1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

The Verso Escanaba LLC operates a pulp and paper mill in Escanaba, Michigan. The facility is operated under the Michigan Department of Environment, Great Lakes, and Energy (EGLE) issued Renewable Operating Permit (ROP) Number MI-ROP-A0884-2016

Processes at the facility include a Bleach Plant Scrubber (FGB25) System and Thermal Oxidizer (FGT033) each of which are subject to the applicable operational requirements and HAP emission standards of the facility's ROP and 40 CFR 63 Subpart S – *National Emission Standards for Hazardous Air Pollutants from the Pulp and Paper Industry.*

A 5-year regulatory compliance test was conducted to determine compliance with applicable regulatory limits of the Bleach Plant Scrubber System and the Thermal Oxidizer.

The field sampling portion of the test program was conducted on June 17-18, 2020, in accordance with the site-specific Test Plan submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE). All test methods and procedures were performed by Advanced Industrial Resources, Inc. (*AIR*) in accordance with USEPA Methods (i.e., 40 CFR 60 Appendix A Methods 1, 2, 3A, 4, and 320) and the methodology described in 40 CFR Subpart S 63.457(b)(5)(ii) (aka *Method 26A modified* or NCASI 520).

1.2 KEY PERSONNEL

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

Adam Becker, Environmental Engineer, Verso Escanaba LLC	906- 233-2929
Bill Racine, PE, Environmental Manager, Verso Escanaba LL	906- 233-2772
Derek Stephens, Advanced Industrial Resources	404-843-2100
Scott Wilson, Advanced Industrial Resources	800-224-5007

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS & CONTROL EQUIPMENT DESCRIPTION

2.1.1 BLEACH PLANT SCRUBBER SYSTEM

Verso Escanaba LLC operates a Bleaching System (FGB25) which is used to whiten Brownstock pulp for papermaking. Gases from the pulp bleaching process are routed in a closed vent collection system to the Bleach Plant Scrubber System which consists of two (2) packed tower scrubbers in series. The BPS System is subject to the operational and emission standards established in 40 CFR 63 S 63.445(c). Specifically, 40 CFR 63 Subpart S 63.445(c) limits the emissions of total chlorinated HAPs to 10 ppmv.

2.1.2 THERMAL OXIDIZER

The facility also operates a Thermal Oxidizer System (FGTO33) which controls emissions from the LVHC and Soda Ash Storage Tank. The Thermal Oxidizer System receives and incinerates gases from enclosures and closed-vent systems. These are low volume high concentration (LVHC) noncondensable gases from the Evaporator System, Steam Stripping System, and the Digester System. The Thermal Oxidizer System uses a natural gas fired thermal oxidizer to oxidize the TRS compounds into SO_2. This is followed by a packed scrubber which uses a caustic scrubbing solution to control SO_2 emissions. The Lime Kiln serves as a back-up for the Thermal Oxidizer. The Thermal Oxidizer is subject to the operational and emission standards established in the facility's Title V ROP Flexible Group Conditions permit section and 40 CFR Subpart S 63.443(d)(2) which limits the total HAP emissions, measured as methanol, to 20 ppm corrected to 10% oxygen on a dry basis.

2.2 SAMPLING LOCATION

2.2.1 BLEACH PLANT SCRUBBER SYSTEM

The sampling location on the Bleach Plant Scrubber System exhaust does not meet EPA Method 1 requirements. Specifically, the sample location is positioned within a curved portion of the scrubber system exhaust duct work which precludes being able to conduct volumetric flow rate measurements in accordance with EPA Methods 2 and 4. Therefore, a single, centroidally positioned traverse point was utilized throughout sampling via 40 CFR 63 S 63.457(b)(5)(ii) (aka 'modified Method 26A' or NCASI 520) in order to obtain concentration based chlorine and chlorine dioxide emissions only.

2.2.2 Thermal Oxidizer

The sampling location on the Thermal Oxidizer exhaust is located approximately 5.5 equivalent diameters downstream from the nearest upstream flow disturbance and approximately 20.0 equivalent diameters upstream from the stack exhaust. The exhaust stack has a circular cross-section with an internal diameter of 48.0 inches. The stack has two sampling ports oriented on a 90 degree horizontal plane perpendicular to the exhaust flow direction. A schematic diagram of the sampling location is presented in Appendix D. Twelve sampling points (six points per port) were used for USEPA Method 2 velocity and temperature measurements, in accordance with USEPA Method 1. The centroid of the duct was used for conducting EPA Method 320 for methanol emission concentrations and moisture content of the gas stream.

3.0 SUMMARY AND DISCUSSION OF TEST RESULTS

3.1 OBJECTIVES

A 5-year renewal regulatory HAPs emissions test was conducted on facility's Bleach Plant Scrubber System and the Thermal Oxidizer. Testing was conducted to demonstrate compliance with the applicable emission standards established in the applicable sections of 40 CFR 63 Subpart S – *National Emission Standards for Hazardous Air Pollutants from the Pulp and Paper Industry*. The applicable Bleach Plant Scrubber System and Thermal Oxidizer operating parameter limits were also re-established during this testing.

3.2 FIELD TEST CHANGES AND PROBLEMS

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

3.3 PRESENTATION OF TEST RESULTS

Emission rates and concentrations are summarized and compared to permit limits in Table 3-1. 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 are presented in Appendix E.

3.4 PROCESS DATA

Process operating and control device parameters were monitored and recorded throughout the respective performance tests in order to establish applicable operating limits. The process operation and control device data that was collected during the testing is in Appendix G.

TABLE: 3-1 Results Summary

Source	Pollutant	Average Measured	Allowable	Units	% of Allowable
Bleach Plant Scrubber #2 Outlet	**Cl_2**	4.6	10	ppm	**46%**
Bleach Plant Scrubber #1 Exhaust (#2 Scrubber Inlet)	**Cl_2**	4.7	10	ppm	**47%**
Thermal Oxidizer Exhaust	**Methanol**	< 1.5	20	ppm-dry @ 10% O2	**< 6%**

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Emission rate testing was performed on the Bleach Plant Scrubber System exhaust and Thermal Oxidizer exhaust in accordance with 40 *CFR* 60 Appendix A, as applicable. Specifically:

- 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 3A was used for the calculation of the density and dry molecular weight of the effluent stack gas as well as to determine the oxygen and carbon dioxide concentrations using a calibrated instrumental analyzer.

- 40 CFR 63 S – 63.457(b)(5)(ii) – *Method 26A modified* was used for the determination of chlorine and chlorine dioxide concentrations on the Bleach Plant Scrubber System exhaust. Analysis via titration of each respective sample was conducted on-site within one (1) hour of concluding the respective sampling test runs. AIR purchased the standard titrant solution (0.010 N Sodium thiosulfate) from a reputable chemical manufacturing company.

    - 40 CFR 63 S – 63.457(b)(5)(ii) – *Method 26A modified* specifies sample rates to be between 200-250 mL/min, however EPA has supported sample rate increases up to 1000 mL/min as described in a letter dated August 29, 2001, from Gary McAlister (EPA) to Gary Lloyd (Roy F. Weston, Inc.). ***AIR* used a dry gas meter instead of a critical orifice and sample at approximately 500 mL/min.**

- EPA Method 320 (FTIR) was used to determine methanol (MeOH) emission concentrations and the exhaust gas stream moisture content on the Thermal Oxidizer.

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 EPA reference methodologies, in Subparts A of 40 *CFR* 60 and 40 *CFR 63*, and in the *EPA QA/QC Handbook*, Volume III (EPA 600/R-94/038c) were employed, as applicable. Such measures included, but were not limited to, the procedures detailed below.

5.1.1 Pitot Tube Face Plane Alignment

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 EPA 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.

5.1.2 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%.

5.1.3 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%.

5.1.4 FTIR QUALITY ASSURANCE

Quality assurance activities conducted prior to and throughout testing are delineated and documented in the raw data and FTIR Test Log file included in Appendices D & F, respectively. In addition to aligning the detector, assessing the peak analysis, conducting the mono calibration, establishing the NVS memory, configuring the FTIR, and running the Signal-to-Noise (SNL) test, the instrument was challenged with calibration gases including N2 (zero gas) as well upscale ethylene and methanol calibration gases. These responses were recorded and compared to the respective calibration gas bottle certified values. Additionally, just prior to and at the conclusion of each test run, ethylene and methanol calibration gases were injected through the entire system to assess bias. Spike recoveries were also conducted just prior to and at the conclusion of each test run where the combined calibration gas cylinder for Methanol and SF6 was diluted to 4% and the instruments response assessed.

5.1.5 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.

5.2 EXTERNAL QUALITY ASSURANCE

5.2.1 TEST PROTOCOL EVALUATION

A Site-Specific Test Protocol (SSTP) was submitted to the EGLE 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 EGLE 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. Ms. Lindsay Wells of the EGLE was present during Thermal Oxidizer emissions testing on June 17, 2020 to evaluate the testing.

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* 60 Appendix A 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 with the Site-Specific Test Protocol submitted to the EGLE to ensure that DQOs were met for this project.