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April 25, 2024

Brandon Hadzinsky
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Sent via email only

Brandon Hadzinsky,

PCC Structurals, Inc. Large Parts Campus (PCC-LPC) was called in to the Cleaner Air Oregon (CAO) program on October 4, 2019, and submitted an initial Emissions Inventory (Inventory) on January 2, 2020. Since that time, PCC-LPC has been working with DEQ to update the Inventory, including submitting a revised Inventory on September 3, 2020. In accordance with Oregon Administrative Rule (OAR) 340-245-0030(2), DEQ issued a written request on October 19, 2021, requiring additional information to be submitted by December 15, 2021 and source testing of baghouses to verify assumed control efficiencies by January 31, 2022. On December 1, 2021, PCC-LPC requested an extension for portions of the October 19, 2021, request until January 21, 2022. PPC-LPC submitted responses to the October 19, 2021, request on December 15, 2021, and January 21, 2022. On April 12, 2022, DEQ sent a letter to PCC regarding updates to the list of activities that qualify as Categorically Exempt Toxics Emissions Units (TEUs). PCC responded to the Exempt TEU request on May 27, 2022. DEQ reviewed confidential business information regarding the October 19, 2021, request in person on July 19 and September 26, 2023.

General Comments

In a letter dated October 19, 2021, DEQ requested PCC perform representative source testing of baghouses to verify assumed control efficiencies. There are several baghouses at this facility. Some baghouses are equipped with secondary filtration (e.g., High Efficiency Particulate Air (HEPA) or Ultra Low Particulate Air (ULPA) filters), and some control processes with operating conditions (e.g., temperature) that may impact removal efficiencies for some Toxic Air Contaminants (TACs). PCC conducted the source testing on June 27 – 30, 2023.

On December 21, 2023, PCC submitted three updated reports titled “Metals Emissions Test Report” for Baghouses 9203, 8901, and 9256. Removal efficiencies calculated from these reports did not meet the assumed control efficiency stated in the September 3, 2020, Emissions Inventory. Review memoranda and spreadsheets with DEQ calculated results for these reports are attached.

- Baghouse 8901 removal efficiencies ranged from -48% (hexavalent chromium CASRN 18540-29-9) to 99.94% (cobalt CASRN 7440-48-4).
- Baghouse 9256 removal efficiencies ranged from -205.8% (cadmium CASRN 7440-43-9) to 98.1% (copper CASRN 7440-50-8). Hexavalent chromium (CASRN 18540-29-9) and cobalt (CASRN 7440-48-4) also had negative removal efficiencies.
- Baghouse 9203 removal efficiencies ranged from 43% (manganese CASRN 7439-96-5) to 99.4% (nickel DEQ ID 365).

Specific Comments

DEQ has reviewed the Inventory and source test reports and identified additional updates that are needed before approval. In accordance with [OAR 340-245-0030(4)(b)](), please submit the information specified below by no later than **60 days** from the issuance of this letter, **by June 24, 2024**.

1. Proposal for revising emission estimates from baghouse and filter controlled activities: Given that the June 2023 source testing demonstrated significant decreases in control efficiencies from those reported in the Inventory, submit a proposal for revising the Inventory for all TEUs that exhaust to a baghouse. Estimates should be based on the best available data which should include the June 2023 source testing. The following are some items for consideration when developing this proposal:
   - The current control efficiencies in the Inventory, based on manufacturer data for control of Particulate Matter (PM) reported at 99.9% or greater, are not acceptable for individual TACs and are not approvable for the purposes of this Risk Assessment.
   - DEQ recommends using the outlet mass emission rates from the June 2023 source test data as opposed to control efficiencies for estimating TAC emissions. PCC may consider methods to apply this data to baghouses with similar processes as those included in the source test if applicable.
   - DEQ may consider allowing the use of the following approach provided that it includes appropriately conservative assumptions:
     - Emissions based on baghouse catch data or available, preferred activity-specific PM emission factors (e.g., RTI International[1]), coupled with a percent composition for TACs and that use TAC-specific control efficiencies based on June 2023 source testing.
   - In all cases, detailed references and justification must be provided for any proposed emission estimates.
   - PCC must use the corrected data provided in the attached spreadsheets for the June 2023 source test data.
   - Consider additional source testing to enhance the data set.
   - DEQ recommends setting up meetings to discuss the proposal prior to the submittal deadline.

2. Oil-Water Separators: Provide additional information on the oil-water separators to confirm these units are exempt. Include where and how the wastewater entering the oil-water separator is generated as well as the quantities of wastewater generated and wastewater composition data.

3. Acid Etch Tank: For the following acid etch tank TEUs please provide supporting documentation (such as ventilation system design) for the acid etch tank design component values used in equation 6.5-5 of "Preferred and Alternative Methods for Estimating Air Emissions from Semiconductor Manufacturing" dated February 1999, prepared by Eastern Research Group, Inc., as shown in Table 15 of the Revised potential to emit emissions inventory, submitted September 3, 2020.
   a. ETCH_LMA,
   b. ETCH_T, and
   c. ETCH_S

[1]Coburn, J., & Raymond, G. (2012). *Emission estimation protocol for iron and steel foundries: Version 1, Final*. U.S Environmental Protection Agency. (https://www.rti.org/publication/emission-estimation-protocol-iron-and-steel-foundries/fulltext.pdf).

4. Baghouses: Please update the following to reflect the current list and type of baghouses and their after-filters.
    a. Process flow diagram, and
    b. Site diagram

5. Heat Treat Ovens: Please provide details on the source of the emission factor for hexavalent chromium (CASRN 18540-29-9) for the following Heat Treat TEUs – only total Chromium was provided in source the test ("Emissions Test Report, PCC Structurals, Inc. Heat Treat Furnace #23 Engineering Tests" dated August 5, 2020, prepared by Bison Engineering, Inc.) referenced in the Emissions Inventory:
    a. HT_NG_VP_S, and
    b. HT_NG_AP_S

6. Wax Burnout Furnace: Provide Appendix C (Process Data) from the "Technical Report: Organic Emissions from Wax Burnout Furnace 44 at PCC Structurals, Inc." dated October 31, 2018, prepared by Bison Engineering, Inc. This entire Appendix was redacted.

7. Ammonia Gel Booth: During a site visit on November 16, 2023, DEQ staff detected an ammonia type odor on the roof near the wax reclaim stack. PCC staff indicated that the odor was likely from the "Ammonia Gel Booth". Please provide additional information on this emission unit and include it in the Inventory.

8. Investing: Provide supporting documentation for the hydrochloric acid (CASRN 7647-01-0) emission factor used for the Titanium Investing (INV_T) and Steel Investing (INV_S) TEUs including documentation of the previous permitting and calculations used to modify the previous permitting emission factor, if any.

9. Vacuum Casting: Provide additional supporting documentation for the control efficiencies assumed for the melting, pouring and cooling processes of vacuum casting for the following TEUs: VC_OP_TP, VC_DP_TP, VC_ST_P_VF3-4, VC_ST_P_MC1_M, VC_ST_P_MC1_C, VC_ST_I_VMM1, VC_ST_I_VMM2.

10. Burnout Ovens: For TEUs BURNOUT_NW_S and BURNOUT_NW_T, please provide data to support the engineering estimate for the emission factors listed. This data might include any bench or source test reports (provide name and date of the report and date submitted if this has been previously submitted to DEQ CAO Program), Safety Data Sheet (SDS) information, assumptions, or additional calculations used.

Please submit the information specified below by no later than **60 days from DEQ approval of the Emissions Inventory update proposal** discussed in the Specific Comment 1, above.

11. Potential to Emit (PTE) Calculations: Provide the following additional information in the PTE Calculations:
    a. Include TEU IDs in the PTE calculations to aid in review of these calculations as they apply to the Inventory.
    b. If data from a test report is used in the calculations, provide the name and date of the report. If "Engineering Estimate" is referenced in the calculations, provide information on the basis of the engineering estimate.
    c. Update the calculations and emissions for baghouse TEUs per the approved proposal (requested in Specific Comment 1).

12. Material percent composition values: When a range of material percentages is included in the Safety Data Sheet of an alloy or welding rod, be consistent with how the percent assumed is calculated (average or maximum are both acceptable).

13. Inventory Form: DEQ requires emissions inventories to be provided on the updated Emissions Inventory submittal form (previously AQ405, now AQ520). Revise the Inventory submittal form to be on the current version (AQ520) and as follows:
    a. Exhaust Points: On Tab 2 and Tab 3, include separate TEU IDs (line items) for each applicable "Stack or Fugitive ID" for all TEUs.
    b. Baghouses: Update the AQ520 form to reflect the current list and type of baghouses and their after-filters.
    c. Control Devices: On Tab 2, "unquantified" is listed as a control device for the WELD_S, WELD_TI, WELD_LSBSI, WELD_LSBSII, WELD_LMA, and WELD_TBS. If these TEUs are controlled, please specify the type of control equipment.
    d. Baghouses: Update the Inventory in accordance with the approved Emissions Inventory Update Proposal requested in Specific Comment 1.

14. Non-exempt TEUs: As detailed in PCC's letter dated May 27, 2022 regarding *Categorically Exempt Toxics Emissions Units – LPC*, DEQ concurs that the following TEUs are not exempt and must be added to the Inventory:
    a. Air cooling or ventilating equipment, and;
    b. Diesel fired emergency generator engines

15. Exempt TEUs: Based on information provided by PCC-LPC, DEQ concurs that the following TEUs are exempt in accordance with OAR 340-245-0060(3)(a). Include these exempt TEUs in the Inventory by listing them on Tab 2 of the AQ520 form. Emissions from these units do not need to be calculated:
    a. Chemical usage and welding activities in the maintenance and repair shop
    b. Diesel storage tanks (include number, size, and throughput of tanks either in AQ520 or as supporting documentation)
    c. Propane storage tank (include number, size, and throughput of tanks either in AQ520 or as supporting documentation)
    d. Pressurized tanks containing gaseous compounds (include number and size of tanks along with gaseous compounds either in AQ520 or as supporting documentation) and
    e. Industrial Cooling towers

16. Maximum Daily Emissions: For the following TEUs, the Inventory shows the maximum daily usage for these TEUs is assumed to be the annual usage divided by 365. This method assumes continuous use and does not take into account variability in daily usages. Pleasair ce either update the maximum daily usage to reflect worst case usage and provide supporting documentation to confirm the maximum daily usage, or confirm that usage is consistent throughout the year:
    a. Welding: WELD_S, WELD_TI, WELD_LSBSI, WELD_LSBSII, WELS_LMA, and WELD_TBS
    b. Investing: INV_S, and INV_T
    c. Molten Metal Insulation: HOT_TOP_ST
    d. Latex Burnout: BURNOUT_LTX_S
    e. Non-Wax Component Burnout: BURNOUT_NW_S, BURNOUT_NW_T,
    f. Wax Component Burnout: BURNOUT_W_S, BURNOUT_W_T
    g. Air Casting: AC_ST_I, SC_ST_P
    h. Autoclave: AUTOCLAVE_ST, AUTOCLAVE_T

i. Vacuum Casting: VC_DP_TP, VP_OP_TP, VC_ST_I_VMM1, VC_ST_I_VMM2, VC_ST_P_MC1_C, VC_ST_P_MC1_M, VC_ST_P_VF3-4
j. Grinding: GRIND_LMA, GRIND_TI_CONT
k. Heat Treat: HT_NG_AP_S, HT_NG_VP_S, HT_VAC_AP_S, HT_VAC_TP_LMA, HT_VAC_TP_S, HT_VAC_TP_TI, HT_VAC_VP_S

DEQ is requesting that you submit additional information to complete your Inventory. If you think that any of that information is confidential, trade secret or otherwise exempt from disclosure, in whole or in part, you must comply with the requirements in OAR 340-214-0130 to identify this information. This includes clearly marking each page of the writing with a request for exemption from disclosure and stating the specific statutory provision under which you claim exemption. Emissions data is not exempt from disclosure.

DEQ remains available to discuss this information request with you and answer any questions you may have. Failure to provide additional information, corrections, or updates to DEQ by the deadlines above may result in a violation of OAR 340-245-0030(1).

If you have any questions regarding this letter, please contact me directly (503-407-7596, heather.kuoppamaki@deq.oregon.gov), and I look forward to your continued assistance with this process.

Sincerely,

Heather Kuoppamaki, P.E.
Cleaner Air Oregon Project Manager

Encl: Memorandum Re: Source Test Review Report Baghouse 8901
Memorandum Re: Source Test Review Report Baghouse 9203
Memorandum Re: Source Test Review Report Baghouse 9256
Baghouse 8901 Source Test Summary Table
Baghouse 9203 Source Test Summary Table
Baghouse 9256 Source Test Summary Table

Cc: Tom Wood, Stoel Rives
Brian Eagle, MFA
David Graiver, DEQ
J.R. Giska, DEQ
File

State of Oregon

Department of Environmental Quality Memorandum

Date: 4/25/2024

To: File / Heather Kuoppamaki
From: Thomas Rhodes

Subject: Source Test Review Report
PCC Structurals, Inc.
Permit Number: 26-1867-ST-01

Test Dates: June 28-29, 2023
Report Received: September 29, 2023
Revised Report Received: December 21, 2023
Source Testers: Mostardi Platt
DEQ Observed: Yes

Source Description: Steel and titanium investing casting foundry.

Processes / Emissions Units Tested: Baghouse/HEPA 8901 which controls emissions from the ingot finishing operations in the Alloy Service Center, which include cutting and grinding activities.

Test Purpose: Compliance with the October 19, 2021 letter that was sent to PCC in accordance with OAR 340-245-0030(2) to perform representative source testing of baghouses to verify assumed control efficiencies for metal toxic air contaminants (TACs).

Testing Locations:

Baghouse 8901 Outlet:

Diameter:	12”
Distance A (Method 1):	>6” (>0.5 Diameters)
Distance B (Method 1):	>24” (>2.0 Diameter)
Number traverse points utilized:	24

Baghouse 8901 Inlet:

Diameter:	12”
Distance A (Method 1):	102” (8.5 Diameter)
Distance B (Method 1):	240” (20.0 Diameters)
Number traverse points utilized:	24

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

Flow Rate & Moisture Content: EPA Methods 1, 2 & 4
Metals: EPA Method 29
Hexavalent Chromium: EPA SW-846 Test Method 0061

Summary of Results: The testing parameters, test results and operating parameters are summarized in a separate spreadsheet.

Comments:

1) A full review was conducted on the test report. Emission calculations from all runs were checked for accuracy using raw values provided in the test report. The resulting DEQ emissions closely matched those stated in the test report except for barium and phosphorus. Calculations showing all blank corrections was not included in the revised test report as requested in the November 29, 2023 letter from DEQ, so the reported emissions for barium and phosphorus could not be verified.

2) Inlet and outlet test runs were not conducted simultaneously as required in the test plan approval letter. For Run 2, the inlet testing ended ten minutes before the outlet.

3) The distances from the outlet sampling location to upstream and downstream flow disturbances was not properly documented in the report. Example 1: The handwritten field data sheets on pages 71 and 76 recorded the number of diameters upstream from a disturbance as 7.5 and downstream from a disturbance as 72. Testing summary information on pages 47 and 52 claim the number of diameters upstream from a disturbance as 4.0 and downstream from a disturbance as 3.0. The table in Section 4.1 of the report lists the upstream diameters as >0.5 and the downstream as >2.0.

   Failure to properly document Method 1 measurements may result in rejection of source tests. From observations made during source testing, DEQ expects that the testing locations should meet the minimum requirements of EPA Method 1 of 0.5 diameters upstream of any flow disturbance and at least 2.0 diameters downstream.

4) Method 29 outlet testing did not achieve the proposed minimum sample volume of 320 dry standard cubic feet in the approved source test plan.

5) The actual In-Stack Detection Limits (ISDLs) for antimony, arsenic, beryllium and silver were greater than the estimated ISDLs in the approved source test plan.

6) The table in section 3.1 of the test report has a typo for the hexavalent chromium outlet emission rate. The correct Run 1 outlet emission rate of 8.57E-02 lb/hr is presented in the table in section 5.4 of the test report.

7) Outlet flowrates were noticeably lower than the inlet flowrates for the Method 29 test runs. The Method 29 testing had an average difference of 12%. Lower measured flowrates at the outlet will bias the calculated control efficiency high. The inlet flowrates were used to calculate the mass rates that were used for determining control efficiencies for Method 29 in the attached spreadsheet.

8) Hexavalent chromium mass rate was higher at the outlet than the inlet for Run 2.

9) High blank values and sample fractions below analytical detection limits restricts the list of metals that should be used for evaluating control efficiency to cadmium, chromium, cobalt, copper, manganese, nickel, zinc and hexavalent chromium. Further analysis can be done if needed to estimate control efficiencies for lead, mercury, silver and vanadium which had non-detects in one of the sample fractions.

Overall Evaluation: The source test data shows that the baghouse/HEPA does not achieve the assumed removal efficiency of 99.99997% for any metal TAC.

State of Oregon

Department of Environmental Quality Memorandum

Date: 4/25/2024

To: File / Heather Kuoppamaki
From: Thomas Rhodes

Subject: Source Test Review Report
PCC Structurals, Inc.
Permit Number: 26-1867-ST-01

Test Dates: June 27 & 30, 2023
Report Received: September 29, 2023
Revised Report Received: December 21, 2023
Source Testers: Mostardi Platt
DEQ Observed: Yes

Source Description: Steel and titanium investing casting foundry.

Processes / Emissions Units Tested: Baghouse/HEPA 9203 which controls emissions from cutting activities related to the cleaning process.

Test Purpose: Compliance with the October 19, 2021 letter that was sent to PCC in accordance with OAR 340-245-0030(2) to perform representative source testing of baghouses to verify assumed control efficiencies for metal toxic air contaminants (TACs).

Testing Locations:

Baghouse 9203 Outlets (6):

Diameter:	34”
Distance A (Method 1):	>68” (>2.0 Diameters)
Distance B (Method 1):	>17” (>0.5 Diameter)
Number traverse points utilized:	24

Baghouse 9203 Inlets (3):

Diameter:	36”
Distance A (Method 1):	>72” (>2.0 Diameter)
Distance B (Method 1):	>18” (>0.5 Diameters)
Number traverse points utilized:	24

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

Flow Rate & Moisture Content: EPA Methods 1, 2 & 4
Metals: EPA Method 29
Hexavalent Chromium: EPA SW-846 Test Method 0061

Summary of Results: The testing parameters, test results and operating parameters are summarized in a separate spreadsheet.

Comments:

1) A full review was conducted on the test report. Emission calculations from all runs were checked for accuracy using raw values provided in the test report. The resulting DEQ emissions closely matched those stated in the test report except for barium and phosphorus. Calculations showing all blank corrections was not included in the revised test report as requested in the November 29, 2023 letter from DEQ, so the reported emissions for barium and phosphorus could not be verified.

2) Inlet and outlet test runs were not conducted simultaneously as required in the test plan approval letter. Inlet and outlet test runs were started at the same time but did not end at the same time.

3) Beryllium and thallium were the only metals that were below the analytical detection limits for all sample fractions in all test runs.

4) The distances from the sampling locations to upstream and downstream flow disturbances were not properly documented in the report. There are also inconsistencies between the handwritten field data sheets and other pages in the report.

   Example 1. The handwritten field data sheets for the center inlet on pages 126 and 145 have no recorded measurements for upstream and downstream but page 56 claims an upstream of 18.0' and a downstream of 32.0' and page 69 says upstream of 1.0 diameters (3.0') and downstream of 8.0 diameters (24.0').

   Example 2. The outlet stack sheets on pages 75, 80, 85, 88, 155, 162, 169 and 174 give an upstream distance of either 7.5 diameters (21.3') or >0.5 diameters (1.4') and a downstream distance of either 72.0 diameters (204') or >2.0 diameters. From DEQ observations, the 7.5 and 72.0 diameters are not possible for the outlet stacks. It is likely that what appear to be 7s on the handwritten field data sheets are actually > symbols. For locations that are easily measurable such as the outlet stacks, it is not acceptable to simply record that the Method 1 distances are greater than then minimum distance required.

   Failure to properly document Method 1 measurements may result in rejection of source tests. From observations made during source testing, DEQ expects that the testing locations should meet the minimum requirements of EPA Method 1 of 0.5 diameters upstream of any flow disturbance and at least 2.0 diameters downstream.

5) The total outlet emission rates of aluminum and barium in the Tables in Section 3.1 and 3.3 were calculated only using the stacks tested with EPA Method 29 and does not take into account the flow from the other 4 outlet stacks. The correct total outlet emission rates for those metals are in the attached DEQ spreadsheet.

6) The reported Method 29 flowrates for the outlet East stack in Table 5.3.2 closely match DEQ calculated values but do not match the flow summaries in Section 5.5. It is unclear which flow rates were used to calculate the total outlet emission rates in Tables 3.1 and 3.3.

7) The total mass of mercury collected for both test runs at the outlet East stack do not match the DEQ calculated values. The total mass of mercury for the test runs reported on page 337 is less than the sum of the analytical fractions from the lab analysis on pages 269-271. The DEQ calculated values should be used instead of the source test report values.

8) The total mass of copper for Run 2 outlet East does not match the DEQ calculated value. The value reported on page 336 is significantly greater than the sum of the analytical fractions from

the lab analysis on pages 270-271. The DEQ calculated value should be used instead of the source test report value.

9) West Inlet hexavalent chromium Run 1 values in Table 5.2.1 match DEQ calculated values but the values are incorrect in summary Tables 3.1 and 3.2.

10) West Inlet hexavalent chromium Run 2, calculated sample volume on page 68 was revised as requested by DEQ using the documented sample volume from the field data sheet but the sample volume was not revised in the emission calculations on page 21.

11) DEQ calculated flowrates, sample volumes and sample mass closely match the Method 0061 on Outlets East and West, as calculated on pages 30 and 31 of the source test report but the concentration, lb/hr and lb/ton values do not. DEQ requested in the November 29, 2023 letter that the calculations be checked and revised as necessary, but no revisions were made.

Example: BH9203 Outlet West Run 1
Source test report sample volume: 357.472 dscf
Source test report sample mass: 0.94 ug
Concentration equals 2.63E-03 ug/dscf but the reported value on page 30 is 2.55E-03 ug/dscf

The DEQ calculated values for hexavalent chromium emissions should be used instead of the source test report values.

12) The cobalt lb/ton Run 1 Total Inlet value in the Table 3.2 does not match the DEQ calculated value. DEQ values closely match the individual inlet values in Tables 5.1.1, 5.1.2, and 5.1.3.

13) High blank values and sample fractions below analytical detection limits restricts the list of metals that should be used for evaluating control efficiency to cadmium, chromium, cobalt, manganese, nickel, zinc and hexavalent chromium. Further analysis can be done if needed to estimate control efficiencies for copper, lead, mercury and vanadium which had non-detects in one of the sample fractions.

Overall Evaluation: The source test data shows that the baghouse/HEPA does not achieve the assumed removal efficiency of 99.99997% for any metal TAC.

State of Oregon

Department of Environmental Quality Memorandum

Date: 4/25/2024

To: File / Heather Kuoppamaki
From: Thomas Rhodes

Subject: Source Test Review Report
PCC Structurals, Inc.
Permit Number: 26-1867-ST-01

Test Dates: June 28-29, 2023
Report Received: September 29, 2023
Revised Report Received: December 21, 2023
Source Testers: Mostardi Platt
DEQ Observed: Yes

Source Description: Steel and titanium investing casting foundry.

Processes / Emissions Units Tested: Baghouse/HEPA 9256 which controls emissions from the air casting process and the outfeed of the Master Caster furnace.

Test Purpose: Compliance with the October 19, 2021 letter that was sent to PCC in accordance with OAR 340-245-0030(2) to perform representative source testing of baghouses to verify assumed control efficiencies for metal toxic air contaminants (TACs).

Testing Locations:

Baghouse 9256 Outlet:

Diameter:	60”
Distance A (Method 1):	240” (4.0 Diameters)
Distance B (Method 1):	360” (6.0 Diameter)
Number traverse points utilized:	24

Baghouse 9256 Inlet:

Diameter:	60”
Distance A (Method 1):	160” (2.7 Diameter)
Distance B (Method 1):	78” (1.3 Diameters)
Number traverse points utilized:	40

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

Flow Rate & Moisture Content: EPA Methods 1, 2 & 4
Metals: EPA Method 29
Hexavalent Chromium: EPA SW-846 Test Method 0061

Summary of Results: The testing parameters, test results and operating parameters are summarized in a separate spreadsheet.

Comments:

1) A full review was conducted on the test report. Emission calculations from all runs were checked for accuracy using raw values provided in the test report. The resulting DEQ emissions closely matched those stated in the test report except for barium and phosphorus. Calculations showing all blank corrections was not included in the revised test report as requested in the November 29, 2023 letter from DEQ, so the reported emissions for barium and phosphorus could not be verified.

2) Inlet and outlet test runs were not conducted simultaneously as required in the test plan approval letter. For Run 1, the inlet testing started fifteen minutes after the outlet and ended at one hour and forty-six minutes after the outlet. For Run 2, the inlet testing ended ten minutes after the outlet.

3) Arsenic and beryllium were the only metals that were below the analytical detection limits for all sample fractions in all test runs.

4) Outlet flowrates were noticeably lower than the inlet flowrates for all test runs. The Method 29 testing had an average difference of 9%. Lower measured flowrates at the outlet will bias the calculated control efficiency high. The inlet flowrates were used to calculate the mass rates that were used for determining control efficiencies for Method 29 in the attached spreadsheet.

5) Cadmium mass rates were higher at the outlet than the inlet for both test runs. Cobalt and hexavalent chromium mass rates were higher at the outlet than the inlet for one of the two test runs. All analytical values were above the detection limits. Due to the nature of the samples and the analysis, it is unlikely that samples were mislabeled or the results transposed.

6) High blank values and sample fractions below analytical detection limits restricts the list of metals that should be used for evaluating control efficiency to cadmium, chromium, cobalt, copper, manganese, nickel, zinc and hexavalent chromium. Further analysis can be done if needed to estimate control efficiencies for lead, mercury and vanadium which had non-detects in one of the sample fractions.

7) Total metal poured during the source test was reported as 33,515 lbs over the two, 8 hour runs (28,850 air cast and 4,665 master caster). The maximum daily (24-hours) potential to emit (PTE) activity information included in form AQ405 (The Emissions Inventory) the three TEUs listed as emitting to baghouse 9256 is 27,396 lb metal poured. This includes steel parts air casting (TEU AC_ST_P) maximum daily metal poured reported as 5,479 lb, steel cast ingots air casting (TEU AC_ST_I) maximum daily metal poured reported as 2,739 lb metal poured, the steel parts vacuum casting, master caster 1 (VM_ST_P_MC1_C) maximum daily metal poured reported as 19,178 lb metal poured.

Overall Evaluation: The source test data shows that the baghouse/HEPA does not achieve the assumed removal efficiency of 99.99997% for any metal TAC.

	8901 Inlet			8901 Outlet			Removal %		
	Run 1	**Run 2**	**Average**	**Run 1**	**Run 2**	**Average**	**Run 1**	**Run 2**	**Average**
Date	6/28/2023	6/29/2023		6/28/2023	6/29/2023				
Start Time	9:05	6:40		9:05	6:40				
End Time	18:00	15:25		18:00	15:35				
Run length (min)	480	480		480	480				
Exhaust Gas Temperature (F)	78.1	73.6	**75.9**	87.0	81.6	**84.3**			
Exhaust Gas Moisture (%)	0.9	1.2	**1.1**	1.1	1.0	**1.0**			
Exhaust Gas Velocity (ft/m)	5638	4920	**5279**	4634	4597	**4616**			
Exhaust Gas Velocity (m/s)	28.6	25.0	**26.8**	23.5	23.4	**23.4**			
Exhaust Gas Flow Rate (dscf/m)	4,265	3,734	**4,000**	3,485	3,507	**3,496**			
Sample Volume (dscf)	412.423	361.219	**386.821**	299.382	301.090	**300.236**			
Tons metal processed (tons)	8.863	5.979	**7.421**	8.863	5.979	**7.421**			
Primary Filter dP ("H_2O)	0.4	0.4	**0.4**	0.4	0.4	**0.4**			
HEPA dP ("H_2O)	1.0	1.0	**1.0**	1.0	1.0	**1.0**			
Isokinetic Variation	99.3	99.3	**99.3**	100.7	100.7	**100.7**			
Aluminum Al Emissions:	--	--	--	--	--	--			
· mg/dscm	8.13E-01	1.30E-01	**4.72E-01**	6.46E-02	6.35E-02	**6.40E-02**			
· lb/hr	1.30E-02	1.81E-03	**7.39E-03**	8.41E-04	8.33E-04	**8.37E-04**			
· lb/ton	1.17E-02	2.42E-03	**7.06E-03**	7.60E-04	1.11E-03	**9.37E-04**			
Antimony Sb Emissions:	--	--	--	--	--	--			
· mg/dscm	< 1.23E-04	< 1.41E-04	**< 1.32E-04**	< 1.82E-04	< 1.80E-04	**< 1.81E-04**			
· lb/hr	< 1.97E-06	< 1.97E-06	**< 1.97E-06**	< 2.37E-06	< 2.36E-06	**< 2.36E-06**			
· lb/ton	< 1.77E-06	< 2.64E-06	**< 2.21E-06**	< 2.14E-06	< 3.15E-06	**< 2.64E-06**			
Arsenic As Emissions:	--	--	--	--	--	--			
· mg/dscm	< 8.30E-04	< 3.20E-04	**< 5.75E-04**	< 4.06E-04	< 4.02E-04	**< 4.04E-04**			
· lb/hr	< 1.32E-05	< 4.47E-06	**< 8.85E-06**	< 5.29E-06	< 5.27E-06	**< 5.28E-06**			
· lb/ton	< 1.19E-05	< 5.98E-06	**< 8.96E-06**	< 4.78E-06	< 7.06E-06	**< 5.92E-06**			
Barium Ba Emissions:	--	--	--	--	--	--			
· mg/dscm	4.39E-03	1.17E-03	**2.78E-03**	6.16E-04	2.86E-04	**4.51E-04**			
· lb/hr	7.01E-05	1.63E-05	**4.32E-05**	8.03E-06	3.75E-06	**5.89E-06**			
· lb/ton	6.32E-05	2.18E-05	**4.25E-05**	7.25E-06	5.01E-06	**6.13E-06**			
Beryllium Be Emissions:	--	--	--	--	--	--			
· mg/dscm	< 2.12E-05	< 7.04E-06	**< 1.41E-05**	< 9.08E-06	< 9.03E-06	**< 9.06E-06**			
· lb/hr	< 3.39E-07	< 9.83E-08	**< 2.18E-07**	< 1.18E-07	< 1.18E-07	**< 1.18E-07**			
· lb/ton	< 3.06E-07	< 1.31E-07	**< 2.19E-07**	< 1.07E-07	< 1.58E-07	**< 1.33E-07**			
Cadmium Cd Emissions:	--	--	--	--	--	--			
· mg/dscm	2.39E-04	4.07E-05	**1.40E-04**	1.30E-04	1.89E-05	**7.44E-05**			
· lb/hr	3.81E-06	5.68E-07	**2.19E-06**	1.69E-06	2.48E-07	**9.70E-07**	45.7%	53.6%	**49.6%**
· lb/ton	3.44E-06	7.60E-07	**2.10E-06**	1.53E-06	3.31E-07	**9.29E-07**			
Chromium Cr Emissions:	--	--	--	--	--	--			
· mg/dscm	1.24E+01	2.78E-01	**6.35E+00**	1.38E-02	1.12E-03	**7.48E-03**			
· lb/hr	1.98E-01	3.88E-03	**1.01E-01**	1.80E-04	1.46E-05	**9.75E-05**	99.9%	99.6%	**99.7%**
· lb/ton	1.79E-01	5.19E-03	**9.19E-02**	1.63E-04	1.96E-05	**9.12E-05**			
Cobalt Co Emissions:	--	--	--	--	--	--			
· mg/dscm	6.92E+00	1.12E-01	**3.52E+00**	3.50E-04	1.31E-04	**2.41E-04**			
· lb/hr	1.10E-01	1.57E-03	**5.59E-02**	4.56E-06	1.72E-06	**3.14E-06**	99.99%	99.88%	**99.94%**
· lb/ton	9.96E-02	2.10E-03	**5.08E-02**	4.12E-06	2.30E-06	**3.21E-06**			
Copper Cu Emissions:	--	--	--	--	--	--			
· mg/dscm	4.35E-03	5.86E-04	**2.47E-03**	7.51E-04	5.98E-04	**6.75E-04**			
· lb/hr	6.94E-05	8.17E-06	**3.88E-05**	9.79E-06	7.84E-06	**8.81E-06**	82.7%	-2.1%	**40.3%**
· lb/ton	6.26E-05	1.09E-05	**3.68E-05**	8.83E-06	1.05E-05	**9.66E-06**			
Lead Pb Emissions:	--	--	--	--	--	--			
· mg/dscm	6.95E-04	2.26E-04	**4.61E-04**	1.63E-04	< 1.04E-04	**< 1.33E-04**			
· lb/hr	1.11E-05	3.15E-06	**7.12E-06**	2.12E-06	< 1.36E-06	**< 1.74E-06**			
· lb/ton	1.00E-05	4.22E-06	**7.11E-06**	1.92E-06	< 1.82E-06	**< 1.87E-06**			
Manganese Mn Emissions:	--	--	--	--	--	--			
· mg/dscm	1.16E-02	3.13E-02	**2.15E-02**	3.97E-03	3.93E-03	**3.95E-03**			
· lb/hr	1.86E-04	4.36E-04	**3.11E-04**	5.17E-05	5.16E-05	**5.16E-05**	65.9%	87.4%	**76.7%**
· lb/ton	1.68E-04	5.84E-04	**3.76E-04**	4.67E-05	6.90E-05	**5.78E-05**			
Mercury Hg Emissions:	--	--	--	--	--	--			
· mg/dscm	< 5.60E-05	< 5.78E-05	**< 5.69E-05**	< 5.30E-05	< 5.73E-05	**< 5.51E-05**			
· lb/hr	< 8.93E-07	< 8.07E-07	**< 8.50E-07**	< 6.91E-07	< 7.51E-07	**< 7.21E-07**			
· lb/ton	< 8.06E-07	< 1.08E-06	**< 9.43E-07**	< 6.23E-07	< 1.00E-06	**< 8.14E-07**			
Nickel Ni Emissions:	--	--	--	--	--	--			
· mg/dscm	2.92E+01	7.94E-01	**1.50E+01**	1.23E-02	3.22E-03	**7.78E-03**			
· lb/hr	4.66E-01	1.11E-02	**2.38E-01**	1.61E-04	4.22E-05	**1.01E-04**	99.96%	99.6%	**99.8%**
· lb/ton	4.20E-01	1.48E-02	**2.18E-01**	1.45E-04	5.65E-05	**1.01E-04**			
Phosphorus P Emissions:	--	--	--	--	--	--			
· mg/dscm	3.19E-02	1.12E-02	**2.16E-02**	1.29E-02	1.20E-02	**1.24E-02**			
· lb/hr	5.09E-04	1.56E-04	**3.33E-04**	1.68E-04	1.57E-04	**1.63E-04**			
· lb/ton	4.60E-04	2.09E-04	**3.34E-04**	1.51E-04	2.11E-04	**1.81E-04**			
Selenium Se Emissions:	--	--	--	--	--	--			
· mg/dscm	3.46E-04	< 2.11E-04	**< 2.79E-04**	< 4.94E-04	< 2.93E-04	**< 3.94E-04**			
· lb/hr	5.51E-06	< 2.95E-06	**< 4.23E-06**	< 6.44E-06	< 3.84E-06	**< 5.14E-06**			
· lb/ton	4.98E-06	< 3.94E-06	**< 4.46E-06**	< 5.81E-06	< 5.14E-06	**< 5.48E-06**			
Silver Ag Emissions:	--	--	--	--	--	--			
· mg/dscm	7.38E-03	< 4.88E-04	**< 3.94E-03**	< 1.58E-03	< 1.48E-04	**< 8.63E-04**			
· lb/hr	1.18E-04	< 6.81E-06	**< 6.23E-05**	< 2.05E-05	< 1.95E-06	**< 1.12E-05**			
· lb/ton	1.06E-04	< 9.11E-06	**< 5.77E-05**	< 1.85E-05	< 2.60E-06	**< 1.06E-05**			
Thallium Tl Emissions:	--	--	--	--	--	--			
· mg/dscm	< 1.03E-04	< 1.18E-04	**< 1.11E-04**	< 1.71E-04	< 1.68E-04	**< 1.69E-04**			
· lb/hr	< 1.64E-06	< 1.65E-06	**< 1.65E-06**	< 2.23E-06	< 2.20E-06	**< 2.21E-06**			
· lb/ton	< 1.48E-06	< 2.21E-06	**< 1.84E-06**	< 2.01E-06	< 2.94E-06	**< 2.48E-06**			
Vanadium V Emissions:	--	--	--	--	--	--			
· mg/dscm	< 6.05E-03	< 3.86E-04	**< 3.22E-03**	< 1.12E-04	< 2.78E-05	**< 6.97E-05**			
· lb/hr	< 9.65E-05	< 5.39E-06	**< 5.10E-05**	< 1.45E-06	< 3.64E-07	**< 9.10E-07**			
· lb/ton	< 8.71E-05	< 7.21E-06	**< 4.72E-05**	< 1.31E-06	< 4.88E-07	**< 9.00E-07**			
Zinc Zn Emissions:	--	--	--	--	--	--			
· mg/dscm	2.13E-01	9.20E-03	**1.11E-01**	3.90E-03	3.55E-03	**3.73E-03**			
· lb/hr	3.40E-03	1.28E-04	**1.77E-03**	5.08E-05	4.66E-05	**4.87E-05**	98.2%	61.4%	**79.8%**
· lb/ton	3.07E-03	1.72E-04	**1.62E-03**	4.59E-05	6.23E-05	**5.41E-05**			

	8901 Inlet			8901 Outlet			Removal %		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Run	1	2		1	2				
Start Time	9:05	6:40		9:05	6:40				
End Time	18:00	15:25		18:00	15:35				
Run length (min)	480	480		480	480				
Exhaust Gas Temperature (F)	80.1	75.3	**77.7**	85.4	80.6	**83.0**			
Exhaust Gas Velocity (ft/m)	4569	5010	**4790**	4623	4591	**4607**			
Exhaust Gas Flow Rate (dscf/m)	3443	3791	**3617**	3487	3508	**3498**			
Cr Sample Volume (dscf)	360.103	397.785	**378.944**	375.669	377.876	**376.772**			
Isokinetic Variation	99.1	99.4	**99.2**	99.8	99.8	**99.8**			
Hex Cr Collected (mg)	0.0149704	0.0011504		0.0069804	0.0029604				
Hex Cr Emissions:	--	--	--	--	--	--			
· mg/dscm	1.47E-03	1.02E-04	**7.85E-04**	6.56E-04	2.77E-04	**4.66E-04**			
· lb/hr	1.89E-05	1.45041E-06	**1.02E-05**	8.57E-06	3.64E-06	**6.10E-06**	55%	-150.7%	**-48.0%**
· lb/ton	1.71E-05	1.94E-06	**9.52E-06**	7.74E-06	4.86E-06	**6.30E-06**			
· % of total Cr	0.01%	0.04%		4.7%	24.8%				

	9203 Inlet			9203 Outlet				Outlet 2 Run Average	
	Total	Total	Average	**Total**	RE	**Total**	RE		RE
	Run 1	**Run 2**		**Run 1**		**Run 2**			
Date	6/27/2023	6/30/2023		6/27/2023		6/30/2023			
Start Time				5:15		5:25			
End Time				13:13		13:35			
Sample Time	480	450	7.5	480		480			
Exhaust Gas Temperature (F)	69.5	72.5	71.0	71.2		75.7		**73.4**	
Exhaust Gas Moisture (%)	0.8	1.3	1	0.8		0.9		**0.9**	
Exhaust Gas Velocity (m/s)				17.4		17.1		**17.2**	
Exhaust Gas Flow Rate (dscf/m)	81,145	83,009	82,077	127,073		123,952		**125,513**	
Sample Volume (dscf)	386.690	371.320	379.005	386.773		389.552		**388.163**	
Tons metal processed (tons)	8.853	9.55	9.20	8.853		9.55		**9.20**	
Primary Filter West dP ("H_2O)				0.3		0.3		**0.3**	
HEPA West dP ("H_2O)				1.2		1.2		**1.2**	
Primary Filter East dP ("H_2O)				0.3		0.3		**0.3**	
HEPA East dP ("H_2O)				1.2		1.2		**1.2**	
Isokinetic Variation	100.2	100.1	100.1	100.7		100.5		**100.6**	
Aluminum Al Emissions:	--	--	--						
· lb/hr	2.18E-02	2.77E-02	2.47E-02	2.31E-02	-6%	2.18E-02	21%	**2.25E-02**	
· lb/ton	1.97E-02	2.18E-02	2.07E-02	2.10E-02		1.82E-02		**1.96E-02**	
Antimony Sb Emissions:	--	--	--	--		--		--	
· lb/hr	< 4.23E-05	< 4.71E-05	< 4.47E-05	< 6.63E-05	-57%	< 6.39E-05	-36%	**< 6.51E-05**	
· lb/ton	< 3.83E-05	< 3.70E-05	< 3.76E-05	< 6.03E-05		< 5.36E-05		**< 5.69E-05**	
Arsenic As Emissions:	--	--	--	--		--		--	
· lb/hr	< 1.05E-04	< 1.01E-04	< 1.03E-04	< 1.49E-04	-41%	< 1.42E-04	-40%	**< 1.45E-04**	
· lb/ton	< 9.51E-05	< 7.95E-05	< 8.73E-05	< 1.35E-04		< 1.19E-04		**< 1.27E-04**	
Barium Ba Emissions:	--	--	--	--		--		--	
· lb/hr	1.08E-03	2.38E-04	6.58E-04	3.59E-04	67%	1.18E-04	50%	**2.39E-04**	
· lb/ton	9.73E-04	1.87E-04	5.80E-04	3.27E-04		9.89E-05		**2.13E-04**	
Beryllium Be Emissions:	--	--	--	--		--		--	
· lb/hr	< 2.11E-06	< 2.26E-06	< 2.19E-06	< 3.36E-06	-59%	< 3.16E-06	-40%	**< 3.26E-06**	
· lb/ton	< 1.91E-06	< 1.77E-06	< 1.84E-06	< 3.05E-06		< 2.65E-06		**< 2.85E-06**	
Cadmium Cd Emissions:	--	--	--	--		--		--	
· lb/hr	9.89E-05	8.74E-05	9.31E-05	2.11E-05	78.6%	8.11E-06	91%	**1.46E-05**	**84.7%**
· lb/ton	8.93E-05	6.87E-05	7.90E-05	1.92E-05		6.79E-06		**1.30E-05**	
Chromium Cr Emissions:	--	--	--	--		--		--	
· lb/hr	3.97E-02	7.61E-02	5.79E-02	1.69E-04	99.6%	1.02E-03	98.7%	**5.92E-04**	**99.1%**
· lb/ton	3.59E-02	5.97E-02	4.78E-02	1.53E-04		8.51E-04		**5.02E-04**	
Cobalt Co Emissions:	--	--	--	--		--		--	
· lb/hr	3.56E-03	3.95E-03	3.75E-03	8.62E-06	99.8%	4.25E-04	89%	**2.17E-04**	**94.5%**
· lb/ton	3.22E-03	3.10E-03	3.16E-03	7.84E-06		3.56E-04		**1.82E-04**	
Copper Cu Emissions:	--	--	--	--		--		--	
· lb/hr	9.63E-03	1.85E-02	1.41E-02	4.28E-04	96%	< 9.81E-05	99.47%	**< 2.63E-04**	
· lb/ton	8.70E-03	1.46E-02	1.16E-02	3.89E-04		< 8.22E-05		**< 2.35E-04**	
Lead Pb Emissions:	--	--	--	--		--		--	
· lb/hr	< 7.58E-05	< 5.67E-05	< 6.63E-05	< 5.93E-05	22%	< 3.33E-05	41%	**< 4.63E-05**	
· lb/ton	< 6.85E-05	< 4.45E-05	< 5.65E-05	< 5.39E-05		< 2.79E-05		**< 4.09E-05**	
Manganese Mn Emissions:	--	--	--	--		--		--	
· lb/hr	1.82E-03	4.50E-03	3.16E-03	1.07E-03	41%	2.50E-03	44%	**1.78E-03**	**43.0%**
· lb/ton	1.65E-03	3.54E-03	2.59E-03	9.71E-04		2.09E-03		**1.53E-03**	
Mercury Hg Emissions:	--	--	--	--		--		--	
· lb/hr	< 1.43E-05	< 1.91E-05	< 1.67E-05	< 4.44E-05	-211%	< 3.18E-05	-66%	**< 3.81E-05**	
· lb/ton	< 1.29E-05	< 1.50E-05	< 1.40E-05	< 4.04E-05		< 2.66E-05		**< 3.35E-05**	
Nickel Ni Emissions:	--	--	--	--		--		--	
· lb/hr	1.80E-01	3.83E-01	2.82E-01	7.92E-04	99.6%	2.81E-03	99.3%	**1.80E-03**	**99.4%**
· lb/ton	1.63E-01	3.01E-01	2.32E-01	7.20E-04		2.35E-03		**1.54E-03**	
Phosphorus P Emissions:	--	--	--	--		--		--	
· lb/hr	3.75E-03	3.79E-03	3.77E-03	4.27E-03	-14%	4.26E-03	-12%	**4.26E-03**	
· lb/ton	3.39E-03	2.98E-03	3.18E-03	3.88E-03		3.57E-03		**3.72E-03**	
Selenium Se Emissions:	--	--	--	--		--		--	
· lb/hr	< 1.57E-04	< 7.30E-05	< 1.15E-04	< 1.39E-04	12%	< 1.15E-04	-58%	**< 1.27E-04**	
· lb/ton	< 1.42E-04	< 5.73E-05	< 9.96E-05	< 1.26E-04		< 9.67E-05		**< 1.11E-04**	
Silver Ag Emissions:	--	--	--	--		--		--	
· lb/hr	1.15E-04	< 6.73E-05	< 9.09E-05	< 3.31E-05	71%	< 3.15E-05	53%	**< 3.23E-05**	
· lb/ton	1.04E-04	< 5.29E-05	< 7.82E-05	< 3.01E-05		< 2.64E-05		**< 2.83E-05**	
Thallium Tl Emissions:	--	--	--	--		--		--	
· lb/hr	< 3.93E-05	< 4.18E-05	< 4.05E-05	< 6.12E-05	-56%	< 5.61E-05	-34%	**< 5.86E-05**	
· lb/ton	< 3.55E-05	< 3.28E-05	< 3.42E-05	< 5.56E-05		< 4.70E-05		**< 5.13E-05**	
Vanadium V Emissions:	--	--	--	--		--		--	
· lb/hr	< 1.04E-04	1.34E-04	< 1.19E-04	< 1.12E-05	89%	< 9.72E-06	93%	**< 1.05E-05**	
· lb/ton	< 9.43E-05	1.05E-04	< 9.97E-05	< 1.02E-05		< 8.14E-06		**< 9.17E-06**	
Zinc Zn Emissions:	--	--	--	--		--		--	
· lb/hr	9.27E-03	6.41E-03	7.84E-03	9.97E-04	89%	7.79E-04	88%	**8.88E-04**	**88.5%**
· lb/ton	8.38E-03	5.03E-03	6.70E-03	9.06E-04		6.53E-04		**7.79E-04**	
				--		--		--	

	9203 Inlet			9203 Outlet				Outlet 2 Run Average	
	Total	Total	Average	**Total**	RE	**Total**	RE		RE
	Run 1	**Run 2**		**Run 1**		**Run 2**			
Start Time				5:15		5:25			
End Time				13:33		13:25			
Run length (min)				480		470			
Exhaust Gas Temperature (F)	68.2	70.9	69.5	71.5		76.2		**73.9**	
Exhaust Gas Flow Rate (dscf/m)	81,123	81,126	81,125	125,283		121,566		**123,425**	
Cr Sample Volume (dscf)	381.917	358.373	370.1	370.179		357.157		**363.668**	
Isokinetic Variation	99.1	96.2	97.7	99.6		100.9		**100.2**	
Hex Cr Emissions:	--	--	--	--		--		--	
· lb/hr	3.16E-03	2.19E-03	2.67E-03	6.45E-05	98%	1.52E-04	93%	**1.08E-04**	**95.5%**
· lb/ton	2.85E-03	1.72E-03	2.29E-03	5.86E-05		1.27E-04		**9.29E-05**	
· % of total Cr	12.7%	5.3%	9.0%	38.2%		15.0%		**27%**	

	9256 Inlet			9256 Outlet			Removal %		
	Run 1	**Run 2**	**Average**	**Run 1**	**Run 2**	**Average**	**Run 1**	**Run 2**	**Average**
Date	6/28/2023	6/29/2023		6/28/2023	6/29/2023				
Start Time	3:45	3:30		3:30	3:30				
End Time	13:56	12:12		12:10	11:50				
Run length (min)	480	480		480	480				
Exhaust Gas Temperature (F)	95.9	97.7	**96.8**	98.9	100.4	**99.7**			
Exhaust Gas Moisture (%)	0.8	0.7	**0.7**	1.7	1.1	**1.4**			
Exhaust Gas Velocity (ft/m)	4817	4930	**4874**	4355	4533	**4444**			
Exhaust Gas Velocity (m/s)	24.5	25.0	**24.8**	22.1	23.0	**22.6**			
Exhaust Gas Flow Rate (dscf/m)	88,284	89,912	**89,098**	79,330	82,652	**80,991**			
Sample Volume (dscf)	467.565	473.060	**470.313**	368.404	381.431	**374.917**			
Pour Weight Air Cast (lb)	12020	16830	**14425**	12020	16830	**14425**			
Pour Weight Master Caster (lb)	4665	0	**2333**	4665	0	**2333**			
Total Pour Weight (lb)	16,685	16,830	**16,758**	16,685	16,830	**16,758**			
Total Hot Top (lb)	85	93	**89**	85	93	**89**			
Primary Filter dP ("H_2O)	1.2	1.1	**1.1**	1.2	1.1	**1.1**			
HEPA 1 dP ("H_2O)	2.3	2.3	**2.3**	2.3	2.3	**2.3**			
HEPA 2 dP ("H_2O)	1.4	1.4	**1.4**	1.4	1.4	**1.4**			
HEPA 3 dP ("H_2O)	1.0	0.9	**1.0**	1.0	0.9	**1.0**			
HEPA 4 dP ("H_2O)	0.4	0.4	**0.4**	0.4	0.4	**0.4**			
Isokinetic Variation	100.4	99.7	**100.0**	99.7	99.0	**99.3**			
Aluminum Al Emissions:	--	--	--	--	--	--			
· mg/dscm	2.26E-01	2.18E-01	**2.22E-01**	4.90E-02	4.92E-02	**4.91E-02**			
· lb/hr	7.46E-02	7.31E-02	**7.39E-02**	1.45E-02	1.52E-02	**1.49E-02**			
· lb/lb poured	3.58E-05	3.48E-05	**3.53E-05**	6.97E-06	7.23E-06	**7.10E-06**			
Antimony Sb Emissions:	--	--	--	--	--	--			
· mg/dscm	< 1.18E-04	< 1.15E-04	**< 1.17E-04**	< 1.40E-04	< 1.42E-04	**< 1.41E-04**			
· lb/hr	< 3.90E-05	< 3.87E-05	**< 3.89E-05**	< 4.14E-05	< 4.38E-05	**< 4.26E-05**			
· lb/lb poured	< 1.87E-08	< 1.84E-08	**< 1.86E-08**	< 1.98E-08	< 2.08E-08	**< 2.03E-08**			
Arsenic As Emissions:	--	--	--	--	--	--			
· mg/dscm	< 2.54E-04	< 2.45E-04	**< 2.49E-04**	< 3.16E-04	< 3.18E-04	**< 3.17E-04**			
· lb/hr	< 8.39E-05	< 8.22E-05	**< 8.31E-05**	< 9.37E-05	< 9.81E-05	**< 9.59E-05**			
· lb/lb poured	< 4.02E-08	< 3.91E-08	**< 3.97E-08**	< 4.49E-08	< 4.66E-08	**< 4.58E-08**			
Barium Ba Emissions:	--	--	--	--	--	--			
· mg/dscm	1.02E-03	1.92E-03	**1.47E-03**	1.03E-03	3.64E-04	**6.95E-04**			
· lb/hr	3.36E-04	6.45E-04	**4.91E-04**	3.05E-04	1.12E-04	**2.08E-04**			
· lb/lb poured	1.61E-07	3.07E-07	**2.34E-07**	1.46E-07	5.34E-08	**9.97E-08**			
Beryllium Be Emissions:	--	--	--	--	--	--			
· mg/dscm	< 5.66E-06	< 5.37E-06	**< 5.52E-06**	< 7.00E-06	< 7.13E-06	**< 7.06E-06**			
· lb/hr	< 1.87E-06	< 1.81E-06	**< 1.84E-06**	< 2.07E-06	< 2.20E-06	**< 2.14E-06**			
· lb/lb poured	< 8.96E-10	< 8.59E-10	**< 8.77E-10**	< 9.95E-10	< 1.05E-09	**< 1.02E-09**			
Cadmium Cd Emissions:	--	--	--	--	--	--			
· mg/dscm	1.77E-05	4.40E-05	**3.09E-05**	6.95E-05	9.67E-05	**8.31E-05**			
· lb/hr	5.86E-06	1.48E-05	**1.03E-05**	2.06E-05	2.99E-05	**2.52E-05**	-291.6%	-120.0%	**-205.8%**
· lb/lb poured	2.81E-09	7.02E-09	**4.92E-09**	9.88E-09	1.42E-08	**1.20E-08**			
Chromium Cr Emissions:	--	--	--	--	--	--			
· mg/dscm	7.37E-03	7.86E-03	**7.61E-03**	2.67E-04	2.86E-03	**1.56E-03**			
· lb/hr	2.43E-03	2.64E-03	**2.54E-03**	7.92E-05	8.83E-04	**4.81E-04**	96.4%	63.6%	**80.0%**
· lb/lb poured	1.17E-06	1.26E-06	**1.21E-06**	3.80E-08	4.20E-07	**2.29E-07**			
Cobalt Co Emissions:	--	--	--	--	--	--			
· mg/dscm	1.97E-04	2.64E-04	**2.31E-04**	1.74E-05	6.67E-04	**3.42E-04**			
· lb/hr	6.51E-05	8.88E-05	**7.70E-05**	5.17E-06	2.06E-04	**1.06E-04**	91.2%	-152.3%	**-30.6%**
· lb/lb poured	3.12E-08	4.22E-08	**3.67E-08**	2.48E-09	9.79E-08	**5.02E-08**			
Copper Cu Emissions:	--	--	--	--	--	--			
· mg/dscm	2.57E-02	3.13E-02	**2.85E-02**	5.05E-04	5.78E-04	**5.42E-04**			
· lb/hr	8.48E-03	1.05E-02	**9.50E-03**	1.50E-04	1.78E-04	**1.64E-04**	98.0%	98.2%	**98.1%**
· lb/lb poured	4.07E-06	5.00E-06	**4.53E-06**	7.19E-08	8.48E-08	**7.84E-08**			
Lead Pb Emissions:	--	--	--	--	--	--			
· mg/dscm	< 6.99E-04	< 3.97E-04	**< 5.48E-04**	< 7.17E-05	< 9.89E-05	**< 8.53E-05**			
· lb/hr	< 2.31E-04	< 1.34E-04	**< 1.82E-04**	< 2.13E-05	< 3.05E-05	**< 2.59E-05**			
· lb/lb poured	< 1.11E-07	< 6.35E-08	**< 8.71E-08**	< 1.02E-08	< 1.45E-08	**< 1.24E-08**			
Manganese Mn Emissions:	--	--	--	--	--	--			
· mg/dscm	5.96E-02	3.23E-02	**4.60E-02**	6.74E-04	2.31E-03	**1.49E-03**			
· lb/hr	1.97E-02	1.09E-02	**1.53E-02**	2.00E-04	7.14E-04	**4.57E-04**	98.9%	92.9%	**95.9%**
· lb/lb poured	9.43E-06	5.16E-06	**7.30E-06**	9.58E-08	3.39E-07	**2.18E-07**			
Mercury Hg Emissions:	--	--	--	--	--	--			
· mg/dscm	< 1.06E-04	< 4.09E-05	**< 7.35E-05**	< 6.69E-05	< 5.85E-05	**< 6.27E-05**			
· lb/hr	< 3.50E-05	< 1.37E-05	**< 2.44E-05**	< 1.98E-05	< 1.81E-05	**< 1.89E-05**			
· lb/lb poured	< 1.68E-08	< 6.53E-09	**< 1.17E-08**	< 9.51E-09	< 8.59E-09	**< 9.05E-09**			
Nickel Ni Emissions:	--	--	--	--	--	--			
· mg/dscm	1.36E-02	1.72E-02	**1.54E-02**	1.14E-03	1.19E-02	**6.54E-03**			
· lb/hr	4.49E-03	5.78E-03	**5.14E-03**	3.39E-04	3.69E-03	**2.01E-03**	91.6%	30.6%	**61.1%**
· lb/lb poured	2.15E-06	2.75E-06	**2.45E-06**	1.63E-07	1.75E-06	**9.58E-07**			
Phosphorus P Emissions:	--	--	--	--	--	--			
· mg/dscm	8.70E-03	8.88E-03	**8.79E-03**	1.02E-02	9.53E-03	**9.86E-03**			
· lb/hr	2.87E-03	2.98E-03	**2.93E-03**	3.02E-03	2.95E-03	**2.98E-03**			
· lb/lb poured	1.38E-06	1.42E-06	**1.40E-06**	1.45E-06	1.40E-06	**1.42E-06**			
Selenium Se Emissions:	--	--	--	--	--	--			
· mg/dscm	< 1.88E-04	< 1.61E-04	**< 1.75E-04**	< 2.92E-04	< 2.31E-04	**< 2.62E-04**			
· lb/hr	< 6.22E-05	< 5.42E-05	**< 5.82E-05**	< 8.67E-05	< 7.15E-05	**< 7.91E-05**			
· lb/lb poured	< 2.98E-08	< 2.58E-08	**< 2.78E-08**	< 4.16E-08	< 3.40E-08	**< 3.78E-08**			
Silver Ag Emissions:	--	--	--	--	--	--			

	9256 Inlet			9256 Outlet			Removal %		
	Run 1	**Run 2**	**Average**	**Run 1**	**Run 2**	**Average**	**Run 1**	**Run 2**	**Average**
· mg/dscm	8.14E-05	< 1.02E-04	**< 9.15E-05**	< 6.98E-05	< 1.17E-04	**< 9.35E-05**			
· lb/hr	2.69E-05	< 3.42E-05	**< 3.05E-05**	< 2.07E-05	< 3.62E-05	**< 2.85E-05**			
· lb/lb poured	1.29E-08	< 1.62E-08	**< 1.46E-08**	< 9.92E-09	< 1.72E-08	**< 1.36E-08**			
Thallium Tl Emissions:	--	--	--	--	--	--			
· mg/dscm	< 1.01E-04	< 9.03E-05	**< 9.58E-05**	< 1.19E-04	< 1.32E-04	**< 1.26E-04**			
· lb/hr	< 3.34E-05	< 3.04E-05	**< 3.19E-05**	< 3.52E-05	< 4.09E-05	**< 3.81E-05**			
· lb/lb poured	< 1.60E-08	< 1.44E-08	**< 1.52E-08**	< 1.69E-08	< 1.94E-08	**< 1.82E-08**			
Vanadium V Emissions:	--	--	--	--	--	--			
· mg/dscm	< 9.85E-05	< 1.36E-04	**< 1.17E-04**	< 2.26E-05	< 2.53E-05	**< 2.39E-05**			
· lb/hr	< 3.25E-05	< 4.57E-05	**< 3.91E-05**	< 6.71E-06	< 7.81E-06	**< 7.26E-06**			
· lb/lb poured	< 1.56E-08	< 2.17E-08	**< 1.86E-08**	< 3.22E-09	< 3.71E-09	**< 3.46E-09**			
Zinc Zn Emissions:	--	--	--	--	--	--			
· mg/dscm	8.70E-03	9.17E-03	**8.94E-03**	2.83E-03	1.48E-03	**2.15E-03**			
· lb/hr	2.87E-03	3.08E-03	**2.98E-03**	8.38E-04	4.58E-04	**6.48E-04**	67.5%	83.9%	**75.7%**
· lb/lb poured	1.38E-06	1.47E-06	**1.42E-06**	4.02E-07	2.18E-07	**3.10E-07**			

Run	1	2	Average	1	2	Average			
Start Time	3:45	3:30		3:30	3:30				
End Time	13:56	12:00		12:10	11:50				
Run length (min)	480	480		480	480				
Exhaust Gas Temperature (F)	99.5	101.6	**100.6**	97.9	99.1	**98.5**			
Exhaust Gas Velocity (ft/m)	4727	4738	**4732**	4490	4586	**4538**			
Exhaust Gas Flow Rate (dscf/m)	86075	85807	**85941**	81926	83817	**82872**			
Cr Sample Volume (dscf)	439.807	366.539	**403.173**	369.607	378.466	**374.037**			
Isokinetic Variation	99.8	100.0	**99.9**	98.9	99.0	**99.0**			
Hex Cr Emissions:	--	--	--	--	--	--			
· mg/dscm	1.31E-04	1.53E-04	**1.42E-04**	5.99E-04	6.57E-05	**3.32E-04**			
· lb/hr	4.22E-05	4.92E-05	**4.57E-05**	1.84E-04	2.06E-05	**1.02E-04**	-335.6%	58.1%	**-138.7%**
· lb/lb poured	2.02E-08	2.34E-08	**2.18E-08**	8.82E-08	9.81E-09	**4.90E-08**			
· % of total Cr	2%	2%		224%	2%				