Boiler PTE Evaluation Template

Equipment: One 60 MMBtu/hr natural gas boiler with #2 fuel oil backup and
One 10 MMBtu/hr Boiler fired by natural gas only.

Assumptions:
AP-42, section 1.4 and 1.3 AP-42 is the standard default, specific source test results are preferable.

Pollutant	**Natural Gas Emission Factors (lb/mmcf)**	**Emission Factor Rating**	**Fuel Oil Emission Factors (lb/1000 gal)**	**Emission Factor Rating**
NO_x	100	B	20	A
CO	84	B	5	A
PM	7.6	D	2	E
PM_{10}	7.6	D	1	E
SO_2	0.6	A	142S, where S = 0.5	A
VOC	5.5	C	0.34	A
Lead	0.0005	D	9 lb/10^{12} Btu	C
Single HAP Hexane Formaldehyde	 1.8 .0750	 E E	 NA .033	 NA C
Total HAP	1.89		0.041 lb/1000 gal for the non-metals 49 lb/10^{12} btu for metals (0.0068 lb/1000gal) 0.048 lb/1000gal total HAPs	

Calculations:

PTE for NOx:

Boiler (60 MMBtu/hr):

Natural gas:

[(60 MMBtu/hr)/(1020 MMBtu/mmcf)](100 lb/mmcf)(8760 hr/yr)/(2000 lb/ton)
= 25.76 tpy NOx

Fuel Oil:

[(60 MMBtu/hr)/(140 MMBtu/1000 gal)](20 lb/1000 gal)(8760 hr/yr)/(2000 lb/ton)
= 37.54tpy NOx <— Worst Case

Boiler (10 MMBtu/hr):

Natural Gas:

[(10 MMBtu/hr)/(1020 MMBtu/mmcf)](100 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 4.29 tpy

Total NOx = 37.54 tpy + 4.29 tpy = **41.83 tpy**

PTE for CO:

Boiler(60MMBtu/hr):

Natural Gas:[(60 MMBtu/hr)/(1020 MMBtu/mmcf)](84 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 21.64 tpy CO<— Worst Case

Fuel Oil:[(60 MMBtu/hr)/(140 MMBtu/1000 gal)](5 lb/1000 gal)(8760 hr/yr)/(2000 lb/ton) = 9.38 tpy CO

Boiler (10 MMBtu/hr):

Natural Gas:[(10 MMBtu/hr)/(1020 MMBtu/mmcf)](84 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 3.61 tpy CO

Total CO= 21.64tpy CO + 3.61tpy CO = **25.25tpy CO**

PTE for PM:

Boiler(60MMBtu/hr):

Natural Gas:[(60 MMBtu/hr)/(1020 MMBtu/mmcf)](7.6 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 1.96 tpy PM

Fuel Oil:[(60 MMBtu/hr)/(140 MMBtu/1000 gal)](2 lb/1000 gal)(8760 hr/yr)/(2000 lb/ton) = 3.75 tpy PM <— Worst Case

Boiler (10 MMBtu/hr):

Natural Gas:[(10 MMBtu/hr)/(1020 MMBtu/mmcf)](7.6 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 0.33 tpy PM

Total PM= 3.75 tpy PM + 0.33 tpy PM = 4.08 tpy

PTE for PM_{10}:

Boiler(60MMBtu/hr):

Natural Gas:[(60 MMBtu/hr)/(1020 MMBtu/mmcf)](7.6 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) =1.96 tpy PM_{10} <— Worst Case

Fuel Oil:[(60MMBtu/hr)/(140 MMBtu/1000 gal)](1 lb/1000 gal)(8760 hr/yr)/(2000 lb/ton)=1.88 tpy PM_{10}

Boiler (10 MMBtu/hr):

Natural Gas:[(10 MMBtu/hr)/(1020 MMBtu/mmcf)](7.6 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 0.33 tpy PM_{10}

Total PM_{10}= 1.96 tpy PM_{10} + 0.33 tpy PM_{10} = **2.29 tpy**

(Assuming all PM is PM_{10} for natural gas.)

PTE for SO_2:

Boiler(60MMBtu/hr):

Natural Gas:[(60MMBtu/hr)/(1020 MMBtu/mmcf)](0.6 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 0.15 tpy SO_2

Fuel Oil:[(60 MMBtu/hr)/(140 MMBtu/1000 gal)](71 lb/1000 gal)(8760 hr/yr)/(2000 lb/ton) = 133.3 tpy SO_2<— Worst Case

Boiler (10 MMBtu/hr):

Natural Gas:[(10MMBtu/hr)/(1020 MMBtu/mmcf)](0.6 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 0.03tpy SO_2

Total SO_2= 133.3tpy SO_2 + 0.03 tpy SO_2 = **133.33 tpy**

PTE for VOC:

Boiler(60MMBtu/hr):

Natural Gas:[(60MMBtu/hr)/(1020 MMBtu/mmcf)](5.5 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 1.42 tpy VOC<— Worst Case

Fuel Oil:[(60 MMBtu/hr)/(140 MMBtu/1000 gal)](0.34 lb/1000 gal)(8760 hr/yr)/(2000 lb/ton) = 0.64 tpy VOC

Boiler (10 MMBtu/hr):

Natural Gas:[(10MMBtu/hr)/(1020 MMBtu/mmcf)](5.5 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 0.24tpy VOC

Total VOC= 1.42 tpy VOC + 0.24 tpy VOC = **1.66 tpy**

PTE for Lead:

Boiler(60MMBtu/hr):

Natural Gas:[(60MMBtu/hr)/(1020 MMBtu/mmcf)](0.0005 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) =0.00013 tpy Lead

Fuel Oil:[(60 MMBtu/hr)(9 lb/10^{12} Btu)](8760 hr/yr)/(2000 lb/ton) = 0.0024 tpy Lead<— Worst Case

Boiler (10 MMBtu/hr):

Natural Gas:[(10MMBtu/hr)/(1020 MMBtu/mmcf)](0.0005lb/mmcf)(8760 hr/yr)/(2000 lb/ton) =2.15*10^{-5} tpy Lead

Total Lead= 0.0024 tpy Lead + 2.15*10^{-5} tpy Lead = **0.00242 tpy**

PTE for Single HAP (Hexane):

Boiler(60MMBtu/hr):

Natural Gas(Hexane):[(60MMBtu/hr)/(1020 MMBtu/mmcf)](1.8 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 0.46tpy Hexane

Boiler (10 MMBtu/hr):

Natural Gas(Hexane):[(10MMBtu/hr)/(1020 MMBtu/mmcf)](1.8 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 0.08 tpy Hexane

Total Single HAP= 0.46 tpy Hexane + 0.08 tpy Hexane = **0.54 tpy** <— Worst Case Single HAP

PTE for Single HAP (Formaldehyde):

Boiler(60MMBtu/hr):

Natural Gas(Formaldehyde):[(60MMBtu/hr)/(1020 MMBtu/mmcf)](0.075 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 0.02tpy Formaldehyde

Fuel Oil (Formaldehyde):[(60 MMBtu/hr)/(140 MMBtu/1000 gal)](0.033 lb/1000 gal)(8760 hr/yr)/(2000 lb/ton) = 0.062 tpy Formaldehyde <— Worst Case

Boiler (10 MMBtu/hr):

Natural Gas(Formaldehyde):[(10MMBtu/hr)/(1020 MMBtu/mmcf)](0.075lb/mmcf)(8760 hr/yr)/(2000 lb/ton) =0.003tpy Formaldehyde

Total Single HAP= 0.062 tpy Formaldehyde + 0.003 tpy Formaldehyde = 0.065 tpy

PTE for Total HAP:

Boiler(60MMBtu/hr):

Natural Gas:[(60MMBtu/hr)/(1020 MMBtu/mmcf)](1.9 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) =0.49 tpy Total HAP <— Worst Case

Fuel Oil:[(60 MMBtu/hr)/(140 MMBtu/1000 gal)](0.048 lb Total HAP/1000 gal)(8760 hr/yr)/(2000 lb/ton) =0.090 tpy Total HAP

Boiler (10 MMBtu/hr):

Natural Gas:[(10MMBtu/hr)/(1020 MMBtu/mmcf)](1.9 lb/mmcf)(8760 hr/yr)/(2000 lb/ton) = 0.08 tpy Total HAP

Total Total HAP= 0.49 tpy Total HAP + 0.08 tpy Total HAP= **0.57 tpy**