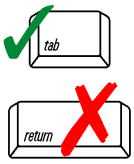
Massachusetts Department of Environmental Protection
Bureau of Air and Waste - Air Quality

BAW AQ Scrubber

Submit with Form CPA-FUEL and/or CPA-PROCESS whenever construction, substantial reconstruction or alteration of a Scrubber is proposed unless exempt per 310 CMR 7.02(2)(b).

Facility ID (if known)

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A. Inlet Operating Conditions

1. Complete the tables below with information on inlet gas flow(s).

Table 1a						
Emission Unit No(s). Being Controlled	**Average Inlet Gas Flow** (Actual Cubic Feet Per Minute)	**Maximum Gaseous Emission Rate Before Control** (Pounds Per Hour)	**Moisture Content in the Inlet** (Pounds Per Minute)	**Inlet Temperature** (Degrees Fahrenheit (ºF))	**Static Pressure in the Inlet** (Inches of Water)	**Normal Liquid to Gas Ratio** (By Weight, Specify Units)
Totals:						

Table 1b			
Emission Unit No(s). Being Controlled	**Is the Gas Stream Pre-Cooled?** (If Yes, Indicate to What Temperature)	**Is the Gas Stream Conditioned?**	**If Conditioned, Explain**
	☐ Yes ☐ No Temperature (ºF):	☐ Yes ☐ No	
	☐ Yes ☐ No Temperature (ºF):	☐ Yes ☐ No	
	☐ Yes ☐ No Temperature (ºF):	☐ Yes ☐ No	

2. Complete the table below with information on the inlet particulate size for the proposed unit:

Table 2				
Emission Unit No(s). Being Controlled	**Particle Size**	**Particulate Concentration Before Control** (Grains Per Actual Cubic Foot)	**Particulate Emission Rate Before Control** (Pounds Per hour)	**Total Weight Percent (%) Before Control**
	≤ 2.5 Microns			
	> 2.5 Microns & ≤10 Microns			
	> 10 Microns			

A. Inlet Operating Conditions (continued)

Table 2 (continued)				
Emission Unit No(s). Being Controlled	**Particle Size**	**Particulate Concentration Before Control** (Grains Per Actual Cubic Foot)	**Particulate Emission Rate Before Control** (Pounds Per hour)	**Total Weight Percent (%) Before Control**
	≤ 2.5 Microns			
	> 2.5 Microns & ≤10 Microns			
	> 10 Microns			
	≤ 2.5 Microns			
	> 2.5 Microns & ≤10 Microns			
	> 10 Microns			

B. Drawing of Scrubber Control System

You must attach to this form a schematic drawing of the proposed Scrubber. At a minimum, it must indicate the locations of the following: gas inlet duct, gas outlet duct, liquid inlet piping, liquid outlet piping, backflow preventer, temperature sensors, pH indicators, flow sensors, flow meter, liquid level sensors, stack, nozzle, and by-pass stack. If proposing "other," attach a description of relevant deign and operating parameters along with supporting calculations.

C. Specifications

1. Manufacturer of Scrubber: _____ Company
2. Model Number (or equivalent): _____ Number
3. Type of Scrubber: ☐ Gravity Spray Tower ☐ Plate Scrubber ☐ Venturi Scrubber ☐ Packed Bed Scrubber ☐ Centrifugal Spray ☐ Other (See 24 Below)
4. Capacity of the Unit: _____ Actual Cubic Feet Per Minute at _____ Degrees Fahrenheit (°F)
5. Outer shell material: ☐ Mild Steel ☐ Stainless Steel ☐ Nonferrous Metal ☐ Plastic ☐ Other – Specify:
6. Inner shell material: _____ Describe

C. Specifications (continued)

7. Expected useful life of the equipment: _____ Years

8. Describe features designed to protect against corrosion:

_____

_____

9. Cross sectional area: _____ Square Feet

10. Number of collection stages: _____ Number

11. Length of the unit: _____ Feet

12. Cross sectional shape: (e.g. square, round) _____ Describe

13. Describe the internal features (e.g. demisters, gas/liquid, diffusion plates, liquid redistributors, bed limiters):

_____

_____

14. Outlet gas flow rate: _____ Actual Cubic Feet Per Minute

15. Temperature of the outlet: _____ Degrees Fahrenheit (ºF)

16. Static pressure in the outlet: _____ Inches of Water

17. Normal oxidation/reduction design potential set point range: _____

18. Normal pH design set point range: _____

19. Complete this section if proposing a gravity spray tower.

a. Type of spray nozzles to be installed:
☐ Pressure ☐ Rotating
☐ Gas Atomizing ☐ Sonic
☐ Other – Specify:

Explain:

_____

_____

b. Number of nozzles to be installed: _____ Number

c. Pressure drop across the nozzles: _____ Pounds Per Square Inch Gauge

C. Specifications (continued)

19. Gravity spray tower (continued)

d. Cross sectional area of the tower: _____ Square Feet

e. Height of the tower: _____ Feet

f. Superficial gas velocity: _____ Feet Per Second

g. Type of flow: ☐ Concurrent ☐ Countercurrent

h. Gas retention time: _____ Seconds

i. Is a mist emulator used? ☐ Yes ☐ No

j. Are baffles present? ☐ Yes ☐ No

k. Does the unit have liquid redistributors? ☐ Yes ☐ No

l. Describe other features:

_____

_____

m. Attach supporting calculations to justify the information entered above.

20. Complete this section if proposing a plate scrubber.

a. Cross sectional area: _____ Square Feet

b. Height of the unit: _____ Feet

c. Number of trays: _____ Number

d. Spacing between the trays: _____ Inches

e. List and briefly describe the type of tray to be used (e.g. sieve, impingement, bubble cap, valve):

_____

_____

f. Depth of the liquid seal: _____ Inches

g. Size of the tray active area: _____ Square Inches

h. Size of the tray perforation area: _____ Square Inches

i. Number of liquid passes per tray: _____ Number

C. Specifications (continued)

20. Plate scrubber (continued)

j. Type of flow: ☐ Cross ☐ Counter ☐ Cascade ☐ Split

k. Describe other features

l. Attach supporting calculations to justify the information entered above.

21. Complete this section if proposing a Venturi scrubber.

a. Is the throat adjustable? ☐ Yes – Complete b. ☐ No – Skip to c.

b. Explain how the throat is controlled.

c. Size of throat area: _____ Square Inches

d. Shape of throat cross section: _____ Describe

e. Throat pressure drop: _____ Inches of Water

f. Throat velocity: _____ Feet Per Second

g. Number of thoats: _____ Number

h. Describe other features

i. Attach supporting calculations to justify the information entered above.

22. Complete this section if proposing a packed bed scrubber.

a. Height of the bed: _____ Feet

b. Cross sectional area of each bed: _____ Square Feet

c. Type of packing element: _____ Describe

C. Specifications (continued)

22. Packed bed scrubber (continued)

d. Size of the packing element: _____ Inches

a. Type of packing configuration: ☐ Random ☐ Stacked ☐ Other – Specify:

e. Number of stages: _____ Number

f. Packing factor: _____ As Given By Manufacturer

g. Height of the transfer unit: _____ Feet

h. Number of transfer units per bed: _____ Number

i. Liquid flooding point: _____ Cubic Feet Per Second

j. Gas loading point: _____ Cubic Feet Per Second

k. Percentage of flooding point that is the operating point: _____ Percent

l. Describe the packed bed (crossflow, counterflow, parallel flow, fluid bed, flooded bed, other):

m. Number of liquid redistributors: _____ Number

n. Distance between liquid redistributors: _____ Inches

o. Describe other features

p. Attach supporting calculations to justify the information entered above.

23. Complete this section if proposing a centrifugal spray scrubber.

a. Height of the unit: _____ Feet

b. Diameter of the unit: _____ Feet

c. Retention time of the gas: _____ Seconds

d. Is the spray directed outward? ☐ Yes ☐ No

C. Specifications (continued)

23. Centrifugal spray scrubber (continued)

e. Type of spray nozzles to be installed:
(e.g. pressure, rotating, gas atomizing, sonic) _____ Describe

f. Attach supporting calculations to justify the information entered above.

24. Complete this section if proposing another type of scrubber.

a. Describe relevant operating features and parameters. Continue on a separate attachment, if necessary.

_____

_____

_____

b. Attach supporting calculations to justify the information entered above.

D. Description of Scrubbing Liquid

1. Complete the table below with information about the chemical additive(s) to be used:

Table 3			
Chemical Name	**Maximum Feed Rate** (Pounds Per Hour)	**Percent Strength (As Mixed With Water)** (Weight Percent)	**Reaction Products**

2. Normal scrubbing liquid flow rate: _____ Gallons Per Minute

3. Liquid temperature at the inlet and outlet: _____ Inlet Degrees Fahrenheit (ºF) _____ Outlet ºF

4. Density of the liquid: _____ Pounds Per Gallon at _____ Operating Temperature (ºF)

5a. Liquid pressure to the nozzles: _____ Pounds Per Square Inch Gauge

5b. Indicate the pressure gauge location on the process diagram.

6. If liquid is re-circulated, indicate make-up rate: _____ Gallons Per Minute

7. If liquid is re-circulated, indicate re-circulation rate: _____ Gallons Per Minute

D. Description of Scrubbing Liquid (continued)

8. Is the re-circulated liquid treated for reuse? ☐ Yes ☐ No

   If Yes, explain:

9. Is the pH of the liquid controlled for the purpose of maintaining collection efficiency? ☐ Yes ☐ No

   If Yes, explain how the pH is controlled:

10. Describe the contaminants transferred to the scrubbing liquid.

    a. Liquid/solid contaminants: _____ Pounds Per Hour

       Describe:

    b. Gases absorbed: _____ Pounds Per Hour

       Describe:

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E. Emissions Data

1a. Complete the table below to provide detailed information about the presence of contaminants in the gas stream (e.g. volatile organic compounds, halogenated compounds, sufur, hazardous air pollutants, heavy metals, asbestos).

Table 4		
Provide the Maximum Gaseous Emissions		
Air Contaminant	**After Control** (Pounds Per Hour)	**After Control** (Micrograms Per Dry Standard Cubic Meter)

1b. Overall gaseous emission collection efficiency: _____ Weight Percent

2a. Complete the table below to provide detailed information about particle size.

Table 5		
Provide the Maximum Particulate Matter Emissions Rate		
Particle Size	**After Control** (Pounds Per Hour)	**After Control** (Micrograms Per Dry Standard Cubic Meter)
≤ 2.5 Microns		
> 2.5 Microns & ≤10 Microns		
> 10 Microns		
Total Particulate Matter		
≤ 2.5 Microns		
> 2.5 Microns & ≤10 Microns		
> 10 Microns		
Total Particulate Matter		

E. Emissions Data (continued)

Table 5 (continued)		
Particle Size	**After Control** (Pounds Per Hour)	**After Control** (Micrograms Per Dry Standard Cubic Meter)
≤ 2.5 Microns		
> 2.5 Microns & ≤10 Microns		
> 10 Microns		
Total Particulate Matter		

2b. Overall particulate matter collection efficiency: _____
Weight Percent

3a. Capture efficiency of the ventilation systems serving the Scrubber: The presumption is that the capture efficiency of the system meets the criteria of Permanent Total Enclosure (PTE) as detailed in U.S. Environmental Protection Agency (EPA) Method 204.

_____
Weight Percent

3b. If the proposed system does not meet PTE criteria, explain:

4. Attach supporting calculations to justify the information entered above.

F. Monitoring, Record Keeping & Failure Notification

1. Describe the parameters that will be monitored as a surrogate for control device efficiency, and the frequency of monitoring. Continue on a separate attachment, if necessary.

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F. Monitoring, Record Keeping & Failure Notification (continued)

2. Describe the monitoring methods and warning/alarm system that protect against operation when the unit is not meeting design efficiency (e.g. visual monitoring, audible alarm, flashing lights, temperature indicator, pressure indicator). Continue on a separate attachment, if necessary.

3. Describe the record keeping procedures to be used to verify monitoring and to identify the cause, duration and resolution of each failure. Continue on a separate attachment, if necessary.

4. Describe how failure of the Scrubber will be made known to the operator during normal operations (e.g. visual monitoring, audible alarm, flashing lights, time indicator, pressure indicator). Continue on a separate attachment, if necessary.

5. List and explain all operating and safety controls associated with this system, including interlock systems that prevent introduction of the air contaminant(s) stream until the Scrubber is operating properly. Continue on a separate attachment, if necessary.

6. Describe the Scrubber's emergency procedures during system upsets. Continue on a separate attachment, if necessary.

F. Monitoring, Record Keeping & Failure Notification (continued)

7. Describe features of the system design and operation that will allow for emissions testing using MassDEP-sanctioned test methods. Continue on a separate attachment, if necessary.

G. Standard Operating & Maintenance Procedures

Attach to this form the standard operating and maintenance procedures for the proposed Scrubber, as well as a list of the spare parts inventory that you will maintain on site, as recommended by the equipment vendor(s).