

Combustion Default Emission Factors – December 2014

Criteria Pollutant Emission Factors

External Combustion Equipment (for all sizes)

Fuel Type (fuel unit)	Organic Gases (lb/unit)	Nitrogen Oxides (lb/unit)	Sulfur Oxides (lb/unit)	Carbon Monoxide (lb/unit)	Particulate Matter (lb/unit)
Natural Gas (mmscf) / Boilers Only	5.50	100.00	0.60	84.00	7.60
Natural Gas (mmscf) / Other Equipment	7.00	130.00	0.60	35.00	7.50
LPG, Propane, Butane (1000 gal.)	0.26	12.80	4.60	3.20	0.28
Diesel/Distillate Oil (1000 gal.)	1.32	20.00	0.21	5.00	2.00

Internal Combustion Engines (ICE) (for all sizes)

Fuel Type (fuel unit) / Engine Type	Organic Gases (lb/unit)	Nitrogen Oxides (lb/unit)	Sulfur Oxides (lb/unit)	Carbon Monoxide (lb/unit)	Particulate Matter (lb/unit)
Natural Gas (mmscf) / 2 Stroke (Lean-Burn) ICE	122.00	3,233.00	0.60	394.00	39.00
Natural Gas (mmscf) / 4 Stroke (Lean-Burn) ICE*	120.00	4,162.00	0.60	323.00	10.00
Natural Gas (mmscf) / 4 Stroke (Rich-Burn) ICE	30.00	2,254.00	0.60	3,794.00	10.00
Natural Gas (mmscf) / Micro Turbine	77.7	54.4	0.6	466.00	6.73
LPG, Propane, Butane (1000 gal.) / All ICEs & Micro Turbine	83.00	139.00	0.35	129.00	5.00
Diesel/Distillate Oil (1000 gal.) / All ICEs & Micro Turbine	37.5	469.00	0.21	102.00	33.50
Gasoline (1000 gal.) / All ICEs & Micro Turbine	206.00	102.00	5.30	3,940.0	6.50

* If engine specification is not available, assume 4 Stroke (Lean-Burn) ICE.

Toxic Air Contaminant (TAC) Emission Factors

Natural Gas (lbs/mmscf)

External Combustion Equipment

Toxic Compound	CAS No.	Equipment Rating, MMBTU/ Hr		
		<10	10-100	>100
Benzene	71432	0.0080	0.0058	0.0017
Formaldehyde	50000	0.0170	0.0123	0.0036
PAHs*	1151	0.0004	0.0004	0.0004
Ammonia**	7664417	18.000	18.000	18.000

* This value represents a combined default emission factor for toxic compounds within the PAH family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH emission.

** This value corresponds to equipment with Selective Non-catalytic Reduction (SNCR), for equipment with Selective Catalytic Reduction (SCR) substitute listed value by 9.1 lbs/mmscf, and for equipment without SNCR or SCR by 3.2 lbs/mmscf.

Turbine

Toxic Compound	CAS No.	All Sizes
Benzene	71432	0.0122
1,3-Butadiene	106990	0.000439
Formaldehyde	50000	0.724
PAHs *	1151	0.00225
Ammonia**	7664417	18.000

* This value represents a combined default emission factor for toxic compounds within the PAH family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH emission.

** This value corresponds to equipment with Selective Non-catalytic Reduction (SNCR), for equipment with Selective Catalytic Reduction (SCR) substitute listed value by 9.1 lbs/mmscf, and for equipment without SNCR or SCR by 3.2 lbs/mmscf.

Stationary and Portable Internal Combustion Engines (ICE) & Micro Turbines

Toxic Compound	CAS No.	2 Stroke-Lean Burn ICE	4 Stroke-Lean Burn ICE & Micro Turbines	4 Stroke-Rich Burn ICE
Benzene	71432	1.98	0.449	1.61
1,3-Butadiene	106990	0.836	0.272	0.676
Carbon Tetrachloride	56235	0.0619	0.0374	0.0181
Ethylene Dibromide	106934	0.0749	0.0452	0.0217
1,2-Dichloroethane	107062	0.0430	0.0241	0.0115
Formaldehyde	50000	56.3	53.9	20.9
Methylene Chloride	75092	0.150	0.0204	0.0420
PAHs *	1151	0.133	0.137	0.0990
Vinyl Chloride	75014	0.0252	0.0152	0.00732
Ammonia**	7664417	18.000	18.000	18.000

* This value represents a combined default emission factor for toxic compounds within the PAH family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH emission.

** This value corresponds to equipment with Selective Non-catalytic Reduction (SNCR), for equipment with Selective Catalytic Reduction (SCR) substitute listed value by 9.1 lbs/mmscf, and for equipment without SNCR or SCR by 3.2 lbs/mmscf.

Gasoline (lb/1000 gallons)

Stationary and Portable Internal Combustion Engines (ICE) & Micro Turbines

Toxic Compound	CAS No.	Non-catalyst (Portable and Stationary) ICE & Micro Turbines	Catalyst, Portable ICE	Catalyst, Stationary ICE
Benzene	71432	3.8061	1.5726	0.1564
1,3 Butadiene	106990	0.9183	0.3240	0.0322
Formaldehyde	50000	3.4520	1.0131	0.1007
Nickel	7440020	0.0033	0.0033	0.0033
PAHs*	1151	0.1438	0.0295	0.0029

* This value represents a combined default emission factor for toxic compounds within the PAH family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH emission.

Jet Fuel (lb/1000 gallons)

Turbine

Toxic Compound	CAS No.	All Sizes
Benzene	71432	0.9377
1,3-Butadiene	106990	0.8563
Cadmium	7440439	0.0168
Formaldehyde	50000	7.2700
Arsenic	7440382	0.1776
Lead	7439921	0.1843
Nickel	7440020	0.0168
PAHs*	1151	0.2740

* This value represents a combined default emission factor for toxic compounds within the PAH family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH emission.

Diesel / Distillate Oil (lb/1000 gallons)

Stationary and Portable Internal Combustion Engines (ICE), Turbines and Micro Turbines

Toxic Compound	CAS No.	All Sizes
Benzene	71432	0.1863
1,3-Butadiene	106990	0.2174
Cadmium	7440439	0.0015
Formaldehyde	50000	1.7261
Hexavalent chromium	18540299	0.0001
Arsenic	7440382	0.0016
Lead	7439921	0.0083
Nickel	7440020	0.0039
PAHs *	1151	0.0559
Ammonia**	7664417	2.9000

* This value represents a combined default emission factor for toxic compounds within the PAH family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH emission.

** This value corresponds to equipment with Selective Non-catalytic Reduction (SNCR), for equipment with Selective Catalytic Reduction (SCR) substitute listed value by 1.4 lbs/1000 gallons, and for equipment without SNCR or SCR by 0.8 lbs/1000 gallons.

LPG (lb/1000 gallons)

External Combustion Equipment

Toxic Compound	CAS No.	Equipment Rating, MMBTU/HR		
		<10	10 - 100	>100
Benzene	71432	0.00071	0.00051	0.00015
Formaldehyde	50000	0.00151	0.00109	0.00032
PAHs *	1151	0.00004	0.00004	0.00004
Ammonia	7664417	0.30	0.30	0.30

* This value represents a combined default emission factor for toxic compounds within the PAH family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH emission.

Turbine

Toxic Compound	CAS No.	All Sizes
Benzene	71432	0.00109
1,3-Butadiene	106990	0.0000389
Formaldehyde	50000	0.0643
PAHs *	1151	0.0002
Ammonia	7664417	0.30

* This value represents a combined default emission factor for toxic compounds within the PAH family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH emission.

Stationary and Portable Internal Combustion Engines (ICE) and Micro Turbine

Toxic Compound	CAS No.	2 Stroke Lean Burn ICE	4 Stroke Lean Burn ICE & Micro Turbine	4 Stroke Rich Burn ICE
Benzene	71432	0.17757	0.0398	0.143
1,3-Butadiene	106990	0.0742	0.0242	0.06
Carbon Tetrachloride	56235	0.00549	0.00332	0.0016
Ethylene Dibromide	106934	0.00664	0.00401	0.00193
1,2-Dichloroethane	107062	0.00382	0.00214	0.00102
Formaldehyde	50000	5.00	4.78	1.86
Methylene Chloride	75092	0.0133	0.00181	0.00373
PAHs *	1151	0.011788179	0.0121728	0.00879
Vinyl Chloride	75014	0.00224	0.00135	0.00065
Ammonia	7664417	0.30	0.30	0.30

* This value represents a combined default emission factor for toxic compounds within the PAH family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH emission.

Landfill Gas (lb/mmscf)

External Combustion Equipment

Toxic Compound	CAS No.	All Sizes
Beryllium	7440417	0.0011
Cadmium	7440439	0.0067
Chlorinated dioxins and dibenzofurans*	1080	0.0000102
Formaldehyde	50000	0.134
Hexavalent chromium	18540299	0.000714
Arsenic	7440382	0.00394
Lead	7439921	0.00685
Nickel	7440020	0.115
PAHs *	1151	0.265
Ammonia	7664417	2.3500

* This value represents a combined default emission factor for toxic compounds within the PAH and Chlorinated dioxins and dibenzofurans family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH and Chlorinated dioxins and dibenzofurans emission

Stationary and Portable Internal Combustion Engines (ICE), Turbines and Micro Turbine

Toxic Compound	CAS No.	All Sizes
Benzene	71432	0.0084
Carbon tetrachloride	56235	0.0007200
Methylene chloride	75092	0.000920
Perchloroethylene	127184	0.00100
Trichloroethylene	79016	0.000760
Vinyl chloride	75014	0.000640

Digester Gas (lb/mmscf)

External Combustion Equipment

Toxic Compound	CAS No.	Equipment Rating, MMBTU/ HR		
		<10	10-100	>100
Benzene	71432	0.0080	0.0058	0.0017
Formaldehyde	50000	0.0170	0.0123	0.0036
PAHs *	1151	0.0004	0.0004	0.0004
Ammonia	7664417	3.2	3.2	3.2

* This value represents a combined default emission factor for toxic compounds within the PAH and Chlorinated dioxins and dibenzofurans family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH and Chlorinated dioxins and dibenzofurans emission.

Stationary and Portable Internal Combustion Engines (ICE) Turbines and Micro Turbine

Toxic Compound	CAS No.	All Sizes
1,3 Butadiene	106990	0.00588
Cadmium	7440439	0.000348
Carbon tetrachloride	56235	0.0120
Ethylene dichloride	107062	0.00900
Formaldehyde	50000	0.1140
Arsenic	7440382	0.00138
Lead	7439921	0.00204
Methylene chloride	75092	0.00780
Nickel	7440020	0.00120
Perchloroethylene	127184	0.0126
Trichloroethylene	79016	0.0108
Vinyl chloride	75014	0.0216
Ammonia	7664417	3.2

Associated Process Gas (lbs/mmscf) (all equipment)

Toxic Compound	CAS No.	All Sizes
Benzene	71432	0.159
Formaldehyde	50000	1.169
PAHs *	1151	0.014

* This value represents a combined default emission factor for toxic compounds within the PAH and Chlorinated dioxins and dibenzofurans family. Speciated (by CAS#) default emission factors are listed in the software. Non-AB2588 facilities may use either method to report PAH and Chlorinated dioxins and dibenzofurans emission.