

APPENDIX B

**SOURCE TEST RESULTS FROM PETROLEUM REFINERY FLUIDIZED CATALYTIC
CRACKING UNITS THROUGHOUT THE UNITED STATES**

Air District staff reviewed available data on total particulate matter emissions from fluidized catalytic cracking units at refineries throughout the United States. A summary of the relevant data and results and is shown below in Table B.1.

Table B.1 – Source Test Results from Petroleum Refinery Fluidized Catalytic Cracking Units Throughout the United States

| Refinery/Unit | Agency | Test Methods | Test Date(s) | Total PM ₁₀ (gr/dscf) | Total PM ₁₀ @ 5% O ₂ (gr/dscf) | Primary PM Control Technology |
|---|------------------------------------|--------------------|---------------------|----------------------------------|--|-------------------------------|
| BP Whiting, IN - FCU 500 | US EPA | EPA 5 and 201A/202 | 6/9/11 & 8/2/11 | 0.020 | 0.016 | ESP |
| BP Whiting, IN - FCU 500 | Indiana DEM | EPA 201A/202 | 4/14/16 - 4/15/16 | 0.026 | 0.021 | ESP |
| BP Whiting, IN - FCU 500 | Indiana DEM | EPA 201A/202 | 8/16/16 - 8/18/16 | 0.020 | 0.016 | ESP |
| BP Whiting, IN - FCU 500 | Indiana DEM | EPA 201A/202 | 4/20/18 & 4/23/18 | 0.026 | 0.022 | ESP |
| BP Whiting, IN - FCU 500 | Indiana DEM | EPA 201A/202 | 6/5/19 - 6/6/19 | 0.016 | 0.014 | ESP |
| BP Whiting, IN - FCU 600 | Indiana DEM | EPA 201A/202 | 4/19/16 - 4/20/16 | 0.024 | 0.020 | ESP |
| BP Whiting, IN - FCU 600 | Indiana DEM | EPA 201A/202 | 8/22/16 - 8/23/16 | 0.019 | 0.016 | ESP |
| BP Whiting, IN - FCU 600 | Indiana DEM | EPA 201A/202 | 5/17/17 - 5/18/17 | 0.018 | 0.015 | ESP |
| BP Whiting, IN - FCU 600 | Indiana DEM | EPA 201A/202 | 4/25/18 - 4/26/18 | 0.009 | 0.007 | ESP |
| BP Whiting, IN - FCU 600 | Indiana DEM | EPA 201A/202 | 6/12/19 - 6/13/19 | 0.006 | 0.005 | ESP |
| Chevron Kapolei, HI | US EPA, Hawaii DOH | EPA 5 and 201A/202 | 6/24/11 - 6/26/11 | 0.014 | 0.014 | ESP |
| Chevron Salt Lake Refinery, UT | Utah DEQ | EPA 201A/202 | 12/10/14 | 0.009 | 0.007 | ESP |
| Chevron Salt Lake Refinery, UT | Utah DEQ | EPA 201A/202 | 8/3/17 | 0.026 | 0.022 | ESP |
| CITGO Corpus Christi East Refinery, TX | Texas CEQ | EPA 5/202 | 8/21/18 | 0.031 | 0.024 | ESP |
| CITGO - Lake Charles, LA | USEPA | EPA 5B/202 | 5/26/11 - 5/27/11 | 0.010 | N/A ^a | WGS |
| ExxonMobil Baton Rouge Refinery, LA | Louisiana DEQ | EPA 5/202 | 5/23/12 | 0.040 | 0.032 | WGS |
| ExxonMobil Baton Rouge Refinery, LA | Louisiana DEQ | EPA 5/202 | 11/21/13 - 11/22/13 | 0.032 | 0.026 | WGS |
| ExxonMobil Baton Rouge Refinery, LA | Louisiana DEQ | EPA 5/202 | 6/16/15 - 6/17/15 | 0.036 | 0.030 | WGS |
| ExxonMobil Baton Rouge Refinery, LA | Louisiana DEQ | EPA 5/202 | 11/18/15 | 0.027 | 0.023 | WGS |
| ExxonMobil Baton Rouge Refinery, LA | Louisiana DEQ | EPA 5/202 | 4/20/17 | 0.020 | 0.016 | WGS |
| ExxonMobil Baton Rouge Refinery, LA | Louisiana DEQ | EPA 5/202 | 11/15/17 | 0.032 | 0.026 | WGS |
| ExxonMobil Baton Rouge Refinery, LA | Louisiana DEQ | EPA 5/202 | 1/28/20 - 1/29/20 | 0.078 | 0.065 | WGS |
| ExxonMobil Torrance, CA | US EPA | EPA 201A/202 | 6/30/11 | 0.010 | 0.010 | ESP |
| Flint Hills Resources, LP - Pine Bend, MI | Minnesota Pollution Control Agency | EPA 201A/202 | 11/2/11 - 11/3/11 | 0.019 | 0.018 | ESP |

| Refinery/Unit | Agency | Test Methods | Test Date(s) | Total PM ₁₀ (gr/dscf) | Total PM ₁₀ @ 5% O ₂ (gr/dscf) | Primary PM Control Technology |
|--|------------------------------------|--------------|---------------------|----------------------------------|--|-------------------------------|
| Flint Hills Resources, LP - Pine Bend, MI | Minnesota Pollution Control Agency | EPA 201A/202 | 8/20/14 - 8/22/14 | 0.016 | N/A ^a | ESP |
| Flint Hills Resources, LP - Pine Bend, MI | Minnesota Pollution Control Agency | EPA 201A/202 | 6/27/17 - 6/29/17 | 0.019 | 0.018 | ESP |
| HollyFrontier Woods Cross, UT - Unit 4 FCC #1 | Utah DEQ | EPA 5B/202 | 12/20/12 | 0.004 | 0.004 | WGS |
| HollyFrontier Woods Cross, UT - Unit 4 FCC #1 | Utah DEQ | EPA 5/202 | 10/22/15 | 0.003 | 0.002 | WGS |
| HollyFrontier Woods Cross, UT - Unit 4 FCC #1 | Utah DEQ | EPA 5/202 | 10/2/14 - 10/3/14 | 0.005 | 0.004 | WGS |
| HollyFrontier Woods Cross, UT - Unit 25 FCC #2 | Utah DEQ | EPA 5/202 | 9/14/16 - 9/15/16 | 0.008 | 0.006 | WGS |
| HollyFrontier Woods Cross, UT - Unit 25 FCC #2 | Utah DEQ | EPA 5/202 | 10/31/17 | 0.010 | 0.009 | WGS |
| HollyFrontier Cheyenne Refining, WY | Wyoming DEQ | EPA 5/202 | 3/3/17 | 0.002 | 0.002 | WGS |
| HollyFrontier Cheyenne Refining, WY | Wyoming DEQ | EPA 5/202 | 11/8/17 | 0.007 | 0.006 | WGS |
| HollyFrontier Cheyenne Refining, WY | Wyoming DEQ | EPA 5/202 | 8/22/18 | 0.006 | 0.004 | WGS |
| HollyFrontier Cheyenne Refining, WY | Wyoming DEQ | EPA 5/202 | 7/24/19 | 0.008 | 0.007 | WGS |
| Hovensa - US Virgin Islands | US EPA | EPA 5/202 | 6/18/11 - 6/19/11 | 0.017 | 0.014 | WGS |
| Marathon - Robinson, IL | US EPA | EPA 5/202 | 7/19/11 | 0.028 | 0.026 | WGS |
| Marathon - Detroit, MI | US EPA | EPA 5F/202 | 4/24/12 | 0.033 | 0.028 | ESP |
| Marathon - Detroit, MI | US EPA | EPA 5F/202 | 4/25/12 | 0.025 | 0.021 | ESP |
| Marathon - Detroit, MI | US EPA | EPA 5F/202 | 4/26/12 | 0.026 | 0.022 | ESP |
| Marathon - Detroit, MI | Michigan DEQ | EPA 5F/202 | 11/18/14 | 0.019 | 0.017 | ESP |
| Marathon - Detroit, MI | Michigan DEQ | EPA 5F/202 | 11/19/14 - 11/20/14 | 0.022 | 0.019 | ESP |
| Marathon - Detroit, MI | Michigan DEQ | EPA 5F/202 | 9/1/15 | 0.027 | 0.022 | ESP |
| Marathon - Detroit, MI | Michigan DEQ | EPA 5F/202 | 8/30/16 - 8/31/16 | 0.043 | 0.035 | ESP |
| Marathon - Detroit, MI | Michigan DEQ | EPA 5F/202 | 8/31/16 - 9/1/16 | 0.042 | 0.035 | ESP |
| Marathon - Detroit, MI | Michigan DEQ | EPA 5F/202 | 2/28/17 | 0.030 | 0.025 | ESP |
| Marathon - Detroit, MI | Michigan DEQ | EPA 5F/202 | 2/13/18 - 2/14/18 | 0.035 | 0.033 | ESP |
| Marathon - Detroit, MI | Michigan DEQ | EPA 5F/202 | 3/13/19 | 0.012 | 0.010 | ESP |
| Marathon Refining - Galveston Bay, TX | Texas CEQ | EPA 5/202 | 6/30/16 | 0.020 | 0.018 | WGS |
| Marathon Refining - Garyville, LA | US EPA | EPA 5/202 | 3/18/14 - 3/19/14 | 0.010 | 0.008 | WGS |
| Marathon Refining - Garyville, LA | Louisiana DEQ | EPA 5/202 | 10/25/17 | 0.004 | 0.003 | WGS |
| Marathon Refining - Garyville, LA | Louisiana DEQ | EPA 5/202 | 11/6/18 | 0.004 | 0.004 | WGS |

| Refinery/Unit | Agency | Test Methods | Test Date(s) | Total PM₁₀ (gr/dscf) | Total PM₁₀ @ 5% O₂ (gr/dscf) | Primary PM Control Technology |
|--|---------------|---------------------|---------------------|--|---|--------------------------------------|
| Marathon Refining - Garyville, LA | Louisiana DEQ | EPA 5/202 | 10/12/19 | 0.005 | 0.004 | WGS |
| Sunoco - Girard Point Philadelphia, PA | US EPA | EPA 5/202 | 6/24/11 | 0.034 | N/A ^a | WGS |
| Tesoro Salt Lake City Refinery, UT | Utah DEQ | EPA 5/202 | 11/8/19 - 11/9/19 | 0.016 | 0.014 | WGS ^b |
| Tesoro Salt Lake City Refinery, UT | Utah DEQ | EPA 5/202 | 2/19/19 - 2/20/19 | 0.025 | 0.024 | WGS ^b |
| Tesoro Salt Lake City Refinery, UT | Utah DEQ | EPA 5/202 | 9/20/18 | 0.005 | 0.004 | WGS ^b |
| Tesoro Salt Lake City Refinery, UT | Utah DEQ | EPA 5/202 | 8/24/18 | 0.013 | 0.012 | WGS ^b |
| Tesoro Salt Lake City Refinery, UT | Utah DEQ | EPA 201A/202 | 8/8/17 | 0.041 | 0.037 | ESP |
| Tesoro Salt Lake City Refinery, UT | Utah DEQ | EPA 201A/202 | 8/18/16 | 0.022 | 0.020 | ESP |
| Tesoro Salt Lake City Refinery, UT | Utah DEQ | EPA 201A/202 | 7/7/15 | 0.019 | 0.017 | ESP |
| Tesoro Salt Lake City Refinery, UT | Utah DEQ | EPA 201A/202 | 7/11/12 | 0.030 | 0.034 | ESP |
| Valero - Port Arthur, TX | US EPA | EPA 5/202 | 6/13/11 - 6/14/11 | 0.008 | 0.007 | WGS |

^a No oxygen information available in source test report.

^b Tesoro Salt Lake City Refinery began operation of a WGS system to abate FCCU emissions in 2018.