ADVANCED INDUSTRIAL RESOURCES

RECEIVED
JUL 24 2018
AIR QUALITY DIVISION

COMPLIANCE TEST REPORT
SMELT DISSOLVING TANK
AT
VERSO ESCANABA LLC
ESCANABA, MICHIGAN
PROJECT ID: KR-9989

PREPARED FOR:

VERSO

Verso Escanaba LLC
7100 COUNTY ROAD 426
ESCANABA, MICHIGAN 49829

PREPARED BY:

ADVANCED INDUSTRIAL RESOURCES, INC.
3407 NOVIS POINTE
ACWORTH, GEORGIA 30101

Test Dates:
MAY 25, 2018

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

The Verso Escanaba LLC operates a pulp and paper mill in Escanaba, Michigan. Mill operations include the Smelt Dissolving Tank, which is subject to the requirements of the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) Number MI-ROP-A0884-2016.

Permit compliance testing was conducted on the Smelt Dissolving Tank (EUST15). Testing was conducted to determine mass flow rates and concentrations of particulate matter (total filterable) and total reduced sulfur (TRS).

The field sampling portion of the test program was conducted on May 25, 2018, in accordance with the site-specific Test Plan submitted to the MDEQ and the associated approval letter received from MDEQ by the facility, dated April 26, 2018. All test methods and procedures were performed by Advanced Industrial Resources, Inc. (*AIR*) in accordance with approved USEPA Methods (i.e., 40 CFR 60 Appendix A, Methods 1, 2, 3, 4, 5, and 16C) and 40 CFR 60 Subpart BB and 40 CFR 63 Subpart MM.

1.2 KEY PERSONNEL

The key personnel who coordinated the test program and their telephone numbers are:

Adam Becker, Verso Escanaba LLC	906-233-2929
Derek Stephens, *QSTI I-IV*, Advanced Industrial Resources	404-843-2100
Scott Wilson, Advanced Industrial Resources	800-224-5007

2.0 PROCESS AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION

The Smelt Dissolving Tank (EUST15) is used to regenerate chemicals used in the kraft process. The Smelt Dissolving Tank receives smelt from the #10 Recovery Furnace, which it mixes with weak wash to generate green liquor that is transported to the Recausticizing System. Emissions controls include a wet scrubber and mist eliminator.

2.2 SAMPLING LOCATION

The 6th Floor sampling location on the Smelt Dissolving Tank exhausts are located at 2.7 equivalent diameters downstream from the nearest flow disturbance and at 2.6 equivalent diameters upstream from the stack exhaust. The stack from the Smelt Dissolving Tank has a circular cross-section with an internal diameter of 48.0 inches. The exhaust stack has two sampling ports oriented 90 degrees to one another in a plane perpendicular to the exhaust flow direction. A schematic diagram of the sampling locations is presented in Appendix D. Twenty-four sampling points (twelve points per each port) were used for USEPA Methods 2, 3, 4, 5, and 16C sampling, in accordance with USEPA Method 1 requirements.

3.0 SUMMARY AND DISCUSSION OF TEST RESULTS

3.1 OBJECTIVES AND TEST MATRIX

Permit compliance testing was conducted on the Smelt Dissolving Tank (EUST15). Testing was conducted to determine mass flow rates and concentrations of particulate matter (total filterable) and total reduced sulfur (TRS).

3.2 FIELD TEST CHANGES AND PROBLEMS

The testing was conducted in accordance with the Site-Specific Test Protocol submitted to the MDEQ. No significant problems were encountered during testing that required deviation from the planned test protocol.

3.3 PRESENTATION OF TEST RESULTS

Emission rates and concentrations are summarized and compared to permit limits in Table 3-1. Emission concentrations and mass rates are presented in Appendix A. Reduced and tabulated data from the field-testing is included in Appendix B. The calculations and nomenclature used to reduce the data are presented in Appendix C. Actual raw field data sheets are presented in Appendix D. Laboratory reports and custody records are presented in Appendix E.

TABLE 3-1: Measured and Allowable Emissions

Pollutant	Average Measured	Allowable	Units	% of Allowable
PM	0.101	0.2	lb PM/ton black liquor solid	**50%**
	0.073	0.15	lb/1000 lb exhaust gases	**49%**
TRS	0.0027	0.0084	g/kg BLS	**32%**

3.3.1 SMELT DISSOLVING TANK PARTICULATE MATTTER TEST RESULTS

The MDEQ ROP Number MI-ROP-A0884-2016 establishes an emission limit of 0.20 pounds per ton of black liquor solids (lb PM/ton BLS) on EUST15. The emission rate of particulate matter was determined to be **0.101 lb PM/ton BLS, which is 50% of the allowable limit.** Thus, the EUST15 is operating within the PM emission rate limits established in Permit No. MI-ROP-A0884-2016.

The MDEQ ROP Number MI-ROP-A0884-2016 also establishes an emission limit of 0.15 pounds per 1000 pounds of exhaust gas (lbs/1000lbs of exhaust gas). The emission rate of the particulate emission was determined to be **0.073 lb/1000lb of exhaust gas, which is 49% of the allowable limit.** Thus, the EUST15 is operating within the PM emission rate limits established in Permit No. MI-ROP-A0884-2016.

3.3.2 SMELT DISSOLVING TANK TOTAL REDUCED SULFUR TEST RESULTS

The MDEQ ROP Number MI-ROP-A0884-2016 establishes a total reduced sulfur (TRS) concentration limit of 0.0084 grams per kilogram of black liquor solids (g/kg BLS). The emission rate of TRS was determined to be **0.0027 g/kg of BLS, which is 32% of the allowable emission limit**. Thus, the EUST15 is operating within the TRS emission rate limits established in Permit No. MI-ROP-A0884-2016.

3.4 PROCESS MONITORING

All essential process monitoring equipment on the Smelt Dissolving Tank exhaust points were operating properly and recording data throughout the test period and summarized below. Detailed process data is presented in Appendix G.

Run No.	Date & Time	BLS Production rate MMlbs/day	Steam Flow KPPH	Opacity %	Scrubber Fan Nozzle Flow gpm	Total Scrubber Flow gpm	Fan status (Run/off)
1	Start 5/25/2018 9:33 Stop 5/25/2018 10:37	3.72	542	5.26	66	141	Run
2	Start 5/25/2018 10:49 Stop 5/25/2018 11:55	3.72	541	6.24	61	132	Run
3	Start 5/25/2018 12:05 Stop 5/25/2018 13:10	3.72	537	6.35	64	136	Run

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Testing was conducted according to the methodology in the *Title 40 Code of Federal Regulation*, Part 60, Appendix A and in accordance to the Site-Specific Test Protocol and acceptance letter, as applicable. The following methods were employed for emission sampling and analyses:

- EPA Method 1 was used for the qualification of the location of sampling ports and for the determination of the number and positions of stack traverse points, as applicable to sample traverses for Method 2.

- EPA Method 2 was employed for the determination of the stack gas velocity and volumetric flow rate during stack sampling using the Type "S" Pitot tube.

- EPA Method 3 was used for the calculation of the density and dry molecular weight of the effluent stack gas.

- Method 4 was used for the determination of the moisture content of effluent stack gas.

- EPA Method 5 was used for determination of particulate matter emissions.

- EPA Method 16C was used for determination of total reduced sulfur emissions.

Method 5 was used for the determination of particulate matter emissions from stationary sources on the Smelt Dissolving Tank. Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature of 120 ± 14°C (248 ± 25°F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. The particulate matter mass, which includes any material that condenses at or above the filtration temperature, was determined gravimetrically after the removal of uncombined water.

Prior to each test run for particulate matter emissions, the sampling line was cleaned with distilled water, and a labeled pre-tarred glass-fiber filter was placed in the filter holder. The first two impingers were loaded with 100 mL each of water; the last impinger was loaded with 200 g of indicating silica gel; and the train was reassembled. After each test

run, the filter was recovered and stored in a labeled Petri dish, and the filter holder was rinsed with distilled water into a labeled sample bottle. The nozzle and probe liner were brushed and rinsed with distilled water, and the rinsing was added to the same sample bottle. Finally, the moisture collected in the impingers was measured, and the spent silica gel was stored in a labeled container. The final fluid level in the wash sample bottle was marked prior to shipment. All recovered filters and sample bottle were kept in a closed sample box until final laboratory analysis.

5.0 QUALITY ASSURANCE ACTIVITIES

5.1 INTERNAL QUALITY ASSURANCE

The quality assurance/quality control (QA/QC) measures associated with the sampling and analysis procedures given in the noted USEPA reference methodologies, in Subparts A of 40 *CFR* 60 and 40 *CFR 63*, and in the *USEPA QA/QC Handbook*, Volume III (EPA 600/R-94/038c) were employed, as applicable. Such measures include, but are not limited to, the procedures detailed below.

5.1.1 PARTICULATE MATTER FILTER PREPARATION

Particulate matter filters employed for the determination of particulate matter emissions per USEPA Method 5 are high-purity glass-fiber filters, without organic binder. These filters exhibit at least 99.95% efficiency of removal of 0.3-micron dioctyl phthalate smoke particles and are manufactured by Scientific Glass & Instruments, Inc.

All filters are conditioned before field use according to procedures given in Section 4.1.1 of USEPA Method 5. The glass-fiber filters are oven dried at 220 °F for 2 to 3 hours. Filters are then quickly transferred to an ambient-pressure desiccator cabinet maintained at laboratory temperatures of 68 ± 10 °F, where they are stored for not less than 24 hours, though only 2 hours is required. Filters are counted into groups of 15 and stored inside plastic Petri dishes, which are sealed with tape. After sample collection, each filter is collected individually, placed in a labeled Petri dish, and stored upright in the secure sample shipping box. After field sampling, one of the unused filters from this set of 15 is separated, placed individually in a labeled Petri dish, and stored upright with the other samples for use in the laboratory analysis blank.

5.1.2 PROBE NOZZLE DIAMETER CHECKS

Probe nozzles were calibrated before field testing by measuring the internal diameter of the nozzle entrance orifice along three different diameters. Each diameter was measured to the nearest 0.001 inch, and all measurements were averaged. The diameters were within the limit of acceptable variation of 0.004".

5.1.3 PITOT TUBE FACE PLANE ALIGNMENT CHECK

Before field testing, each Type S Pitot tube was examined in order to verify that the face planes of the tube were properly aligned, per Method 2 of 40 *CFR* 60, Appendix A. The external tubing diameter and base-to-face plane distances were measured in order to verify the use of 0.84 as the baseline (isolated) Pitot coefficient. At that time the entire probe assembly (i.e., the sampling probe, nozzle, thermocouple, and Pitot tube) was inspected in order to verify that its components met the interference-free alignment specifications given in USEPA Method 2. Because the specifications were met, then the baseline Pitot coefficient was used for the entire probe assembly.

After field testing, the face plane alignment of each Pitot tube was checked. No damage to the tube orifices was noted.

5.1.4 METERING SYSTEM CALIBRATION

Every three months each dry gas meter (DGM) console is calibrated at five orifice settings according to Method 5 of 40 *CFR* 60, Appendix A. From the calibration data, calculations of the values of Y_m and $\Delta H_@$ are made, and an average of each set of values is obtained. The limit of total variation of Y_m values is ± 0.02, and the limit for $\Delta H_@$ values is ± 0.20.

After field testing, the calibration of the DGM console was checked by performing three calibration runs at a single intermediate orifice setting that is representative of the range used during field-testing. Each DGM was within the limit of acceptable relative variation from Y_m of 5.0%.

5.1.5 TEMPERATURE GAUGE CALIBRATION

After field testing, the temperature measuring instruments on each sampling train was calibrated against standardized mercury-in-glass reference thermometers. Each indicated temperature was within the limit of acceptable variation between the absolute reference temperature and the absolute indicated temperature of 1.5%.

5.1.6 SAMPLING TRAIN LEAK CHECKS

Determinations of the leakage rate of the sampling train were made before and after each sampling run using the procedure detailed in Section 8.4.4 of USEPA Method 5. Before the sampling run, after the sampling train had been assembled and probe and filter box temperatures had time enough to settle at their appropriate operating values, the probe nozzle was plugged and the system evacuated to a pressure of 15 inches of Hg below ambient pressure. The volumetric leakage rate was measured by the dry gas meter over the course of one (1) minute. The leakage rate was less than 0.020 cfm for each run. After the sampling run, before the train was disassembled the probe nozzle was plugged and the system depressurized to a vacuum equal to or greater than the maximum value reached during the sampling run. The volumetric leakage rate was measured by the dry gas meter over the course of one (1) minute. The leakage rate was less than 0.020 cfm for Runs 1, 2 and 3, validating these runs.

The Type "S" Pitot tube assembly was also checked for leaks before and after sampling runs using the procedure in Section 3.1 of USEPA Method 2. The impact opening of the Pitot tube was blown through until a pressure of at least 3 inches of water registered on the manometer. The impact opening was quickly plugged and held for at least 15 seconds, during which time the manometer reading held. The same operation was performed on the static pressure side of the Pitot tube, except suction was used to obtain the pressure differential.

5.1.7 DATA REDUCTION CHECKS

AIR ran an independent check (using a validated computer program) of the calculations with predetermined data before the field test, and the *AIR* Team Leader conducted spot checks on-site to assure that data was being recorded accurately. After the test, *AIR* checked the data input to assure that the raw data had been transferred to the computer accurately. Flow rates, temperatures and moisture levels were relatively constant (variation <5%) during the three test runs, which indicates that data recording and Method 2 and 4 sampling and calculation errors are not likely.

5.2 EXTERNAL QUALITY ASSURANCE

5.2.1 TEST PROTOCOL EVALUATION

A Site-Specific Test Protocol (SSTP) was submitted to MDEQ in advance of testing, which provided regulatory personnel the opportunity to review and comment upon the test and quality assurance procedures used in conducting this testing.

5.2.2 ON-SITE TEST EVALUATION

A test schedule was submitted with the Site-Specific Test Protocol and MDEQ personnel were notified of all changes in the schedule. No tests were performed earlier than stated in the original schedule. Therefore, regulatory personnel were afforded the opportunity for on-site evaluation of all test procedures.

6.0 DATA QUALITY OBJECTIVES

The data quality objectives (DQOs) process is generally a seven-step iterative planning approach to ensure development of sampling designs for data collection activities that support decision making. The seven steps are as follows: (1) defining the problem; (2) stating decisions and alternative actions; (3) identifying inputs into the decision; (4) defining the study boundaries; (5) defining statistical parameters, specifying action levels, and developing action logic; (6) specifying acceptable error limits; and (7) selecting resource-effective sampling and analysis plan to meet the performance criteria. The first five steps are primarily focused on identifying qualitative criteria such as the type of data needed and defining how the data will be used. The sixth step defines quantitative criteria and the seventh step is used to develop a data collection design. In regards to emissions sampling, these steps have already been identified for typical monitoring parameters.

Monitoring methods presented in 40 *CFR* 63 indicate the following regarding DQOs: Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods. At a minimum, each method provides the following types of information: summary of method; equipment and supplies; reagents and standards; sample collection, preservation, storage, and transportation; quality control; calibration and standardization; analytical procedures, data analysis and calculations; and alternative procedures. These test methods have been designed and tested according to DQOs for emissions testing and analysis. These test methods have been specified and were followed in accordance to their specifications to ensure that DQOs were met for this project.