Reservoirs for Alt 2B and 2D	Checked By:	C. Chapin 11/22/95

These alternatives have two reservoirs that will be worked at the same time.

Off-Road Equipment Types and Usage Hours per Day

Equipment Type	Number of Pieces	Daily Duration (Hours)
Dozers	6	10
Scapers	10	10
Backhoes	4	10
Graders	4	10
Water Truck	4	10
Compactors	4	10

Source: Rust memo September 28, 1995

Equipment Emission Factors and Horsepower

Equipment Type	Emission Factors (grams/hp-hr)					Horsepower
	HC	CO	NOx	PM	SOx	
Dozers	0.37	2.28	8.15	0.41	0.89	356
Scrapers	0.5	2.5	8.7	0.79	0.9	311
Backhoes	1.4	6.8	10.1	1.05	0.85	77
Graders	1.1	1.9	9.6	0.63	0.87	172
Water Trucks	0.37	2.28	8.15	0.5	0.89	658
Compactors	0.8	3.1	9.3	0.9	0.93	8

Source: Nonroad Engine and Vehicle Emission Study (EPA 1991)

Off Road Equipment Emissions per Day

Equipment Type	Emissions ^a (pounds/day)				
	HC	CO	NOx	PM	SOx
Dozers	17.39	107.14	382.98	19.27	41.82
Scrapers	34.21	171.05	595.25	54.05	61.58
Backhoes	9.49	46.08	68.44	7.11	5.76
Graders	16.65	28.76	145.31	9.54	13.17
Water Trucks	21.42	132.02	471.92	28.95	51.53
Compactors	0.56	2.18	6.55	0.63	0.65
Total	99.72	487.23	1670.45	119.55	174.52

^a Emissions (pounds/day) = Number of pieces x Number of hours x Horsepower x Emission factor x 0.0022 lbs/grams

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - Off- Road Equipment Emissions	Date Prepared:	10/13/95
	Reservoirs for Alt 2C	Checked By:	C. Chapin 11/22/95

Off-Road Equipment Types and Usage Hours per Day

Equipment Type	Number of Pieces	Daily Duration (Hours)
Dozers	4	10
Scapers	7	10
Backhoes	2	10
Graders	2	10
Water Truck	2	10
Compactors	2	10

Source: Rust memo September 28, 1995

Equipment Emission Factors and Horsepower

Equipment Type	Emission Factors (grams/hp-hr)					Horsepower
	HC	CO	NOx	PM	SOx	
Dozers	0.37	2.28	8.15	0.41	0.89	356
Scrapers	0.5	2.5	8.7	0.79	0.9	311
Backhoes	1.4	6.8	10.1	1.05	0.85	77
Graders	1.1	1.9	9.6	0.63	0.87	172
Water Trucks	0.37	2.28	8.15	0.5	0.89	658
Compactors	0.8	3.1	9.3	0.9	0.93	8

Source: Nonroad Engine and Vehicle Emission Study (EPA 1991)

Off Road Equipment Emissions per Day

Equipment Type	Emissions* (pounds/day)				
	HC	CO	NOx	PM	SOx
Dozers	11.59	71.43	255.32	12.84	27.88
Scrapers	23.95	119.74	416.68	37.84	43.10
Backhoes	4.74	23.04	34.22	3.56	2.88
Graders	8.32	14.38	72.65	4.77	6.58
Water Trucks	10.71	66.01	235.96	14.48	25.77
Compactors	0.28	1.09	3.27	0.32	0.33
Total	59.60	295.68	1018.11	73.80	106.55

* Emissions (pounds/day) = Number of pieces x Number of hours x Horsepower x Emission factor x 0.0022 lbs/grams

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - Off- Road Equipment Emissions	Date Prepared:	10/13/95
	Reservoirs for Alt 3	Checked By:	C. Chapin 11/22/95

Off-Road Equipment Types and Usage Hours per Day

Equipment Type	Number of Pieces	Daily Duration (Hours)
Dozers	3	10
Scapers	5	10
Backhoes	2	10
Graders	2	10
Water Truck	2	10
Compactors	2	10

Source: Rust memo September 28, 1995

Equipment Emission Factors and Horsepower

Equipment Type	Emission Factors (grams/hp-hr)					Horsepower
	HC	CO	NOx	PM	SOx	
Dozers	0.37	2.28	8.15	0.41	0.89	356
Scrapers	0.5	2.5	8.7	0.79	0.9	311
Backhoes	1.4	6.8	10.1	1.05	0.85	77
Graders	1.1	1.9	9.6	0.63	0.87	172
Water Trucks	0.37	2.28	8.15	0.5	0.89	658
Compactors	0.8	3.1	9.3	0.9	0.93	8

Source: Nonroad Engine and Vehicle Emission Study (EPA 1991)

Off Road Equipment Emissions per Day

Equipment Type	Emissions* (pounds/day)				
	HC	CO	NOx	PM	SOx
Dozers	8.69	53.57	191.49	9.63	20.91
Scrapers	17.11	85.53	297.63	27.03	30.79
Backhoes	4.74	23.04	34.22	3.56	2.88
Graders	8.32	14.38	72.65	4.77	6.58
Water Trucks	10.71	66.01	235.96	14.48	25.77
Compactors	0.28	1.09	3.27	0.32	0.33
Total	49.86	243.62	835.22	59.78	87.26

* Emissions (pounds/day) = Number of pieces x Number of hours x Horsepower x Emission factor x 0.0022 lbs/grams

Project:	Santa Rose Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - Off-Road Equipment Emissions For Each Pump Station	Date Prepared:	10/13/95
		Checked By:	C. Chapin 11/22/95

Off Road Equipment Types and Usage Hours per Day per Pump Station

Equipment Type	Number of Pieces	Daily Duration (Hours)
Dozer	1	4
Excavator	1	1
Backhoe	1	4
Front End Loader	1	4
Water Truck	1	2.6
Crane	1	0.8
Compactor	1	3
Paver	1	1.2
Welding Machine	2	3
Generator	1	4

Source: Parsons ES Noise Department

Equipment Emission Factors and Horsepower

Equipment Type	Emission Factors (grams/hp-hr)					Horsepower
	HC	CO	NOx	PM	SOx	
Dozer	0.37	2.28	8.15	0.41	0.89	356
Excavator	0.7	5.2	10.75	1.44	0.93	183
Backhoe	1.4	6.8	10.1	1.05	0.85	77
Front End Loader	0.9	2.4	10.3	0.69	0.85	175
Water Truck	0.37	2.28	8.15	0.5	0.89	658
Crane	1.26	4.2	10.3	1.44	0.93	194
Compactor	0.8	3.1	9.3	0.9	0.93	8
Paver	0.6	3.2	10.3	0.9	0.93	91
Welding Machine	1.2	5	8	1	0.93	35
Generator	1.2	5	8	1	0.93	22

Source: Nonroad Engine and Vehicle Emission Study (EPA 1991)

Off Road Equipment Emissions per Day per Pump Station

Equipment Type	Emissions ^a (pounds/day)				
	HC	CO	NOx	PM	SOx
Dozer	1.16	7.14	25.53	1.28	2.79
Excavator	0.28	2.09	4.33	0.58	0.37
Backhoe	0.95	4.61	6.84	0.71	0.58
Front End Loader	1.39	3.70	15.86	1.06	1.31
Water Truck	1.39	8.58	30.67	1.88	3.35
Crane	0.43	1.43	3.52	0.49	0.32
Compactor	0.04	0.16	0.49	0.05	0.05
Paver	0.14	0.77	2.47	0.22	0.22
Welding Machine	0.55	2.31	3.70	0.46	0.43
Generator	0.23	0.97	1.55	0.19	0.18
Total	6.57	31.77	94.97	6.93	9.60

^a Emissions (pounds/day) = Number of pieces x Number of hours x Horsepower x Emission factor x 0.0022 lbs/grams

Project: Santa Rosa Subregional Long-Term Wastewater Project
 Subject: Construction - Off- Road Equipment Emissions
 For ASR Wells

Prepared By: I. Edmonds
 Date Prepared: 11/28/95
 Checked By: C. Chapin 11/28/95

Off-Road Equipment Types and Usage Hours per Day

Equipment Type	Number of Pieces	Daily Duration (Hours)
Drill Rig	1	10
Front End Loader	1	10
Welding Machine	1	0.75
Generator	1	2.05

Equipment Emission Factors and Horsepower

Equipment Type	Emission Factors (grams/hp-hr)					Horsepower
	HC	CO	NOx	PM	SOx	
Drill Rig	1.41	9.2	11.01	1.44	0.93	209
Front End Loader	0.9	2.4	10.3	0.69	0.85	175
Welding Machine	1.2	5	8	1	0.93	35
Generator	1.2	5	8	1	0.93	22

Source: Nonroad Engine and Vehicle Emission Study (EPA 1991)

Off Road Equipment Emissions per Day per Well

Equipment Type	Emissions* (pounds/day)				
	HC	CO	NOx	PM	SOx
Drill Rig	6.48	42.30	50.62	6.62	4.28
Front End Loader	3.47	9.24	39.66	2.66	3.27
Welding Machine	0.07	0.29	0.46	0.06	0.05
Generator	0.12	0.50	0.79	0.10	0.09
Total	10.14	52.33	91.53	9.43	7.69

* Emissions (pounds/day) = Number of pieces x Number of hours x Horsepower x Emission factor x 0.0022 lbs/grams

Project:	Santa Rosa Subregional Long-Term Wastewater Project	Prepared By:	I. Edmonds
Subject:	Construction - Off-Road Equipment Emissions For Each Geyser Storage Tank	Date Prepared:	11/29/95
		Checked By:	C. Chapin 11/29/95

Off Road Equipment Types and Usage Hours per Day per Pump Station

Equipment Type	Number of Pieces	Daily Duration (Hours)
Dozer	1	10
Excavator	1	1
Backhoe	1	10
Front End Loader	1	4
Water Truck	1	2.6
Crane	1	0.8
Compactor	1	10
Paver	1	1.2
Welding Machine	2	3
Generator	1	4

Equipment Emission Factors and Horsepower

Equipment Type	Emission Factors (grams/hp-hr)					Horsepower
	HC	CO	NOx	PM	SOx	
Dozer	0.37	2.28	8.15	0.41	0.89	356
Excavator	0.7	5.2	10.75	1.44	0.93	183
Backhoe	1.4	6.8	10.1	1.05	0.85	77
Front End Loader	0.9	2.4	10.3	0.69	0.85	175
Water Truck	0.37	2.28	8.15	0.5	0.89	658
Crane	1.26	4.2	10.3	1.44	0.93	194
Compactor	0.8	3.1	9.3	0.9	0.93	8
Paver	0.6	3.2	10.3	0.9	0.93	91
Welding Machine	1.2	5	8	1	0.93	35
Generator	1.2	5	8	1	0.93	22

Source: Nonroad Engine and Vehicle Emission Study (EPA 1991)

Off Road Equipment Emissions per Day per Storage Tank

Equipment Type	Emissions* (pounds/day)				
	HC	CO	NOx	PM	SOx
Dozer	2.90	17.86	63.83	3.21	6.97
Excavator	0.28	2.09	4.33	0.58	0.37
Backhoe	2.37	11.52	17.11	1.78	1.44
Front End Loader	1.39	3.70	15.86	1.06	1.31
Water Truck	1.39	8.58	30.67	1.88	3.35
Crane	0.43	1.43	3.52	0.49	0.32
Compactor	0.14	0.55	1.64	0.16	0.16
Paver	0.14	0.77	2.47	0.22	0.22
Welding Machine	0.55	2.31	3.70	0.46	0.43
Generator	0.23	0.97	1.55	0.19	0.18
Total	9.83	49.77	144.68	10.04	14.76

* Emissions (pounds/day) = Number of pieces x Number of hours x Horsepower x Emission factor x 0.0022 lbs/grams