Example Calculations and Forms

Introduction

This section provides example calculations and forms to show how emission estimation methods are used to develop an inventory for both potential and actual emissions. There are six basic approaches or methods used to develop emission estimates and inventories. These methods are:

- Continuous emissions monitoring
- Stack test data
- Material balance
- EPA approved emission factors
- Vendor supplied factors
- Engineering estimates based on best available process operating data

Most sources will use material balance or EPA-approved emission factors for estimating emissions. These two methods will be the focus of this section. Each example calculation shows how the method may be used for a specific emissions source category. It is intended that the reader use the information to apply the methods to other applicable source categories.

Potential Emissions

Potential to emit is calculated assuming equipment is running at maximum capacity while operating at the maximum hours of operation under its physical and operational design. Usually, maximum hours of operation are 8,760 hours per year unless enforceable limitations on hours of operation have been incorporated within the construction permit or an enforcement order for that equipment.

Only federally enforceable limitations on raw materials, fuels, capacity or hours of operation can be used to limit potential emissions. 'Bottlenecks' do not count unless federally enforceable.

Calculation of potential emissions must be done with "worst-case" values for each pollutant. An example would be emissions from solvent use at a facility. Solvent A contains 3 lb/gal toluene and 2 lb/gal benzene, while solvent B contains 1 lb/gal toluene and 4 lb/gal benzene. Solvent emissions would be calculated based on the solvent A toluene value of 3 lb/gal and the solvent B benzene value of 4 lb/gal. An example of this scenario is detailed on pages 36 - 38.

Calculating potential to emit with control equipment general equation:

(Maximum Hourly Design Rate) x (Emission factor) x (Control Efficiency) x (Potential hours) x (conversion factor to tons) = tons per year

Rate: Process rate is based on the maximum design rate of the equipment, i.e., tons/hr, gal/hr, or MMcf/hr

Emission factors are values based on the amount of pollution produced and the raw material processed such as lb/ton, lb/gal, or lb/MMcf.

Control Efficiency = Control equipment pollutant removal efficiency

Potential hours will be 8,760 hr/yr unless there is a federally enforceable limit such as a construction permit which limits the number of hours the emission unit can operate.

To convert to tons, see the conversion factors listed on page 85 in Appendix D.

Actual Emissions

Actual emissions are the actual rate of air pollution from an emission unit calculated using the emission unit's actual operating hours, production rates, and types of materials processed, stored, or combusted for the calendar year.

General equation for calculating actual emissions with control equipment:

(Actual Throughput) x (Emission Factor) x (Control Efficiency) x (conversion factor to tons) = tons per year

***Actual Throughput*:** Amount of material actually used for the calendar year such as gallons per year, tons per year, million cubic feet per year, etc.

Emission factors are values based on the amount of pollution produced and the raw material processed such as lb/ton, lb/gal, or lb/MMcf.

Control Efficiency is the control equipment pollutant removal efficiency.

To convert to tons, see the conversion factors listed on page 85 in Appendix D.

Example MSEI's

The following example shows how calculations are performed and where data is reported on the inventory forms.

ACME Corporation manufactures grain wagons and has three reportable emission units including a welding station, paint booth, and No. 2 fuel oil-fired boiler. Each emission unit has one emission point associated with it. The emission points, emission units, and any control equipment were identified and assigned a number.

ACME Hospital has four reportable emission units including a natural gas-fired boiler, two diesel-fired generators, and a dual-fuel fired generator.

For each emission point, information was gathered on the stack opening, height, flow rate (fan rating), and temperature. Information gathered for each emission unit included a description of the process, raw materials used, the maximum hourly design rate, and any permit limits. If there is an air quality construction permit for the emission source, most of this information can be found in the permit.

The next step was finding emission factors in EPA documents for each pollutant produced by the boiler and welding station. A mass balance calculation was performed using Safety Data Sheets (SDS) information to estimate emission factors for the paint booth.

The following calculations were performed and inventory forms for ACME Corporation and ACME Hospital were completed:

AIR QUALITY BUREAU
7900 Hickman Rd., Suite 1
Windsor Heights, 1A 50324

IOWA DNR Emission Inventory Questionnaire

Form INV -1 Facility Identification

1) Application Type	Initial ☒	Supplemental Information ☐	
2) Facility Number	99-99-999		
3) Company/Facility Name	ACME CORPORATION		
4) Number of State-Wide Company Employees	Less Than or Equal to 100 ☒	Greater Than 100 ☐	
5) Emission Year	2014		
6) Facility Street Address	111 N 2 ND ST		
7) Facility City	ANYTOWN		IA
8) Zip Code	55555		
9) Facility Contact Person	JOHN BEEMER		
10) Facility Contact Phone Number / E-Mail Address	515-555-5555	JBEEMER@EMAILACMECORP	
11) Mailing Street/PO Box	PO BOX 123		
12) Mailing City	ANYTOWN		
13) State	IA		
14) Zip Code	55555		
15) Parent Company / Owner Name			
16) Parent Company / Owner Mailing Address			
17) City			
18) State			
19) Zip Code			
20) Parent Company Contact/Agent			
21) Parent Company Contact Phone Number			

CERTIFICATION STATEMENT

"I certify under penalty of law that, based on the information and belief formed after reasonable inquiry, the statements and information contained in this application are true, accurate, and complete. I understand that making false statements, representations, or certifications of this submission may result in civil or criminal penalties."

22) Name of Responsible Official	23) Title of Responsible Official
24) Signature of Responsible Official	25) Date of Signature

26) Primary Standard Industrial Classification (SIC)	3523	Primary North American Industrial Classification System (NAICS)	333111
27) Activity Description	Manufacture farm equipment and grain wagons		

28) SECONDARY ACTIVITIES

SI SIC		NAICS	
Activity Description		Activity Description	
SSIC		NAICS	
Activity Description		Activity Description	

29) PLANT LOCATION

Latitude	41.605621
Longitude	-93.588353

Form INV-2 EMISSION POINT DESCRIPTION

Duplicate this form for EACH Emission POINT

1) Company/Facility Name	ACME CORPORATION	1a) Form INV-2 Page	1	of	3
2) Emission Point Number	EP1				
3) Emission Point Description	WELDING VENT				
4) Is this stack/vent used as an Emergency Bypass Stack?	No ☒	Yes ☐			
If YES, for which stack(s)? List Emission Point Nos.:					

EMISSION POINT INFORMATION

5) Emission Point Type

Stack/Vent	☒	
Fugitive (specify)	☐	
Other (specify)	☐	

6) Stack Shape and Dimensions: (interior dimensions at exit point)

Circular Diameter:	☐		inches			
Rectangular Dimensions:	☒	8	inches	x	10	inches
Other Dimensions	☐		inches			

7) Stack Height Above Ground	12	feet

8) Does the Emission Point have a rain cap (or anything else) which obstructs the flow of gases leaving the Emission Point, or a horizontal discharge?

No	☐	YES (specify):	☒	HORIZONTAL DISCHARGE

9) COMPOSTION OF EXHAUST STREAM

Exhaust Stream Characteristics	Emission Point Composition of Exhaust Stream	Units of Measure
a) Flow Rate	900	☒ ACFM ☐ SCFM
b) Temperature	Ambient	Degree Fahrenheit

10) BYPASS STACKS

Bypass Stack – Emission Point No.		Bypass Stack Description	
Bypass Stack – Emission Point No.		Bypass Stack Description	

11) LIST OF EMISSION UNITS VENTING THROUGH THIS EMISSION POINT

Emission Unit No.	Emission Unit No	Emission Unit No.	Emission Unit No.
EU1			

Duplicate this form as needed | TYPE ALL INFORMATION | (DNR Form 542-4004. December 24, 2007)

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME CORPORATION			1a) Form INV-5 Page	1	of	5
2) Emission Point No.	EP1	3)	Emission Unit No.	EU1			
4) Calculations are provided in support of information reported on Form INV -	3 ☒	4 ☒	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

Process: Gas Metal Arc Welding, E308 Electrode
SCC No.: 30905212

Maximum rate: 30 lb of electrode per hour
Actual Year Throughput – Yearly Total: 40,000 pounds of electrode

Pollutant	Emission Factors from AP-42, Chapter 12.19
$PM_{2.5}$	5.4 lb/1,000 lbs of electrode consumed ($PM_{2.5}$ is assumed to be equal to PM_{10} for welding)
PM_{10}	5.4 lb/1,000 lbs of electrode consumed
Chromium	0.524 lb/1,000 lbs of electrode consumed
Manganese	0.346 lb/1,000 lbs of electrode consumed
Nickel	0.184 lb/1,000 lbs of electrode consumed

Calculations

POTENTIAL EMISSIONS:
Potential $PM_{2.5}$ tons/yr
Potential PM_{10} tons/yr

(.030 1,000 lb/hr) *x* (5.4 lb/1,000 lbs) *x* (8,760 hrs/year) *x* (1 ton/2,000 lbs) = 0.71 tons per year

The same formula is used to calculate the other pollutants with their corresponding emission factors.

Potential Chromium tons/yr = 0.07
Potential Manganese tons/yr = 0.05
Potential Nickel tons/yr = 0.02

ACTUAL EMISSIONS:
Actual $PM_{2.5}$ tons
Actual PM_{10} tons

(40 1,000 lbs) *x* (5.4 lb/1,000lbs) *x* (1 ton/2,000 lbs) = 0.11 tons

The same formula is used to calculate the other pollutants with their corresponding emission factors.

Actual Chromium tons = 0.01
Actual Manganese tons = 0.01
Actual Nickel tons = 0.00

Form INV-3 EMISSION UNIT DESCRIPTION – POTENTIAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1)	Company/Facility Name	ACME CORPORATION	1a) Form INV-3 Page	1	of	3	
2)	Emission Point Number	EP1					
	EMISSION UNIT (PROCESS) IDENTIFICATION & DESCRIPTION						
3)	Emission Unit Number	EU1					
4)	SCC Number	30905212					
5)	Description of Process	GAS METAL ARC WELDING					
6)	Date of Construction	2/15/1985	7) Date of Installation	2/15/1985	8) Date of Modification		
9)	Raw Material – OR Fuels Used List worst case for EACH pollutant	E308 WELDING WIRE					
10)	Federally Enforceable Limit						
11)	Permit or Rule Establishing Limit						
12)	Maximum Hourly Design Rate	0.030	1,000 POUNDS	Per Hour			
13)	AIR POLLUTION CONTROL EQUIPMENT (CE)						
	Control Equipment Number						
	Control Equipment Description						
	Control Equipment Number						
	Control Equipment Description						

POTENTIAL EMISSIONS

14 Air Pollutant	15 Emission Factor	16 Emission Factor Units	17 Source of Emission Factor	18 Ash or Sulfur %	19 Potential Hourly Uncontrolled Emissions (Lbs/Hr)	20 Combined Control Efficiency	21 Transfer Efficiency	22 Potential Hourly Controlled Emissions (Lbs/Hr)	23 Potential Annual Emissions (Tons/Yr)
PM-2.5	5.4	LB/1,000 LB	AP-42		0.16				0.71
PM-10	5.4	LB/1,000 LB	AP-42		0.16				0.71
SO_2									
NOx									
VOC									
CO									
Lead									
Ammonia									
POTENTIAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 14									
Cr	0.524	LB/1,000 LB	AP-42		0.02				0.07
Mn	0.346	LB/1,000 LB	AP-42		0.01				0.05
Ni	0.184	LB/1,000 LB	AP-42		0.01				0.02

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4001. December 24, 2007)

Form INV-4 EMISSION UNIT DESCRIPTION – ACTUAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1) Company/Facility Name	ACME CORPORATION			1a) Form INV-4 Page	1	of	3
2) Emission Year	2014	3) Emission Point Number	EP1				
EMISSION UNIT – ACTUAL OPERATIONS AND EMISSIONS							
4) Emission Unit Number	EU1			5) SCC Number	30905212		
6) Description of Process	GAS METAL ARC WELDING						
ACTUAL THROUGHPUT							
7) Raw Material	ELECTRODE E308						
8) Actual Throughput – Yearly Total	40	9)	Units Raw Material	1,000 POUNDS			

Actual Operating Rate/Schedule

	10) Percent of Total Operating Time	11) Hours/Day	12) Days/Week	13) Weeks/Quarter
JAN – MAR	25	8	6	13
APR – JUN	25	8	6	13
JUL – SEP	25	8	6	13
OCT - DEC	25	8	6	13

14) AIR POLLUTION CONTROL EQUIPMENT (CE)

Control Equipment Number	
Control Equipment Description	
Control Equipment Number	
Control Equipment Description	

ACTUAL EMISSIONS

15 Air Pollutant	16 Emission Factor	17 Emission Factor Units	18 Source of Emission Factor	19 Ash or Sulfur %	20 Combined Control Efficiency	21 Transfer Efficiency	22 Actual Emissions (Tons/Yr)
PM-2.5	5.4	LB/1,000 LB	AP-42				0.11
PM-10	5.4	LB/1,000 LB	AP-42				0.11
SO_2							
NOX							
VOC							
CO							
Lead							
Ammonia							
ACTUAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 15							
Cr	0.524	LB/1,000 LB	AP-42				0.01
Mn	0.346	LB/1,000 LB	AP-42				0.01
Ni	0.184	LB/1,000 LB	AP-42				0.00

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4002 December 24, 2007)

Form INV-2 EMISSION POINT DESCRIPTION

Duplicate this form for EACH Emission POINT

1) Company/Facility Name	ACME CORPORATION	1a) Form INV-2 Page	2	of	3
2) Emission Point Number	EP2				
3) Emission Point Description	SPRAY PAINT BOOTH STACK				
4) Is this stack/vent used as an Emergency Bypass Stack?	No ☒	Yes ☐			
If YES, for which stack(s)? List Emission Point Nos.:					

EMISSION POINT INFORMATION

5) Emission Point Type					
Stack/Vent	☒				
Fugitive (specify)	☐				
Other (specify)	☐				
6) Stack Shape and Dimensions: (interior dimensions at exit point)					
Circular Diameter:	☒	30	inches		
Rectangular Dimensions:	☐		inches	x	inches
Other Dimensions	☐		inches		
7) Stack Height Above Ground	18	feet			

8) Does the Emission Point have a rain cap (or anything else) which obstructs the flow of gases leaving the Emission Point, or a horizontal discharge?

No	☐	YES (specify):	☒	RAIN CAP

9) COMPOSTION OF EXHAUST STREAM

Exhaust Stream Characteristics	Emission Point Composition of Exhaust Stream	Units of Measure
a) Flow Rate	18,000	☒ ACFM ☐ SCFM
b) Temperature	ambient	Degree Fahrenheit

10) BYPASS STACKS

Bypass Stack – Emission Point No.		Bypass Stack Description	
Bypass Stack – Emission Point No.		Bypass Stack Description	

11) LIST OF EMISSION UNITS VENTING THROUGH THIS EMISSION POINT

Emission Unit No.	Emission Unit No	Emission Unit No.	Emission Unit No.
EU2			

Duplicate this form as needed | TYPE ALL INFORMATION | (DNR Form 542-4004. December 24, 2007)

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME CORPORATION			1a) Form INV-5 Page	2	of	5
2) Emission Point No.	EP2	3)	Emission Unit No.	EU2			
4) Calculations are provided in support of information reported on Form INV -	3 ☒	4 ☐	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

ACME Corporation applies a base coat and a top coat to each wagon in the same spray booth. The paint comes in five gallon pails and is sprayed directly from the container with no thinning or mixing at the facility. The paint booth has an Iowa Air Quality construction permit with a paint usage limit of 4,000 gallons per year. ACME Corp only sprayed 1,300 gallons per year (500 gallons of basecoat and 800 gallons of top coat). ACME Corp. uses a high volume low pressure (HVLP) spray gun with a maximum capacity of 7 gallons/hr. The filter used in the booth has a 95 percent particulate removal efficiency.

Material balance (also known as mass balance) utilizes the raw material usage rate to estimate the amount of pollutant emitted. In this method, emissions are estimated as the difference between material input and material output across a process. This method is typically used in surface coating processes. Information regarding the amount of pollutants in a material can be found on the material safety data sheet (MSDS).

Most material balances assume that all solvent used in a process will evaporate to become air emissions somewhere at the facility. In these cases, emissions equal the amount of solvent contained in the surface coating.

From information found on paint MSDS the top and base coats have the following characteristics and HAP components:

	Top Coat	Base Coat
Paint Weight (lbs/gal)	8.75	7.21
% VOC	25	42
% Solids	75	58
% Xylene	8	2
% Toluene	0	15

Note: All percents are weight percents and expressed as percent of total paint weight

POTENTIAL EMISSIONS:

Step 1 - Determine the maximum amount of paint that could be used

Since ACME Corp. has a usage limit of **4,000** gallons per year, this is the maximum amount of paint that could be used. If they didn't have this limit, the maximum usage would be calculated by taking the maximum gun capacity (7 gallon/hr), and multiplying by 8,760 hours per year.

(7 gallon/hr) x (8,760 hrs/yr) = 61,320 gallons/yr

Step 2 - Calculate the yearly potential VOC and HAP emissions

To calculate the maximum amount of VOC and HAP emitted from this spray booth in one year, the highest amounts of each constituent from the base or top coat must be used.

In this case the top coat VOC = 0.25 x 8.75 lbs/gal = 2.19 lbs VOC/gal.
The base coat VOC = 0.42 x 7.21 lbs/gal = 3.03 lbs VOC/gal, which is the higher VOC content.

First, multiply the greatest VOC density (base coat 3.03 lbs/gal) by the maximum paint used (4,000 gallons). To convert it to tons per year divide the answer by 2,000 lbs/ton.

(Density lbs/gal) *x* (Max. annual paint usage gal/yr) *x* (1 ton/2,000 lb) = 3.03 lbs/gal x 4,000 gal/yr x 1ton/2,000 lbs = 6.06 tons/yr

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME CORPORATION			1a) Form INV-5 Page	3	of	5
2) Emission Point No.	EP2	3)	Emission Unit No.	EU2			
4) Calculations are provided in support of information reported on Form INV -	3 ☒	4 ☐	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

POTENTIAL EMISSIONS (CONTINUED)

To calculate the maximum emissions of each HAP, use the same formula, but in each case use the paint with the highest density of the HAP.

Xylene = (8.75 lb/gal) *x* (4,000 gallon/yr) *x* (0.08) *x* (1 ton/2,000 lbs) = **1.40 tons/yr**
Toluene = (7.21 lb/gal) *x* (4,000 gallon/yr) *x* (0.15) *x* (1 ton/2,000 lbs) = **2.16 tons/yr**

Step 3 - Calculate the yearly potential $PM_{2.5}$ and PM_{10} emissions. For surface coating, $PM_{2.5}$ and PM_{10} are assumed to be equal. To calculate $PM_{2.5}$ and PM_{10} emissions the spray transfer efficiency (TE) of the spray gun and the control efficiency (CE) of the filter must be inserted in the formula used to calculate the VOC and HAP emissions. The transfer efficiency is the percentage of paint from the gun that actually adheres to the part being painted. The HVLP gun has a transfer efficiency of 65%, and the filter control efficiency is 95%. Refer to Appendices C and D or other supporting documentation for guidance on transfer and control efficiencies.

In ACME Corp.'s painting process 65% of the paint being sprayed hits the part and the remaining (35%) goes in the exhaust stream. The filters capture 95% of the solids in the exhaust and the remaining (5%) is discharged out the stack.

(Density lb/gal) *x* (Max. annual paint usage gal/yr) *x* (Max.% solid) *x* (1-TE) *x* (1-CE) *x* (1 ton/2000 lbs)

(8.75 lb/gal) *x* (4,000 gal/yr) *x* (0.75) *x* (1-0.65) *x* (1-0.95) *x* (1 ton/2,000 lbs) = **0.23 tons/yr**

Step 4 - Calculating maximum hourly emissions

To calculate maximum hourly emissions multiply the maximum gun capacity by the weight of the highest constituent, considering all paints used. The lb/gal density for each paint, multiplied by the percent of the pollutant in each paint equals a pound per gallon emission factor. To calculate the hourly PM_{10} emissions the transfer efficiency and filter control efficiency must be included in the formula.

(Max. Gun Capacity gal/hr) *x* (Density lbs/gal *x* Max. % VOC/HAP) = VOC or HAP
(Max. Gun Capacity gal/hr) *x* (Density lbs/gal *x* Max. % solids) *x* (1-TE) *x* (1-CE) = $PM_{2.5}$ or PM_{10}

VOC s = (7 gal/hr) *x* (7.21 lb/gal *x* 0.42) = **21.20 lb/hr**
Xylene = (7 gal/hr) *x* (8.75 lb/gal *x* 0.08) = **4.9 lb/hr**
Toluene = (7 gal/hr) *x* (7.21 lb/gal *x* 0.15) = **7.57 lb/hr**
$PM_{2.5}$ = (7 gal/hr) *x* (8.75 lb/gal *x* 0.75) = 45.94 lb/hr uncontrolled *x* (1-0.65) *x* (1-0.95) = **0.80 lb/hr controlled**
PM_{10} = (7 gal/hr) *x* (8.75 lb/gal *x* 0.75) = 45.94 lb/hr uncontrolled *x* (1-0.65) *x* (1-0.95) = **0.80 lb/hr controlled**

Step 5 – Calculate the emission factor

To determine the emission factor to report in Box 15, divide the lb/hr uncontrolled potential emissions by the gallons/hr capacity.

(lb/hr emissions uncontrolled) x (hr/gallons) = lb/gal

VOC s = (21.20 lb/hr) x (hr/7 gal) = 3.03 lb/gal
Xylene = (4.9 lb/hr) x (hr/7 gal) = 0.7 lb/gal
Toluene = (7.57 lb/hr) x (hr/7 gal) = 1.08 lb/gal
$PM_{2.5}$ = (45.94 lb/hr) x (hr/7 gal) = 6.56 lb/gal
PM_{10} = (45.94 lb/hr) x (hr/7 gal) = 6.56 lb/gal

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME CORPORATION			1a) Form INV-5 Page	4	of	5
2) Emission Point No.	EP2	3) Emission Unit No.	EU2				
4) Calculations are provided in support of information reported on Form INV -	3 ☐	4 ☒	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

ANNUAL ACTUAL EMISSIONS:

Step 6 - Calculating annual actual VOC and HAP emissions

To calculate annual VOC and HAP emissions you must calculate the emissions from each coating then add them together.

(Paint used gal/yr) *x* (Paint Weight lb/gal *x* Pollutant %) *x* (1 ton/2,000 lbs)

VOC - Top Coat: (800 gal) *x* (8.75 lb/gal *x* 0.25) = 1,750 lb *x* (1 ton/2,000 lbs) = 0.875 tons
VOC - Base Coat: (500 gal) *x* (7.21 lb/gal *x* 0.42) = 1,514 lb *x* (1 ton/2,000 lbs) = 0.75 tons
\+ _____
1.63 tons of VOC

Xylene - Top Coat: (800 gal) *x* (8.75 lb/gal *x* 0.08) = 560 lb *x* (1 ton/2,000 lbs) = 0.28 tons
Xylene -Base Coat: (500 gal) *x* (7.21 lb/gal *x* 0.02) = 72.1 lb *x* (1 ton/2,000 lbs) = 0.04 tons
\+ _____
0.32 tons of Xylene

Toluene -Top Coat: (800 gal) *x* (8.75 lb/gal *x* 0.00) = 0.00 lb *x* (1 ton/2,000 lbs) = 0.0 tons
Toluene -Base Coat: (500 gal) *x* (7.21 lb/gal *x* 0.15) = 540.75 lb *x* (1 ton/2,000 lbs) = 0.27 tons
\+ _____
0.27 tons of Toluene

Step 7 - Calculating yearly $PM_{2.5}$ and PM_{10} emissions

To calculate the yearly $PM_{2.5}$ and PM_{10} emissions, the same formula is used, but transfer efficiency and control efficiency must be taken into account.

Top Coat: (800 gal) *x* (8.75 lb/gal *x* 0.75) *x* (1-0.65) *x* (1-0.95) = 91.88 lb *x* (1 ton/2,000 lbs) = 0.05 tons
Base Coat: (500 gal) *x* (7.21 lb/gal *x* 0.58) *x* (1-0.65) *x* (1-0.95) = 36.59 lb *x* (1 ton/2,000 lbs) = 0.02 tons
\+ _____
0.07 tons of $PM_{2.5}$ and PM_{10}

Note: This example is for a painting operation where the paint is not thinned on-site. If thinning occurs on-site this must be taken into account to determine the maximum constituents of each coating. For additional guidance on this, contact the Department of Natural Resources.

Step 8– Calculate the emission factor

To determine the emission factor to report in Box 16, divide the total tons of emissions by the gallons used and convert tons to pounds.

[(tons) / (gallons)] x (2,000 lbs/ton) = lb/gal

VOC s = (1.63 tons/1,300 gallons x 2,000 lbs/ton) = 2.51 lb/gal
Xylene = (0.32 tons/1,300 gallons x 2,000 lbs/ton) = 0.49 lb/gal
Toluene = (0.27 tons/1,300 gallons x 2,000 lbs/ton) = 0.42 lb/gal
$PM_{2.5}$ = (0.07 tons/1,300 gallons x 2,000 lbs/ton) x (1/1-.95) x (1-.65) = 6.15 lb/gal
PM_{10} = (0.07 tons/1,300 gallons x 2,000 lbs/ton) x (1/1-.95) x (1-.65) = 6.15 lb/gal

Form INV-3 EMISSION UNIT DESCRIPTION – POTENTIAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1)	Company/Facility Name	ACME CORPORATION			1a) Form INV-3 Page	2	of	3	
2)	Emission Point Number	EP2							
	EMISSION UNIT (PROCESS) IDENTIFICATION & DESCRIPTION								
3)	Emission Unit Number	EU2							
4)	SCC Number	40202501							
5)	Description of Process	SPRAY PAINTING							
6)	Date of Construction	8/1/1985	7)	Date of Installation	8/1/1985	8)	Date of Modification		
9)	Raw Material – OR Fuels Used List worst case for EACH pollutant	PAINT							
10)	Federally Enforceable Limit	4,000 GALLONS PER YEAR							
11)	Permit or Rule Establishing Limit	CONSTRUCTION PERMIT 85-A-036							
12)	Maximum Hourly Design Rate	7.0	GALLONS						
13)	AIR POLLUTION CONTROL EQUIPMENT (CE)								
	Control Equipment Number	CE1							
	Control Equipment Description	PANEL FILTER							
	Control Equipment Number								
	Control Equipment Description								

POTENTIAL EMISSIONS

14 Air Pollutant	15 Emission Factor	16 Emission Factor Units	17 Source of Emission Factor	18 Ash or Sulfur %	19 Potential Hourly Uncontrolled Emissions (Lbs/Hr)	20 Combined Control Efficiency	21 Transfer Efficiency	22 Potential Hourly Controlled Emissions (Lbs/Hr)	23 Potential Annual Emissions (Tons/Yr)
PM-2.5	6.56	LB/GAL	MASS BAL		45.92	95	65	0.8	0.23
PM-10	6.56	LB/GAL	MASS BAL		45.92	95	65	0.8	0.23
SO_2									
NOx									
VOC	3.03	LB/GAL	MASS BAL		21.21				6.06
CO									
Lead									
Ammonia									
POTENTIAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 14									
Xylene	0.7	LB/GAL	MASS BAL		4.9				1.40
Toluene	1.08	LB/GAL	MASS BAL		7.56				2.16

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4001. December 24, 2007)

Form INV-4 EMISSION UNIT DESCRIPTION – ACTUAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1) Company/Facility Name	ACME CORPORATION			1a) Form INV-4 Page	2	of	3
2) Emission Year	2014	3) Emission Point Number	EP2				
EMISSION UNIT – ACTUAL OPERATIONS AND EMISSIONS							
4) Emission Unit Number	EU2			5) SCC Number	40202501		
6) Description of Process	SPRAY PAINT BOOTH						
ACTUAL THROUGHPUT							
7) Raw Material	PAINT						
8) Actual Throughput – Yearly Total	1,300	9)	Units Raw Material	GALLONS			

Actual Operating Rate/Schedule

	10) Percent of Total Operating Time	11) Hours/Day	12) Days/Week	13) Weeks/Quarter
JAN – MAR	25	8	5	13
APR – JUN	25	8	5	13
JUL – SEP	25	8	5	13
OCT - DEC	25	8	5	13

14) AIR POLLUTION CONTROL EQUIPMENT (CE)

Control Equipment Number	CE2
Control Equipment Description	PANEL FILTER
Control Equipment Number	
Control Equipment Description	

ACTUAL EMISSIONS

15 Air Pollutant	16 Emission Factor	17 Emission Factor Units	18 Source of Emission Factor	19 Ash or Sulfur %	20 Combined Control Efficiency	21 Transfer Efficiency	22 Actual Emissions (Tons/Yr)
PM-2.5	6.15	LB/GAL	MASS BAL		95	65	0.07
PM-10	6.15	LB/GAL	MASS BAL		95	65	0.07
SO_2							
NOX							
VOC	2.51	LB/GAL	MASS BAL				1.63
CO							
Lead							
Ammonia							
ACTUAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 15							
Xylene	0.49	LB/GAL	MASS BAL				0.32
Toluene	0.42	LB/GAL	MASS BAL				0.27

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4002 December 24, 2007)

Form INV-2 EMISSION POINT DESCRIPTION

Duplicate this form for EACH Emission POINT

1) Company/Facility Name	ACME CORPORATION	1a) Form INV-2 Page	3	of	3
2) Emission Point Number	EP3				
3) Emission Point Description	BOILER STACK				
4) Is this stack/vent used as an Emergency Bypass Stack?	No ☒	Yes ☐			
If YES, for which stack(s)? List Emission Point Nos.:					

EMISSION POINT INFORMATION

5) Emission Point Type					
Stack/Vent	☒				
Fugitive (specify)	☐				
Other (specify)	☐				
6) Stack Shape and Dimensions: (interior dimensions at exit point)					
Circular Diameter:	☒	24	inches		
Rectangular Dimensions:	☐		inches	x	inches
Other Dimensions	☐		inches		
7) Stack Height Above Ground	35	feet			

8) Does the Emission Point have a rain cap (or anything else) which obstructs the flow of gases leaving the Emission Point, or a horizontal discharge?

No	☐	YES (specify):	☒	RAIN CAP

9) COMPOSTION OF EXHAUST STREAM

Exhaust Stream Characteristics	Emission Point Composition of Exhaust Stream	Units of Measure
a) Flow Rate	6,100	☒ ACFM ☐ SCFM
b) Temperature	350	Degree Fahrenheit

10) BYPASS STACKS

Bypass Stack – Emission Point No.		Bypass Stack Description	
Bypass Stack – Emission Point No.		Bypass Stack Description	

11) LIST OF EMISSION UNITS VENTING THROUGH THIS EMISSION POINT

Emission Unit No.	Emission Unit No	Emission Unit No.	Emission Unit No.
EU3			

Duplicate this form as needed | TYPE ALL INFORMATION | (DNR Form 542-4004. December 24, 2007)

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME CORPORATION		1a) Form INV-5 Page	5	of 5
2) Emission Point No.	EP3	3) Emission Unit No.	EU3		
4) Calculations are provided in support of information reported on Form INV -	3 ☒	4 ☒	for the Emission Point and Emission Unit listed above.		
5) Emissions Calculations					

Process: Industrial Boiler SCC No. 10200502

Fuel: No. 2 Fuel Oil: 140,000 Btu per gallon, Percent sulfur content = 0.4
Maximum rate: 15 Million Btu/hr, 107 gallons per hour = 0.107 1,000 gallons per hour
Actual Year Throughput - Yearly Total: 5,000 gallons

Pollutant	Emission Factors from FIRE 6.25 (SCC No. 10200502)	
$PM_{2.5}$	1.55 lb per 1,000 gallons burned	
PM_{10}	2.3 lb per 1,000 gallons burned	
SO_2	142 (S) lb per 1,000 gallons burned	S = percent sulfur in fuel
NOx	20.0 lb per 1,000 gallons burned	
VOC	0.2 lb per 1,000 gallons burned	
CO	5.00 lb per 1,000 gallons burned	
Ammonia	0.8 lb per 1,000 gallons burned	

Calculations

POTENTIAL EMISSIONS:
In order for the calculation to work, the design capacity units of measure have to cancel with the emission factor units of measure to obtain a pound per hour value. Since the emission factor units of measure are in pounds per 1,000 gallons, the maximum design rate must be in 1,000 gallons per hour.

Potential $PM_{2.5}$ tons/yr
(0.107 1,000 gal/hr) *x* (1.55 lb/1,000 gal) *x* (8,760 hr/yr) *x* (1 ton/2,000 lb) = 0.73

Potential SO_2 tons/yr
(0.107 1,000 gal/hr) *x* [142 (0.4 % sulfur) lb/1,000 gal] *x* (8,760 hr/yr) *x* (1 ton/2,000 lb) = 26.62

Potential PM_{10} tons/yr = 1.08
Potential NOx tons/yr = 9.37
Potential VOC tons/yr = 0.09
Potential CO tons/yr = 2.34
Potential Ammonia tons/yr = 0.37

ACTUAL ANNUAL EMISSIONS:
Actual $PM_{2.5}$ tons
(5 1,000 gal) *x* (1.55 lb/1,000 gal) *x* (1 ton/2,000 lb) = 0.00

Actual SO_2 tons
(5 1,000 gal) *x* [142 (0.4 % sulfur) lb/1,000 gal] *x* (1 ton/2,000 lb) = 0.14

Actual PM_{10} tons = 0.01
Actual NOx tons = 0.05
Actual VOC tons = 0.00
Actual CO tons = 0.01
Actual Ammonia tons = 0.00

Form INV-3 EMISSION UNIT DESCRIPTION – POTENTIAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1)	Company/Facility Name	ACME CORPORATION				1a) Form INV-3 Page	3	of	3	
2)	Emission Point Number	EP3								
	EMISSION UNIT (PROCESS) IDENTIFICATION & DESCRIPTION									
3)	Emission Unit Number	EU3								
4)	SCC Number	10200502								
5)	Description of Process	NO. 2 FUEL OIL COMBUSTION								
6)	Date of Construction	10/30/1985	7)	Date of Installation	10/30/1985	8)	Date of Modification			
9)	Raw Material – OR Fuels Used List worst case for EACH pollutant	NO. 2 FUEL OIL								
10)	Federally Enforceable Limit									
11)	Permit or Rule Establishing Limit									
12)	Maximum Hourly Design Rate	0.107	1,000 GALLONS			Per Hour				
13)	AIR POLLUTION CONTROL EQUIPMENT (CE)									
	Control Equipment Number									
	Control Equipment Description									
	Control Equipment Number									
	Control Equipment Description									

POTENTIAL EMISSIONS

14 Air Pollutant	15 Emission Factor	16 Emission Factor Units	17 Source of Emission Factor	18 Ash or Sulfur %	19 Potential Hourly Uncontrolled Emissions (Lbs/Hr)	20 Combined Control Efficiency	21 Transfer Efficiency	22 Potential Hourly Controlled Emissions (Lbs/Hr)	23 Potential Annual Emissions (Tons/Yr)
PM-2.5	1.55	LB/1,000 GAL	WEBFIRE		0.17				0.73
PM-10	2.3	LB/1,000 GAL	WEBFIRE		0.25				1.08
SO_2	142	LB/1,000 GAL	WEBFIRE	0.4	6.08				26.62
NOx	20.0	LB/1,000 GAL	WEBFIRE		2.14				9.37
VOC	0.2	LB/1,000 GAL	WEBFIRE		0.02				0.09
CO	5.0	LB/1,000 GAL	WEBFIRE		0.54				2.34
Lead									
Ammonia	0.80	LB/1000 GAL	WEBFIRE		0.09				0.37
POTENTIAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 14									

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4001. December 24, 2007)

Form INV-4 EMISSION UNIT DESCRIPTION – ACTUAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1) Company/Facility Name	ACME CORPORATION			1a) Form INV-4 Page	3	of	3
2) Emission Year	2014	3) Emission Point Number	EP3				
EMISSION UNIT – ACTUAL OPERATIONS AND EMISSIONS							
4) Emission Unit Number	EU3			5) SCC Number	10200502		
6) Description of Process	NO. 2 FUEL OIL COMBUSTION						
ACTUAL THROUGHPUT							
7) Raw Material	NO. 2 FUEL OIL						
8) Actual Throughput – Yearly Total	5	9)	Units Raw Material	1,000 GALLONS			

Actual Operating Rate/Schedule

	10) Percent of Total Operating Time	11) Hours/Day	12) Days/Week	13) Weeks/Quarter
JAN – MAR	35	24	7	13
APR – JUN	15	24	7	6
JUL – SEP	15	24	7	6
OCT - DEC	35	24	7	13

14) AIR POLLUTION CONTROL EQUIPMENT (CE)

Control Equipment Number	
Control Equipment Description	
Control Equipment Number	
Control Equipment Description	

ACTUAL EMISSIONS

15 Air Pollutant	16 Emission Factor	17 Emission Factor Units	18 Source of Emission Factor	19 Ash or Sulfur %	20 Combined Control Efficiency	21 Transfer Efficiency	22 Actual Emissions (Tons/Yr)
PM-2.5	1.55	LB/1,000 GAL	WEBFIRE				0.00
PM-10	2.3	LB/1,000 GAL	WEBFIRE				0.01
SO_2	142	LB/1,000 GAL	WEBFIRE	0.4			0.14
NOX	20.0	LB/1,000 GAL	WEBFIRE				0.05
VOC	0.2	LB/1,000 GAL	WEBFIRE				0.00
CO	5.0	LB/1,000 GAL	WEBFIRE				0.01
Lead							
Ammonia	0.80	LB/1,000 GAL	WEBFIRE				0.00
ACTUAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 15							

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4002 December 24, 2007)

Form INV-6 FACILITY-WIDE POTENTIAL & ACTUAL EMISSIONS

1) Facility Name	ACME CORPORATION	2) Form INV-6 Page	1	of	1
3) Emission Year					2014

The facility-wide potential emission totals for each air pollutant may be calculated by summing the "potential annual emissions" (box #23) on the INV-3 forms

The facility-wide actual emission totals for each air pollutant may be calculated by summing the "actual emissions" (box #22) on the INV-4 forms

4) Facility-Wide Criteria Air Pollutant and Ammonia Emissions (Use Facility-Wide Permit Limit For Potential Tons/Yr Where Applicable)

Air Pollutant	ID or CAS Number	Potential Tons/Yr	Actual Tons
PM-2.5	PM-2.5	1.67	0.18
PM-10	PM-10	2.02	0.19
Sulfur Dioxide	7446-09-5	26.62	0.14
Nitrogen Oxides	NO_x	9.37	0.05
Volatile Organic Compounds	VOC	6.15	1.63
Carbon Monoxide	630-08-0	2.34	0.01
Lead	7439-92-1	----	----
Ammonia	7664-41-7	0.37	0.00

5) Facility-Wide Hazardous Air Pollutant and Other Regulated Air Pollutant Emissions (Use Facility-Wide Permit Limit For Potential Tons/Yr Where Applicable)

Please duplicate this form as necessary to include all hazardous air pollutants and other regulated air pollutants being emitted at the facility

Air Pollutant	ID or CAS Number	Potential Tons/Yr	Actual Tons
Chromium Compounds	7440-47-3	0.07	0.01
Manganese Compounds	7439-96-5	0.05	0.01
Nickel Compounds	7440-02-0	0.02	0.00
Xylene	1330-20-7	1.40	0.32
Toluene	108-88-3	2.16	0.27

AIR QUALITY BUREAU
7900 Hickman Rd., Suite 1
Windsor Heights, IA 50324

IOWA DNR Emission Inventory Questionnaire

Form INV-1 Facility Identification

1) Application Type	Initial ☒	Supplemental Information	☐
2) Facility Number	99-99-999		
3) Company/Facility Name	ACME HOSPITAL		
4) Number of State-Wide Company Employees	Less Than or Equal to 100 ☒	Greater Than 100	☐
5) Emission Year	2014		
6) Facility Street Address	222 N 2ND ST		
7) Facility City	ANYTOWN		IA
8) Zip Code	55555		
9) Facility Contact Person	DAVID SMITH		
10) Facility Contact Phone Number / E-Mail Address	515-555-5555	DSMITH@EMAILACMECORP	
11) Mailing Street/PO Box	PO BOX 123		
12) Mailing City	ANYTOWN		
13) State	IA		
14) Zip Code	55555		
15) Parent Company / Owner Name			
16) Parent Company / Owner Mailing Address			
17) City			
18) State			
19) Zip Code			
20) Parent Company Contact/Agent			
21) Parent Company Contact Phone Number			

CERTIFICATION STATEMENT

"I certify under penalty of law that, based on the information and belief formed after reasonable inquiry, the statements and information contained in this application are true, accurate, and complete. I understand that making false statements, representations, or certifications of this submission may result in civil or criminal penalties."

22) Name of Responsible Official

23) Title of Responsible Official

24) Signature of Responsible Official

25) Date of Signature

26) Primary Standard Industrial Classification (SIC)	8062	Primary North American Industrial Classification System (NAICS)	622110
27) Activity Description	General medical and surgical hospitals		

28) SECONDARY ACTIVITIES

SIC		NAICS	
Activity Description		Activity Description	
SIC		NAICS	
Activity Description		Activity Description	

29) PLANT LOCATION

Latitude	41.605621
Longitude	-93.588353

TYPE ALL INFORMATION

(DNR Form 542-4017. November 16, 2010)

Form INV-2 EMISSION POINT DESCRIPTION

Duplicate this form for EACH Emission POINT

1) Company/Facility Name	ACME HOSPITAL	1a) Form INV-2 Page	1	of	4
2) Emission Point Number	EP4				
3) Emission Point Description	BOILER STACK				
4) Is this stack/vent used as an Emergency Bypass Stack?	No ☒	Yes ☐			
If YES, for which stack(s)? List Emission Point Nos.:					

EMISSION POINT INFORMATION

5) Emission Point Type					
Stack/Vent	☒				
Fugitive (specify)	☐				
Other (specify)	☐				
6) Stack Shape and Dimensions: (interior dimensions at exit point)					
Circular Diameter:	☒	18	inches		
Rectangular Dimensions:	☐		inches	x	inches
Other Dimensions	☐		inches		
7) Stack Height Above Ground	20	feet			

8) Does the Emission Point have a rain cap (or anything else) which obstructs the flow of gases leaving the Emission Point, or a horizontal discharge?

No	☒	YES (specify):	☐	

9) COMPOSTION OF EXHAUST STREAM

Exhaust Stream Characteristics	Emission Point Composition of Exhaust Stream	Units of Measure
a) Flow Rate	3,600	☒ ACFM ☐ SCFM
b) Temperature	300	Degree Fahrenheit

10) BYPASS STACKS

Bypass Stack – Emission Point No.		Bypass Stack Description	
Bypass Stack – Emission Point No.		Bypass Stack Description	

11) LIST OF EMISSION UNITS VENTING THROUGH THIS EMISSION POINT

Emission Unit No.	Emission Unit No	Emission Unit No.	Emission Unit No.
EU4			

Duplicate this form as needed | TYPE ALL INFORMATION | (DNR Form 542-4004. December 24, 2007)

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-5 Page	1	of	7
2) Emission Point No.	EP4	3)	Emission Unit No.	EU4			
4) Calculations are provided in support of information reported on Form INV -	3 ☒	4 ☒	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

Process: Industrial Boiler SCC No. 10200602

Fuel: Natural Gas: 1050 Btu/ft^3
Maximum rate: 15 Million Btu/hr, 14,286 ft^3/hr = .014 MMcf/hr
Actual Year Throughput - Yearly Total: 24.5 MMcf

Pollutant	Emission Factors from WebFIRE (SCC No. 10200602)
$PM_{2.5}$	7.6 lb per MMcf burned
PM_{10}	7.6 lb per MMcf burned
SO_2	0.6 lb per MMcf burned
NOx	100 lb per MMcf burned
VOC	5.5 lb per MMcf burned
CO	84 lb per MMcf burned
Ammonia	3.2 lb per MMcf burned
Hexane	1.8 lb per MMcf burned

Calculations

POTENTIAL EMISSIONS:

Potential $PM_{2.5}$ tons/yr
Potential PM_{10} tons/yr
(0.014 MMcf/hr) *x* (7.6 lb/MMcf) *x* (8,760 hr/yr) *x* (1 ton/2,000 lb) = 0.47 tons/yr

Potential SO_2 tons/yr = 0.04
Potential NOx tons/yr = 6.13
Potential VOC tons/yr = 0.34
Potential CO tons/yr = 5.15
Potential Ammonia tons/yr = 0.20
Potential Hexane tons/yr = 0.11

ACTUAL ANNUAL EMISSIONS:
Actual $PM_{2.5}$ tons
Actual PM_{10} tons
(24.5 MMcf) *x* (7.6 lb/MMcf) *x* (1 ton/2000 lb) = 0.09 tons

Actual SO_2 tons = 0.01
Actual NOx tons = 1.23
Actual VOC tons = 0.07
Actual CO tons = 1.03
Actual Ammonia tons = 0.04
Actual Hexane tons = 0.02

Form INV-3 EMISSION UNIT DESCRIPTION – POTENTIAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1)	Company/Facility Name	ACME HOSPITAL			1a) Form INV-3 Page	1	of	4	
2)	Emission Point Number	EP4							
	EMISSION UNIT (PROCESS) IDENTIFICATION & DESCRIPTION								
3)	Emission Unit Number	EU4							
4)	SCC Number	10200602							
5)	Description of Process	NATURAL GAS COMBUSTION							
6)	Date of Construction	10/30/1985	7)	Date of Installation	10/30/1985	8)	Date of Modification		
9)	Raw Material – OR Fuels Used List worst case for EACH pollutant	NATURAL GAS							
10)	Federally Enforceable Limit								
11)	Permit or Rule Establishing Limit								
12)	Maximum Hourly Design Rate	0.014	MMCF	Per Hour					
13)	AIR POLLUTION CONTROL EQUIPMENT (CE)								
	Control Equipment Number								
	Control Equipment Description								
	Control Equipment Number								
	Control Equipment Description								

POTENTIAL EMISSIONS

14 Air Pollutant	15 Emission Factor	16 Emission Factor Units	17 Source of Emission Factor	18 Ash or Sulfur %	19 Potential Hourly Uncontrolled Emissions (Lbs/Hr)	20 Combined Control Efficiency	21 Transfer Efficiency	22 Potential Hourly Controlled Emissions (Lbs/Hr)	23 Potential Annual Emissions (Tons/Yr)
PM-2.5	7.6	LB/MCCF	WEBFIRE		0.11				0.47
PM-10	7.6	LB/MMCF	WEBFIRE		0.11				0.47
SO_2	0.6	LB/MMCF	WEBFIRE		0.01				0.04
NOx	100	LB/MMCF	WEBFIRE		1.40				6.13
VOC	5.5	LB/MMCF	WEBFIRE		0.08				0.34
CO	84	LB/MMCF	WEBFIRE		1.18				5.15
Lead									
Ammonia	3.2	LB/MMCF	WEBFIRE		0.04				0.20
POTENTIAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 14									
Hexane	1.8	LB/MMCF	WEBFIRE		0.03				0.11

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4001. December 24, 2007)

Form INV-4 EMISSION UNIT DESCRIPTION – ACTUAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-4 Page	1	of	5
2) Emission Year	2014	3) Emission Point Number	EP4				
EMISSION UNIT – ACTUAL OPERATIONS AND EMISSIONS							
4) Emission Unit Number	EU4			5) SCC Number	10200602		
6) Description of Process	NATURAL GAS COMBUSTION						
ACTUAL THROUGHPUT							
7) Raw Material	NATURAL GAS						
8) Actual Throughput – Yearly Total	24.5	9)	Units Raw Material	MMCF			

Actual Operating Rate/Schedule

	10) Percent of Total Operating Time	11) Hours/Day	12) Days/Week	13) Weeks/Quarter
JAN – MAR	25	8	5	13
APR – JUN	25	8	5	13
JUL – SEP	25	8	5	13
OCT - DEC	25	8	5	13

14) AIR POLLUTION CONTROL EQUIPMENT (CE)

Control Equipment Number	
Control Equipment Description	
Control Equipment Number	
Control Equipment Description	

ACTUAL EMISSIONS

15 Air Pollutant	16 Emission Factor	17 Emission Factor Units	18 Source of Emission Factor	19 Ash or Sulfur %	20 Combined Control Efficiency	21 Transfer Efficiency	22 Actual Emissions (Tons/Yr)
PM-2.5	7.6	LB/MMCF	WEBFIRE				0.09
PM-10	7.6	LB/MMCF	WEBFIRE				0.09
SO_2	0.6	LB/MMCF	WEBFIRE				0.01
NOX	100	LB/MMCF	WEBFIRE				1.23
VOC	5.5	LB/MMCF	WEBFIRE				0.07
CO	84	LB/MMCF	WEBFIRE				1.03
Lead							
Ammonia	3.2	LB/MMCF	WEBFIRE				0.04
ACTUAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 15							
Hexane	1.8	LB/MMCF	WEBFIRE				0.02

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4002 December 24, 2007)

Form INV-2 EMISSION POINT DESCRIPTION

Duplicate this form for EACH Emission POINT

1) Company/Facility Name	ACME HOSPITAL	1a) Form INV-2 Page	2	of	4
2) Emission Point Number	EP5				
3) Emission Point Description	DIESEL GENERATOR STACK				
4) Is this stack/vent used as an Emergency Bypass Stack?	No ☒	Yes ☐			
If YES, for which stack(s)? List Emission Point Nos.:					

EMISSION POINT INFORMATION

5) Emission Point Type

Stack/Vent	☒	
Fugitive (specify)	☐	
Other (specify)	☐	

6) Stack Shape and Dimensions: (interior dimensions at exit point)

Circular Diameter:	☒	5	inches		
Rectangular Dimensions:	☐		inches	x	inches
Other Dimensions	☐		inches		

7) Stack Height Above Ground	67	feet

8) Does the Emission Point have a rain cap (or anything else) which obstructs the flow of gases leaving the Emission Point, or a horizontal discharge?

No	☒	YES (specify):	☐	

9) COMPOSTION OF EXHAUST STREAM

Exhaust Stream Characteristics	Emission Point Composition of Exhaust Stream	Units of Measure
a) Flow Rate	7,795	☒ ACFM ☐ SCFM
b) Temperature	400	Degree Fahrenheit

10) BYPASS STACKS

Bypass Stack – Emission Point No.		Bypass Stack Description	
Bypass Stack – Emission Point No.		Bypass Stack Description	

11) LIST OF EMISSION UNITS VENTING THROUGH THIS EMISSION POINT

Emission Unit No.	Emission Unit No	Emission Unit No.	Emission Unit No.
EU5			

Duplicate this form as needed | TYPE ALL INFORMATION | (DNR Form 542-4004. December 24, 2007)

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-5 Page	2	of	7
2) Emission Point No.	EP5	3)	Emission Unit No.	EU5			
4) Calculations are provided in support of information reported on Form INV -	3 ☒	4 ☒	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

Process: Diesel Generator < 600 BHP SCC No. 20200102

Fuel: Diesel Fuel
Maximum rate: 119.29 gallons/hr, 0.140 MMBtu/gallon = 16.7 MMBtu/hr
Actual Year Throughput - Yearly Total: 1,000 gallons, 0.140 MMBtu/gallon = 140 MMBtu

Pollutant	Emission Factors from AP-42 (SCC No. 20200102)
$PM_{2.5}$	0.31 lb per MMBtu burned (Note: Per WebFIRE, $PM_{2.5}$ = PM_{10} = PM for SCC 20200102)
PM_{10}	0.31 lb per MMBtu burned
SO_2	0.29 lb per MMBtu burned
NOx	4.41 lb per MMBtu burned
VOC	0.35 lb per MMBtu burned
CO	0.95 lb per MMBtu burned

Calculations

POTENTIAL EMISSIONS:

Note: *The potential to emit for most generators can be calculated using an operating limit of 500 hours/year if the generator meets the following definition of potential to emit from 567 IAC 22.100:*

> *…For the purposes of calculating potential to emit for emergency generators, "maximum capacity" means one of the following:*
>
> - *500 hours of operation annually, if the generator has actually been operated less than 500 hours per year for the past five years;*
> - *8,760 hours of operation annually, if the generator has actually been operated more than 500 hours in one of the past five years; or*
> - *The number of hours specified in a state or federally enforceable limit.*

Potential $PM_{2.5}$ tons/yr
Potential PM_{10} tons/yr
(16.7 MMBtu/hr) *x* (0.31 lb/MMBtu) = 5.177 lb/hr *x* (500 hours/year) *x* (1 ton/2,000 lb) = 1.29 tons/yr

Potential SO_2 tons/yr = 1.21
Potential NOx tons/yr = 18.41
Potential VOC tons/yr = 1.46
Potential CO tons/yr = 3.97

ACTUAL ANNUAL EMISSIONS:

Actual $PM_{2.5}$ tons
Actual PM_{10} tons
(140 MMBtu) *x* (0.31 lb/MMBtu) *x* (1 ton/2,000 lb) = 0.02 tons

Actual SO_2 tons = 0.02
Actual NOx tons = 0.31
Actual VOC tons = 0.02
Actual CO tons = 0.07

Form INV-3 EMISSION UNIT DESCRIPTION – POTENTIAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1)	Company/Facility Name	ACME HOSPITAL	1a) Form INV-3 Page	2	of 4
2)	Emission Point Number	EP5			
	EMISSION UNIT (PROCESS) IDENTIFICATION & DESCRIPTION				
3)	Emission Unit Number	EU5			
4)	SCC Number	20200102			
5)	Description of Process	DIESEL FUEL COMBUSTION < 600 BHP			
6)	Date of Construction	6/1/85	7) Date of Installation	6/1/85	8) Date of Modification
9)	Raw Material – OR Fuels Used List worst case for EACH pollutant	DIESEL FUEL			
10)	Federally Enforceable Limit	500 HOURS/YEAR			
11)	Permit or Rule Establishing Limit	567 IAC 22.100			
12)	Maximum Hourly Design Rate	16.7	MMBTU		Per Hour
13)	AIR POLLUTION CONTROL EQUIPMENT (CE)				
	Control Equipment Number				
	Control Equipment Description				
	Control Equipment Number				
	Control Equipment Description				

POTENTIAL EMISSIONS

14 Air Pollutant	15 Emission Factor	16 Emission Factor Units	17 Source of Emission Factor	18 Ash or Sulfur %	19 Potential Hourly Uncontrolled Emissions (Lbs/Hr)	20 Combined Control Efficiency	21 Transfer Efficiency	22 Potential Hourly Controlled Emissions (Lbs/Hr)	23 Potential Annual Emissions (Tons/Yr)
PM-2.5	0.31	LB/MMBTU	WebFIRE		5.18				1.29
PM-10	0.31	LB/MMBTU	AP-42		5.18				1.29
SO_2	0.29	LB/MMBTU	AP-42		4.84				1.21
NOx	4.41	LB/MMBTU	AP-42		73.65				18.41
VOC	0.35	LB/MMBTU	AP-42		5.85				1.46
CO	0.95	LB/MMBTU	AP-42		15.87				3.97
Lead									
Ammonia									
POTENTIAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 14									

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4001. December 24, 2007)

Form INV-4 EMISSION UNIT DESCRIPTION – ACTUAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-4 Page	2	of	5
2) Emission Year	2014	3) Emission Point Number	EP5				
EMISSION UNIT – ACTUAL OPERATIONS AND EMISSIONS							
4) Emission Unit Number	EU5	5) SCC Number	20200102				
6) Description of Process	DIESEL COMBUSTION < 600 HP						
ACTUAL THROUGHPUT							
7) Raw Material	DIESEL FUEL						
8) Actual Throughput – Yearly Total	140	9)	Units Raw Material	MMBTU			

Actual Operating Rate/Schedule

	10) Percent of Total Operating Time	11) Hours/Day	12) Days/Week	13) Weeks/Quarter
JAN – MAR	23.5	1	1	2
APR – JUN	23.5	1	1	2
JUL – SEP	23.5	1	1	2
OCT - DEC	29.4	1.25	1	2

14) AIR POLLUTION CONTROL EQUIPMENT (CE)

Control Equipment Number	
Control Equipment Description	
Control Equipment Number	
Control Equipment Description	

ACTUAL EMISSIONS

15 Air Pollutant	16 Emission Factor	17 Emission Factor Units	18 Source of Emission Factor	19 Ash or Sulfur %	20 Combined Control Efficiency	21 Transfer Efficiency	22 Actual Emissions (Tons/Yr)
PM-2.5	0.31	LB/MMBTU	WebFIRE				0.02
PM-10	0.31	LB/MMBTU	AP-42				0.02
SO_2	0.29	LB/MMBTU	AP-42				0.02
NOX	4.41	LB/MMBTU	AP-42				0.31
VOC	0.35	LB/MMBTU	AP-42				0.02
CO	0.95	LB/MMBTU	AP-42				0.07
Lead							
Ammonia							
ACTUAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 15							

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4002 December 24, 2007)

Form INV-2 EMISSION POINT DESCRIPTION

Duplicate this form for EACH Emission POINT

1) Company/Facility Name	ACME HOSPTIAL	1a) Form INV-2 Page	3	of	4
2) Emission Point Number	EP6				
3) Emission Point Description	DIESEL GENERATOR STACK				
4) Is this stack/vent used as an Emergency Bypass Stack?	No ☒	Yes ☐			
If YES, for which stack(s)? List Emission Point Nos.:					

EMISSION POINT INFORMATION

5) Emission Point Type					
Stack/Vent	☒				
Fugitive (specify)	☐				
Other (specify)	☐				
6) Stack Shape and Dimensions: (interior dimensions at exit point)					
Circular Diameter:	☒	5	inches		
Rectangular Dimensions:	☐		inches	x	inches
Other Dimensions	☐		inches		
7) Stack Height Above Ground	67	feet			

8) Does the Emission Point have a rain cap (or anything else) which obstructs the flow of gases leaving the Emission Point, or a horizontal discharge?

No	☒	YES (specify):	☐	

9) COMPOSTION OF EXHAUST STREAM

Exhaust Stream Characteristics	Emission Point Composition of Exhaust Stream	Units of Measure
a) Flow Rate	7,795	☒ ACFM ☐ SCFM
b) Temperature	400	Degree Fahrenheit

10) BYPASS STACKS

Bypass Stack – Emission Point No.		Bypass Stack Description	
Bypass Stack – Emission Point No.		Bypass Stack Description	

11) LIST OF EMISSION UNITS VENTING THROUGH THIS EMISSION POINT

Emission Unit No.	Emission Unit No	Emission Unit No.	Emission Unit No.
EU6			

Duplicate this form as needed | TYPE ALL INFORMATION | (DNR Form 542-4004. December 24, 2007)

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-5 Page	3	of	7
2) Emission Point No.	EP6	3)	Emission Unit No.	EU6			
4) Calculations are provided in support of information reported on Form INV -	3 ☒	4 ☒	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

Process: Diesel Generator > 600 BHP SCC No. 20200401
Fuel: Diesel Fuel
Maximum rate: 226.9 gallons/hr, 0.140 MMBtu/gallon = 31.77 MMBtu/hr
Actual Year Throughput - Yearly Total: 1,900 gallons, 0.140 MMBtu/gallon = 266 MMBtu

Pollutant	Emission Factor from WebFIRE (SCC No. 20200401)
$PM_{2.5}$	7.55 lb/1,000 gallons or 0.05 lb/MMBtu

Pollutant	Emission Factors from DNR Memo. This emission factor is an Iowa emission factor. It is based on stack tests performed in the state. An emission factor rating has not been determined.
PM_{10}	0.14 lb per MMBtu burned

Pollutant	Emission Factors from AP-42 (SCC No. 20200401)
SO_2	1.01(S) lb per MMBtu burned S = percent sulfur in fuel
NOx	3.2 lb per MMBtu burned
VOC	0.0819 lb per MMBtu burned
CO	0.85 lb per MMBtu burned

Calculations

POTENTIAL EMISSIONS:

Note: *The potential to emit for most generators can be calculated using an operating limit of 500 hours/year if the generator meets the following definition of potential to emit from 567 IAC 22.100:*

…For the purposes of calculating potential to emit for emergency generators, "maximum capacity" means one of the following:

- *500 hours of operation annually, if the generator has actually been operated less than 500 hours per year for the past five years;*
- *8,760 hours of operation annually, if the generator has actually been operated more than 500 hours in one of the past five years; or*
- *The number of hours specified in a state or federally enforceable limit.*

Potential $PM_{2.5}$ tons/yr
(31.77 MMBtu/hr) *x* (0.05 lb/MMBtu) = 1.59 lb/hr *x* (500 hours/year) *x* (1 ton/2,000 lb) = 0.40 tons/yr

Potential SO_2 tons/yr
(31.77 MMBtu/hr) *x* [1.01 (0.5 % sulfur) lb/MMBtu] *x* (500 hours/year) *x* (1 ton/2,000 lb) = 4.01 tons/yr

Potential PM_{10} tons/yr = 1.11
Potential NOx tons/yr = 25.42
Potential VOC tons/yr = 0.65
Potential CO tons/yr = 6.75

ACTUAL ANNUAL EMISSIONS:

Actual $PM_{2.5}$ tons
(266 MMBtu) *x* (0.05 lb/MMBtu) *x* (1 ton/2000 lb) = 0.01 tons

Actual PM_{10} tons = 0.02
Actual SO_2 tons = 0.07
Actual NOx tons = 0.43
Actual VOC tons = 0.01
Actual CO tons = 0.11

Form INV-3 EMISSION UNIT DESCRIPTION – POTENTIAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1)	Company/Facility Name	ACME HOSPITAL				1a) Form INV-3 Page	3	of	4		
2)	Emission Point Number	EP6									
	EMISSION UNIT (PROCESS) IDENTIFICATION & DESCRIPTION										
3)	Emission Unit Number	EU6									
4)	SCC Number	20200401									
5)	Description of Process	DIESEL FUEL COMBUSTION > 600 BHP									
6)	Date of Construction	6/1/85	7)	Date of Installation	6/1/85	8)	Date of Modification				
9)	Raw Material – OR Fuels Used List worst case for EACH pollutant	DIESEL FUEL									
10)	Federally Enforceable Limit	500 HOURS/YEAR									
11)	Permit or Rule Establishing Limit	567 IAC 22.100									
12)	Maximum Hourly Design Rate	31.77	MMBTU	Per Hour							
13)	AIR POLLUTION CONTROL EQUIPMENT (CE)										
	Control Equipment Number										
	Control Equipment Description										
	Control Equipment Number										
	Control Equipment Description										

POTENTIAL EMISSIONS

14 Air Pollutant	15 Emission Factor	16 Emission Factor Units	17 Source of Emission Factor	18 Ash or Sulfur %	19 Potential Hourly Uncontrolled Emissions (Lbs/Hr)	20 Combined Control Efficiency	21 Transfer Efficiency	22 Potential Hourly Controlled Emissions (Lbs/Hr)	23 Potential Annual Emissions (Tons/Yr)
PM-2.5	0.05	LB/MMBTU	WebFIRE		1.59				0.40
PM-10	0.14	LB/MMBTU	DNR Memo		4.45				1.11
SO_2	1.01	LB/MMBTU	AP-42	0.5	16.04				4.01
NOx	3.2	LB/MMBTU	AP-42		101.66				25.42
VOC	0.0819	LB/MMBTU	AP-42		2.60				0.65
CO	0.85	LB/MMBTU	AP-42		27.00				6.75
Lead									
Ammonia									
POTENTIAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 14									

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4001. December 24, 2007)

Form INV-4 EMISSION UNIT DESCRIPTION – ACTUAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-4 Page	3	of	5
2) Emission Year	2014	3) Emission Point Number	EP6				
EMISSION UNIT – ACTUAL OPERATIONS AND EMISSIONS							
4) Emission Unit Number	EU6			5) SCC Number	20200401		
6) Description of Process	DIESEL COMBUSTION > 600 HP						
ACTUAL THROUGHPUT							
7) Raw Material	DIESEL FUEL						
8) Actual Throughput – Yearly Total	266	9)	Units Raw Material	MMBTU			

Actual Operating Rate/Schedule

	10) Percent of Total Operating Time	11) Hours/Day	12) Days/Week	13) Weeks/Quarter
JAN – MAR	23.5	1	1	2
APR – JUN	23.5	1	1	2
JUL – SEP	23.5	1	1	2
OCT - DEC	29.4	1.25	1	2

14) AIR POLLUTION CONTROL EQUIPMENT (CE)

Control Equipment Number	
Control Equipment Description	
Control Equipment Number	
Control Equipment Description	

ACTUAL EMISSIONS

15 Air Pollutant	16 Emission Factor	17 Emission Factor Units	18 Source of Emission Factor	19 Ash or Sulfur %	20 Combined Control Efficiency	21 Transfer Efficiency	22 Actual Emissions (Tons/Yr)
PM-2.5	0.05	LB/MMBTU	WebFIRE				0.01
PM-10	0.14	LB/MMBTU	DNR MEMO				0.02
SO_2	1.01	LB/MMBTU	AP-42	0.5			0.07
NOX	3.2	LB/MMBTU	AP-42				0.43
VOC	0.0819	LB/MMBTU	AP-42				0.01
CO	0.85	LB/MMBTU	AP-42				0.11
Lead							
Ammonia							

ACTUAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 15

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4002 December 24, 2007)

Form INV-2 EMISSION POINT DESCRIPTION

Duplicate this form for EACH Emission POINT

1) Company/Facility Name	ACME HOSPITAL	1a) Form INV-2 Page	4	of	4
2) Emission Point Number	EP7				
3) Emission Point Description	DUAL FUEL GENERATOR STACK				
4) Is this stack/vent used as an Emergency Bypass Stack?	No ☒	Yes ☐			
If YES, for which stack(s)? List Emission Point Nos.:					

EMISSION POINT INFORMATION

5) Emission Point Type					
Stack/Vent	☒				
Fugitive (specify)	☐				
Other (specify)	☐				
6) Stack Shape and Dimensions: (interior dimensions at exit point)					
Circular Diameter:	☒	15	inches		
Rectangular Dimensions:	☐		inches	x	inches
Other Dimensions	☐		inches		
7) Stack Height Above Ground	30	feet			

8) Does the Emission Point have a rain cap (or anything else) which obstructs the flow of gases leaving the Emission Point, or a horizontal discharge?

No	☒	YES (specify):	☐	

9) COMPOSTION OF EXHAUST STREAM

Exhaust Stream Characteristics	Emission Point Composition of Exhaust Stream	Units of Measure
a) Flow Rate	4,000	☐ ACFM ☒ SCFM
b) Temperature	500	Degree Fahrenheit

10) BYPASS STACKS

Bypass Stack – Emission Point No.		Bypass Stack Description	
Bypass Stack – Emission Point No.		Bypass Stack Description	

11) LIST OF EMISSION UNITS VENTING THROUGH THIS EMISSION POINT

Emission Unit No.	Emission Unit No	Emission Unit No.	Emission Unit No.
EU7			

Duplicate this form as needed | TYPE ALL INFORMATION | (DNR Form 542-4004. December 24, 2007)

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-5 Page	4	of	7
2) Emission Point No.	EP7	3)	Emission Unit No.	EU7			
4) Calculations are provided in support of information reported on Form INV -	3 ☒	4 ☐	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

Process: Internal Diesel Combustion > 600 BHP SCC No. 20200401

Fuel: Diesel Fuel

Maximum rate: 75 gallons/hr x 0.140 MMBtu/gallon = 10.5 MMBtu/hr

Permit Limits: Diesel fuel or dual fuel usage only, maximum Sulfur content of fuel may not exceed 0.5%, 500 hours of operation per 12 months, 2.50 lbs/hr PM_{10}, 5.50 lbs/hr SO_2, and 50 lbs/hr NO_x.

*Applicable pollutants: PM_{10}, SO_2, and NO_x (these emission factors are higher for internal diesel combustion when compared to dual fuel combustion)

*Pollutants attributed to the dual fuel combustion process: $PM_{2.5}$, VOC, CO, Benzene, Formaldehyde, and Toluene (these emission factors are higher for dual fuel combustion when compared to internal diesel combustion)

*Pollutants exempt from reporting for this process: Acetaldehyde and Acrolein (these emission factors, when combined with the 500 hours of operation per 12 months permit limit, lead to emissions of less than .01 tons/yr)

PM_{10}:

75 gal/hr x 0.140 MMBtu/gal x .14 lbs/MMBtu = 1.47 lbs/hr (hourly-uncontrolled emissions)

The permit limit allows for 2.50 lbs/hr of PM_{10} (hourly-controlled emissions)

2.50 lbs/hr x 500 hrs/yr x 1 ton/2,000lbs = .63 tons/yr (potential annual emissions)

SO_2:

75 gal/hr x 0.140 MMBtu/gal x 1.01 lbs/MMBtu x 0.5 (Sulfur content) = 5.30 lbs/hr (hourly-uncontrolled emissions)

The permit limit allows for 5.50 lbs/hr of SO_2 (hourly-controlled emissions)

5.50 lbs/hr x 500 hrs/yr x 1 ton/2,000lbs = 1.38 tons/yr (potential annual emissions)

NO_x:

75 gal/hr x 0.140 MMBtu/gal x 3.2 lbs/MMBtu = 33.60 lbs/hr (hourly-uncontrolled emissions)

The permit limit allows for 50.00 lbs/hr of NO_x (hourly-controlled emissions)

50.00 lbs/hr x 500 hrs/yr x 1 ton/2,000lbs = 12.50 tons/yr (potential annual emissions)

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-5 Page	5	of	7
2) Emission Point No.	EP7	3)	Emission Unit No.	EU7			
4) Calculations are provided in support of information reported on Form INV -	3 ☒	4 ☐	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

Process: Dual Fuel Combustion > 600 BHP SCC No. 20200402

Fuel: Dual Fuel (95% Natural Gas and 5% Diesel Fuel)

Maximum rate: (9,500 ft^3/hr x .00105 MMBtu/ ft^3) + (3.75 gal/hr x 0.140 MMBtu/gal) = 10.5 MMBtu/hr

Permit Limits: Diesel fuel or dual fuel usage only, maximum Sulfur content of fuel may not exceed 0.5%, 500 hours of operation per 12 months, 2.50 lbs/hr PM_{10}, 5.50 lbs/hr SO_2, and 50 lbs/hr NO_x.

*Applicable pollutants: $PM_{2.5}$, VOC, CO, Benzene, Formaldehyde, and Toluene (these emission factors are higher for dual fuel combustion when compared to internal diesel combustion)

*Pollutants attributed to the internal diesel combustion process: PM_{10}, SO_2, and NO_x (these emission factors are higher for internal diesel combustion when compared to dual fuel combustion)

*Pollutants exempt from reporting for this process: Xylene, Naphthalene, and Styrene (these emission factors, when combined with the 500 hours of operation per 12 months permit limit, lead to emissions of less than .01 tons/yr)

Calculations

$PM_{2.5}$:

[(9,500 ft^3/hr x .00105 MMBtu/ ft^3) + (3.75 gal/hr x 0.140 MMBtu/gal)] *x* .0556 lbs/MMBtu = .58 lbs/hr (hourly-uncontrolled emissions)

[(9,500 ft^3/hr x .00105 MMBtu/ ft^3) + (3.75 gal/hr x 0.140 MMBtu/gal)] *x* .0556 lbs/MMBtu x 500 hrs/yr x 1 ton/2,000 lbs = .15 tons/yr (potential annual emissions)

VOC:

[(9,500 ft^3/hr x .00105 MMBtu/ ft^3) + (3.75 gal/hr x 0.140 MMBtu/gal)] *x* 0.2 lbs/MMBtu = 2.10 lbs/hr (hourly-uncontrolled emissions) *x* 500 hrs/yr x 1 ton/2,000 lbs = 0.53 tons/yr (potential annual emissions)

CO:

[(9,500 ft^3/hr x .00105 MMBtu/ ft^3) + (3.75 gal/hr x 0.140 MMBtu/gal)] *x* 1.16 lbs/MMBtu = 12.18 lbs/hr (hourly-uncontrolled emissions) *x* 500 hrs/yr *x* 1 ton/2,000 lbs = 3.05 tons/yr (potential annual emissions)

Benzene:

[(9,500 ft^3/hr x .00105 MMBtu/ ft^3) + (3.75 gal/hr x 0.140 MMBtu/gal)] x .00445 lbs/MMBtu = .05 lbs/hr (hourly-uncontrolled emissions) *x* 500 hrs/yr x 1 ton/2,000 lbs = .01 tons/yr (potential annual emissions)

Formaldehyde:

[(9,500 ft^3/hr x .00105 MMBtu/ ft^3) + (3.75 gal/hr x 0.140 MMBtu/gal)] *x* .0054 lbs/MMBtu = .06 lbs/hr (hourly-uncontrolled emissions) *x* 500 hrs/yr x 1 ton/2,000 lbs = .01 tons/yr (potential annual emissions)

Toluene:

[(9,500 ft^3/hr x .00105 MMBtu/ ft^3) + (3.75 gal/hr x 0.140 MMBtu/gal)] *x* .00523 lbs/MMBtu = .05 lbs/hr (hourly-uncontrolled emissions) *x* 500 hrs/yr x 1 ton/2,000 lbs = .01 tons/yr (potential annual emissions)

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-5 Page	6	of	7
2) Emission Point No.	EP7	3)	Emission Unit No.	EU7			
4) Calculations are provided in support of information reported on Form INV -	3 ☐	4 ☒	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

Process: Internal Diesel Combustion > 600 BHP SCC No. 20200401

Fuel: Diesel Fuel

Actual Throughput: 15,000 gallons x 0.140 MMBtu/gallon = 2,100 MMBtu

*Applicable pollutants: $PM_{2.5}$, PM_{10}, SO_2, NO_x, VOC, CO, Benzene, Formaldehyde, and Toluene (these pollutants have potential emissions of greater than .01 tons/yr for this generator)

*Pollutants exempt from reporting for this process: Xylene, Naphthalene, Acetaldehyde and Acrolein (these emission factors, when combined with the 500 hours of operation per 12 months permit limit, lead to emissions of less than .01 tons/yr)

$PM_{2.5}$:

15,000 gal x 0.140 MMBtu/gal x .05 lbs/MMBtu x 1ton/2,000 lbs = .05 tons

PM_{10}:

15,000 gal x 0.140 MMBtu/gal x .14 lbs/MMBtu x 1ton/2,000 lbs = .15 tons

SO_2:

15,000 gal x 0.140 MMBtu/gal x 1.01 lbs/MMBtu x 0.5 (Sulfur content) x 1ton/2,000 lbs = .53 tons

NO_x:

15,000 gal x 0.140 MMBtu/gal x 3.2 lbs/MMBtu x 1ton/2,000 lbs = 3.36 tons

VOC:

15,000 gal x 0.140 MMBtu/gal x .0819 lbs/MMBtu x 1ton/2,000 lbs = .09 tons

CO:

15,000 gal x 0.140 MMBtu/gal x .85 lbs/MMBtu x 1ton/2,000 lbs = .89 tons

Benzene:

15,000 gal x 0.140 MMBtu/gal x .000776 lbs/MMBtu x 1ton/2,000 lbs = .00 tons

Formaldehyde:

15,000 gal x 0.140 MMBtu/gal x .0000789 lbs/MMBtu x 1ton/2,000 lbs = .00 tons

Toluene:

15,000 gal x 0.140 MMBtu/gal x .000281 lbs/MMBtu x 1ton/2,000 lbs = .00 tons

Form INV-5 CALCULATIONS

Duplicate this form for each Form it will accompany in the Questionnaire

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-5 Page	7	of	7
2) Emission Point No.	EP7	3)	Emission Unit No.	EU7			
4) Calculations are provided in support of information reported on Form INV -	3 ☐	4 ☒	for the Emission Point and Emission Unit listed above.				
5) Emissions Calculations							

Process: Dual Fuel Combustion > 600 BHP SCC No. 20200402

Fuel: Dual Fuel (95% Natural Gas and 5% Diesel Fuel)

Actual Throughput: (1,900,000 ft^3 x .00105 MMBtu/ft^3) + (750 gal x 0.140 MMBtu/gal) = 2,100 MMBtu

*Applicable pollutants: $PM_{2.5}$, PM_{10}, SO_2, NO_x, VOC, CO, Benzene, Formaldehyde, and Toluene (these pollutants have potential emissions of greater than .01 tons/yr for this generator)

*Pollutants exempt from reporting for this process: Xylene, Naphthalene, and Styrene (these emission factors, when combined with the 500 hours of operation per 12 months permit limit, lead to emissions of less than .01 tons/yr)

Calculations

$PM_{2.5}$:

[(1,900,000 ft^3 x .00105 MMBtu/ft^3) + (750 gal x 0.140 MMBtu/gal)] x .0556 lbs/MMBtu x 1 ton/2,000 lbs = .06 tons

PM_{10}:

[(1,900,000 ft^3 x .00105 MMBtu/ft^3) + (750 gal x 0.140 MMBtu/gal)] x .0573 lbs/MMBtu x 1 ton/2,000 lbs = .06 tons

SO_2:

[(1,900,000 ft^3 x .00105 MMBtu/ft^3) + (750 gal x 0.140 MMBtu/gal)] x .05 lbs/MMBtu x 0.5 (Sulfur content) x 1 ton/2,000 lbs = .05 tons

NO_x:

[(1,900,000 ft^3 x .00105 MMBtu/ft^3) + (750 gal x 0.140 MMBtu/gal)] x 2.7 lbs/MMBtu x 1 ton/2,000 lbs = 2.84 tons

VOC:

[(1,900,000 ft^3 x .00105 MMBtu/ft^3) + (750 gal x 0.140 MMBtu/gal)] x 0.2 lbs/MMBtu x 1 ton/2,000 lbs = 0.21 tons

CO:

[(1,900,000 ft^3 x .00105 MMBtu/ft^3) + (750 gal x 0.140 MMBtu/gal)] x 1.16 lbs/MMBtu x 1 ton/2,000 lbs = 1.22 tons

Benzene:

[(1,900,000 ft^3 x .00105 MMBtu/ft^3) + (750 gal x 0.140 MMBtu/gal)] x .00445 lbs/MMBtu x 1 ton/2,000 lbs = .00 tons

Formaldehyde:

[(1,900,000 ft^3 x .00105 MMBtu/ft^3) + (750 gal x 0.140 MMBtu/gal)] x .0054 lbs/MMBtu x 1 ton/2,000 lbs = .01 tons

Toluene:

[(1,900,000 ft^3 x .00105 MMBtu/ft^3) + (750 gal x 0.140 MMBtu/gal)] x .00523 lbs/MMBtu x 1 ton/2,000 lbs = .01 tons

Form INV-3 EMISSION UNIT DESCRIPTION – POTENTIAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1)	Company/Facility Name	ACME HOSPITAL			1a) Form INV-3 Page	4	of	5	
2)	Emission Point Number	EP7							
	EMISSION UNIT (PROCESS) IDENTIFICATION & DESCRIPTION								
3)	Emission Unit Number	EU7							
4)	SCC Number	20200401							
5)	Description of Process	INTERNAL DIESEL COMBUSTION							
6)	Date of Construction	6-15-94	7)	Date of Installation	6-30-94	8)	Date of Modification		
9)	Raw Material – OR Fuels Used List worst case for EACH pollutant	DIESEL FUEL							
10)	Federally Enforceable Limit	Diesel/dual fuel use only, 0.5% maximum Sulfur content, 500 hrs/yr							
11)	Permit or Rule Establishing Limit	85-A-000							
12)	Maximum Hourly Design Rate	10.5	MMBTU	Per Hour					
13)	AIR POLLUTION CONTROL EQUIPMENT (CE)								
	Control Equipment Number								
	Control Equipment Description								
	Control Equipment Number								
	Control Equipment Description								

POTENTIAL EMISSIONS

14 Air Pollutant	15 Emission Factor	16 Emission Factor Units	17 Source of Emission Factor	18 Ash or Sulfur %	19 Potential Hourly Uncontrolled Emissions (Lbs/Hr)	20 Combined Control Efficiency	21 Transfer Efficiency	22 Potential Hourly Controlled Emissions (Lbs/Hr)	23 Potential Annual Emissions (Tons/Yr)
PM-2.5									
PM-10	.14	LB/MMBTU	DNR MEMO		1.47			2.50	0.63
SO_2	1.01	LB/MMBTU	AP-42	0.5	5.30			5.50	1.38
NOx	3.2	LB/MMBTU	AP-42		33.60			50.00	12.50
VOC									
CO									
Lead									
Ammonia									
POTENTIAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 14									

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4001. December 24, 2007)

Form INV-3 EMISSION UNIT DESCRIPTION – POTENTIAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1)	Company/Facility Name	ACME HOSPITAL	1a) Form INV-3 Page	5	of	5	
2)	Emission Point Number	EP7					
	EMISSION UNIT (PROCESS) IDENTIFICATION & DESCRIPTION						
3)	Emission Unit Number	EU7					
4)	SCC Number	20200402					
5)	Description of Process	DUAL FUEL COMBUSTION					
6)	Date of Construction	6-15-94	7) Date of Installation	6-30-94	8)	Date of Modification	
9)	Raw Material – OR Fuels Used List worst case for EACH pollutant	DUAL FUEL (95% NATURAL GAS, 5% DIESEL FUEL)					
10)	Federally Enforceable Limit	Diesel/dual fuel use only, 0.5% maximum Sulfur content, 500 hrs/yr					
11)	Permit or Rule Establishing Limit	85-A-000					
12)	Maximum Hourly Design Rate	10.5	MMBTU	Per Hour			
13)	AIR POLLUTION CONTROL EQUIPMENT (CE)						
	Control Equipment Number						
	Control Equipment Description						
	Control Equipment Number						
	Control Equipment Description						

POTENTIAL EMISSIONS

14 Air Pollutant	15 Emission Factor	16 Emission Factor Units	17 Source of Emission Factor	18 Ash or Sulfur %	19 Potential Hourly Uncontrolled Emissions (Lbs/Hr)	20 Combined Control Efficiency	21 Transfer Efficiency	22 Potential Hourly Controlled Emissions (Lbs/Hr)	23 Potential Annual Emissions (Tons/Yr)
PM-2.5	.0556	LB/MMBTU	FIRE 6.25		.58				.15
PM-10									
SO_2									
NOx									
VOC	0.2	LB/MMBTU	AP-42		2.10				.53
CO	1.16	LB/MMBTU	AP-42		12.18				3.05
Lead									
Ammonia									
POTENTIAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 14									
Benzene	.00445	LB/MMBTU	AP-42		.05				.01
Formaldehyde	.0054	LB/MMBTU	AP-42		.06				.01
Toluene	.00523	LB/MMBTU	AP-42		.05				.01

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4001. December 24, 2007)

Form INV-4 EMISSION UNIT DESCRIPTION – ACTUAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-4 Page	4	of	5
2) Emission Year	2014	3) Emission Point Number	EP7				
EMISSION UNIT – ACTUAL OPERATIONS AND EMISSIONS							
4) Emission Unit Number	EU7	5) SCC Number	20200401				
6) Description of Process	INTERNAL DIESEL COMBUSTION						
ACTUAL THROUGHPUT							
7) Raw Material	DIESEL FUEL						
8) Actual Throughput – Yearly Total	2,100	9) Units Raw Material	MMBTU				

Actual Operating Rate/Schedule

	10) Percent of Total Operating Time	11) Hours/Day	12) Days/Week	13) Weeks/Quarter
JAN – MAR	10	1	4	5
APR – JUN	40	4	4	5
JUL – SEP	40	4	4	5
OCT - DEC	10	1	4	5

14) AIR POLLUTION CONTROL EQUIPMENT (CE)

Control Equipment Number	
Control Equipment Description	
Control Equipment Number	
Control Equipment Description	

ACTUAL EMISSIONS

15 Air Pollutant	16 Emission Factor	17 Emission Factor Units	18 Source of Emission Factor	19 Ash or Sulfur %	20 Combined Control Efficiency	21 Transfer Efficiency	22 Actual Emissions (Tons/Yr)
PM-2.5	.05	LB/MMBTU	WebFIRE				.05
PM-10	.14	LB/MMBTU	DNR MEMO				.15
SO_2	1.01	LB/MMBTU	AP-42	0.5			.53
NOX	3.2	LB/MMBTU	AP-42				3.36
VOC	.0819	LB/MMBTU	AP-42				.09
CO	.85	LB/MMBTU	AP-42				.89
Lead							
Ammonia							
ACTUAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 15							
Benzene	.000776	LB/MMBTU	AP-42				.00
Formaldehyde	.0000789	LB/MMBTU	AP-42				.00
Toluene	.000281	LB/MMBTU	AP-42				.00

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4002 December 24, 2007)

Form INV-4 EMISSION UNIT DESCRIPTION – ACTUAL EMISSIONS

Duplicate this form for EACH Emission UNIT

1) Company/Facility Name	ACME HOSPITAL			1a) Form INV-4 Page	5	of	5
2) Emission Year	2014	3) Emission Point Number	EP7				

EMISSION UNIT – ACTUAL OPERATIONS AND EMISSIONS

4) Emission Unit Number	EU7	5) SCC Number	20200402
6) Description of Process	DUAL FUEL COMBUSTION		

ACTUAL THROUGHPUT

7) Raw Material	DUAL FUEL (95% NATURAL GAS, 5% DIESEL FUEL)		
8) Actual Throughput – Yearly Total	2,100	9) Units Raw Material	MMBTU

Actual Operating Rate/Schedule

	10) Percent of Total Operating Time	11) Hours/Day	12) Days/Week	13) Weeks/Quarter
JAN – MAR	10	1	4	5
APR – JUN	40	4	4	5
JUL – SEP	40	4	4	5
OCT - DEC	10	1	4	5

14) AIR POLLUTION CONTROL EQUIPMENT (CE)

Control Equipment Number	
Control Equipment Description	
Control Equipment Number	
Control Equipment Description	

ACTUAL EMISSIONS

15 Air Pollutant	16 Emission Factor	17 Emission Factor Units	18 Source of Emission Factor	19 Ash or Sulfur %	20 Combined Control Efficiency	21 Transfer Efficiency	22 Actual Emissions (Tons/Yr)
PM-2.5	.0556	LB/MMBTU	WebFIRE				.06
PM-10	.0573	LB/MMBTU	WebFIRE				.06
SO_2	.05	LB/MMBTU	AP-42	0.5			.03
NOX	2.7	LB/MMBTU	AP-42				2.84
VOC	0.2	LB/MMBTU	AP-42				.21
CO	1.16	LB/MMBTU	AP-42				1.22
Lead							
Ammonia							
ACTUAL EMISSIONS – Individual HAPs and additional regulated air pollutants – list each individual pollutant name in Column 15							
Benzene	.00445	LB/MMBTU	AP-42				.00
Formaldehyde	.0054	LB/MMBTU	AP-42				.01
Toluene	.00523	LB/MMBTU	AP-42				.01

*Sources of Emission Factors: CEM .. Stack Test .. Mass Balance .. AP-42 .. WebFIRE.. TANKS.. EPA-L&E .. Worksheet .. Other – Specify

Duplicate this form as needed TYPE ALL INFORMATION (DNR Form 542-4002 December 24, 2007)

Form INV-6 FACILITY-WIDE POTENTIAL & ACTUAL EMISSIONS

1) Facility Name	ACME HOSPITAL	2) Form INV-6 Page	1	of	1
3) Emission Year				2014	

The facility-wide potential emission totals for each air pollutant may be calculated by summing the "potential annual emissions" (box #23) on the INV-3 forms

The facility-wide actual emission totals for each air pollutant may be calculated by summing the "actual emissions" (box #22) on the INV-4 forms

4) Facility-Wide Criteria Air Pollutant and Ammonia Emissions (Use Facility-Wide Permit Limit For Potential Tons/Yr Where Applicable)

Air Pollutant	ID or CAS Number	Potential Tons/Yr	Actual Tons
PM-2.5	PM-2.5	2.31	0.23
PM-10	PM-10	3.50	0.34
Sulfur Dioxide	7446-09-5	6.64	0.66
Nitrogen Oxides	NO_x	62.46	8.17
Volatile Organic Compounds	VOC	2.98	0.40
Carbon Monoxide	630-08-0	18.92	3.32
Lead	7439-92-1	----	----
Ammonia	7664-41-7	0.20	0.04

5) Facility-Wide Hazardous Air Pollutant and Other Regulated Air Pollutant Emissions (Use Facility-Wide Permit Limit For Potential Tons/Yr Where Applicable)

Please duplicate this form as necessary to include all hazardous air pollutants and other regulated air pollutants being emitted at the facility

Air Pollutant	ID or CAS Number	Potential Tons/Yr	Actual Tons
Hexane	110-54-3	0.11	0.02
Benzene	71-43-2	0.01	0.00
Formaldehyde	50-00-0	0.01	0.01
Toluene	108-88-3	0.01	0.01