State of Oregon
Department of Environmental Quality Memorandum

Date: 11/19/2020

To: File/George Yun
From: Thomas Rhodes

Subject: Source Test Review Report
Owens-Brockway Glass Container

Permit Number: Title V 26-1876

Test Dates: August 18-19, 2020
Report Received: October 2, 2020
Revised Report Received: November 4, 2020
Source Tester: Montrose Air Quality Services
DEQ Observed: No

I) Source Description: Glass container manufacturing facility.

II) Process (es)/Emissions Unit(s) Tested: Glass melting furnace D (GM4) producing amber glass.

III) Test Purpose: Compliance with Cleaner Air Oregon request dated February 6, 2020 for source testing on Furnace D while producing amber glass. Owens-Brockway also included testing for particulate matter (PM), nitrogen oxides (NO_x) and sulfur dioxide (SO_2).

IV) Testing Location:

Furnace D (GM4) Exhaust Duct:

Diameter:	29”
Distance A (Method 1):	348” (12.0 Diameters)
Distance B (Method 1):	60” (2.1 Diameters)
Number traverse points utilized:	24

V) Testing Methodology: The following testing methods were utilized during the testing program:

Flow Rate, O_2 & CO_2, & Moisture Content: EPA Methods 1, 2, 3A & 4
Total Particulate: EPA Methods 5/202
Sulfur Dioxide: EPA Method 6C
Nitrogen Oxides: EPA Method 7E
Metals: EPA Method 29
Hexavalent Chromium: EPA SW-846 Method 0061

VI) Summary of Results: The testing parameters, test results and operating parameters are summarized in the Tables below:

Table 1: Furnace D (GM4) – Particulate, SO_2, NO_X
Table 2: Furnace D (GM4) – Multi-metals
Table 3: Furnace D (GM4) – Hexavalent Chromium

TABLE 1: Furnace 4 (GM1) – PM, SO_2, NO_X

TESTING PARAMETERS (PM, SO_2, NO_X)	Run 1	Run 2	Run 3	Average / (99% UCL)	Permit Limit / (EF)
Test Date	8/18/2020	8/18/2020	8/18/2020	--	--
Test Time	0756-0900	0928-1044	1114-1218	--	--
Exhaust Gas Temperature (^oF)	699	709	711	706	--
Exhaust Gas Moisture (%)	15.9	16.4	15.8	16.0	--
Exhaust O_2 (% dry vol)	7.0	7.2	6.9	7.0	--
Exhaust CO_2 (% dry vol)	11.4	11.2	11.6	11.4	--
Exhaust Gas Flow Rate (dscfm)	5,832	5,664	5,933	5,810	--
Filterable Particulate (PM) Emissions:					
• gr/dscf	0.085	0.086	0.086	0.086	0.10
• lb/hr	4.26	4.17	4.36	4.27	
• lb/ton of glass	0.51	0.50	0.52	0.52	1
Total Particulate (PM) Emissions:					
• gr/dscf	0.10	0.11	0.11	0.11	0.10
• lb/hr	4.94	5.33	5.53	5.27	
• lb/ton of glass	0.67	0.72	0.75	0.71	(0.6)
Sulfur Dioxide (SO_2) Emissions:					
• ppmvd	364	356	362	361	
• lb/hr	21.1	20.0	21.4	20.9	
• lb/ton of glass	2.9	2.7	2.9	2.8	(2.1)
Nitrogen Oxides (NO_X) Emissions:					
• ppmvd	643	612	645	633	
• lb/hr	26.8	24.8	27.4	26.3	
• lb/ton of glass	3.6	3.4	3.7	3.6	(3.7)
% Opacity	4.7	4.8	5.4	5.0 (5.1)	20
Glass Production (tons/day)	177	177	177	177	
Type of glass	Amber Red	Amber Red	Amber Red	Amber Red	--
% Cullet	45	45	45	45	--
Natural Gas Usage (kscf/hr)	21.6	22.1	22.7	22.1	--
Electric Boost (kWh/hour)	830	830	831	830	--
Bridgewall Temperature (°F)	2,834	2,829	2,827	2,830	--

TABLE 2: Furnace D (GM4) – Metals

TESTING PARAMETERS (Sb, As, Be, Cd, Co, Cu, Pb, Mn, Hg, Ni, Se)	Run 1	Run 2	Run 3	Average
Test Date	**8/19/2020**	**8/19/2020**	**8/19/2020**	**--**
Test Time	**0816-1024**	**1107-1336**	**1413-1703**	**--**
Exhaust Gas Temperature (°F)	**707**	**709**	**728**	**714**
Exhaust Gas Moisture (%)	**15.3**	**16.0**	**15.9**	**15.7**
Exhaust O_2 (% dry vol)	**7.0**	**7.1**	**6.9**	**7.0**
Exhaust CO_2 (% dry vol)	**11.3**	**11.2**	**11.3**	**11.3**
Exhaust Gas Flow Rate (dscfm)	**5,884**	**6,008**	**5,899**	**5,931**
Sample Volume (dscf)	**70.091**	**71.749**	**71.715**	**71.185**
Antimony (Sb) Emissions:				
• **mg/dscm**	**4.71E-03**	**5.37E-03**	**<6.03E-03**	**<5.37E-03**
• **lb/hr**	**1.04E-04**	**1.21E-04**	**<1.33E-04**	**<1.19E-04**
• **lb/ton of glass**	**1.40E-05**	**1.63E-05**	**<1.80E-05**	**<1.61E-05**
Arsenic (As) Emissions:				
• **mg/dscm**	**1.19E-01**	**1.30E-01**	**1.45E-01**	**1.31E-01**
• **lb/hr**	**2.62E-03**	**2.92E-03**	**3.20E-03**	**2.91E-03**
• **lb/ton of glass**	**3.55E-04**	**3.96E-04**	**4.33E-04**	**3.95E-04**
Beryllium (Be) Emissions:[a]				
• **mg/dscm**	**<3.63E-05**	**<3.54E-05**	**<3.55E-05**	**<3.57E-05**
• **lb/hr**	**<7.98E-07**	**<7.96E-07**	**<7.82E-07**	**<7.92E-07**
• **lb/ton of glass**	**<1.08E-07**	**<1.08E-07**	**<1.06E-07**	**<1.07E-07**
Cadmium (Cd) Emissions:				
• **mg/dscm**	**1.53E-02**	**<1.65E-02**	**2.00E-02**	**<1.91E-02**
• **lb/hr**	**3.36E-04**	**<3.71E-04**	**4.21E-04**	**<3.97E-04**
• **lb/ton of glass**	**4.55E-05**	**<5.03E-05**	**5.68E-05**	**<5.36E-05**
Chromium (Cr) Emissions:				
• **mg/dscm**	**1.20E-01**	**1.37E-01**	**1.32E-01**	**1.30E-01**
• **lb/hr**	**2.64E-03**	**3.08E-03**	**2.91E-03**	**2.88E-03**
• **lb/ton of glass**	**3.58E-04**	**4.18E-04**	**3.95E-04**	**3.90E-04**
Cobalt (Co) Emissions:				
• **mg/dscm**	**4.31E-04**	**4.48E-04**	**1.78E-04**	**3.53E-04**
• **lb/hr**	**9.49E-06**	**1.01E-05**	**3.93E-06**	**7.86E-06**
• **lb/ton of glass**	**1.29E-06**	**1.37E-06**	**5.33E-07**	**1.06E-06**
Copper (Cu) Emissions:				
• **mg/dscm**	**2.86E-02**	**3.00E-02**	**2.89E-02**	**2.92E-02**
• **lb/hr**	**6.29E-04**	**6.74E-04**	**6.38E-04**	**6.47E-04**
• **lb/ton of glass**	**8.53E-05**	**9.14E-05**	**8.64E-05**	**8.77E-05**
Lead (Pb) Emissions:				
• **mg/dscm**	**1.61**	**1.76**	**1.82**	**1.73**
• **lb/hr**	**3.53E-02**	**3.95E-02**	**4.01E-02**	**3.83E-02**
• **lb/ton of glass**	**4.79E-03**	**5.36E-03**	**5.44E-03**	**5.20E-03**
Manganese (Mn) Emissions:				
• **mg/dscm**	**4.00E-03**	**4.79E-03**	**4.08E-03**	**4.29E-03**
• **lb/hr**	**8.80E-05**	**1.08E-04**	**9.00E-05**	**9.52E-05**
• **lb/ton of glass**	**1.19E-05**	**1.46E-05**	**1.22E-05**	**1.29E-05**

'<' denotes results calculated using the MDL for front half and/or back half results that were non-detect.

[a] All sample fractions were below the MDL

TABLE 2 Continued: Furnace D (GM4) – Metals

TESTING PARAMETERS (Sb, As, Be, Cd, Co, Cu, Pb, Mn, Hg, Ni, Se)	Run 1	Run 2	Run 3	Average
Test Date	8/19/2020	8/19/2020	8/19/2020	--
Test Time	0816-1024	1107-1336	1413-1703	--
Mercury (Hg) Emissions:				
• mg/dscm	<3.16E-03	<2.88E-03	<3.01E-03	<3.02E-03
• lb/hr	<6.96E-05	<6.47E-05	<6.63E-05	<6.69E-05
• lb/ton of glass	<9.44E-06	<8.78E-06	<8.99E-06	<9.07E-06
Nickel (Ni) Emissions:				
• mg/dscm	4.84E-03	9.47E-03	6.49E-03	6.94E-03
• lb/hr	1.06E-04	2.13E-04	1.43E-04	1.54E-04
• lb/ton of glass	1.44E-05	2.89E-05	1.94E-05	2.09E-05
Selenium (Se) Emissions:				
• mg/dscm	9.36E-02	7.70E-02	1.07E-01	9.26E-02
• lb/hr	2.06E-03	1.73E-03	2.36E-03	2.05E-03
• lb/ton of glass	2.79E-04	2.35E-04	3.20E-04	2.78E-04
% Opacity (6-min averages)	5.4	6.1	6.3	5.9
Glass Production (tons/day)	177	177	177	177
Type of glass	Amber Red	Amber Red	Amber Red	Amber Red
% Cullet	45	45	45	45
Natural Gas Usage (kscf/hr)	22.8	22.7	22.4	22.6
Electric Boost (kWh/hour)	839	863	880	861
Bridgewall Temperature (°F)	2,819	2,827	2,824	2,823

'<' denotes results calculated using the MDL for front half and/or back half results that were non-detect.

TABLE 3: Furnace D (GM4) – Hexavalent Chromium

TESTING PARAMETERS (Cr^{+6})	Run 1[a]	Run 2	Run 3	Average
Test Date	8/19/2020	8/19/2020	8/19/2020	--
Test Time	0816-1024	1107-1336	1413-1703	--
Exhaust Gas Temperature (°F)	703	702	691	699
Exhaust Gas Moisture (%)	--	17.6	14.6	16.1
Exhaust Gas Flow Rate (dscfm)	--	5,880	5,950	5,915
Sample Volume (dscf)	--	69.410	69.119	69.264
Hexavalent Chromium (Cr^{+6}) Emissions:				
• mg/dscm	--	1.61E-04	1.57E-04	1.59E-04
• lb/hr	--	3.55E-06	3.50E-06	3.52E-06
• lb/ton of glass	--	4.82E-07	4.74E-07	4.78E-07
• % of Total Chromium	--	0.12	0.12	0.12

[a] Run 1 was excluded due to possible loss of sample.

VII) Comments & Concerns:

1) Test results show that the Owens-Brockway exceeded the Furnace D (GM4) Total Particulate Matter (PM) gr/dscf limit listed in permit condition 14.

2) Emissions of Total Particulate Matter, SO_2 and lead were found to be higher than Emission Factors provided in section 33.b.ii. of the permit.

3) Page 7. The emission factor listed for hexavalent chromium in Table 1-2 is not correct. 0.02 lb/ton glass melted is the metal HAP emission limit. No metal HAPs are used in the production of amber glass.

4) Page 10. Section 2.3 should specify that the glass production rate of 174.6 US tons per day was the 90th percentile of amber glass production over the last 12 months.

5) Page 14. The method options listed in Section 3.1.5 are not correct. The full Method 29 train was utilized and analysis was completed for antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, and selenium.

6) Page 19. The hexavalent chromium average contains the Run 1 results even though the note says it has been excluded. The Run 3 lb/hr and lb/ton glass melted results do not match the calculated values on page 86.

7) Pages 29-31. The barometric pressure recorded on the field data sheets is the sea level barometric pressure and not the stack elevation corrected barometric pressure.

VIII) Overall Evaluation: The test methods conducted and the data provided are sufficient to evaluate the emissions from the unit at the operating condition tested.

Test results show that the source **exceeded** the Total Particulate Matter grain loading limit of 0.10 gr/dscf (340-226-0210(2)(a)).

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