Table B-1

Pollutant Potential Total Emissions for the Facility

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Pollutant	Biosolids Handling[1]		Liquid Wastewater Treatment[1]		Emergency Open Flare[1]		Enclosed Flare[1]		Boiler #1 8.368 MMBTU[1]		Boiler #2 8.368 MMBTU[1]		Boiler #3 - Sellers[1]		Boiler #4 6.3 MMBtu[1]		Boiler #5 6.3 MMBtu[1]		Natural Gas Generator[1]		Diesel Generator[1]		Totals[2]		Major Source Thresholds
	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	PTE (lb/hour)	PTE (ton/year)	(ton/year)
NOx	---	---	---	---	1.01	4.41	3.54	15.51	0.80	3.49	0.80	3.49	0.60	2.62	0.60	2.63	0.60	2.63	12.77	3.19	4.19	0.21	24.89	38.17	**100**
CO	---	---	---	---	1.19	5.20	7.08	31.01	0.67	2.93	0.67	2.93	0.50	2.20	0.50	2.21	0.50	2.21	0.99	0.25	0.90	0.05	13.01	48.98	**100**
VOC	1.78	7.79	1.88	8.24	0.24	1.04	0.21	0.94	0.10	0.43	0.10	0.43	0.06	0.26	0.03	0.14	0.03	0.14	0.18	0.04	0.33	0.02	4.94	19.47	**100**
SO_2	---	---	---	---	0.24	1.04	0.21	0.94	0.08	0.35	0.08	0.35	0.05	0.21	3.60E-03	0.02	3.60E-03	0.02	5.73E-04	1.43E-04	0.28	0.01	0.94	2.94	**100**
PM_{10}	---	---	---	---	0.44	1.92	0.66	2.90	0.09	0.42	0.09	0.42	0.06	0.25	0.01	0.05	0.01	0.05	0.00	1.88E-05	0.30	0.01	1.67	6.02	**100**
$PM_{2.5}$	---	---	---	---	0.44	1.92	0.66	2.90	0.09	0.42	0.09	0.42	0.06	0.25	0.05	0.20	0.05	0.20	0.01	2.43E-03	0.33	0.02	1.78	6.32	**100**
TOTAL HAPs[3]	0.39	1.69	1.52	6.67	0.08	0.36	0.11	0.50	0.03	0.15	0.03	0.15	0.02	0.09	0.01	0.05	0.01	0.05	0.07	0.02	0.01	3.02E-04	2.28	9.71	**10 Individual/25 Total**
Lead	---	---	---	---	2.16E-05	9.46E-05	3.00E-05	1.31E-04	8.90E-06	3.90E-05	8.90E-06	3.90E-05	5.32E-06	2.33E-05	3.00E-06	1.31E-05	3.00E-06	1.31E-05	---	---	---	---	<0.01	<0.01	
1,1,2,2-Tetrachlorethane	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.9E-05	4.9E-06	---	---	<0.01	<0.01	
1,1,2-Trichloroethane	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.5E-05	3.9E-06	---	---	<0.01	<0.01	
1,3-Butadiene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.6E-04	6.5E-05	1.8E-05	9.2E-07	<0.01	<0.01	
1,3-Dichloropropene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.3E-05	3.2E-06	---	---	<0.01	<0.01	
2,2,4-Trimethylpentane	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.4E-04	6.1E-05	---	---	<0.01	<0.01	
Acetylaldehyde	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.1E-03	2.0E-03	7.2E-04	3.6E-05	0.01	<0.01	
Acrolein	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	5.0E-03	1.3E-03	4.4E-05	2.2E-06	0.01	<0.01	
Benzene	1.6E-02	7.0E-02	---	---	9.07E-05	3.97E-04	1.26E-04	5.52E-04	3.7E-05	1.6E-04	3.7E-05	1.6E-04	2.2E-05	9.8E-05	1.3E-05	5.5E-05	1.3E-05	5.5E-05	4.3E-04	1.1E-04	8.8E-04	4.4E-05	0.02	0.07	
Biphenyl	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.1E-04	5.2E-05	---	---	<0.01	<0.01	
Carbon Tetrachloride	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.8E-05	4.5E-06	---	---	<0.01	<0.01	
Chlorobenzene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.5E-05	3.7E-06	---	---	<0.01	<0.01	
Chloroform	4.4E-02	1.9E-01	0.04	0.18	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.4E-05	3.5E-06	---	---	0.09	0.37	
Dichlorobenzene	---	---	---	---	5.18E-05	2.27E-04	7.20E-05	3.15E-04	2.1E-05	9.4E-05	2.1E-05	9.4E-05	1.3E-05	5.6E-05	7.2E-06	3.2E-05	7.2E-06	3.2E-05	---	---	---	---	<0.01	<0.01	
Ethylbenzene	1.12E-02	4.92E-02	0.02	0.09	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3.9E-05	9.7E-06	---	---	0.03	0.14	
Ethylene Dibromide	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.2E-05	5.4E-06	---	---	<0.01	<0.01	
Formaldehyde	---	---	---	---	3.24E-03	1.42E-02	4.50E-03	1.97E-02	1.3E-03	5.8E-03	1.3E-03	5.8E-03	8.0E-04	3.5E-03	4.5E-04	2.0E-03	4.5E-04	2.0E-03	5.1E-02	1.3E-02	1.1E-03	5.6E-05	0.06	0.07	
Hexane	---	---	---	---	7.78E-02	3.41E-01	1.08E-01	4.73E-01	3.2E-02	1.4E-01	3.2E-02	1.4E-01	1.9E-02	8.4E-02	1.1E-02	4.7E-02	1.1E-02	4.7E-02	1.1E-03	2.7E-04	---	---	0.29	1.27	
Methanol	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.4E-03	6.1E-04	---	---	<0.01	<0.01	
Methylene Chloride	0.04	0.18	0.03	0.13	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.9E-05	4.9E-06	---	---	0.07	0.30	
Naphthalene	--	--	0.02	0.08	2.64E-05	1.15E-04	3.66E-05	1.60E-04	1.1E-05	4.8E-05	1.1E-05	4.8E-05	6.5E-06	2.8E-05	3.7E-06	1.6E-05	3.7E-06	1.6E-05	7.2E-05	1.8E-05	---	---	0.02	0.08	
Phenol	--	--	0.15	0.66	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.4E-05	3.5E-06	---	---	0.15	0.66	
Propylene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.4E-03	1.2E-04	<0.01	<0.01	
Styrene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.1E-05	2.9E-06	---	---	<0.01	<0.01	
Tetrachloroethane	---	---	0.03	0.13	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.4E-06	6.0E-07	---	---	0.03	0.13	
Toluene	0.07	0.30	0.03	0.11	1.47E-04	6.43E-04	2.04E-04	8.94E-04	6.1E-05	2.7E-04	6.1E-05	2.7E-04	3.6E-05	1.6E-04	2.0E-05	8.9E-05	2.0E-05	8.9E-05	4.0E-04	9.9E-05	3.9E-04	1.9E-05	0.10	0.41	
Total PAH	---	---	---	---	3.02E-06	1.32E-05	4.20E-06	1.84E-05	1.2E-06	5.5E-06	1.2E-06	5.5E-06	7.4E-07	3.3E-06	4.2E-07	1.8E-06	4.2E-07	1.8E-06	2.6E-05	6.5E-06	1.6E-04	7.9E-06	<0.01	<0.01	
Vinyl Chloride	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.5E-05	3.6E-06	---	---	<0.01	<0.01	
Xylenes	6.6E-02	2.9E-01	0.02	0.07	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.8E-04	4.5E-05	2.7E-04	1.3E-05	0.08	0.36	
Arsenic	---	---	---	---	8.64E-06	3.78E-05	1.20E-05	5.26E-05	3.6E-06	1.6E-05	3.6E-06	1.6E-05	2.1E-06	9.3E-06	1.2E-06	5.3E-06	1.2E-06	5.3E-06	---	---	---	---	<0.01	<0.01	
Beryllium	---	---	---	---	2.59E-07	1.14E-06	3.60E-07	1.58E-06	1.1E-07	4.7E-07	1.1E-07	4.7E-07	6.4E-08	2.8E-07	3.6E-08	1.6E-07	3.6E-08	1.6E-07	---	---	---	---	<0.01	<0.01	
Cadmium	---	---	---	---	4.75E-05	2.08E-04	6.60E-05	2.89E-04	2.0E-05	8.6E-05	2.0E-05	8.6E-05	1.2E-05	5.1E-05	6.6E-06	2.9E-05	6.6E-06	2.9E-05	---	---	---	---	<0.01	<0.01	
Chromium	---	---	---	---	6.05E-05	2.65E-04	8.40E-05	3.68E-04	2.5E-05	1.1E-04	2.5E-05	1.1E-04	1.5E-05	6.5E-05	8.4E-06	3.7E-05	8.4E-06	3.7E-05	---	---	---	---	<0.01	<0.01	
Cobalt	---	---	---	---	3.63E-06	1.59E-05	5.04E-06	2.21E-05	1.5E-06	6.5E-06	1.5E-06	6.5E-06	8.9E-07	3.9E-06	5.0E-07	2.2E-06	5.0E-07	2.2E-06	---	---	---	---	<0.01	<0.01	
Manganese	---	---	---	---	1.64E-05	7.19E-05	2.28E-05	9.99E-05	6.8E-06	3.0E-05	6.8E-06	3.0E-05	4.0E-06	1.8E-05	2.3E-06	1.0E-05	2.3E-06	1.0E-05	---	---	---	---	<0.01	<0.01	
Mercury	---	---	---	---	1.12E-05	4.92E-05	1.56E-05	6.83E-05	4.6E-06	2.0E-05	4.6E-06	2.0E-05	2.8E-06	1.2E-05	1.6E-06	6.8E-06	1.6E-06	6.8E-06	---	---	---	---	<0.01	<0.01	
Nickel	---	---	---	---	9.07E-05	3.97E-04	1.26E-04	5.52E-04	3.7E-05	1.6E-04	3.7E-05	1.6E-04	2.2E-05	9.8E-05	1.3E-05	5.5E-05	1.3E-05	5.5E-05	---	---	---	---	<0.01	<0.01	
Selenium	---	---	---	---	5.18E-07	2.27E-06	7.20E-07	3.15E-06	2.1E-07	9.4E-07	2.1E-07	9.4E-07	1.3E-07	5.6E-07	7.2E-08	3.2E-07	7.2E-08	3.2E-07	---	---	---	---	<0.01	<0.01	

Notes:

KW: Kilowatts
HP: Horsepower
MMBTU: Million British Thermal Units
g: gram
hr: hour
lb: pound
PAH: Polycyclic Aromatic Hydrocarbons

1. PTE is based on the maximum potential emissions for each unit operating 8,760 hours per year (natural gas generator based on 500 hours per year). The flares operate only on digester gas and the boilers can operate on natural gas, digester gas, or a combination of the two. The natural gas generator only operates on natural gas. Based on a comparison of emission factors for the boilers, the higher emission rate for each pollutant based upon fuel was used to calculate the PTE for each boiler.

2. Values less than 0.01 are noted as "<0.01" and are rounded for presentation.

3. Total PTE assumes digester gas is burned in the flare. Cleaning the digester gas prior to combustion results in negligible PM and SO_2 emissions.

Table B-2

Pollutant Emissions for Biosolids Handling

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Biosolids Handling

Flow from Tres Rios WRF through Biosolids Handling Process[1]=	50	MGD
Flow from Roger Road WPCF through Biosolids Handling Process[1]=	32	MGD
Total Flow through Biosolids Handling Process=	82	MGD
Hours of Operation per Year (Annual Operating Hours) =	8,760	hours/year

Pollutant	Emission Factor (lb/year/MGD)[2]	PTE (lb/hr)	PTE (ton/year)
VOCs	190	**1.78**	**7.79**
Total HAPs[3]	--	**0.39**	**1.69**
Benzene	1.7	0.02	0.07
Ethyl benzene	1.2	0.01	0.05
Toluene	7.3	0.07	0.30
Xylene	7.0	0.07	0.29
1,1,1-tri-chloroethane	6.5	0.06	0.27
Chloroform	4.7	0.04	0.19
Methylene chloride	4.3	0.04	0.18
Tetrachloroethylene	8.5	0.08	0.35
Acetone	3.2E-02	<0.01	<0.01
MEK	6.4E-03	<0.01	<0.01
MIBK	5.8E-03	<0.01	<0.01

Notes:

JEIP: Joint Emissions Inventory Program

[1]Flow is based on the design maximum daily average flow.

[2]Emission factors based on JEIP emission factors for diffused air activated sludge as published in Table 14.7 of VOC Emissions from Wastewater Treatment Plants, 2003.

[3]PTE for total HAPs was calculated as a sum of each individual HAP compound PTE.

Biosolids Handling PTE Equations

The following equation was used to calculate the VOC and HAP PTE for the Biosolids Handling Process:

VOC PTE lb/hour = VOC Emission Factor, lb/year/MGD x Average Design Flow, MGD x 1 year/8,760 hours

Individual HAP PTE lb/hour = HAP Emission Factor, lb/year/MGD x Average Design Flow, MGD x 1 year/8,760 hours

VOC PTE ton/year = VOC Emission Factor, lb/year/MGD x Average Design Flow, MGD x 1 ton/2000 lb

Individual HAP PTE ton/year = HAP Emission Factor, lb/year/MGD x Average Design Flow, MGD x 1 ton/2000 lb

Table B-3

Pollutant Emissions for Liquid Wastewater Treatment Process

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Total VOCs

Pollutant	Influent Concentration (ug/L)[1]	Average Design Flow (MGD)	PTE (lb/hour)	PTE (tons/year)
1,4-Dichlorobenzene	1.81	50	0.03	0.14
Bis (2-Ethylhexyl) Pthalate	46.73	50	0.81	3.56
Bromochloromethane	0.50	50	0.01	0.04
Bromoform	0.26	50	<0.01	0.02
Chloroform	2.36	50	0.04	0.18
Dibromomethane	0.63	50	0.01	0.05
Diethyl Phthalate	16.15	50	0.28	1.23
Di-n-Butyl Phthalate	19.69	50	0.34	1.50
Ethyl Benzene	1.16	50	0.02	0.09
G-BHc (gamma)	0.69	50	0.01	0.05
Methylene Chloride	1.68	50	0.03	0.13
Naphthalene	1.05	50	0.02	0.08
Phenol	8.73	50	0.15	0.66
p-Isopropyltoluene	2.03	50	0.04	0.15
Tetrachloroethane	1.68	50	0.03	0.13
1,2,4-Trimethyl benzene	0.64	50	0.01	0.05
Toluene	1.46	50	0.03	0.11
Xylene	0.97	50	0.02	0.07
		Total VOCs	**1.88**	**8.24**

[1]Maximum concentrations of Influent compounds based on the highest detected concentrations from April 14, 1997 Air Permit Application and 2002 Annual Emissions Inventory plus a 25% safety factor.

Total HAPs

Pollutant	Influent Concentration (ug/L)[1]	Average Design Flow (MGD)	PTE (lb/hour)	PTE (tons/year)
1,4-Dichlorobenzene	1.81	50	0.03	0.14
Bis (2-Ethylhexyl) Pthalate	46.73	50	0.81	3.56
Bromoform	0.26	50	<0.01	0.02
Chloroform	2.36	50	0.04	0.18
Di-n-Butyl Phthalate	19.69	50	0.34	1.50
Ethyl Benzene	1.16	50	0.02	0.09
Methylene Chloride	1.68	50	0.03	0.13
Naphthalene	1.05	50	0.02	0.08
Phenol	8.73	50	0.15	0.66
Tetrachloroethane	1.68	50	0.03	0.13
Toluene	1.46	50	0.03	0.11
Xylene	0.97	50	0.02	0.07
		Total HAPs	**1.52**	**6.67**

[1]Maximum concentrations of Influent compounds based on the highest detected concentrations from April 14, 1997 Air Permit Application and 2002 Annual Emissions Inventory plus a 25% safety factor.

Due to the variability concentrations of VOC/HAP compounds in the wastewater received by the Ina Road WRF (the facility is required to treat whatever wastewater it receives) and because the total PTE for the liquid wastewater treatment units for total HAPs does not exceed 10 tons, it is requested that a total HAP PTE be given to the liquid wastewater treatment units.

Table B-3

Liquid Wastewater PTE Equations

The following equation was used to calculate the VOC and HAP compound PTE for Liquid Wastewater Units:
PTE lb/hour = Influent Concentration, ug/L x Average Design Flow, MGD x 1 day/24 hours x 1E6 gallon/MG x 1 g/1E6 ug x 1 lb/453.59 g x 3.785 L/gallon

PTE ton/year = Influent Concentration, ug/L x Average Design Flow, MGD x 365 days/year x 1E6 gallon/MG x 1 g/1E6 ug x 1 lb/453.59 g x 1 ton/2000 lb x 3.785 L/gallon

Disinfection

Assumptions:
VOC emission = HAP emissions = Total Trihalomethanes Emissions

Flow through Chlorine Contact Basin and Effluent[1] =	50	MGD
Hours of Operation per Year (Annual Operating Hours) =	8,760	hours/year
JEIP Emission Factor for Chlorination[2] =	0.019	lb VOC/year/MGD
JEIP Emission Factor for Final Effluent Weir[2] =	0.001	lb VOC/year/MGD

Chlorine Contact Basin Emissions

Pollutant	lb/hr	ton/year
VOCs	0.01	0.01
HAPs	0.01	0.01

Final Effluent Weir Emissions

Pollutant	lb/hr	ton/year
VOCs	0.01	0.01
HAPs	0.01	0.01

Notes:
JEIP: Joint Emissions Inventory Program
[1]Flow is based on the design maximum daily average flow.
[2]Emissions factors based on JEIP emission factors for chlorination and effluent weir as published in VOC Emissions from Wastewater Treatment Plants, 2003.

Example Calculation:
Chlorine Contact Basin VOC Emissions, lb/hour = JEIP Emission Factor, lb
Chlorine emissions from the disinfection process (chlorine contact basins) will be negligible because chlorine from the addition of sodium hypochlorite reacts rapidly with the wastewater. However, the chlorine reacts with organics contained in the wastewater and forms trihalomethanes (THMs). Trihalomethanes are regulated as both HAPs and VOCs. Chlorine disinfection systems are unique in that trihalomethanes are produced in the process, rather than originating from the influent waste stream.

Disinfection PTE Equations

The following equation was used to calculate the VOC and HAP PTE for Disinfection Process:
VOC PTE lb/hour = VOC Emission Factor, lb VOC/year/MGD x Average Design Flow, MGD x 1 year/8,760 hours
HAP PTE lb/hour = HAP Emission Factor, lb VOC/year/MGD x Average Design Flow, MGD x 1 year/8,760 hours
VOC PTE ton/year = VOC Emission Factor, lb VOC/year/MGD x Average Design Flow, MGD x 1 ton/2000 lb
HAP PTE ton/year = HAP Emission Factor, lb VOC/year/MGD x Average Design Flow, MGD x 1 ton/2000 lb

Table B-4

Pollutant Emissions for 720 SCFM Open Flare for Digester Gas

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Maximum Potential Hours of Operation:	8,760	hours/year
Heating Value of Gas Stream[1]:	600	BTU/SCF
Flare Capacity[2]:	720	SCFM
	43,200	SCF/hour
	0.0432	MMSCF/hour
	25.92	MMBTU/hour
Maximum Percent Methane[3]	60%	

Pollutant	Emission Factor		PTE (lb/hour)	PTE (ton/year)	Emission Factor Reference
NOx[4]	39.00	lb/MMSCF of methane	1.01	4.4	AP-42 Chapter 2, Draft Section 2.4, Table 2.4-4 (10/08)
CO[4]	46.00	lb/MMSCF of methane	1.19	5.2	AP-42 Chapter 2, Draft Section 2.4, Table 2.4-4 (10/08)
VOC[5]	5.5	lb/MMSCF	0.24	1.04	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98) for natural gas
SO_2[6]	5.5	lb/MMSCF	0.24	1.04	SO_2 emission factor from EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors for Digester Gas Boiler
PM[4]	17	lb/MMSCF of methane	0.44	1.92	AP-42 Chapter 2, Section 2.4, Table 2.4-5 (11/98)(size distribution data was not available)
Total HAPS[7]	--	--	0.08	0.36	Total HAPs is sum of all HAPs. Individual HAPs from AP-42, Chapter 1, Section 1.4 (7/98) in the specified table.
Lead	0.0005	lb/MMSCF	2.2E-05	9.5E-05	Table 1-4.2
Benzene	2.10E-03	lb/MMSCF	9.1E-05	4.0E-04	Table 1.4-3
Dichlorobenzene	1.20E-03	lb/MMSCF	5.2E-05	2.3E-04	Table 1.4-3
Formaldehyde	7.50E-02	lb/MMSCF	3.2E-03	1.4E-02	Table 1.4-3
Hexane	1.8	lb/MMSCF	7.8E-02	3.4E-01	Table 1.4-3
Naphthalene	6.10E-04	lb/MMSCF	2.6E-05	1.2E-04	Table 1..4-3
Toluene	3.40E-03	lb/MMSCF	1.5E-04	6.4E-04	Table 1.4-3
Total PAHs[8]	7.00E-05	lb/MMSCF	3.0E-06	1.3E-05	Table 1.4-3
Arsenic	2.00E-04	lb/MMSCF	8.6E-06	3.8E-05	Table 1.4-4
Beryllium	6.00E-06	lb/MMSCF	2.6E-07	1.1E-06	Table 1.4-4
Cadmium	1.10E-03	lb/MMSCF	4.8E-05	2.1E-04	Table 1.4-4
Chromium	1.40E-03	lb/MMSCF	6.0E-05	2.6E-04	Table 1.4-4
Cobalt	8.40E-05	lb/MMSCF	3.6E-06	1.6E-05	Table 1.4-4
Manganese	3.80E-04	lb/MMSCF	1.6E-05	7.2E-05	Table 1.4-4
Mercury	2.60E-04	lb/MMSCF	1.1E-05	4.9E-05	Table 1.4-4
Nickel	2.10E-03	lb/MMSCF	9.1E-05	4.0E-04	Table 1.4-4
Selenium	1.20E-05	lb/MMSCF	5.2E-07	2.3E-06	Table 1.4-4

Table B-4

Notes:

DG: digester gas
MMSCF: Million Standard Cubic Feet
MMBTU: Million British Thermal Units
hr: hour
lb: pound
PAH: Polycyclic Aromatic Hydrocarbons
SCFM: Standard Cubic Feet per Minute

1. Heating Value of digester gas from AP-42, Chapter 3, Section 3.1
2. Flare capacity based on the flare burning only digester gas at maximum capacity (300 scfm).
3. Maximum percent methane contained in the digester gas is based on information provided in the Technical Support Document (TSD) of the current Operating Permit for the facility.
4. NOx and CO emission factors were obtained from AP-42, Chapter 2, Draft Section 2.4, Table 2.4-4 (October 2008) and the PM emission factor was obtained from AP-42, Chapter 2, Section 2.4, Table 2.4-5 (November 1998) for combustion of landfill gas in a flare. Landfill gas and digester gas have similar levels of methane and CO2. . The emission factor is provided in lb/MMSCF of methane and is based on digester gas that has not been "cleaned" to remove particulates. The following equation was used to estimate emissions:

Flare Capacity (MMSCF Digester Gas/hour) xPM Emission Factor (lb/MMSCF of methane) x % Methane in Digester Gas

5. VOC emission factor for digester gas was not available, therefore, a VOC emission factor for combustion of natural gas from AP-42, Chapter 1, Section 1.4, Table 1-4.2 was used to estimate PTE.
6. Sulfur content in the digester gas was not available, therefore SO_2 emission factors from EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors for Digester Gas Boiler was used. However, if "cleaned" digester gas is used SO_2 emissions would be negligible.
7. Emission factors for HAPs in digester gas were not available, therefore, individual HAP emission factors for combustion of natural gas in boilers from AP-42, Chapter 1, Section 1.4, Tables 1-4.1, 1-4.2, and 1.4-3 were used. Individual HAP emissions were summed to obtain Total HAP emissions.
8. Total PAHs represent a sum of the emission factors provided in Table 1.4-3 for individual PAHs. Where the individual PAH emission factor was provided as a nondetectable value (e.g., <1.8E-5), one-half of the detection limit was used in the calculation.

Table B-5

Pollutant Emissions for 1,000 SCFM Enclosed Flare for Digester Gas

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Maximum Potential Hours of Operation	8,760	hours/year
Heating Value of Gas Stream[1]:	590	BTU/SCF
Flare Capacity[2]:	1,000	SCFM
	60,000	SCF/hour
	0.06	MMSCF/hour
	35.4	MMBTU/hour
Maximum Percent Methane[3]	65%	

Pollutant	Emission Factor		PTE (lb/hour)	PTE (ton/year)	Emission Factor Reference
NOx[4]	0.10	lb/MMBTU	3.54	15.5	Manufacturer Data Sheet for operation at 1800°F
CO[4]	0.20	lb/MMBTU	7.08	31.0	Manufacturer Data Sheet for operation at 1600°F
VOC[5]	5.5	lb/MMSCF	0.21	0.94	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98) for natural gas
SO_2[6]	5.5	lb/MMSCF	0.21	0.94	SO_2 emission factor from EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors for Digester Gas Boiler
PM[7]	17	lb/MMSCF of methane	0.66	2.90	AP-42 Chapter 2, Section 2.4, Table 2.4-5 (11/98)
Total HAPS[8]			0.11	0.50	Total HAPs is sum of all HAPs. Individual HAPs from AP-42, Chapter 1, Section 1.4 (7/98) in the specified table.
Lead	0.0005	lb/MMSCF	3.0E-05	1.3E-04	Table 1-4.2
Benzene	2.10E-03	lb/MMSCF	1.3E-04	5.5E-04	Table 1.4-3
Dichlorobenzene	1.20E-03	lb/MMSCF	7.2E-05	3.2E-04	Table 1.4-3
Formaldehyde	7.50E-02	lb/MMSCF	4.5E-03	2.0E-02	Table 1.4-3
Hexane	1.8	lb/MMSCF	1.1E-01	4.7E-01	Table 1.4-3
Naphthalene	6.10E-04	lb/MMSCF	3.7E-05	1.6E-04	Table 1..4-3
Toluene	3.40E-03	lb/MMSCF	2.0E-04	8.9E-04	Table 1.4-3
Total PAHs[9]	7.00E-05	lb/MMSCF	4.2E-06	1.8E-05	Table 1.4-3
Arsenic	2.00E-04	lb/MMSCF	1.2E-05	5.3E-05	Table 1.4-4
Beryllium	6.00E-06	lb/MMSCF	3.6E-07	1.6E-06	Table 1.4-4
Cadmium	1.10E-03	lb/MMSCF	6.6E-05	2.9E-04	Table 1.4-4
Chromium	1.40E-03	lb/MMSCF	8.4E-05	3.7E-04	Table 1.4-4
Cobalt	8.40E-05	lb/MMSCF	5.0E-06	2.2E-05	Table 1.4-4
Manganese	3.80E-04	lb/MMSCF	2.3E-05	1.0E-04	Table 1.4-4
Mercury	2.60E-04	lb/MMSCF	1.6E-05	6.8E-05	Table 1.4-4
Nickel	2.10E-03	lb/MMSCF	1.3E-04	5.5E-04	Table 1.4-4
Selenium	1.20E-05	lb/MMSCF	7.2E-07	3.2E-06	Table 1.4-4

Table B-5

Notes:

DG: digester gas
MMSCF: Million Standard Cubic Feet
MMBTU: Million British Thermal Units
hr: hour
lb: pound
PAH: Polycyclic Aromatic Hydrocarbons
SCFM: Standard Cubic Feet per Minute

1. Heating Value of digester gas is based on lower heating value provided in the manufacturer specifications for the enclosed flare.
2. Flare capacity based on the flare burning only digester gas at maximum capacity (1000 scfm).
3. Maximum percent methane contained in the digester gas is based on information provided in the manufacturer specifications for the flare.
4. NOx and CO emission factors are based on the maximum value provided in the manufacturer specifications. Flare capacity of 1000 SCFM and the heating value of the gas stream were used in the following equation to estimate rated MMBTU of the flare:

Flare Capacity (SCFM) x Heating Value of Gas Stream (BTU/SCF) x 60 (min/hour) = Flare Capacity (BTU/hr)

5. VOC emission factor for digester gas was not available, therefore, a VOC emission factor for combustion of natural gas from AP-42, Chapter 1, Section 1.4, Table 1-4.2 was used to estimate PTE.
6. Sulfur content in the digester gas was not available, therefore SO_2 emission factors from EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors for Digester Gas Boiler was used. However, if "cleaned" digester gas is used SO_2 emissions would be negligible.
7. PM emission factor was obtained from AP-42, Chapter 2, Section 2.4, Table 2.4-5 for combustion of landfill gas in a flare. Landfill gas and digester gas have similar levels of methane and CO2. The emission factor is provided in lb/MMSCF of methane and is based on digester gas that has not been "cleaned" to remove particulates. The following equation was used to estimate emissions:

   Flare Capacity (MMSCF Digester Gas/hour) xPM Emission Factor (lb/MMSCF of methane) x % Methane in Digester Gas

   If the digester gas is cleaned, the PM emissions from the flare would be negligible.
8. Emission factors for HAPs in digester gas were not available, therefore, individual HAP emission factors for combustion of natural gas in boilers from AP-42, Chapter 1, Section 1.4, Tables 1-4.1, 1-4.2, and 1.4-3 were used. Individual HAP emissions were summed to obtain Total HAP emissions.
9. Total PAHs represent a sum of the emission factors provided in Table 1.4-3 for individual PAHs. Where the individual PAH emission factor was provided as a nondetectable value (e.g., <1.8E-5), one-half of the detection limit was used in the calculation.

Table B-6

Pollutant Emissions for 8.368 MMBTU Boiler #1

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Boiler # 1 PTE Operating on Natural Gas

Maximum Potential Hours of Operation	8,760	hours/year
Heating Value of Natural Gas[1]	1,050	MMBTU/MMSCF
Boiler Capacity:	8.368	MMBTU/hour
Natural Gas	0.008	MMSCF/hour
	69.813	MMSCF/Year

Pollutant	Emission Factor[2]		PTE[3] (lb/hour)	PTE[3] (ton/year)	Emission Factor Reference
NOx	100	lb/MMSCF natural gas	0.80	3.49	AP-42 Chapter 1, Section 1.4 Table 1.4-1 (7/98) for Small Boilers (<100 MMBTU)
CO	84	lb/MMSCF natural gas	0.67	2.93	AP-42 Chapter 1, Section 1.4 Table 1.4-1 (7/98) for Small Boilers (<100 MMBTU)
VOC	5.5	lb/MMSCF natural gas	0.04	0.19	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
SO_2	0.60	lb/MMSCF natural gas	0.00	0.02	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
PM_{10}	1.90	lb/MMSCF natural gas	0.02	0.07	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98), Filterable Only
$PM_{2.5}$	7.6	lb/MMSCF natural gas	0.06	0.27	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
Total HAPS[4]			0.02	0.07	Total HAPs is sum of all HAPs. Individual HAPs from AP-42, Chapter 1, Section 1.4 (7/98) in the specified table.
Lead	0.0005	lb/MMSCF	4E-06	1.75E-05	Table 1-4.2
Benzene	2.10E-03	lb/MMSCF	1.7E-05	7.33E-05	Table 1.4-3
Dichlorobenzene	1.20E-03	lb/MMSCF	9.6E-06	4.19E-05	Table 1.4-3
Formaldehyde	7.50E-02	lb/MMSCF	5.98E-04	2.62E-03	Table 1.4-3
Hexane	1.8	lb/MMSCF	1.43E-02	6.28E-02	Table 1.4-3
Naphthalene	6.10E-04	lb/MMSCF	4.86E-06	2.13E-05	Table 1.4-3
Toluene	3.40E-03	lb/MMSCF	2.71E-05	1.19E-04	Table 1.4-3
Total PAHs[5]	7.00E-05	lb/MMSCF	5.6E-07	2.44E-06	Table 1.4-3
Arsenic	2.00E-04	lb/MMSCF	1.6E-06	6.98E-06	Table 1.4-4
Beryllium	6.00E-06	lb/MMSCF	4.8E-08	2.09E-07	Table 1.4-4
Cadmium	1.10E-03	lb/MMSCF	8.8E-06	3.84E-05	Table 1.4-4
Chromium	1.40E-03	lb/MMSCF	1.1E-05	4.89E-05	Table 1.4-4
Cobalt	8.40E-05	lb/MMSCF	6.7E-07	2.93E-06	Table 1.4-4
Manganese	3.80E-04	lb/MMSCF	3E-06	1.33E-05	Table 1.4-4
Mercury	2.60E-04	lb/MMSCF	2.1E-06	9.08E-06	Table 1.4-4
Nickel	2.10E-03	lb/MMSCF	1.7E-05	7.33E-05	Table 1.4-4
Selenium	1.20E-05	lb/MMSCF	9.6E-08	4.19E-07	Table 1.4-4

Table B-6

Boiler # 1 PTE Operating on Digester Gas

Maximum Potential Hours of Operation	8760	hours/year
Heating Value of Natural Gas[1]	590	MMBTU/MMSCF
Maximum Percent Methane[6]	65%	
Boiler Capacity:	10.5	MMBTU/hour
Digester Gas	0.018	MMSCF/hour
	155.90	MMSCF/year

Pollutant	Emission Factor[6,7,8, 9, 10]		PTE[11] (lb/hour)	PTE[11] (ton/year)	Emission Factor Reference
NOx	33.0	lb/MMSCF Methane digester gas	0.38	1.67	AP-42 Chapter 2, Section 2.4 Table 2.4-5 Boilers (11/98)
CO	5.7	lb/MMSCF Methane digester gas	0.07	0.29	AP-42 Chapter 2, Section 2.4 Table 2.4-5 Boilers (11/98)
VOC	5.5	lb/MMSCF digester gas	0.10	0.43	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
SO_2	4.5	lb/MMSCF digester gas	0.08	0.35	SO_2 emission factor from EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors for Digester Gas Boiler
PM	8.2	lb/MMSCF Methane digester gas	0.09	0.42	AP-42 Chapter 2, Section 2.4 Table 2.4-5 Boilers (no size distribution data was available) (11/98)
Total HAPS			0.03	0.15	Total HAPs is sum of all HAPs. Individual HAPs from AP-42, Chapter 1, Section 1.4 (7/98)
Lead	0.0005	lb/MMSCF	8.9E-06	3.90E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Benzene	2.10E-03	lb/MMSCF	3.7E-05	1.64E-04	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Dichlorobenzene	1.20E-03	lb/MMSCF	2.1E-05	9.35E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Formaldehyde	7.50E-02	lb/MMSCF	0.00133	5.85E-03	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Hexane	1.8	lb/MMSCF	0.03203	1.40E-01	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Naphthalene	6.10E-04	lb/MMSCF	1.1E-05	4.75E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Toluene	3.40E-03	lb/MMSCF	6.1E-05	2.65E-04	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Total PAHs[5]	7.00E-05	lb/MMSCF	1.2E-06	5.46E-06	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Arsenic	2.00E-04	lb/MMSCF	3.6E-06	1.56E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Beryllium	6.00E-06	lb/MMSCF	1.1E-07	4.68E-07	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Cadmium	1.10E-03	lb/MMSCF	2E-05	8.57E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Chromium	1.40E-03	lb/MMSCF	2.5E-05	1.09E-04	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Cobalt	8.40E-05	lb/MMSCF	1.5E-06	6.55E-06	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Manganese	3.80E-04	lb/MMSCF	6.8E-06	2.96E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Mercury	2.60E-04	lb/MMSCF	4.6E-06	2.03E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Nickel	2.10E-03	lb/MMSCF	3.7E-05	1.64E-04	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Selenium	1.20E-05	lb/MMSCF	2.1E-07	9.35E-07	AP-42 Chapter 1, Section 1.4 Table 1.4-2

Table B-6

Total Boiler #1 PTE Operating on both Natural Gas and Digester Gas

Pollutant	PTE[12] (lb/hour)	PTE[12] (ton/year)
NOx	0.80	3.49
CO	0.67	2.93
VOC	0.10	0.43
SO_2	0.08	0.35
PM	0.09	0.42
Total HAPS	0.03	0.15
Lead	8.90E-06	3.90E-05
Benzene	3.74E-05	1.64E-04
Dichlorobenzene	2.14E-05	9.35E-05
Formaldehyde	1.33E-03	5.85E-03
Hexane	3.20E-02	1.40E-01
Naphthalene	1.09E-05	4.75E-05
Toluene	6.05E-05	2.65E-04
Total PAHs[5]	1.25E-06	5.46E-06
Arsenic	3.56E-06	1.56E-05
Beryllium	1.07E-07	4.68E-07
Cadmium	1.96E-05	8.57E-05
Chromium	2.49E-05	1.09E-04
Cobalt	1.49E-06	6.55E-06
Manganese	6.76E-06	2.96E-05
Mercury	4.63E-06	2.03E-05
Nickel	3.74E-05	1.64E-04
Selenium	2.14E-07	9.35E-07

Table B-6

Notes:

MMSCF: Million Standard Cubic Feet
MMBTU: Million British Thermal Units
hr: hour
lb: pound
PAH: Polycyclic Aromatic Hydrocarbons

1. Heating Value of Natural Gas obtained from Appendix A of AP-42 (9/85). Heating Value of digester gas is based on lower heating value provided in the manufacturer specifications for the enclosed flare.
2. Emission factors from AP-42, Chapter 1, Section 1.4 were used for emission estimates of all pollutants for natural gas combustion.

3. The boiler can operate on natural gas, digester gas, or a combination of the two fuels. PTE assumes that the boiler operates 8,760 hours per year on whichever fuel has the higher emission rate for each pollutant.

4. Individual HAP emission factors for combustion of natural gas from AP-42, Chapter 1, Section 1.4, Tables 1-4.1, 1-4.2, and 1.4-3 were used. Individual HAP emissions were summed to obtain Total HAP emissions.
5. Total PAHs represent a sum of the emission factors provided in Table 1.4-3 for individual PAHs. Where the individual PAH emission factor was provided as a nondetectable value (e.g., <1.8E-5), one-half of the detection limit was used in the calculation.
6. Maximum percent methane contained in the digester gas is based on information provided in the manufacturer specifications for the flare.

7. CO, NOx, and PM emission factor was obtained from AP-42, Chapter 2, Section 2.4, Table 2.4-5 for combustion of landfill gas in a boiler. Landfill gas and digester gas have similar levels of methane and CO2. The emission factor is provided in lb/MMSCF of methane. Emission factors assume boilers are equipped with a low NOx burner. The following equation was used to estimate emissions:

Boiler Capacity (MMSCF Digester Gas/hour) Emission Factor (lb/MMSCF of methane) x % Methane in Digester Gas

8. VOC emission factor for digester gas was not available, therefore, a VOC emission factor for combustion of natural gas from AP-42, Chapter 1, Section 1.4, Table 1-4.2 was used to estimate PTE.

9. Sulfur content in the digester gas was not available, therefore SO_2 emission factors from EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors for Digester Gas Boiler was used. However, if "cleaned" digester gas is used, SO_2 emissions would be negligible.
10. Emission factors for HAPs in digester gas were not available, therefore, individual HAP emission factors for combustion of natural gas in boilers from AP-42, Chapter 1, Section 1.4, Tables 1-4.1, 1-4.2, and 1.4-3 were used. Individual HAP emissions were summed to obtain Total HAP emissions.

11. The boiler can operate on natural gas, digester gas, or a combination of the two fuels. PTE assumes that the boiler operates 8,760 hours per year on the fuel that has the higher emission rate for each pollutant.

12. The boiler can operate on natural gas, digester gas, or a combination of the two fuels. PTE assumes that the boiler operates 8,760 hours per year on the fuel that has the higher emission rate for each pollutant.

Table B-7

Pollutant Emissions for 8.368 MMBTU Boiler #2

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Boiler # 2 PTE Operating on Natural Gas

Maximum Potential Hours of Operation	8,760	hours/year
Heating Value of Natural Gas[1]	1,050	MMBTU/MMSCF
Boiler Capacity:	8.368	MMBTU/hour
Natural Gas	0.008	MMSCF/hour
	69.813	MMSCF/Year

Pollutant	Emission Factor[2]		PTE[3] (lb/hour)	PTE[3] (ton/year)	Emission Factor Reference
NOx	100	lb/MMSCF natural gas	0.80	3.49	AP-42 Chapter 1, Section 1.4 Table 1.4-1 (7/98) for Small Boilers (<100 MMBTU)
CO	84	lb/MMSCF natural gas	0.67	2.93	AP-42 Chapter 1, Section 1.4 Table 1.4-1 (7/98) for Small Boilers (<100 MMBTU)
VOC	5.5	lb/MMSCF natural gas	0.04	0.19	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
SO_2	0.60	lb/MMSCF natural gas	4.78E-03	0.02	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
PM_{10}	1.90	lb/MMSCF natural gas	0.02	0.07	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98), Filterable Only
$PM_{2.5}$	7.6	lb/MMSCF natural gas	0.06	0.27	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
Total HAPS[4]			0.02	0.07	Total HAPs is sum of all HAPs. Individual HAPs from AP-42, Chapter 1, Section 1.4 (7/98) in the specified table.
Lead	0.0005	lb/MMSCF	4E-06	1.75E-05	Table 1-4.2
Benzene	2.10E-03	lb/MMSCF	1.7E-05	7.33E-05	Table 1.4-3
Dichlorobenzene	1.20E-03	lb/MMSCF	9.6E-06	4.19E-05	Table 1.4-3
Formaldehyde	7.50E-02	lb/MMSCF	5.98E-04	2.62E-03	Table 1.4-3
Hexane	1.8	lb/MMSCF	1.43E-02	6.28E-02	Table 1.4-3
Naphthalene	6.10E-04	lb/MMSCF	4.86E-06	2.13E-05	Table 1.4-3
Toluene	3.40E-03	lb/MMSCF	2.71E-05	1.19E-04	Table 1.4-3
Total PAHs[5]	7.00E-05	lb/MMSCF	5.6E-07	2.44E-06	Table 1.4-3
Arsenic	2.00E-04	lb/MMSCF	1.6E-06	6.98E-06	Table 1.4-4
Beryllium	6.00E-06	lb/MMSCF	4.8E-08	2.09E-07	Table 1.4-4
Cadmium	1.10E-03	lb/MMSCF	8.8E-06	3.84E-05	Table 1.4-4
Chromium	1.40E-03	lb/MMSCF	1.1E-05	4.89E-05	Table 1.4-4
Cobalt	8.40E-05	lb/MMSCF	6.7E-07	2.93E-06	Table 1.4-4
Manganese	3.80E-04	lb/MMSCF	3E-06	1.33E-05	Table 1.4-4
Mercury	2.60E-04	lb/MMSCF	2.1E-06	9.08E-06	Table 1.4-4
Nickel	2.10E-03	lb/MMSCF	1.7E-05	7.33E-05	Table 1.4-4
Selenium	1.20E-05	lb/MMSCF	9.6E-08	4.19E-07	Table 1.4-4

Table B-7

Boiler # 2 PTE Operating on Digester Gas

Maximum Potential Hours of Operation	8760	hours/year
Heating Value of Natural Gas[1]	590	MMBTU/MMSCF
Maximum Percent Methane[6]	65%	
Boiler Capacity:	10.5	MMBTU/hour
Digester Gas	0.018	MMSCF/hour
	155.90	MMSCF/year

Pollutant	Emission Factor[6,7,8, 9, 10]		PTE[11] (lb/hour)	PTE[11] (ton/year)	Emission Factor Reference
NOx	33.0	lb/MMSCF Methane digester gas	0.38	1.67	AP-42 Chapter 2, Section 2.4 Table 2.4-5 Boilers (11/98)
CO	5.7	lb/MMSCF Methane digester gas	0.07	0.29	AP-42 Chapter 2, Section 2.4 Table 2.4-5 Boilers (11/98)
VOC	5.5	lb/MMSCF digester gas	0.10	0.43	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
SO_2	4.5	lb/MMSCF digester gas	0.08	0.35	SO2 emission factor from EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors for Digester Gas Boiler
PM	8.2	lb/MMSCF Methane digester gas	0.09	0.42	AP-42 Chapter 2, Section 2.4 Table 2.4-5 Boilers (no size distribution data was available) (11/98)
Total HAPS			0.03	0.15	Total HAPs is sum of all HAPs. Individual HAPs from AP-42, Chapter 1, Section 1.4 (7/98)
Lead	0.0005	lb/MMSCF	8.9E-06	3.90E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Benzene	2.10E-03	lb/MMSCF	3.7E-05	1.64E-04	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Dichlorobenzene	1.20E-03	lb/MMSCF	2.1E-05	9.35E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Formaldehyde	7.50E-02	lb/MMSCF	0.00133	5.85E-03	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Hexane	1.8	lb/MMSCF	0.03203	1.40E-01	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Naphthalene	6.10E-04	lb/MMSCF	1.1E-05	4.75E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Toluene	3.40E-03	lb/MMSCF	6.1E-05	2.65E-04	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Total PAHs[5]	7.00E-05	lb/MMSCF	1.2E-06	5.46E-06	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Arsenic	2.00E-04	lb/MMSCF	3.6E-06	1.56E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Beryllium	6.00E-06	lb/MMSCF	1.1E-07	4.68E-07	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Cadmium	1.10E-03	lb/MMSCF	2E-05	8.57E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Chromium	1.40E-03	lb/MMSCF	2.5E-05	1.09E-04	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Cobalt	8.40E-05	lb/MMSCF	1.5E-06	6.55E-06	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Manganese	3.80E-04	lb/MMSCF	6.8E-06	2.96E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Mercury	2.60E-04	lb/MMSCF	4.6E-06	2.03E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Nickel	2.10E-03	lb/MMSCF	3.7E-05	1.64E-04	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Selenium	1.20E-05	lb/MMSCF	2.1E-07	9.35E-07	AP-42 Chapter 1, Section 1.4 Table 1.4-2

Table B-7

Total Boiler #2 PTE Operating on both Natural Gas and Digester Gas

Pollutant	PTE[12] (lb/hour)	PTE[12] (ton/year)
NOx	0.80	3.49
CO	0.67	2.93
VOC	0.10	0.43
SO_2	0.08	0.35
PM	0.09	0.42
Total HAPS	0.03	0.15
Lead	8.90E-06	3.90E-05
Benzene	3.74E-05	1.64E-04
Dichlorobenzene	2.14E-05	9.35E-05
Formaldehyde	1.33E-03	5.85E-03
Hexane	3.20E-02	1.40E-01
Naphthalene	1.09E-05	4.75E-05
Toluene	6.05E-05	2.65E-04
Total PAHs[5]	1.25E-06	5.46E-06
Arsenic	3.56E-06	1.56E-05
Beryllium	1.07E-07	4.68E-07
Cadmium	1.96E-05	8.57E-05
Chromium	2.49E-05	1.09E-04
Cobalt	1.49E-06	6.55E-06
Manganese	6.76E-06	2.96E-05
Mercury	4.63E-06	2.03E-05
Nickel	3.74E-05	1.64E-04
Selenium	2.14E-07	9.35E-07

Table B-7

Notes:

MMSCF: Million Standard Cubic Feet

MMBTU: Million British Thermal Units

1. Heating Value of Natural Gas obtained from Appendix A of AP-42 (9/85). Heating Value of digester gas is based on lower heating value provided in the manufacturer specifications for the enclosed flare.

2. Emission factors from AP-42, Chapter 1, Section 1.4 were used for emission estimates of all pollutants for natural gas combustion.

3. The boiler can operate on natural gas, digester gas, or a combination of the two fuels. PTE assumes that the boiler operates 8,760 hours per year on whichever fuel has the higher emission rate for each pollutant.

4. Individual HAP emission factors for combustion of natural gas from AP-42, Chapter 1, Section 1.4, Tables 1-4.1, 1-4.2, and 1.4-3 were used. Individual HAP emissions were summed to obtain Total HAP emissions.

5. Total PAHs represent a sum of the emission factors provided in Table 1.4-3 for individual PAHs. Where the individual PAH emission factor was provided as a nondetectable value (e.g., <1.8E-5), one-half of the detection limit was used in the calculation.

6. Maximum percent methane contained in the digester gas is based on information provided in the manufacturer specifications for the flare.

7. CO, NOx, and PM emission factor was obtained from AP-42, Chapter 2, Section 2.4, Table 2.4-5 for combustion of landfill gas in a boiler. Landfill gas and digester gas have similar levels of methane and CO2. The emission factor is provided in lb/MMSCF of methane. Emission factors assume boilers are equipped with a low NOx burner. The following equation was used to estimate emissions:

   Boiler Capacity (MMSCF Digester Gas/hour) Emission Factor (lb/MMSCF of methane) x % Methane in Digester Gas

8. VOC emission factor for digester gas was not available, therefore, a VOC emission factor for combustion of natural gas from AP-42, Chapter 1, Section 1.4, Table 1-4.2 was used to estimate PTE.

9. Sulfur content in the digester gas was not available, therefore SO_2 emission factors from EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors for Digester Gas Boiler was used. However, if "cleaned" digester gas is used, SO_2 emissions would be negligible.

10. Emission factors for HAPs in digester gas were not available, therefore, individual HAP emission factors for combustion of natural gas in boilers from AP-42, Chapter 1, Section 1.4, Tables 1-4.1, 1-4.2, and 1.4-3 were used. Individual HAP emissions were summed to obtain Total HAP emissions.

11. The boiler can operate on natural gas, digester gas, or a combination of the two fuels. PTE assumes that the boiler operates 8,760 hours per year on the fuel that has the higher emission rate for each pollutant.

12. The boiler can operate on natural gas, digester gas, or a combination of the two fuels. PTE assumes that the boiler operates 8,760 hours per year on the fuel that has the higher emission rate for each pollutant.

Table B-8

Pollutant Emissions for Sellers Immersion Fired Steam Boiler

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Boiler #3 - Sellers PTE Operating on Natural Gas

Maximum Potential Hours of Operation	8,760	hours/year
Heating Value of Natural Gas[1]	1,050	MMBTU/MMSCF
Boiler Capacity:	6.278	MMBTU/hour
Natural Gas	0.006	MMSCF/hour
	52.376	MMSCF/Year

Pollutant	Emission Factor[2]		PTE[3] (lb/hour)	PTE[3] (ton/year)	Emission Factor Reference
NOx	100	lb/MMSCF natural gas	0.60	2.62	AP-42 Chapter 1, Section 1.4 Table 1.4-1 (7/98) for Small Boilers (<100 MMBTU)
CO	84	lb/MMSCF natural gas	0.50	2.20	AP-42 Chapter 1, Section 1.4 Table 1.4-1 (7/98) for Small Boilers (<100 MMBTU)
VOC	5.5	lb/MMSCF natural gas	0.03	0.14	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
SO_2	0.60	lb/MMSCF natural gas	0.00	0.02	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
PM_{10}	1.90	lb/MMSCF natural gas	0.01	0.05	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98), Filterable Only
$PM_{2.5}$	7.6	lb/MMSCF natural gas	0.05	0.20	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
Total HAPS[4]			0.01	0.05	Total HAPs is sum of all HAPs. Individual HAPs from AP-42, Chapter 1, Section 1.4 (7/98) in the specified table.
Lead	0.0005	lb/MMSCF	2.99E-06	1.31E-05	Table 1-4.2
Benzene	2.10E-03	lb/MMSCF	1.256E-05	5.50E-05	Table 1.4-3
Dichlorobenzene	1.20E-03	lb/MMSCF	7.175E-06	3.14E-05	Table 1.4-3
Formaldehyde	7.50E-02	lb/MMSCF	4.48E-04	1.96E-03	Table 1.4-3
Hexane	1.8	lb/MMSCF	1.08E-02	4.71E-02	Table 1.4-3
Naphthalene	6.10E-04	lb/MMSCF	3.65E-06	1.60E-05	Table 1.4-3
Toluene	3.40E-03	lb/MMSCF	2.03E-05	8.90E-05	Table 1.4-3
Total PAHs[5]	7.00E-05	lb/MMSCF	4.185E-07	1.83E-06	Table 1.4-3
Arsenic	2.00E-04	lb/MMSCF	1.196E-06	5.24E-06	Table 1.4-4
Beryllium	6.00E-06	lb/MMSCF	3.587E-08	1.57E-07	Table 1.4-4
Cadmium	1.10E-03	lb/MMSCF	6.577E-06	2.88E-05	Table 1.4-4
Chromium	1.40E-03	lb/MMSCF	8.371E-06	3.67E-05	Table 1.4-4
Cobalt		lb/MMSCF	5.022E-07	2.20E-06	
	8.40E-05				Table 1.4-4
Manganese	3.80E-04	lb/MMSCF	2.272E-06	9.95E-06	Table 1.4-4
Mercury	2.60E-04	lb/MMSCF	1.555E-06	6.81E-06	Table 1.4-4
Nickel	2.10E-03	lb/MMSCF	1.256E-05	5.50E-05	Table 1.4-4
Selenium	1.20E-05	lb/MMSCF	7.175E-08	3.14E-07	Table 1.4-4

Table B-8

Boiler #3 - Sellers PTE Operating on Digester Gas

Maximum Potential Hours of Operation	8760	hours/year
Heating Value of Natural Gas[1]	590	MMBTU/MMSCF
Maximum Percent Methane[6]	65%	
Boiler Capacity:	6.278	MMBTU/hour
Digester Gas	0.011	MMSCF/hour
	93.21	MMSCF/year

Pollutant	Emission Factor[6,7,8, 9, 10]		PTE[11] (lb/hour)	PTE[11] (ton/year)	Emission Factor Reference
NOx	33.0	lb/MMSCF Methane digester gas	0.23	1.00	AP-42 Chapter 2, Section 2.4 Table 2.4-5 Boilers (11/98)
CO	5.7	lb/MMSCF Methane digester gas	0.04	0.17	AP-42 Chapter 2, Section 2.4 Table 2.4-5 Boilers (11/98)
VOC	5.5	lb/MMSCF digester gas	0.06	0.26	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
SO_2	4.5	lb/MMSCF digester gas	0.05	0.21	SO2 emission factor from EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors for Digester Gas Boiler
PM	8.2	lb/MMSCF Methane digester gas	0.06	0.25	AP-42 Chapter 2, Section 2.4 Table 2.4-5 Boilers (no size distribution data was available) (11/98)
Total HAPS			0.02	0.09	Total HAPs is sum of all HAPs. Individual HAPs from AP-42, Chapter 1, Section 1.4 (7/98)
Lead	0.0005	lb/MMSCF	5.32E-06	2.33E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Benzene	2.10E-03	lb/MMSCF	2.235E-05	9.79E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Dichlorobenzene	1.20E-03	lb/MMSCF	1.277E-05	5.59E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Formaldehyde	7.50E-02	lb/MMSCF	0.0007981	3.50E-03	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Hexane	1.8	lb/MMSCF	0.0191532	8.39E-02	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Naphthalene	6.10E-04	lb/MMSCF	6.491E-06	2.84E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Toluene	3.40E-03	lb/MMSCF	3.618E-05	1.58E-04	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Total PAHs[5]	7.00E-05	lb/MMSCF	7.448E-07	3.26E-06	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Arsenic	2.00E-04	lb/MMSCF	2.128E-06	9.32E-06	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Beryllium	6.00E-06	lb/MMSCF	6.384E-08	2.80E-07	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Cadmium	1.10E-03	lb/MMSCF	1.17E-05	5.13E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Chromium	1.40E-03	lb/MMSCF	1.49E-05	6.52E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Cobalt	8.40E-05	lb/MMSCF	8.938E-07	3.91E-06	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Manganese	3.80E-04	lb/MMSCF	4.043E-06	1.77E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Mercury	2.60E-04	lb/MMSCF	2.767E-06	1.21E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Nickel	2.10E-03	lb/MMSCF	2.235E-05	9.79E-05	AP-42 Chapter 1, Section 1.4 Table 1.4-2
Selenium	1.20E-05	lb/MMSCF	1.277E-07	5.59E-07	AP-42 Chapter 1, Section 1.4 Table 1.4-2

Table B-8

Total Boiler #3 - Sellers PTE Operating on both Natural Gas and Digester Gas

Pollutant	PTE[12] (lb/hour)	PTE[12] (ton/year)
NOx	0.60	2.62
CO	0.50	2.20
VOC	0.06	0.26
SO_2	0.05	0.21
PM	0.06	0.25
Total HAPS	0.02	0.09
Lead	5.32E-06	2.33E-05
Benzene	2.23E-05	9.79E-05
Dichlorobenzene	1.28E-05	5.59E-05
Formaldehyde	7.98E-04	3.50E-03
Hexane	1.92E-02	8.39E-02
Naphthalene	6.49E-06	2.84E-05
Toluene	3.62E-05	1.58E-04
Total PAHs[5]	7.45E-07	3.26E-06
Arsenic	2.13E-06	9.32E-06
Beryllium	6.38E-08	2.80E-07
Cadmium	1.17E-05	5.13E-05
Chromium	1.49E-05	6.52E-05
Cobalt	8.94E-07	3.91E-06
Manganese	4.04E-06	1.77E-05
Mercury	2.77E-06	1.21E-05
Nickel	2.23E-05	9.79E-05
Selenium	1.28E-07	5.59E-07

Table B-8

Notes:

MMSCF: Million Standard Cubic Feet

MMBTU: Million British Thermal Units

1. Heating Value of Natural Gas obtained from Appendix A of AP-42 (9/85). Heating Value of digester gas is based on lower heating value provided in the manufacturer specifications for the enclosed flare.
2. Emission factors from AP-42, Chapter 1, Section 1.4 were used for emission estimates of all pollutants for natural gas combustion.

3. The boiler can operate on natural gas, digester gas, or a combination of the two fuels. PTE assumes that the boiler operates 8,760 hours per year on whichever fuel has the higher emission rate for each pollutant.

4. Individual HAP emission factors for combustion of natural gas from AP-42, Chapter 1, Section 1.4, Tables 1-4.1, 1-4.2, and 1.4-3 were used. Individual HAP emissions were summed to obtain Total HAP emissions.
5. Total PAHs represent a sum of the emission factors provided in Table 1.4-3 for individual PAHs. Where the individual PAH emission factor was provided as a nondetectable value (e.g., <1.8E-5), one-half of the detection limit was used in the calculation.
6. Maximum percent methane contained in the digester gas is based on information provided in the manufacturer specifications for the flare.
7. CO, NOx, and PM emission factor was obtained from AP-42, Chapter 2, Section 2.4, Table 2.4-5 for combustion of landfill gas in a boiler. Landfill gas and digester gas have similar levels of methane and CO2. The emission factor is provided in lb/MMSCF of methane. Emission factors assume boilers are equipped with a low NOx burner. The following equation was used to estimate emissions:

   Boiler Capacity (MMSCF Digester Gas/hour) Emission Factor (lb/MMSCF of methane) x % Methane in Digester Gas
8. VOC emission factor for digester gas was not available, therefore, a VOC emission factor for combustion of natural gas from AP-42, Chapter 1, Section 1.4, Table 1-4.2 was used to estimate PTE.
9. Sulfur content in the digester gas was not available, therefore SO_2 emission factors from EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors for Digester Gas Boiler was used. However, if "cleaned" digester gas is used, SO_2 emissions would be negligible.

10. Emission factors for HAPs in digester gas were not available, therefore, individual HAP emission factors for combustion of natural gas in boilers from AP-42, Chapter 1, Section 1.4, Tables 1-4.1, 1-4.2, and 1.4-3 were used. Individual HAP emissions were summed to obtain Total HAP emissions.
11. The boiler can operate on natural gas, digester gas, or a combination of the two fuels. PTE assumes that the boiler operates 8,760 hours per year on the fuel that has the higher emission rate for each pollutant.

12. The boiler can operate on natural gas, digester gas, or a combination of the two fuels. PTE assumes that the boiler operates 8,760 hours per year on the fuel that has the higher emission rate for each pollutant.

Table B-9

Pollutant Emissions 6.3 MMBtu Natural Gas-Fired Boiler

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Boiler #4 - 6.3 MMBtu PTE Operating on Natural Gas

Maximum Potential Hours of Operation	8,760	hours/year
Heating Value of Natural Gas[1]	1,050	MMBTU/MMSCF
Boiler Capacity:	6.3	MMBTU/hour
Natural Gas	0.006	MMSCF/hour
	52.560	MMSCF/Year

Pollutant	Emission Factor[2]		PTE (lb/hour)	PTE (ton/year)	Emission Factor Reference
NOx	100	lb/MMSCF natural gas	0.60	2.63	AP-42 Chapter 1, Section 1.4 Table 1.4-1 (7/98) for Small Boilers (<100 MMBTU)
CO	84	lb/MMSCF natural gas	0.50	2.21	AP-42 Chapter 1, Section 1.4 Table 1.4-1 (7/98) for Small Boilers (<100 MMBTU)
VOC	5.5	lb/MMSCF natural gas	0.03	0.14	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
SO_2	0.60	lb/MMSCF natural gas	3.60E-03	0.02	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
PM_{10}	1.90	lb/MMSCF natural gas	0.01	0.05	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98), Filterable Only
$PM_{2.5}$	7.6	lb/MMSCF natural gas	0.05	0.20	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
Total HAPS[3]			0.01	0.05	Total HAPs is sum of all HAPs. Individual HAPs from AP-42, Chapter 1, Section 1.4 (7/98) in the specified table.
Lead	0.0005	lb/MMSCF	0.000003	1.31E-05	Table 1-4.2
Benzene	2.10E-03	lb/MMSCF	0.0000126	5.52E-05	Table 1.4-3
Dichlorobenzene	1.20E-03	lb/MMSCF	0.0000072	3.15E-05	Table 1.4-3
Formaldehyde	7.50E-02	lb/MMSCF	4.50E-04	1.97E-03	Table 1.4-3
Hexane	1.8	lb/MMSCF	1.08E-02	4.73E-02	Table 1.4-3
Naphthalene	6.10E-04	lb/MMSCF	3.66E-06	1.60E-05	Table 1.4-3
Toluene	3.40E-03	lb/MMSCF	2.04E-05	8.94E-05	Table 1.4-3
Total PAHs[4]	7.00E-05	lb/MMSCF	0.00000042	1.84E-06	Table 1.4-3
Arsenic	2.00E-04	lb/MMSCF	0.0000012	5.26E-06	Table 1.4-4
Beryllium	6.00E-06	lb/MMSCF	0.000000036	1.58E-07	Table 1.4-4
Cadmium	1.10E-03	lb/MMSCF	0.0000066	2.89E-05	Table 1.4-4
Chromium	1.40E-03	lb/MMSCF	0.0000084	3.68E-05	Table 1.4-4
Cobalt	8.40E-05	lb/MMSCF	0.000000504	2.21E-06	Table 1.4-4
Manganese	3.80E-04	lb/MMSCF	0.00000228	9.99E-06	Table 1.4-4
Mercury	2.60E-04	lb/MMSCF	0.00000156	6.83E-06	Table 1.4-4
Nickel	2.10E-03	lb/MMSCF	0.0000126	5.52E-05	Table 1.4-4
Selenium	1.20E-05	lb/MMSCF	0.000000072	3.15E-07	Table 1.4-4

Table B-9

Notes:

MMSCF: Million Standard Cubic Feet

MMBTU: Million British Thermal Units

1. Heating Value of Natural Gas obtained from Appendix A of AP-42 (9/85).

2. Emission factors from AP-42, Chapter 1, Section 1.4 were used for emission estimates of all pollutants for natural gas combustion.

3. Individual HAP emission factors for combustion of natural gas from AP-42, Chapter 1, Section 1.4, Tables 1-4.1, 1-4.2, and 1.4-3 were used. Individual HAP emissions were summed to obtain Total HAP emissions.

4. Total PAHs represent a sum of the emission factors provided in Table 1.4-3 for individual PAHs. Where the individual PAH emission factor was provided as a nondetectable value (e.g., <1.8E-5), one-half of the detection limit was used in the calculation.

Table B-10

Pollutant Emissions 6.3 MMBtu Natural Gas-Fired Boiler

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Boiler #5 - 6.3 MMBtu PTE Operating on Natural Gas

Maximum Potential Hours of Operation	8,760	hours/year
Heating Value of Natural Gas[1]	1,050	MMBTU/MMSCF
Boiler Capacity:	6.3	MMBTU/hour
Natural Gas	0.006	MMSCF/hour
	52.560	MMSCF/Year

Pollutant	Emission Factor[2]		PTE (lb/hour)	PTE (ton/year)	Emission Factor Reference
NOx	100	lb/MMSCF natural gas	0.60	2.63	AP-42 Chapter 1, Section 1.4 Table 1.4-1 (7/98) for Small Boilers (<100 MMBTU)
CO	84	lb/MMSCF natural gas	0.50	2.21	AP-42 Chapter 1, Section 1.4 Table 1.4-1 (7/98) for Small Boilers (<100 MMBTU)
VOC	5.5	lb/MMSCF natural gas	0.03	0.14	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
SO_2	0.60	lb/MMSCF natural gas	3.60E-03	0.02	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
PM_{10}	1.90	lb/MMSCF natural gas	0.01	0.05	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98), Filterable Only
$PM_{2.5}$	7.6	lb/MMSCF natural gas	0.05	0.20	AP-42 Chapter 1, Section 1.4 Table 1.4-2 (7/98)
Total HAPS[3]			0.01	0.05	Total HAPs is sum of all HAPs. Individual HAPs from AP-42, Chapter 1, Section 1.4 (7/98) in the specified table.
Lead	0.0005	lb/MMSCF	0.000003	1.31E-05	Table 1-4.2
Benzene	2.10E-03	lb/MMSCF	1.26E-05	5.52E-05	Table 1.4-3
Dichlorobenzene	1.20E-03	lb/MMSCF	7.2E-06	3.15E-05	Table 1.4-3
Formaldehyde	7.50E-02	lb/MMSCF	4.50E-04	1.97E-03	Table 1.4-3
Hexane	1.8	lb/MMSCF	1.08E-02	4.73E-02	Table 1.4-3
Naphthalene	6.10E-04	lb/MMSCF	3.66E-06	1.60E-05	Table 1.4-3
Toluene	3.40E-03	lb/MMSCF	2.04E-05	8.94E-05	Table 1.4-3
Total PAHs[4]	7.00E-05	lb/MMSCF	4.2E-07	1.84E-06	Table 1.4-3
Arsenic	2.00E-04	lb/MMSCF	1.2E-06	5.26E-06	Table 1.4-4
Beryllium	6.00E-06	lb/MMSCF	3.6E-08	1.58E-07	Table 1.4-4
Cadmium	1.10E-03	lb/MMSCF	6.6E-06	2.89E-05	Table 1.4-4
Chromium	1.40E-03	lb/MMSCF	8.4E-06	3.68E-05	Table 1.4-4
Cobalt	8.40E-05	lb/MMSCF	5.04E-07	2.21E-06	Table 1.4-4
Manganese	3.80E-04	lb/MMSCF	2.28E-06	9.99E-06	Table 1.4-4
Mercury	2.60E-04	lb/MMSCF	1.56E-06	6.83E-06	Table 1.4-4
Nickel	2.10E-03	lb/MMSCF	1.26E-05	5.52E-05	Table 1.4-4
Selenium	1.20E-05	lb/MMSCF	7.2E-08	3.15E-07	Table 1.4-4

Table B-10

Notes:

MMSCF: Million Standard Cubic Feet

MMBTU: Million British Thermal Units

1. Heating Value of Natural Gas obtained from Appendix A of AP-42 (9/85).

2. Emission factors from AP-42, Chapter 1, Section 1.4 were used for emission estimates of all pollutants for natural gas combustion.

3. Individual HAP emission factors for combustion of natural gas from AP-42, Chapter 1, Section 1.4, Tables 1-4.1, 1-4.2, and 1.4-3 were used. Individual HAP emissions were summed to obtain Total HAP emissions.

4. Total PAHs represent a sum of the emission factors provided in Table 1.4-3 for individual PAHs. Where the individual PAH emission factor was provided as a nondetectable value (e.g., <1.8E-5), one-half of the detection limit was used in the calculation.

Table B-11

Pollutant Emissions for 225 HP Natural-Gas, Spark-Ignited Generator

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Maximum Potential Hours of Operation	100	hours/year
Heating Value of Natural Gas[1]	1050	BTU/scf
Maximum Generator Output[2]:	383	HP
Fuel Input Capacity[2]	0.97	MMBTU/hr

Pollutant	Emission Factor[3]		PTE (lb/hour)	PTE (ton/year)	Emission Factor Reference
NOx	15.12	g/HP-hr	12.77	3.19	Manufacturer's Specification
CO	1.17	g/HP-hr	0.99	0.25	Manufacturer's Specification
VOC	0.21	g/HP-hr	0.18	0.04	Manufacturer's Specification
SO_2	5.88E-04	lb/MMBTU	5.73E-04	1.43E-04	AP-42 Chapter 3, Section 3.2 Table 3.2-2 (7/00) for uncontrolled 4-stroke lean burn engines.
PM_{10}	7.71E-05	lb/MMBTU	0.0001	1.88E-05	AP-42 Chapter 3, Section 3.2 Table 3.2-2 (7/00) for uncontrolled 4-stroke lean burn engines. Includes directly emitted particulate less than 1 micron only.
$PM_{2.5}$	9.99E-03	lb/MMBTU	0.0097	2.43E-03	AP-42 Chapter 3, Section 3.2 Table 3.2-2 (7/00) for uncontrolled 4-stroke lean burn engines. Includes PM directly emitted and PM Condensable.
Total HAPS[4]	--	lb/MMBTU	0.07	0.02	Total HAPs is sum of all HAPs. Individual HAP Emission Factors from AP-42, Chapter 3, Section 3.2 Table 3.2-2 (7/00) for uncontrolled 4-stroke lean burn engines.
1,1,2,2-Tetrachlorethane	<4.00E-5	lb/MMBTU	1.9E-05	4.9E-06	
1,1,2-Trichloroethane	<3.18E-5	lb/MMBTU	1.5E-05	3.9E-06	
1,3-Butadiene	2.67E-04	lb/MMBTU	2.6E-04	6.5E-05	
1,3-Dichloropropene	<2.64E-5	lb/MMBTU	1.3E-05	3.2E-06	
2,2,4-Trimethylpentane	2.50E-04	lb/MMBTU	2.4E-04	6.1E-05	
Acetaldehyde	8.36E-03	lb/MMBTU	8.1E-03	2.0E-03	
Acrolein	5.14E-03	lb/MMBTU	5.0E-03	1.3E-03	
Benzene	4.40E-04	lb/MMBTU	4.3E-04	1.1E-04	
Biphenyl	2.12E-04	lb/MMBTU	2.1E-04	5.2E-05	
Carbon Tetrachloride	<3.67E-5	lb/MMBTU	1.8E-05	4.5E-06	
Chlorobenzene	<3.04E-5	lb/MMBTU	1.5E-05	3.7E-06	
Chloroform	<2.85E-5	lb/MMBTU	1.4E-05	3.5E-06	
Ethylbenzene	3.97E-05	lb/MMBTU	3.9E-05	9.7E-06	
Ethylene Dibromide	<4.43E-5	lb/MMBTU	2.2E-05	5.4E-06	
Formaldehyde	5.28E-02	lb/MMBTU	5.1E-02	1.3E-02	
Hexane	1.11E-03	lb/MMBTU	1.1E-03	2.7E-04	
Methanol	2.50E-03	lb/MMBTU	2.4E-03	6.1E-04	
Methylene Chloride	2.00E-05	lb/MMBTU	1.9E-05	4.9E-06	
Naphthalene	7.44E-05	lb/MMBTU	7.2E-05	1.8E-05	
Phenol	2.40E-05	lb/MMBTU	1.4E-05	3.5E-06	
Styrene	<2.36E-5	lb/MMBTU	1.1E-05	2.9E-06	
Tetrachloroethane	2.48E-06	lb/MMBTU	2.4E-06	6.0E-07	
Toluene	4.08E-04	lb/MMBTU	4.0E-04	9.9E-05	
Total PAH[6]	2.69E-05	lb/MMBTU	2.6E-05	6.5E-06	

Table B-11

Vinyl Chloride	1.49E-05	lb/MMBTU	1.5E-05	3.6E-06
Xylenes	1.8E-04	lb/MMBTU	1.8E-04	4.5E-05

Notes:

MMBTU: Million British Thermal Units
g: gram
hr: hour
lb: pound
PAH: Polycyclic Aromatic Hydrocarbons
HP - Horsepower

1. Heating value of natural gas is based on AP-42 value of 1050 BTU/scf (AP-42, Appendix A (9/85)).
2. Maximum generator output provided by manufacturer and HP based on rating used for emissions testing. (Cummins GTA855-B). HP rating converted to MMBTU/hr based on a conversion factor of 2542.5 BTU/HP-hr (AP-42, Appendix A (9/85).
3. Emission factors were for natural-gas fired 4-stroke lean burn reciprocating engines were used in PTE calculations (AP-42, Chapter 3, Section 3.2, Table 3.2-2).
4. Individual HAP emissions were summed to obtain Total HAP emissions.
5. Emission factors that were presented in Table 3.2-2 as nondetectable (e.g., <2.9E-5), were assumed to be half of the detection limit for emissions calculations.
6. Total PAHs represent a sum of the emission factors provided in Table 1.4-3 for individual PAHs. Where the individual PAH emission factor was provided as a nondetectable value (e.g., <1.8E-5), one-half of the detection limit was used in the calculation.

Table B-12

Pollutant Emissions for 135 HP Emergency Diesel Generator

Tres Rios Water Reclamation Facility

Pima County Regional Wastewater Reclamation Department

Maximum Potential Hours of Operation 100 hours/year

Maximum Generator Output: 135 HP

Pollutant	Emission Factor[1,2]		PTE (lb/hour)	PTE (ton/year)	Emission Factor Reference
NOx	0.031	lb/HP-hr	4.19	0.21	AP-42 Chapter 3, Section 3.2 Table 3.3-1 (10/96) for diesel industrial engines.
CO	6.68E-03	lb/HP-hr	0.90	0.05	AP-42 Chapter 3, Section 3.2 Table 3.3-1 (10/96) for diesel industrial engines.
VOC	2.47E-03	lb/HP-hr	0.33	0.02	AP-42 Chapter 3, Section 3.2 Table 3.3-1 (10/96) for diesel industrial engines.
SO_2	2.05E-03	lb/HP-hr	0.28	0.01	AP-42 Chapter 3, Section 3.2 Table 3.3-1 (10/96) for diesel industrial engines.
PM_{10}	2.20E-03	lb/HP-hr	0.30	0.01	AP-42 Chapter 3, Section 3.2 Table 3.3-1 (10/96) for diesel industrial engines.
$PM_{2.5}$	2.46E-03	lb/HP-hr	0.33	0.02	AP-42 Chapter 3, Section 3.2 Table 3.3-1 (10/96) for diesel industrial engines with a 12% increase for condensibles from AP-42 Chapter 3, Section 3.4, Table 3.4-1 (10/96) .
Total HAPS[3]	--	lb/MMBTU	0.006	0.000	Total HAPs is sum of all HAPs. Individual HAP Emission Factors from AP-42, Chapter 3, Section 3.2 Table 3.3-2 (10/96) for diesel industrial engines.
1,3-Butadiene[4]	<3.91E-05	lb/MMBTU	1.8E-05	9.24E-07	
Acetaldehyde	7.67E-04	lb/MMBTU	7.2E-04	3.62E-05	
Acrolein[4]	<9.25E-05	lb/MMBTU	4.4E-05	2.19E-06	
Benzene	9.33E-04	lb/MMBTU	8.8E-04	4.41E-05	
Formaldehyde	1.18E-03	lb/MMBTU	1.1E-03	5.58E-05	
Propylene	2.58E-03	lb/MMBTU	2.4E-03	1.22E-04	
Toluene	4.09E-04	lb/MMBTU	3.9E-04	1.93E-05	
Total PAH	1.68E-04	lb/MMBTU	1.6E-04	7.94E-06	
Xylenes	2.85E-04	lb/MMBTU	2.7E-04	1.35E-05	

Notes:

MMBTU: Million British Thermal Units
hr: hour
lb: pound
PAH: Polycyclic Aromatic Hydrocarbons
HP - Horsepower

1. Emission factors for diesel industrial engines were used in PTE calculations (AP-42, Chapter 3, Section 3.3, Table 3.3-1). Emission factors for 4-stroke engines represented a maximum value when compared to 2-stroke engines.

2. Per AP-42 Chapter 3, Table 3.3-1, an average brake-specific fuel consumption (BSFC) of 7,000 BTU/HP-hr was used to convert HAP emission factors from lb/MMBTU to lb/HP-hr.

3. Individual HAP emissions were summed to obtain Total HAP emissions.

4. Emission factors that were presented in Table 3.2-2 as nondetectable (e.g., <2.9E-5), were assumed to be half of the detection limit for emissions calculations.