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# Hanford Waste Treatment Plant Low Activity Waste Facility Stack Effluent Monitoring

## Sampling Probe Location Qualification Evaluation

April 2022

Julia E Flaherty  
Ernest J Antonio  
Carolynne A Burns  
Richard C Daniel  
Jennifer Yao

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Prepared for  
the U.S. Department of Energy  
under Contract DE-AC05-76RL01830

Pacific Northwest National Laboratory  
Richland, Washington 99354

## Summary

The Hanford Tank Waste Treatment and Immobilization Plant Low Activity Waste (LAW) facility stack monitor locations were qualified using scale model stacks to mitigate the risk of identifying that sampling locations do not meet the qualification criteria on the full-scale stack. As required by the American National Standards Institute/Health Physics Society (ANSI/HPS) N13.1-1999 standard, the scale model and its sampling location were geometrically similar to the actual stack and the Reynolds numbers for both the actual and model stacks were  $>10,000$ . An additional criterion is that the product of the hydraulic diameter and mean velocity (DV) of the full-scale stack must be between 1/6 DV and 6 DV of the scale model stack tests. Verification tests of the LAW stacks were performed at normal operating conditions. The minimum 1/6 DV value, along with the maximum 6 DV value from the scale model testing determines the range of stack flow rates for which the full-scale stack may be operated and remain in compliance with the stack verification criterion. Based on these DV values, the corresponding stack flow rates for each of the LAW stacks are as listed in Table S1.

Table S1. LAW Facility Stack Qualified Flow Range.

Stack Parameter	LV-S1	LV-S2	LV-S3	LV-C2
Minimum Qualified Stack Flow (scfm)	815	982	250	986
Maximum Qualified Stack Flow (scfm)	55,758	112,294	21,669	79,992

The remaining criteria for the stack verification to be considered valid involve the flow angle and velocity uniformity results. First, the flow angle at the full-scale stack must be  $\leq 20^\circ$ . Second, the velocity uniformity at the full-scale stack must be  $\leq 20\%$  coefficient of variance (COV). Finally, the velocity uniformity results for the actual and scale model stack tests must agree within 5% COV. These criteria were met through the full-scale stack tests at the LAW facility. Flow angle results were primarily less than  $10^\circ$ ; all flow angle results were within the  $\leq 20^\circ$  criterion. The velocity uniformity results for each test condition ranged between 1.5% COV and 9.2% COV, which were all within the range of the target % COV values from the scale model tests.

Based on these stack verification test results, the four LAW filtered exhaust stack sampling locations meet the qualification criteria provided in the ANSI/HPS N13.1-1999 standard for all fan operating configurations. This includes single-fan operating conditions for LV-S1 and LV-S2, dual-fan operations for LV-S3 at both the continuous air monitor and record sampler locations, and both the single-fan as well as the dual-fan operations for LV-C2. Further changes to the system configuration or operating conditions that are outside the bounds described in this report may require additional tests or analyses to determine compliance with the standard.

## Acknowledgments

This effort was performed under the project management of Mike Wentink of Bechtel National, Inc. (BNI). We acknowledge support from Ryan Cioli, Bill Jackson, and Clarke Respass from BNI in facilitating Pacific Northwest National Laboratory staff in observing the stack tests at the Low Activity Waste facility. We also acknowledge Zach Harding, Connor Everly, Jeremy Clark, and Kelly Dorsi from Bison Engineering, Inc., who performed their work with PNNL staff observing in the field during testing and asking questions.

The quality assurance measures employed to produce this document include oversight and guidance from our quality engineer, David MacPherson, as well as independent reviews from Xiao-Ying Yu. Chrissy Charron provided administrative support for this effort. Finally, Cary Counts served as the technical editor for this document.

## Acronyms and Abbreviations

% COV	percent coefficient of variation
acfm	actual cubic feet per minute, an air volume flow unit at actual conditions
ANSI	American National Standards Institute
BNI	Bechtel National, Inc.
CAM	continuous air monitor
CFR	Code of Federal Regulations
DV	product of the hydraulic diameter and the mean velocity
EPA	Environmental Protection Agency
HPS	Health Physics Society
LAW	Low Activity Waste (facility)
LV-C2	WTP Low Activity Waste Facility C2V ventilation system exhaust stack
LV-S1	WTP Low Activity Waste Facility C3V ventilation system exhaust stack
LV-S2	WTP Low Activity Waste Facility C5V ventilation system exhaust stack
LV-S3	Stack for the combined melter offgas /vessel vent exhaust system of the WTP Low Activity Waste Facility
M&TE	measuring and test equipment
NESHAP	National Emissions Standards for Hazardous Air Pollutants
PNNL	Pacific Northwest National Laboratory
RS	record sampler
scfm	standard cubic feet per minute, an air volume flow unit at standard air density (standard conditions used here are 68°F and 14.7 psia)
sfp	standard feet per minute, an air velocity unit at standard air density (standard conditions used here are 68°F and 14.7 psia)
WTCC	Waste Treatment Closure Company LLC
WTP	Hanford Tank Waste Treatment and Immobilization Plant
WTPSP	Waste Treatment Plant Support Project

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## 1.0 Introduction

Stack verification tests were performed by a Bechtel National, Inc. (BNI)/Waste Treatment Completion Company contractor at the exhaust stack monitoring location of the Hanford Tank Waste Treatment and Immobilization Plant (WTP) Low Activity Waste (LAW) facility stack to evaluate whether it meets the applicable regulatory criteria (i.e., Washington Administrative Code, Chapter 246-247) governing effluent monitoring systems.

Emissions from three out of the four LAW facility air exhaust stacks are estimated to remain below the 0.1-millirem per year threshold limit given in Title 40 of the Code of Federal Regulations (CFR), Part 61, National Emissions Standards for Hazardous Air Pollutants (NESHAP), Subpart H, National Emissions Standard for Emissions of Radionuclides Other than Radon from Department of Energy Facilities. However, continuous emissions sampling is planned for the first year of stack operations for all four LAW facility stacks. The NESHAP rule requires that a sampling probe be located in the exhaust stack according to criteria established by the American National Standards Institute/Health Physics Society (ANSI/HPS) N13.1-1999, Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stack and Ducts of Nuclear Facilities. Compliance with the standard is demonstrated through a series of tests as described in the standard. This standard allows, under certain conditions, for results from previously tested stacks to be used instead of a full series of tests at the facility stack. For the LAW facility stacks, previous scale model test results were used, and verification tests were performed on the full-scale stack.

While a contractor to BNI performed the verification tests, Pacific Northwest National Laboratory (PNNL) provided guidance for these tests, performed data reduction following the tests, and produced this report to provide an assessment of the compliance of the stack sampling location. PNNL previously performed the scale model tests that served as the basis for these full-scale stack verification tests. This prior involvement put PNNL in a unique position to provide the data reduction rigor and process insight to evaluate these stack verification results. This document provides stack flow information, details of the stack qualification criteria, and a review of the scale model tests. Section 2 describes the verification test methods, while Section 3 describes the results of these tests. Section 4 compares the results from the verification tests against the scale model test results, while conclusions are summarized in Section 5.

The four LAW facility stacks exhaust air from general building ventilation, process areas, non-process areas, and melter offgas/vessel vent process systems. Stack LV-S1 ventilates hoods and maintenance (C3) areas; LV-S2 ventilates hot cells and glovebox (C5) areas; LV-S3 ventilates melter off-gas and vessel vent processes; and LV-C2 ventilates non-process (C2) areas. Table 1 provides information about the LAW stack operations. Each ventilation system has an extra fan available on standby for back-up or maintenance needs. Velocity and flow values presented in this document use standard units, and standard conditions used is 68°F and 14.7 psia.

Table 1. LAW Facility Stack Design Parameters as of February 2018

Stack Parameter	LV-S1 <sup>a</sup>	LV-S2 <sup>b</sup>	LV-S3 <sup>c</sup>	LV-C2 <sup>d</sup>
Discharge diameter (in.)	48	60	18	60
Duct diameter at sampling probes (in.)	48	60	18	60
Number of duct diameters from full-scale test port to upstream disturbance <sup>e</sup>	16.4	18.2	35.4 / 43.1 <sup>f</sup>	10.2
Total available fans	2	2	3	2
Number of operating fans	1	1	2	1
Maximum flow rates (scfm)	48,000	63,000	4,230	62,800
Normal operating flow rates (scfm)	37,905	49,840	3,805	50,680

a. DS No: 24590-LAW-JFD-SDJ-21040, Rev 4 (available from PNNL)

b. DS No: 24590-LAW-JFD-SDJ-21080, Rev 3 (available from PNNL)

c. DS No: 24590-LAW-JFD-SDJ-21130, Rev 2 (available from PNNL)

d. DS No: 24590-LAW-JFD-SDJ-21010, Rev 4 (available from PNNL)

e. Based on values recorded in Bison Engineering (Bison Engineering, Inc. 2022. Low-Activity Waste Facility Flow Verification. 24590-CM-HC4-HX00-00007-01-00008 Rev 00B. Helena, Montana)

f. LV-S3 distances for the record sampler and continuous air monitor locations, respectively.

## 1.1 Qualification Criteria

The qualification criteria for an air monitoring probe location are taken from ANSI/HPS N13.1-1999 and are paraphrased as follows:

1. *Angular Flow* – Sampling nozzles usually are aligned with the axis of the stack. If the air travels up the stack in a cyclonic fashion, the air velocity vector approaching a sampling nozzle could be sufficiently misaligned with the nozzle to impair extraction of particles. The average of the flow angle measurements, made at the several discrete points in the duct cross section at the position of the sampling nozzle, should not exceed 20° relative to the sampling nozzle axis.
2. *Velocity Uniformity* – The air velocity must be uniform across the stack cross section where the sample is extracted. The air velocity is measured at the same grid of points as the flow angle measurements. Uniformity is expressed as the variability of the measurements about the mean. This is expressed using the percent coefficient of variation (% COV),<sup>1</sup> which is the standard deviation divided by the mean and expressed as a percentage. The lower the % COV value, the more uniform the velocity. The acceptance criterion is that the air velocity must be ≤20% COV in the center two-thirds of the duct cross section at the sampling probe location.
3. *Gaseous Tracer Uniformity* – A uniform contaminant concentration in the sampling plane enables the extraction of samples that represent the true concentration within the duct. The uniformity of the concentration is first tested using a tracer gas to represent gaseous effluents. The fan is a good mixer, so injecting the tracer downstream of the fan provides worst-case results. The qualification criteria are that 1) the measured tracer gas concentration is ≤20% COV across the center two-thirds of the duct cross section at the sampling location and 2) the concentrations at any of the measurement points cannot deviate from the mean by >30%.

<sup>1</sup> *Coefficient of variation* is also known as *percent relative standard deviation*. The standard uses the term *coefficient of variation*, so it will likewise be used here.

4. *Particulate Tracer Uniformity* – The second set of tests addressing contaminant concentration uniformity at the sampling position uses tracer particles large enough to exhibit inertial effects. Tracer particles of 10- $\mu$ m aerodynamic diameter are used by default unless it is known that larger contaminant particles will be present in the airstream. The acceptance criterion is that the particle concentration is  $\leq 20\%$  COV across the center two-thirds of the duct at the sampling location.

Tests to determine if Criteria 1 through 4 are met have been conducted on scale model stacks of the exhaust ductwork and stacks from the fans to the planned position of the sampling probes. Scale model test results are documented in Glissmeyer, Antonio, Flaherty, and Amidan (2014); Glissmeyer, Antonio, and Flaherty (2015); and Glissmeyer, Flaherty, and Piepel (2011). The ANSI/HPS N13.1-1999 standard sets additional acceptance criteria for the use of a scale model (or another, similar stack) as a substitute for the actual stack. The criteria for the use of substitute stacks are:

- The scale model and its sampling location must be geometrically similar to the actual stack.
- The product of the hydraulic diameter and the mean velocity (DV) for the candidate stack must be within a factor of six of that of the tested stack, and the hydraulic diameters of the stack must be at least 250 mm at the sampling location.
  - For clarity, the DV requirement can be expressed as:  $1/6 \text{ DV of scale model stack} \leq \text{DV of full-scale stack} \leq 6 \text{ DV of scale model stack}$ .
- The Reynolds number for the actual and model stacks must be  $>10,000$ .

Finally, the scale model results are considered valid if measurements on the full-scale stack show:

- The flow angle criterion (with a mean value  $\leq 20^\circ$ ) is met.
- The velocity uniformity criterion (with  $\leq 20\%$  COV) is met.
- The velocity uniformity results for the actual and model stacks agree within 5% COV.

## 1.2 Scale Model Tests

Scale model tests have been performed at PNNL using primarily 12-in.-diameter ducting to represent each of the LAW facility stacks. Glissmeyer, Antonio, Flaherty, and Amidan (2014); Glissmeyer, Antonio and Flaherty (2015); and Glissmeyer, Flaherty, and Piepel (2011) report on the complete set of tests that were performed with the scale model stacks. This includes tests of flow angle, velocity uniformity, gaseous tracer uniformity, and particulate tracer uniformity. Tests were performed for a range of conditions, including different combinations of fans and flow rates to account for the range of operating conditions that were reported by BNI at the time of the scale model tests. Test matrices for the scale model tests were designed to provide information concerning the well-mixed nature of the sampling location for each stack. That is, different stack operating condition attributes were varied with different fixed operating conditions so that, in total, the full range of conditions were considered. For example, while three port locations may have been tested, each port location may not have been tested with every fan condition or operating flow rate. The resultant data were therefore used to confirm that the stack location is qualified for well-mixed sampling and monitoring.

Table 2 presents a summary of the duct diameter and range of velocity values measured during the velocity uniformity tests performed with the LAW facility scale model stacks. For consistency with the stack data sheets for these stacks and also with verification test results, the velocity values are presented in standard units (i.e., standard feet per minute [sfpm]; the standard conditions used here are 68°F and 14.7 psia).

**Table 2. Summary of the Acceptable Ranges of Diameter x Velocity Products from LAW Scale Model Stacks**

Stack	Diameter (in.)	Velocity Range (sfpm)	1/6 DV (ft <sup>2</sup> /min)	6 DV (ft <sup>2</sup> /min)
LV-S1	11.8	1,581–2,997	259	17,748
LV-S2	12.0	1,501–4,769	250	28,540
LV-S3	11.9	1,355–3,261	224	19,439
LV-C2	11.9	1,514–3,410	251	20,329

Note: Because the stack diameter is nominally 1 ft, the Velocity Range column, based on the range of velocities from the velocity uniformity tests, is essentially equivalent to the DV.

### 1.3 Quality Assurance

Work performed by PNNL staff documented in this report was performed in accordance with the Waste Treatment Plant Support Program (WTPSP) Quality Assurance Plan and associated procedures. The WTPSP implements the requirements of ASME NQA-1-2000, Quality Assurance Requirements for Nuclear Facility Applications, graded on the approach presented in NQA-1-2000, Subpart 4.2, Guidance on Graded Application of Quality Assurance (QA) for Nuclear-Related Research and Development.

The WTPSP works in conjunction with PNNL's laboratory-level Quality Management Program, which is based upon the requirements as defined in the U.S. Department of Energy Order 414.1D, Quality Assurance, and 10 CFR 830, Nuclear Safety Management, Subpart A, Quality Assurance Requirements. PNNL implements these requirements with a graded approach using the consensus standard ASME NQA-1-2000, Quality Assurance Requirements for Nuclear Facility Applications, graded on the approach presented in NQA-1-2000, Subpart 4.2, Guidance on Graded Application of Quality Assurance (QA) for Nuclear-Related Research and Development.

The WTPSP QA Plan describes the technology life cycle stages, which include the progression of technology development, commercialization, and retirement in process phases of basic and applied research and development, engineering and production, and operation until process completion. The work described in this report has been completed under the QA Technology Level of Development Work.

## 2.0 Verification Test Methods

Bison Engineering, Inc. (Bison), performed tests of the four LAW facility stacks during two separate week-long periods of May 24–28, 2021, and June 21–25, 2021. The Test Plan (Bison Engineering Inc. 2021<sup>1</sup>) provided the test matrix of stack fan configurations to be used for the tests (see Table 3). Tests in support of 40 CFR 52, Appendix E, also were performed during this test period, which dictated that 14 stack flow tests be performed as an independent measurement for comparison with the stack flow monitor for each of the four stacks. As shown in Table 3, multiple tests were performed for most fan configurations because variations in results are common among field measurements.

**Table 3. LAW Facility Stack Test Matrix.** All tests performed at normal operating flow conditions. The same number of tests were performed for flow angle and velocity uniformity.

Stack	Fan Configuration	Number of Flow Angle, Velocity Uniformity Tests
LV-S1	Fan A Only	7
	Fan B Only	7
LV-S2	Fan A Only	7
	Fan B Only	7
LV-S3	Exhauster A and B	5
	Exhauster B and C	4
	Exhauster A and C	5
LV-C2	Fan A and B	12
	Fan A Only	1
	Fan B Only	1

Bison followed test measurement practices as guided by Environmental Protection Agency (EPA) Methods 1 and 2 (40 CFR 60, Appendix A) and did not follow a separate Test Instruction or Test Procedure. Flow angle tests were performed with an s-type pitot tube, a digital level, and an electronic manometer. Velocity uniformity tests were performed with either a standard pitot tube or an s-type pitot tube and an electronic manometer, along with a desktop weather station for ambient temperature and pressure measurements and a thermocouple for in-stack temperature measurements. Each stack traverse comprised eight discrete measurement points across the diameter of the duct, plus the center point. Two traverses, positioned 90° apart, were used to complete each measurement set.

Figure 1 shows the four stacks as seen from the rooftop of the LAW facility. The LV-S1, LV-S2, and LV-S3 stacks are the tallest stacks and are enclosed within a common support structure. The LV-C2 stack is slightly northeast of the cluster of other stacks and is in a separate support structure because it is significantly shorter. The LV-C2 stack is also the only stack with sampling and testing locations located along the outdoor, vertical section of the stack.

Figure 2 through Figure 5 shows the testing location of each of the three LAW stacks in the L-0320 Stack Monitoring Room (for LV-S1, LV-S2, and LV-S3) and on the rooftop (for LV-C2). The LV-S1 (Figure 2) and LV-S2 (Figure 3) locations required a scissor-lift to access the testing

<sup>1</sup> Bison Engineering, Inc. 2021. Low-Activity Waste Facility Flow Verification Test Plan. 24590-CM-HC4-HX00-00007. Helena, Montana

ports. The LV-S3 (Figure 4) testing locations were both more centrally located within the room and are elevated higher above the floor, in addition to having two locations (for the continuous air monitor [CAM] and record sampler [RS]), so a scaffold was constructed to allow access. The LV-C2 testing location (Figure 5) was on the roof but was accessible by a staff member standing on the rooftop.



Figure 1. Photograph of the Four LAW Stacks Taken from the Facility Rooftop. Each stack is labeled near the lowest visible portion of the stack.



Figure 2. LAW LV-S1 Stack. The stack is positioned along the west wall of the L-0320 Stack Monitoring Room, with one test port slightly below the horizontal centerline, and the second test port slightly west of plumb (behind the probe in the photo). Stack flow is from left (south) to right (north).

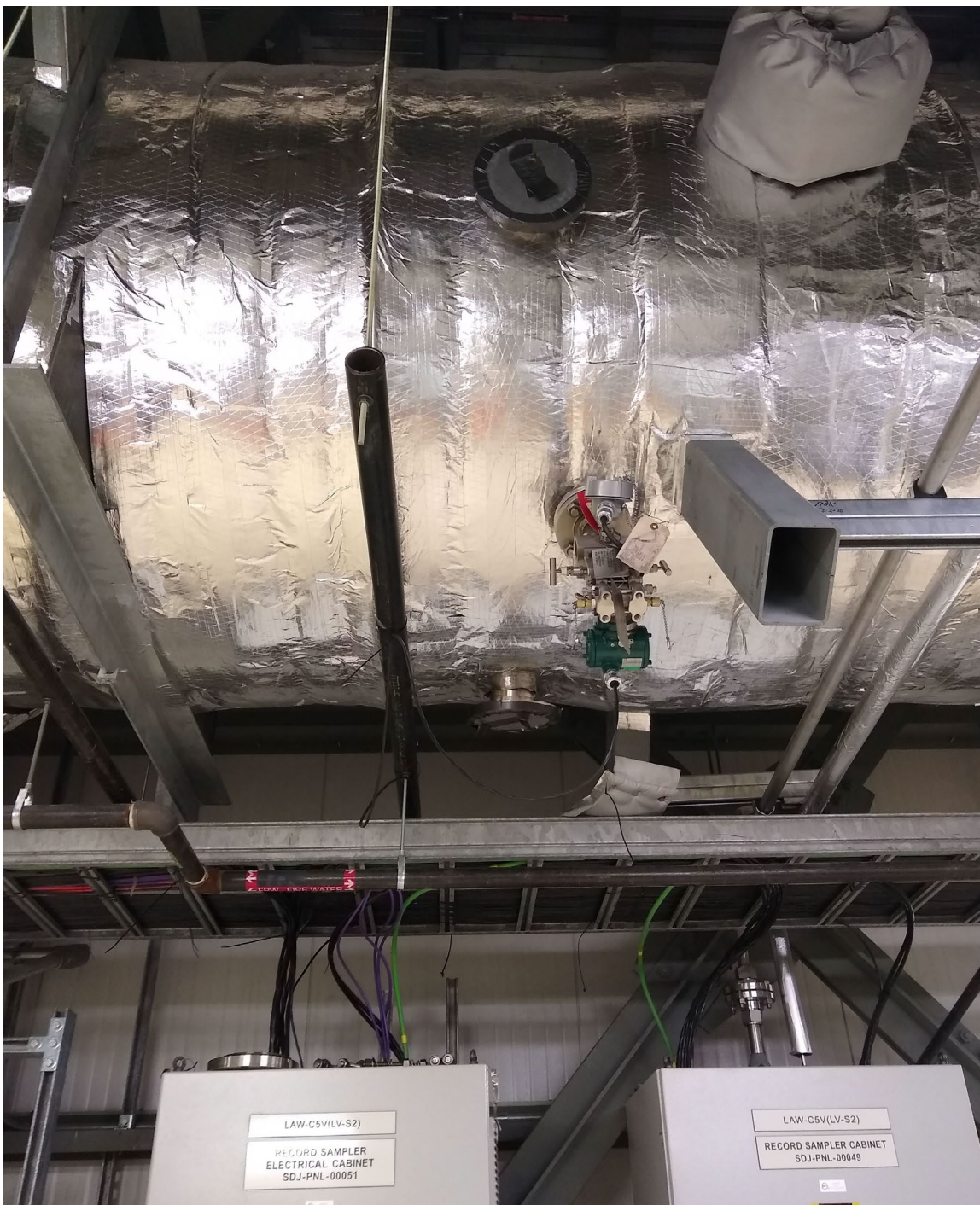


Figure 3. LAW LV-S2 Stack. The stack is positioned along the east wall of the L-0320 Stack Monitoring Room, with one test port near the horizontal centerline, and the second test port nearly plumb (behind and to the left of the probe in the photo). Stack flow is from right (south) to left (north).



Figure 4. LAW LV-S3 Stack. The pair of ports to characterize the record sampler port location is visible in the foreground (near the center of the image) while the ports to characterize the CAM is in the background, at the location of the Bison staff member. The stack is positioned near the center of the L-0320 Stack Monitoring Room, and the photograph is nominally pointed to the north. Stack flow is from the foreground (south) to background (north).



Figure 5. LAW LV-C2 Stack on the Facility Rooftop. Bison staff member is measuring flow angle at the east port, and the west port is visible behind him.

For each traverse, the probe (s-type or standard pitot tube) was inserted completely into the stack such that the tip contacted the far wall, and then backed away from that wall the necessary distance to measure point 1. Triplicate measurements were made at each point before moving to the next point. Method 1 does not specify how measurements should be made and making three measurements at the traverse point is adequate. During tests, the port cover plate was replaced with a relatively thin plate with a hole in the center that was just large enough for the pitot tube, and duct tape was used to seal the opening when the port was not in use (see Figure 2, Figure 3, and Figure 4).

While Bison performed the tests under a subcontract from BNI, PNNL staff observed most tests to understand how they were executed. Because of obstructions in the test area (e.g., beams, platforms, sample cabinets), the pitot tube was not positioned exactly along the stack diameter during all portions of the test. As a result, measurements in the stack may have been co-planar, but not exactly at the specific, planned positions. This will not have a practical impact on the measurement results. Test staff did not appear to record any negative flow angle values in the case of LV-C2, which was along a vertical section of duct, or flow angle values greater than 90° in the case of LV-S1, LV-S2, and LV-S3, which were measurements made at horizontal duct sections. This does not impact the results because the absolute value is used but is listed here to make note of the fact that all flow angle test results presented in the appendices are small positive values.

Finally, we note that equipment used for these tests generally were marked with calibration information. The barometer, digital manometer, and thermocouple, as well as the pitot tubes were also checked in-house before and after each testing trip.

### 3.0 Verification Test Results

PNNL was directed by BNI to use data collected by Bison to perform the LAW verification testing data reduction. PNNL staff were observers during most of the testing so that the equipment used, the measurement techniques, and data recording process could be evaluated. PNNL staff also recorded a subset of measurements from each test when observation was performed to provide secondary quality assurance for the data. The quality assurance process at PNNL included following the procedure for qualification of existing data through data corroboration and sponsor-directed use of data. Test Data Packages were developed to document the observation forms completed by PNNL staff and data sheets provided by the Bison report.

Velocity-uniformity measurements collected by Bison were the delta-pressure values, which were then converted to velocity values by Bison to complete the velocity uniformity data sheets. PNNL performed a spot-check of the conversions from delta-pressure to velocity for these velocity uniformity tests. Data in the Bison report then were used as input to PNNL-controlled Excel spreadsheets to eliminate the possibility that unexpected calculation modifications were made in the spreadsheets transmitted to Bison. These spreadsheets then were subject to calculation reviews to document the accuracy of the calculations from both a theoretical and numerical perspective.

There are some minor differences between the values calculated in the Bison report and the values calculated by PNNL. The primary source of these differences is that Bison provided velocity values to one decimal point in the data sheets, but the value in the cells appear to have more digits (from the conversion from inches of H<sub>2</sub>O). The PNNL data sheets used the single decimal point values in the subsequent calculations. Appendix A, Appendix B, Appendix C, and Appendix D contain the flow angle and velocity data sheets that were produced by PNNL to support this analysis. Due to errors discovered after the initial issue of the Bison (2021<sup>1</sup>) report, the use of the original velocity data as the starting point for corrections to the velocity values, and the small differences that exist due to the rounding that results from those velocity data, there are instances where the individual velocity values differ by less than 0.01% between the Bison (2022<sup>2</sup>) and PNNL velocity data sheets. Average velocities, however, are identical for all tests.

Appendix E contains a table that summarizes the quality assurance documents that have been produced by PNNL as part of this LAW verification effort.

#### 3.1 LV-S1 Verification Tests

Table 4 summarizes the flow angle and velocity uniformity test results from the LV-S1 stack verification tests. The DV values, calculated from the stack nominal diameter and the velocity computed from the EPA Method 1 measurement points is included in Table 4 for reference. Note that the flow angle and velocity uniformity tests for each numbered test were performed in sequence so the velocity uniformity test flow and DV value is expected to be representative of

<sup>1</sup> Bison Engineering, Inc. 2021. Low-Activity Waste Facility Flow Verification. 24590-CM-HC4-HX00-00007-01-00008 Rev 00. Helena, Montana

<sup>2</sup> Bison Engineering, Inc. 2022. Low-Activity Waste Facility Flow Verification. 24590-CM-HC4-HX00-00007-01-00008 Rev 00B. Helena, Montana

the flow during the flow angle test as well. All test results meet the criterion of flow angle values  $\leq 20^\circ$  and velocity uniformity values  $\leq 20\%$  COV.

**Table 4. LV-S1 Verification Test Results**

Fan Configuration	Test Number	Flow Angle ( $^\circ$ )	Velocity Uniformity Test Flow (scfm)	Velocity Uniformity (% COV)	DV (ft <sup>2</sup> /min)
Fan A Only	1	4.8	37,170	1.6	11,834
	2	7.5	37,153	1.9	11,827
	3	5.0	34,310	2.2	10,921
	4	7.3	32,518	1.7	10,352
	5	4.9	37,718	3.2	12,005
	6	3.3	37,456	1.5	11,922
	7	6.3	37,042	1.5	11,792
Fan B Only	8	5.7	38,289	2.5	12,188
	9	5.1	37,294	2.8	11,871
	10	5.1	37,277	2.1	11,867
	11	4.6	38,079	1.8	12,122
	12	2.7	37,845	2.5	12,046
	13	5.7	40,428	1.9	12,870
	14	1.9	37,340	3.1	11,885

### 3.2 LV-S2 Verification Tests

Table 5 summarizes the flow angle and velocity uniformity test results from the LV-S2 stack verification tests. The DV values calculated from the stack nominal diameter and the velocity computed from the EPA Method 1 measurement points are included in Table 5 for reference. Note that the flow angle and velocity uniformity tests for each numbered test were performed in sequence so the velocity uniformity test flow and DV value is expected to be representative of the flow during the flow angle test as well. All test results meet the criterion of flow angle values  $\leq 20^\circ$  and velocity uniformity values  $\leq 20\%$  COV.

Table 5. LV-S2 Verification Test Results

Fan Configuration	Test Number	Flow Angle (°)	Velocity Uniformity Test Flow (scfm)	Velocity Uniformity (% COV)	DV (ft <sup>2</sup> /min)
Fan A Only	1	3.3	36,790	6.9	9,369
	2	3.4	39,485	6.1	10,055
	3	4.4	37,425	4.6	9,528
	4	13.2	37,783	9.2	9,619
	5	3.4	37,826	7.0	9,634
	6	5.0	38,735	5.6	9,865
	7	3.3	37,742	2.8	9,611
Fan B Only	8	3.0	37,858	5.3	9,641
	9	2.4	38,926	1.9	9,914
	10	4.9	37,520	4.0	9,553
	11	2.4	36,257	4.6	9,377
	12	3.2	37,889	5.3	9,649
	13	2.7	38,025	4.3	9,685
	14	4.1	38,060	4.8	9,691

### 3.3 LV-S3 Verification Tests

Table 6 and Table 7 summarize the flow angle and velocity uniformity test results from the LV-S3 stack verification tests at the CAM and record sampling locations. The DV values, calculated from the stack nominal diameter and the velocity computed from the EPA Method 1 measurement points is included in these tables for reference. While the stack data sheet (24590-LAW-JFD-SDJ-21130, Rev 2) listed 18 inches as the diameter for LV-S3, Bison recorded a diameter of 17 inches, which was used for the calculations presented here. Note that the flow angle and velocity uniformity tests for each numbered test were performed in sequence so the velocity uniformity test flow and DV value is expected to be representative of the flow during the flow angle test as well. All test results meet the criterion of flow angle values  $\leq 20^\circ$  and velocity uniformity values  $\leq 20\%$  COV.

The CAM location is downstream of the record sampling location, and tests were performed at the record sampling location first, then at the CAM location, so that each numbered test for the flow angle and velocity at each location was performed within about 1 hour. In general, the stack flow rate at the record sampler location, which used a standard pitot tube, was slightly lower than the stack flow measurements made at the CAM location using an s-type pitot tube. Based on comparisons with the installed stack flow measurement system, the record sampler measurements are approximately 3% lower than the installed continuous emissions monitoring system. Because the installed systems agree within 1% between the CAM and record sampler locations, it appears there is a random low bias at the Bison-measured record sampler location. Given that the bias is small and cannot be attributed to any obvious source, no adjustments are made to the data.

Table 6. LV-S3 CAM Verification Test Results

Fan Configuration	Test Number	Flow Angle (°)	Velocity Uniformity Test Flow (scfm)	Velocity Uniformity (% COV)	DV (ft <sup>2</sup> /min)
Fans A and B	1	4.6	3,881	6.6	3,488
	2	3.7	3,824	6.9	3,436
	3	5.5	3,886	6.6	3,492
	4	7.2	3,861	6.3	3,470
	5	4.2	3,853	6.1	3,463
Fans B and C	6	5.8	3,864	5.7	3,472
	7	3.1	2,095	5.7	3,457
	8	3.9	3,824	6.1	3,437
	9	5.7	3,848	5.4	3,459
Fans A and C	10	4.1	3,885	6.1	3,492
	11	2.6	3,847	6.5	3,457
	12	3.8	3,841	6.0	3,452
	13	4.0	3,853	5.5	3,464
	14	3.5	3,848	6.0	3,459

Table 7. LV-S3 RS Verification Test Results

Fan Configuration	Test Number	Flow Angle (°)	Velocity Uniformity Test Flow (scfm)	Velocity Uniformity (% COV)	DV (ft <sup>2</sup> /min)
Fans A and B	1	3.3	3,556	6.4	3,195
	2	6.2	3,633	5.2	3,265
	3	5.1	3,689	5.1	3,315
	4	5.0	3,712	5.0	3,337
	5	2.9	3,683	4.8	3,310
Fans B and C	6	3.8	3,685	4.4	3,312
	7	3.5	3,688	4.8	3,314
	8	3.5	3,716	5.5	3,340
	9	3.6	3,660	6.1	3,289
Fans A and C	10	4.0	3,734	5.6	3,355
	11	2.8	2,046	4.0	3,365
	12	3.5	3,714	5.3	3,338
	13	3.9	3,704	5.4	3,329
	14	3.3	3,717	5.2	3,340

### 3.4 LV-C2 Verification Tests

Table 8 summarizes the flow angle and velocity uniformity test results from the LV-C2 stack verification tests. The DV values calculated from the stack nominal diameter and the velocity computed from the EPA Method 1 measurement points are included in Table 8 for reference. Note that the flow angle and velocity uniformity tests for each numbered test were performed in sequence so the velocity uniformity test flow and DV value is expected to be representative of

the flow during the flow angle test as well. All test results meet the criterion of flow angle values  $\leq 20^\circ$  and velocity uniformity values  $\leq 20\%$  COV.

Table 8. LV-C2 Verification Test Results

Fan Configuration	Test Number	Flow Angle ( $^\circ$ )	Velocity Uniformity Test Flow (scfm)	Velocity Uniformity (% COV)	DV (ft <sup>2</sup> /min)
Fan A	1	2.3	44,145	4.1	11,241
Fans A and B	2	3.6	48,627	1.8	12,384
	3	4.2	48,224	2.7	12,280
	4	2.9	48,763	1.5	12,418
	5	3.1	48,078	3.0	12,242
	6	3.6	48,314	1.7	12,303
	7	3.9	48,664	1.6	12,390
	8	3.8	48,234	1.7	12,284
	9	3.8	49,012	2.4	12,479
	10	4.2	48,200	1.8	12,276
	11	4.7	48,059	2.0	12,240
	12	4.5	47,422	2.3	12,078
	13	3.1	47,226	2.3	12,027
Fan B	14	6.3	48,240	5.0	12,284

## 4.0 Comparisons of Verification Test and Scale Model Test Results

While the stack verification test results demonstrate that both the flow angle and velocity uniformity values are acceptable compared with the qualification criteria, the velocity uniformity values must be compared with the scale model test results to accept the full suite of stack qualification test results from the scale model tests. Table 9 presents a summary of the normal operating velocity for the stack, along with the corresponding DV values. Additionally, Table 9 includes the scale model DV and 6 DV ranges, which provides the upper limit of the full-scale stack DV values for which the surrogate stack may be used to represent the full-scale stack. Note that, while the LV-S3 stack diameter listed in the stack data sheet was 18 inches, DV calculations used 17 inches, as this was the diameter measured in the field by Bison.

Table 9. Calculation of Acceptable DV Ranges

Stack	Diameter (in.)	Stack Data Sheet		Bison Test Condition		Scale Model	
		Operating Velocity <sup>a</sup> (sfpm)	DV (ft <sup>2</sup> /min)	Operating Velocity <sup>b</sup> (sfpm)	DV (ft <sup>2</sup> /min)	DV (ft <sup>2</sup> /min)	6 DV (ft <sup>2</sup> /min)
LV-S1	48	3,016	12,064	2,955	11,822	259-493	9,338-17,748
LV-S2	60	2,540	12,700	1,931	9,646	250-794	9,002-28,596
LV-S3	17	3,000	4,250	2,393	3,389	225-541	8,089-19,476
LV-C2	60	2,582	12,910	2,442	12,209	251-566	9,022-20,370

a. Velocity based on normal operating flow velocity from stack data sheets (available from PNNL).

- LV-S1: 24590-LAW-JFD-SDJ-21040, Rev 4
- LV-S2: 24590-LAW-JFD-SDJ-21080, Rev 3
- LV-S3: 24590-LAW-JFD-SDJ-21130, Rev 2
- LV-C2: 24590-LAW-JFD-SDJ-21010, Rev 4

b. Velocity based on average velocity measured during velocity uniformity tests performed by Bison.

There were minor differences between the Bison test conditions and the stack design conditions presented in the data sheets. There were slightly more substantive differences between the latest stack data sheet conditions and the conditions that were in place at the time of the scale model stack tests. Therefore, to be complete, comparisons with the scale model stack conditions are made against both sets of conditions (current data sheet and Bison test conditions). Note that the verification of each scale model data point is not required to qualify the sampling location for specific operating configurations or conditions. As noted in Section 1.2, the scale model tests are used to confirm the overall range of conditions for which the stack location is qualified. Table 9 summarizes that both the DV from the stack data sheets and the DV from the Bison test conditions are within the required 1/6 DV (not shown in Table 9) and 6 DV.

### 4.1 LV-S1 Qualification

The LV-S1 stack qualification tests were performed on a scale model of the stack constructed at a PNNL outdoor facility. The results were reported in Glissmeyer, Flaherty, and Piepel (2011). At the time of these tests, the design flow rate for the stack was 40,000 scfm, with a maximum flow of 46,000 scfm (which was assumed, based on 115% of the normal flow rate). However,

the latest version of the data sheet for this stack (24590-LAW-JFD-SDJ-21040, Rev 4) reflects that the normal stack flow is 37,905 scfm and maximum flow is 48,000 scfm. While these differences are relatively minor, and scale model maximum conditions remain within the range of DV values that represent the normal flow conditions, most of the scale model minimum conditions are below the range needed to represent normal full-scale flows.

Scale model tests with this stack were performed with each fan individually and at flows meant to represent the minimum and maximum stack flow rates. Table 10 presents the results of tests performed on the scale model stack.

**Table 10. Summary of LV-S1 Scale Model Velocity Uniformity Tests. Adapted from Table 4.14 of Glissmeyer, Flaherty, and Piepel (2011).**

Operating Fan(s)	Test Port	Flow Condition <sup>a</sup>	Test Number	Velocity (sfpm) <sup>b</sup>	6 DV <sup>c</sup> (ft <sup>2</sup> /min)	% COV	Average % COV	Target % COV
A	1	Max	VT-19	2995	17,690 <sup>D/B</sup>	5.9	5.6	0.6≤x≤10.6
		Max	VT-20	2961	17,489 <sup>D/B</sup>	5.5		
		Max	VT-21	2940	17,365 <sup>D/B</sup>	5.4		
	2	Max	VT-22	2997	17,748 <sup>D/B</sup>	4.5	4.5	≤9.5
		Min	VT-18	1768	10,470 <sup>B</sup>	3.5		
		Min	VT-24	1692	10,020 <sup>N</sup>	3.7		
	3	Max	VT-23	2893	17,088 <sup>D/B</sup>	6.0	6.0	1.0≤x≤11.0
B	1	Max	VT-12	2784	16,444 <sup>D/B</sup>	6.5	6.5	1.5≤x≤11.5
		Min	VT-13	1581	9,338 <sup>N</sup>	4.3		
	2	Max	VT-5	2556	15,137 <sup>D/B</sup>	6.2	5.7	0.7≤x≤10.7
		Max	VT-6	2528	14,971 <sup>D/B</sup>	6.1		
		Max	VT-7	2523	14,941 <sup>D/B</sup>	5.1		
		Max	VT-8	2720	16,108 <sup>D/B</sup>	5.7		
		Max	VT-9	2744	16,250 <sup>D/B</sup>	5.2		
		Max	VT-10	2731	16,173 <sup>D/B</sup>	5.7		
	3	Min	VT-14	1595	9,446 <sup>N</sup>	4.8	4.8	≤9.8
		Max	VT-11	2840	16,774 <sup>D/B</sup>	6.3		
		Min	VT-15	1676	9,899 <sup>N</sup>	6.4		
		Min	VT-16	1674	9,887 <sup>N</sup>	4.7		
		Min	VT-17	1658	9,793 <sup>N</sup>	6.7		

- a. Labeling for maximum or minimum flow conditions (i.e., Max or Min) is based on the data provided at the time of the scale model tests and may not reflect current minimum or maximum design flow rates.
- b. Velocity values previously reported in units of actual feet per minute (afpm,) were converted to sfpm using 68°F as the standard temperature.
- c. DV values result in the latest data sheet values (D), the Bison test conditions (B), or neither (N) fell within the range for the use of scale model stack qualification data.

Three test port locations were used during the scale model tests and Test Port 2, located 12.4 duct diameters from the nearest upstream disturbance, was expected to correspond to the location of the sampling port on the full-scale stack. However, Bison measured the distance to the nearest upstream disturbance as 16.4 duct diameters, which makes Test Port 1, at 17.4 duct diameters, the closer port to represent the full-scale stack sampling location. Differences between the velocity uniformity results for minimum and maximum conditions or between Fan A

or Fan B operations were relatively minor. Fan A, Port 1 was tested at the maximum flow condition with an average result of 5.6% COV, which means that the full-scale verification test result with a velocity uniformity value between 0.6 and 10.6% COV is acceptable based on the criterion that the two tests (full-scale and surrogate) agree within 5%. Fan B, Port 1 test results from the scale model tests were 6.5% COV for the maximum flow rate, and 4.3% COV for the minimum flow rate. Overall, velocity uniformity verification tests with results less than or equal to 9.3% COV meet the ANSI/HPS N13.1-1999 criterion. LV-S1 verification tests performed by Bison were between 1.5 and 3.2% COV with Fan A operations and were between 1.8 and 3.1% COV for Fan B operations, which meets the criterion.

Scale model tests of gaseous and particulate tracer uniformity were performed at the same conditions used for the velocity uniformity tests.

## 4.2 LV-S2 Qualification

The LV-S2 stack qualification tests were performed on a scale model of the stack constructed at a PNNL outdoor facility. The results were reported in Glissmeyer, Antonio, Flaherty, and Amidan (2014). At the time of these tests, the design flow rate for the stack was 60,117 acfm, with a maximum flow of 91,019 acfm. However, the latest version of the data sheet for this stack (24590-LAW-JFD-SDJ-21080, Rev. 3) reflects that the normal stack flow is 49,840 scfm and maximum flow is 63,000 scfm. Scale model maximum conditions remain within the range of DV values that represent the normal flow conditions. The scale model minimum conditions are below the range needed to represent normal full-scale flows from the current data sheets; however, Fan A minimum test flows from the scale model tests were large enough to encompass some Bison test DV values.

Scale model tests with this stack were performed with each fan individually and at flows meant to represent the minimum and maximum stack flow rates. Table 11 presents the results of tests performed on the scale model stack. Test Port 1 corresponds most closely to the location of the sampling port on the full-scale stack monitoring location. Differences between the velocity uniformity results for minimum and maximum conditions or between Fan A or Fan B operations were relatively minor. Fan A, maximum flow conditions had a result of 4.7% COV, while the minimum flow conditions had a result of 4.6% COV. This means that full-scale verification test results with a velocity uniformity value of less than or equal to 9.6% COV is clearly acceptable for Fan A cases. Fan B, maximum flow conditions had a result of 4.0% COV, while the minimum flow result was 5.1% COV. This means that full-scale verification tests with a velocity uniformity value of less than or equal to 9.0% COV is clearly acceptable for Fan B cases. Overall, velocity uniformity verification tests with results less than or equal to 9.0% COV meet the ANSI/HPS N13.1-1999 criterion. LV-S2 verification tests performed by Bison were between 2.8 and 9.2% COV with Fan A operations and were between 1.9 and 5.3% COV for Fan B operations, which meets the criterion.

Scale model tests of gaseous and particulate tracer uniformity were performed at the same conditions used for the velocity uniformity tests and at two different injection port locations.

Table 11. Summary of LV-S2 Scale Model Velocity Uniformity Tests. Adapted from Table 4.1 of Glissmeyer, Antonio, Flaherty, and Amidan (2014).

Operating Fan(s)	Test Port	Flow Condition <sup>a</sup>	Test Number	Velocity (sfpm) <sup>b</sup>	6 DV <sup>c</sup> (ft <sup>2</sup> /min)	% COV	Average % COV	Target % COV
A	1	Max	VT-7	4778	28,596 <sup>D/B</sup>	4.1	4.7	≤9.7
		Max	VT-8	4459	26,682 <sup>D/B</sup>	4.6		
		Max	VT-9	4513	27,008 <sup>D/B</sup>	5.5		
		Min	VT-4	1639	9,811 <sup>B</sup>	4.6	4.6	≤9.6
		Min	VT-5	1637	9,797 <sup>B</sup>	4.7		
		Min	VT-6	1660	9,937 <sup>B</sup>	4.5		
B	1	Max	VT-10	4590	27,466 <sup>D/B</sup>	4.0	4.0	≤9.0
		Min	VT-1	1520	9,099 <sup>N</sup>	5.1	5.1	0.1≤x≤10.1
		Min	VT-2	1505	9,008 <sup>N</sup>	5.2		
		Min	VT-3	1504	9,002 <sup>N</sup>	5.0		

- Labeling for maximum or minimum flow conditions (i.e., Max or Min) is based on the data provided at the time of the scale model tests and may not reflect current minimum or maximum design flow rates.
- Velocity values previously reported in units of afpm were converted to sfpm using 68°F as the standard temperature.
- DV values result in the latest data sheet values (D), the Bison test conditions (B), or neither (N) fell within the range for the use of scale model stack qualification data.

### 4.3 LV-S3 Qualification

The LV-S3 stack qualification tests were performed on a scale model of the stack constructed at a PNNL outdoor facility. The results were reported in Glissmeyer, Antonio, Flaherty, and Amidan (2014). At the time of these tests, the design flow rate for the stack was 5,631 acfm, with a maximum flow of 6,258 acfm. However, the latest version of the data sheet for this stack (24590-LAW-JFD-SDJ-21130, Rev 2) reflects that the normal stack flow is 3,805 scfm and maximum flow is 4,230 scfm. The scale model maximum, normal, and minimum conditions remain within the range of DV values that represent the normal flow conditions.

Scale model tests with this stack were performed with each fan combination and with each fan individually and at flows meant to represent the minimum, normal, and maximum stack flow rates. Table 12 presents the results of tests performed on the scale model stack for the dual-fan conditions. Two test port locations were used during the scale model tests. Test Port 1 corresponds most closely to the record sampler location, while Test Port 2, located five duct diameters downstream of Test Port 1, corresponds to the CAM location.

Table 12. Summary of LV-S3 Scale Model Velocity Uniformity Tests. Adapted from Table 4.5 of Glissmeyer, Antonio, Flaherty, and Amidan (2014).

Operating Fan(s)	Test Port	Flow Condition <sup>a</sup>	Test Number	Velocity (sfpm) <sup>b</sup>	6 DV <sup>c</sup> (ft <sup>2</sup> /min)	% COV	Average % COV	Target % COV
A and B	1	Max	VT-1	2870	17,108 <sup>D/B</sup>	5.9	5.9	0.9≤x≤10.9
		Norm	VT-26	2592	15,448 <sup>D/B</sup>	6.5	6.5	1.5≤x≤11.5
		Min	VT-20	1385	8,256 <sup>D/B</sup>	7.5		
		Min	VT-21	1377	8,208 <sup>D/B</sup>	7.2	7.2	2.2≤x≤12.2
		Min	VT-22	1373	8,182 <sup>D/B</sup>	6.9		
	2	Min	VT-23	1385	8,289 <sup>D/B</sup>	8.4		
		Min	VT-24	1403	8,366 <sup>D/B</sup>	9.3	8.6	3.6≤x≤13.6
		Min	VT-25	1357	8,089 <sup>D/B</sup>	8.0		
B and C	1	Max	VT-5	3267	19,287 <sup>D/B</sup>	5.6		
		Max	VT-6	3237	19,141 <sup>D/B</sup>	5.7	5.5	0.5≤x≤10.5
		Max	VT-7	3248	18,948 <sup>D/B</sup>	5.3		
		Norm	VT-8	3236	17,394 <sup>D/B</sup>	6.0	6.0	1.0≤x≤11.0
		Min	VT-9	3211	8,901 <sup>D/B</sup>	7.0	7.0	2.0≤x≤12.0
	2	Max	VT-2	3179	19,476 <sup>D/B</sup>	6.1		
		Max	VT-3	2918	19,296 <sup>D/B</sup>	5.8	6.0	1.0≤x≤11.0
		Max	VT-4	1493	19,360 <sup>D/B</sup>	6.0		
A and C	1	Max	VT-18	3252	19,382 <sup>D/B</sup>	5.1	5.1	0.1≤x≤10.1
	1	Min	VT-19	1546	9,214 <sup>D/B</sup>	7.1	7.1	2.1≤x≤12.1

- Labeling for maximum or minimum or flow conditions (i.e., Max or Min) is based on the data provided at the time of the scale model tests and may not reflect current minimum or maximum design flow rates.
- Velocity values previously reported in units of afpm were converted to sfpm using 68°F as the standard temperature.
- DV values result in the latest data sheet values (D), the Bison test conditions (B), or neither (N) fell within the range for the use of scale model stack qualification data.

The combination of Fan A and B at minimum flow conditions had an average result of 8.6% COV at the Test Port 2 location, while those same minimum flow conditions had an average result of 7.2% COV at the Test Port 1 location. Single tests were performed at the normal and maximum flow conditions, and these tests resulted in 6.5% COV and 5.9% COV, respectively. Similar results were obtained when the combination of Fan B and C were operated. In this case, multiple maximum flow tests were performed at Test Port 2 with an average result of 6.0% COV, while the Test Port 1 result at maximum flow was slightly lower, with an average of 5.5% COV. Normal and minimum flow tests at Test Port 1 were 6.0% COV and 7.0% COV, respectively. The Fan A and C combination corroborates the similar results of the other fan combinations, with a Test Port 1 maximum flow result of 5.1% COV, and a minimum flow result of 7.1% COV.

Based on these scale model results, full-scale verification test results with a velocity uniformity value between 3.6% COV and 10.1% COV meets the criteria for all cases. LV-S3 verification tests performed by Bison were between 4.0 and 6.4% COV at the Record Sampler location, which meets the criterion. CAM location results were between 5.4% COV and 6.9% COV, which also meets the criterion.

Scale model tests of gaseous and particulate tracer uniformity were performed at conditions like the velocity uniformity tests.

#### 4.4 LV-C2 Qualification

The LV-C2 stack qualification tests were performed on a scale model of the stack constructed at a PNNL outdoor facility. The results were reported in Glissmeyer, Antonio, and Flaherty (2015). At the time of these tests, the design flow rate for the stack was 50,500 scfm, with a maximum flow of 55,550 scfm. However, the latest version of the data sheet for this stack (24590-LAW-JFD-SDJ-21010, Rev 4) reflects that the normal stack flow is 50,680 scfm and maximum flow is 62,800 scfm. The scale model maximum and scale model normal conditions remain within the range of DV values that represent the current stack normal flow conditions. The scale model minimum conditions are below the range needed to represent normal full-scale flows.

Scale model tests with this stack were performed with each fan operated alone, as well as dual-fan operations at flows that were meant to represent the minimum, normal, and maximum stack flow rates. Table 13 presents the results of tests performed on the scale model stack.

While there were limited numbers of tests performed at each flow condition, higher flows tended to have slightly higher levels of mixing compared with lower flows within a specific fan configuration. Fan A maximum flow conditions had a result of 2.1% COV, while the minimum flow conditions had an average result of 2.4% COV. This means that full-scale verification test results with a velocity uniformity value of less than or equal to 7.1% COV is clearly acceptable for Fan A cases. Fan B maximum flow conditions had a result of 4.0% COV, while the normal flow result was 4.3% COV. This means that full-scale verification tests with a velocity uniformity value of less than or equal to 9.0% COV is clearly acceptable for Fan B cases. For dual-fan operations, scale model tests averaged 3.4% COV at maximum flow conditions, which results in an acceptable verification result of 8.4% COV. Overall, velocity uniformity verification tests with results less than or equal to 7.1% COV meet the ANSI/HPS N13.1-1999 criterion. The LV-S2 verification test performed by Bison was 4.1% COV with Fan A operations, 5.0% COV for Fan B operations, and were between 1.5 and 3.0% COV for dual-fan operations, which meets the criterion.

Scale model tests of gaseous and particulate tracer uniformity were performed at conditions like the velocity uniformity tests.

Table 13. Summary of LV-C2 Scale Model Velocity Uniformity Tests. Adapted from Table 4.1 of Glissmeyer, Antonio, and Flaherty (2015).

Operating Fan(s)	Test Port	Flow Condition <sup>a</sup>	Test Number	Velocity (sfpm) <sup>b</sup>	6 DV <sup>c</sup> (ft <sup>2</sup> /min)	% COV	Average % COV	Target % COV
A	1	Max	VT-12	3314	19,752 <sup>D/B</sup>	2.1	2.1	≤7.1
		Norm	VT-16	2698	16,082 <sup>D/B</sup>	2.5	2.5	≤7.5
		Min	VT-13	1666	9,931 <sup>N</sup>	2.7		
		Min	VT-14	1658	9,882 <sup>N</sup>	2.6	2.7	≤7.7
		Min	VT-15	1661	9,901 <sup>N</sup>	2.7		
B	1	Max	VT-1	3417	20,370 <sup>D/B</sup>	3.4		
		Max	VT-2	3364	20,051 <sup>D/B</sup>	4.4	4.0	≤9.0
		Max	VT-3	3347	19,951 <sup>D/B</sup>	4.2		
		Norm	VT-5	2700	16,094 <sup>D/B</sup>	2.8		
		Norm	VT-6	2938	17,513 <sup>D/B</sup>	4.9	4.3	≤9.3
		Norm	VT-7	2468	14,715 <sup>D/B</sup>	5.2		
		Min	VT-4	1517	9,040 <sup>N</sup>	5.1	5.1	0.1≤x≤10.1
A and B	1	Max	VT-8	3074	18,324 <sup>D/B</sup>	3.7		
		Max	VT-9	3074	18,322 <sup>D/B</sup>	3.2	3.4	≤8.4
		Max	VT-10	3059	18,233 <sup>D/B</sup>	3.3		
		Min	VT-11	1655	9,866 <sup>N</sup>	3.7	3.7	≤8.7

- a. Labeling for maximum or minimum flow conditions (i.e., Max or Min) is based on the data provided at the time of the scale model tests and may not reflect current minimum or maximum design flow rates.
- b. Velocity values previously reported in units of afpm were converted to sfpm using 68°F as the standard temperature.
- c. DV values result in the latest data sheet values (D), the Bison test conditions (B), or neither (N) fell within the range for the use of scale model stack qualification data.

## 5.0 Summary/Discussion

The WTP LAW exhaust stack sampling and monitoring locations were qualified using scale model stacks to mitigate the risk of identifying that sampling locations do not meet the qualification criteria on the full-scale stack. As required by the ANSI/HPS N13.1-1999 standard, the scale model and its sampling locations were geometrically similar to the actual stack and the Reynolds numbers for both the actual and model stacks were  $>10,000$ . Table 14 summarizes the stack design conditions, including the duct diameter, the distance to the nearest upstream disturbance from the scale model and full-scale stack tests, and the operating fans.

Table 14. LAW Stack Design Summary

Stack Parameter	LV-S1 <sup>a</sup>	LV-S2 <sup>b</sup>	LV-S3 <sup>c</sup>	LV-C2 <sup>d</sup>
Duct diameter at sampling probes (in.)	48	60	17	60
Number of duct diameters from scale model test port to upstream disturbance	17.4	18.4	37.2 / 44.2 <sup>e</sup>	10
Number of duct diameters from full-scale test port to upstream disturbance	16.4	18.2	35.4 / 43.1 <sup>e</sup>	10.2
Total available fans	2	2	3	2
Number of operating fans	1	1	2	1
Design Maximum flow rate (scfm)	48,000	63,000	4,230	62,800
Design Normal operating flow rate (scfm)	37,905	49,840	3,805	50,680
Design Minimum flow rate (scfm)	18,950	29,000	2,068	38,500

a. DS No: 24590-LAW-JFD-SDJ-21040, Rev 4 (available from PNNL)

b. DS No: 24590-LAW-JFD-SDJ-21080, Rev 3 (available from PNNL)

c. DS No: 24590-LAW-JFD-SDJ-21130, Rev 2 (available from PNNL)

d. DS No: 24590-LAW-JFD-SDJ-21010, Rev 4 (available from PNNL)

e. LV-S3 distances for the record sampler and continuous air monitor locations, respectively

An additional criterion for the use of the scale model test results is that the DV of the full-scale stack must be between 1/6 DV and 6 DV of the scale model tests. Table 15 summarizes the stack flow conditions from the verification tests along with the range of DV values from the qualification tests and the corresponding velocity and flow rates for the full-scale stacks. Verification tests were performed at normal operating conditions and did not specifically address maximum or minimum flows. As a result, the average flow rate represents the typical flow rate from those tests. The minimum and maximum qualified stack flow rates are based on the DV values from the scale model tests and does not address other constraints, such as the rated velocity range of the shrouded probe or deposition on the probe. Based on the range of DV values and the corresponding stack flow rate range, the average verification test flow rate was within the acceptable range and the design flow rates (from Table 14) are also within the acceptable range.

The remaining criteria for the stack verification to be considered valid involve the flow angle and velocity uniformity results. First, the flow angle at the full-scale stack must be  $\leq 20^\circ$ . Second, the velocity uniformity at the full-scale stack must be  $\leq 20\%$  COV. Finally, the velocity uniformity results for the actual and scale model stack tests must agree within 5% COV. In general, these criteria were met through the full-scale stack tests at the LAW facility, as shown in Table 16.

Table 15. LAW Stack Sampling/Monitoring Location Qualification Summary

Stack Parameter	LV-S1	LV-S2	LV-S3	LV-C2
Verification Test Average Flow Rate (scfm)	37,137	37,920	3,771	47,944
Verification Test Average DV (ft <sup>2</sup> /min)	11,822	9,656	3,389	12,209
Minimum Allowable DV (1/6DV, ft <sup>2</sup> /min) <sup>a</sup>	259	250	225	251
Maximum Allowable DV (6DV, ft <sup>2</sup> /min) <sup>b</sup>	17,748	28,596	19,476	20,370
Minimum Qualified Stack Velocity (sfpm)	65	50	159	50
Maximum Qualified Stack Velocity (sfpm)	4,437	5,719	13,747	4,074
Minimum Qualified Stack Flow (scfm)	815	982	250	986
Maximum Qualified Stack Flow (scfm)	55,758	112,294	21,669	79,992

a. Minimum DV values at the LAW stacks based on 1/6 DV from the scale model tests, also found in Table 2.

b. Maximum DV values at the LAW stacks based on 6 DV from scale model tests, also found in Table 2 and Table 9.

Table 16. LAW Stack Sampling/Monitoring Location Qualification Test Result Summary

Stack	Operating Fan(s)	Average Flow Angle (°)	Average Velocity Uniformity (% COV)	Target % COV <sup>a</sup>
LV-S1	Fan A Only	5.6	1.9	0.6 ≤ x ≤ 10.6
	Fan B Only	4.4	2.4	0.4 ≤ x ≤ 10.4
LV-S2	Fan A Only	5.1	6.0	≤ 9.7
	Fan B Only	3.2	4.3	≤ 9.8
LV-S3 CAM	Exhauster A and B	5.0	6.5	3.6 ≤ x ≤ 13.6
	Exhauster B and C	4.6	5.7	1.0 ≤ x ≤ 11.0
	Exhauster A and C	3.6	6.0	1.1 ≤ x ≤ 11.1 <sup>b</sup>
LV-S3 Record Sampler	Exhauster A and B	4.5	5.3	1.8 ≤ x ≤ 11.8
	Exhauster B and C	3.6	5.2	0.9 ≤ x ≤ 10.9
	Exhauster A and C	3.5	5.1	1.1 ≤ x ≤ 11.1
LV-C2	Fan A Only	2.3	4.1	≤ 7.5
	Fan A and B	3.8	2.1	≤ 8.5
	Fan B Only	6.3	5.0	≤ 9.3

a. The % COV values are based on the most comparable scale model test conditions when available or the most conservative bounds when multiple, similarly comparable conditions exist.

b. LV-S3 scale model stack tests were not performed at Test Port 2 (the CAM location) with Fans A and C in operation. The Target % COV listed here is for the Test Port 1 result.

Based on these stack verification test results, the four LAW filtered exhaust stack sampling locations meet the qualification criteria provided in the ANSI/HPS N13.1-1999 standard for all fan operating conditions. This includes single-fan operating conditions for LV-S1 and LV-S2, dual-fan operations for LV-S3 at both the CAM and record sampler locations, and both the single-fan as well as the dual-fan operations for LV-C2. Further changes to the system configuration or operating conditions that are outside the qualified flow rates described in this report may require additional tests or analyses to determine compliance with the standard.

## 6.0 References

10 CFR 830, Subpart A. "Quality Assurance Requirements." *Code of Federal Regulations*, U.S. Department of Energy.

40 CFR 60, Appendix A, Method 1. "Method 1—Sample and Velocity Traverses for Stationary Sources." *Code of Federal Regulations*, U.S. Environmental Protection Agency.

40 CFR 61, Subpart H. "National Emission Standard for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities." *Code of Federal Regulations*, U.S. Environmental Protection Agency.

ANSI/HPS N13.1-1999. *Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and ducts of Nuclear Facilities*. American National Standards Institute and the Health Physics Society, McLean, VA (reaffirmed in 2011 as ANSI/HPS N13.1-2011).

Glissmeyer JA, EJ Antonio, JE Flaherty, and BG Amidan. 2014. *Assessment of the LV-S2 & LV-S3 Stack Sampling Probe Locations for Compliance with ANSI/HPS N13.1-1999*. PNNL-23386, WTP-RPT-231 Rev 0, Pacific Northwest National Laboratory, Richland, Washington.

Glissmeyer JA, EJ Antonio, and JE Flaherty. 2015. *Assessment of the LV-C2 Stack Sampling Probe Locations for Compliance with ANSI/HPS N13.1-1999*. PNNL-24467, WTP-RPT-236 Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

Glissmeyer JA, JE Flaherty, and GF Piepel. 2011. *Assessment of the Group 5-6 (LB-C2, LB-S2, LV-S1) Stack Sampling Probe Locations for Compliance with ANSI/HPS N13.1-1999*. PNNL-20154, WTP-RPT-209 Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

Peterson R to C Luchi. April 10, 2020. *Subcontract No. 24590-QL-HC9-WA49-00001, Project No. 53024 (WA#09) Transmittal of Revised LAW Verification Test Input Document*. [Memorandum] WTP/RPP-MOA-PNNL-01019, Rev 0.0, Pacific Northwest National Laboratory, Richland, Washington.

Washington Administrative Code, Chapter 246-247, Radiation Protection – Air Emissions.

## Appendix A – LV-S1 Stack Verification Data Sheets

### A.1 Flow Angle Data Forms

#### FLOW ANGLE DATA FORM

Stack	LV-S1 (C3V)			Run No.	FA-1				
Date	5/24/2021			Fan Setting	NA Hz				
Start/End Time	14:17 14:26			Fan Configuration	Fan A				
Testers	ZDHLCE			Stack Temp	79.7 deg F				
Stack Dia.	48	in		Units	Degrees				
Stack X-Area	1809.6	in <sup>2</sup>		Ports	A & B				
Elevation	691 ft								
Distance to disturbance	65.67 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw			deg. cw				
1	1.54	3.0	1.5	1.4	2.0	6.1	5.9	6.3	6.1
2	5.04	3.0	2.8	2.8	2.9	6.5	6.6	4.9	6.0
3	9.31	5.2	4.7	4.4	4.8	6.4	5.9	5.6	6.0
4	15.50	7.5	7.4	6.6	7.2	1.2	1.0	1.5	1.2
Center	24.00	12.4	12.2	11.3	12.0	3.2	4.0	3.3	3.5
5	32.50	3.1	4.9	4.5	4.2	2.6	2.2	2.1	2.3
6	38.69	8.3	6.7	7.6	7.5	3.8	3.3	3.3	3.5
7	42.96	3.9	3.9	3.8	3.9	2.3	2.1	2.2	2.2
8	46.96	6.6	6.8	7.0	6.8	0.3	0.3	1.4	0.7
Mean of absolute values:				5.7	3.5				
" " w/o points by wall:				6.0	3.5				
Instruments Used:				Cal. Due	Grand mean ABS 4.6				
S-type pitot (ID: A100-19, 72")				Pre-test calibration; Post-test inspection.	Grand mean ABS w/o wall pts 4.8				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary					
Digisense 20250-13 Manometer (SN: 191212877)				Pre-test inspection; post test calibration check.					

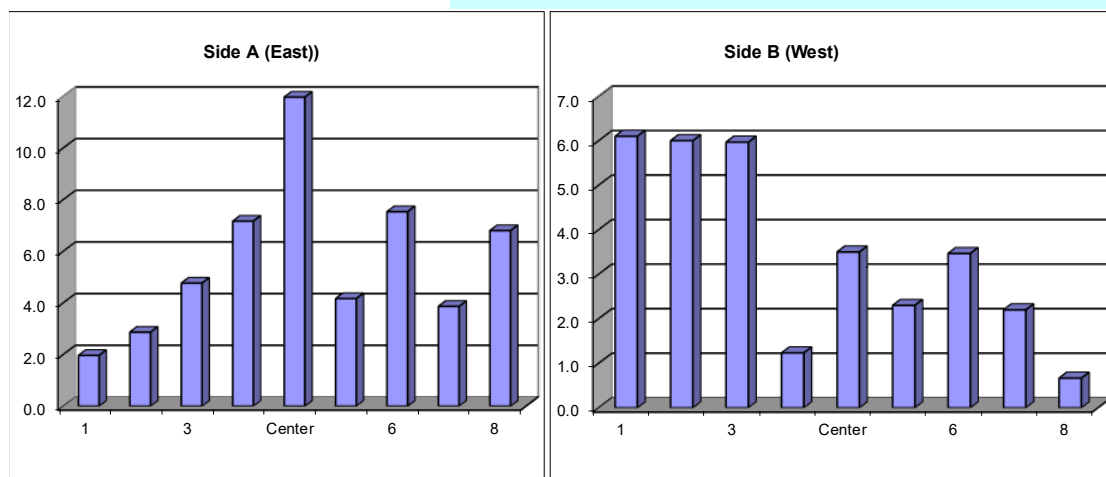
Note:

#### Notes:

Traverse point depth = the distance from inside stack wall to each point.

First traverse point is all the way into the stack

Approx. air velocity was derived from all points on the Verlocity Traverse Form



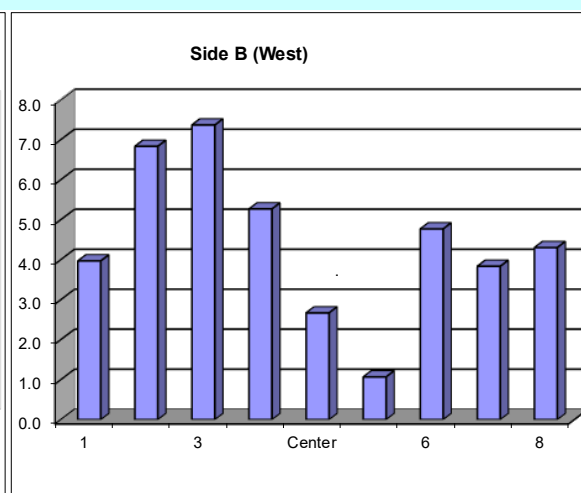
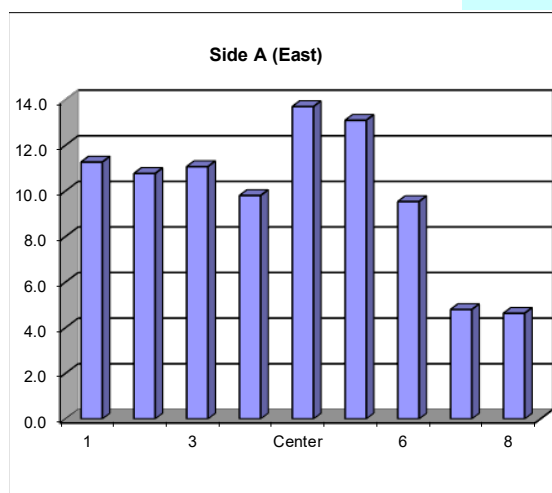
# FLOW ANGLE DATA FORM

Stack	LV-S1 (C3V)			Run No.	FA-2			
Date	5/25/2021			Fan Setting	NA Hz			
Start/End Time	10:03 10:12			Fan Configuration	A			
Testers	ZDH/LCE			Stack Temp	79.2 deg F			
Stack Dia.	48 in			Units	Degrees			
Stack X-Area	1809.6 in <sup>2</sup>			Ports	A & B			
Elevation	691 ft							
Distance to disturbance	65.67 ft							
Order -->	First			Second				
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	1.54	10.6	12.1	11.1	11.3	4.5	2.6	4.8
2	5.04	10.1	11.5	10.7	10.8	7.9	6.3	6.3
3	9.31	11.3	10.8	11.1	11.1	7.5	7.7	6.9
4	15.50	10.3	9.9	9.2	9.8	5.6	4.7	5.5
Center	24.00	13.4	13.9	13.8	13.7	2.7	2.7	2.6
5	32.50	13.2	13.1	13	13.1	0.1	1.2	1.9
6	38.69	10.1	9.6	8.9	9.5	5.5	4.3	4.5
7	42.96	5.6	3.2	5.6	4.8	3.4	3.9	4.2
8	46.96	3.8	4.8	5.3	4.6	4.3	4.7	3.9
Mean of absolute values:				9.9	4.5			
" w/o points by wall:				10.4	4.5			
Instruments Used:				Cal. Due	Grand mean ABS 7.2			
					Grand mean ABS w/o wall pts 7.5			
S-type pitot (ID: A100-19, 72")				Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary				
Digisense 20250-13 Manometer (SN: 191212877)				Pre-test inspection; post test calibration check.				

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Velocity Traverse Form



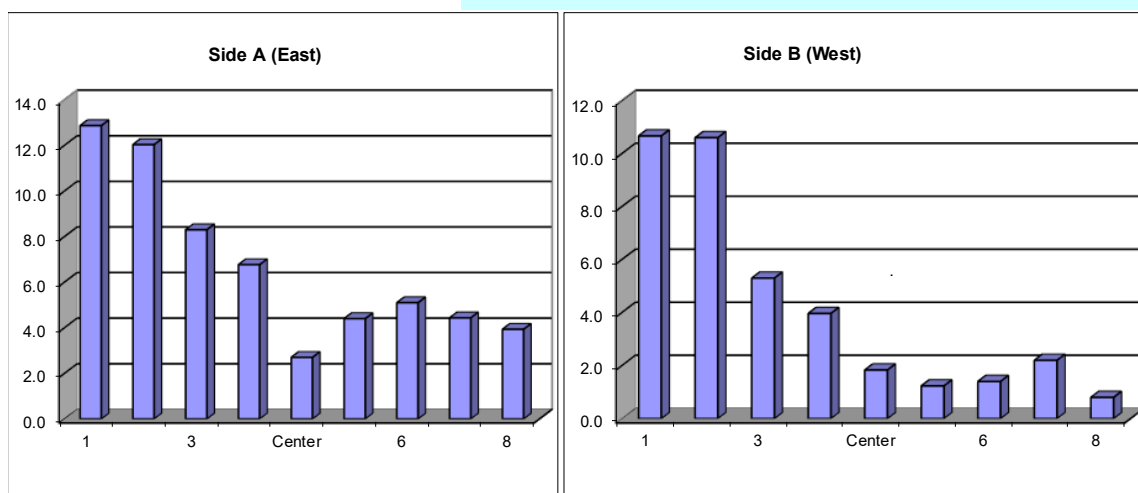
# FLOW ANGLE DATA FORM

Stack	LV-S1 (C3V)			Run No.	FA-3			
Date	5/25/2021			Fan Setting	NA Hz			
Start/End Time	11:18 11:25			Fan Configuration	Fan A			
Testers	ZDH/LCE			Stack Temp	80.2 deg F			
Stack Dia.	48 in			Units	Degrees			
Stack X-Area	1809.6 in <sup>2</sup>			Ports	A & B			
Elevation	691 ft							
Distance to disturbance	65.67 ft							
Order -->	First				Second			
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	1.54	13.0	13.1	12.5	12.9	10.6	10.7	10.7
2	5.04	12.5	11.9	11.7	12.0	11.5	11.3	10.6
3	9.31	9.6	6.3	9.0	8.3	5.5	5.9	5.3
4	15.50	7.4	6.6	6.3	6.8	4.4	3.3	4.0
Center	24.00	2.6	3.0	2.5	2.7	1.4	1.9	1.8
5	32.50	3.6	4.3	5.3	4.4	1.8	1.5	1.2
6	38.69	5.9	4.7	4.7	5.1	1.0	1.3	1.4
7	42.96	4.4	4.3	4.6	4.4	2.5	2.4	2.2
8	46.96	4.1	3.7	4.0	3.9	0.8	0.6	0.8
Mean of absolute values:					6.7	4.2		
" " w/o points by wall:					6.2	3.8		
Instruments Used:					Cal. Due	Grand mean ABS 5.5		
S-type pitot (ID: A100-19, 72")					Grand mean ABS w/o wall pts 5.0			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.			
Digisense 20250-13 Manometer (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary			
					Pre-test inspection; post test calibration check.			

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Verlocity Traverse Form



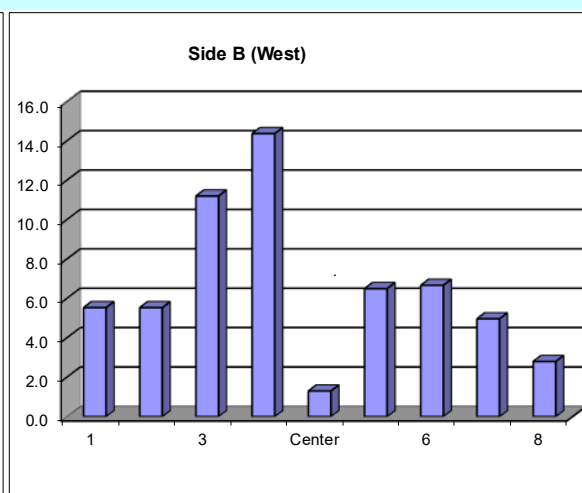
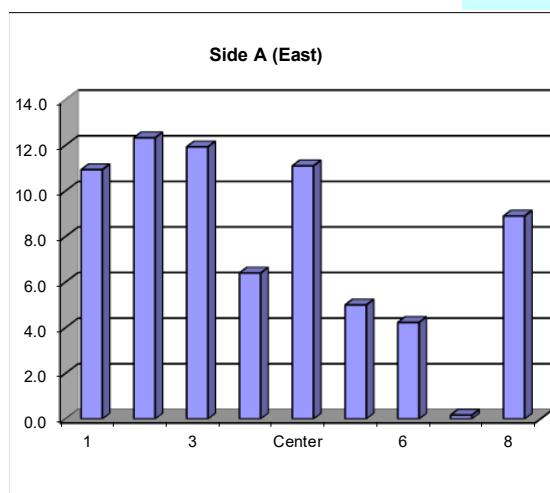
# FLOW ANGLE DATA FORM

Stack	LV-S1 (C3V)			Run No.	FA-4			
Date	5/25/2021			Fan Setting	NA Hz			
Start/End Time	13:30 13:37			Fan Configuration	Fan A			
Testers	ZDH/LCE			Stack Temp	79.8 deg F			
Stack Dia.	48 in			Units	Degrees			
Stack X-Area	1809.6 in <sup>2</sup>			Ports	A & B			
Elevation	691 ft							
Distance to disturbance	65.67 ft							
Order -->	First				Second			
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	1.54	11.0	10.8	11.0	6.4	5.0	5.2	5.5
2	5.04	12.6	12.2	12.2	5.1	6.8	4.7	5.5
3	9.31	12.3	11.8	11.7	11.3	11.6	10.7	11.2
4	15.50	7.0	6.2	6.0	14.4	14.1	14.6	14.4
Center	24.00	10.8	11.6	10.9	1.0	0.8	2.1	1.3
5	32.50	5.0	4.9	5.1	6.9	6.7	5.9	6.5
6	38.69	6.3	3.4	3.0	7.5	6.6	5.9	6.7
7	42.96	0.2	0.3	0.0	5.0	5.1	4.8	5.0
8	46.96	9.0	8.7	9.0	5.5	2.5	0.4	2.8
Mean of absolute values:				7.9	6.5			
" " w/o points by wall:				7.3	7.2			
Instruments Used:				Cal. Due	Grand mean ABS 7.2			
					Grand mean ABS w/o wall pts 7.3			
S-type pitot		(ID: A100-19, 72")		Pre-test calibration; Post-test inspection.				
Angle indicator		SPI Tronic PRO 360 (SN 31-038-3)		Accuracy check prior to each use; field recalibration as necessary				
Digisense 20250-13 Manometer (SN: 191212877)				Pre-test inspection; post test calibration check.				

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Velocity Traverse Form



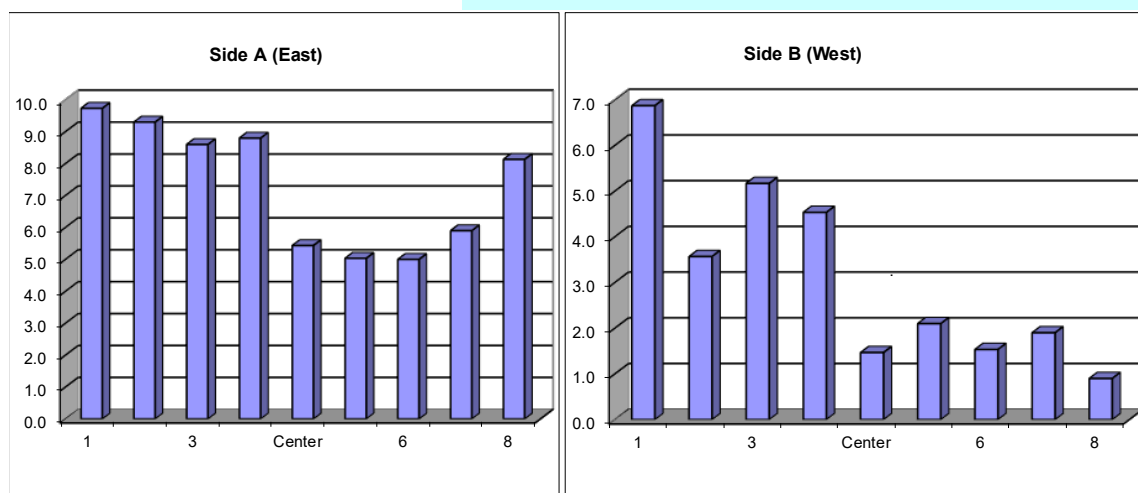
# FLOW ANGLE DATA FORM

Stack	LV-S1 (C3V)			Run No.	FA-5			
Date	5/25/2021			Fan Setting	NA Hz			
Start/End Time	14:32 14:38			Fan Configuration	Fan A			
Testers	ZDH/LCE			Stack Temp	81.3 deg F			
Stack Dia.	48 in			Units	Degrees			
Stack X-Area	1809.6 in <sup>2</sup>			Ports	A & B			
Elevation	691 ft							
Distance to disturbance	65.67 ft							
Order -->	First				Second			
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	1.54	10.0	9.7	9.5	9.7	7.6	5.3	7.7
2	5.04	9.7	9.4	8.8	9.3	4.5	4.4	1.8
3	9.31	8.5	8.9	8.4	8.6	5.5	4.7	5.3
4	15.50	9.0	8.9	8.5	8.8	4.8	4.5	4.3
Center	24.00	6.4	5.0	4.9	5.4	2.1	0.8	1.5
5	32.50	4.9	4.8	5.4	5.0	1.2	2.4	2.7
6	38.69	5.5	4.4	5.1	5.0	0.4	2.4	1.8
7	42.96	5.7	6.1	5.9	5.9	2.7	1.6	1.4
8	46.96	7.9	8.0	8.5	8.1	0.1	1.3	1.3
Mean of absolute values:				7.3	3.1			
" " w/o points by wall:				6.9	2.9			
Instruments Used:				Cal. Due	Grand mean ABS 5.2			
					Grand mean ABS w/o wall pts 4.9			
S-type pitot		(ID: A100-19, 72")		Pre-test calibration; Post-test inspection.				
Angle indicator		SPI Tronic PRO 360 (SN 31-038-3)		Accuracy check prior to each use; field recalibration as necessary				
Digisense 20250-13 Manometer (SN: 191212877)				Pre-test inspection; post test calibration check.				

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Velocity Traverse Form



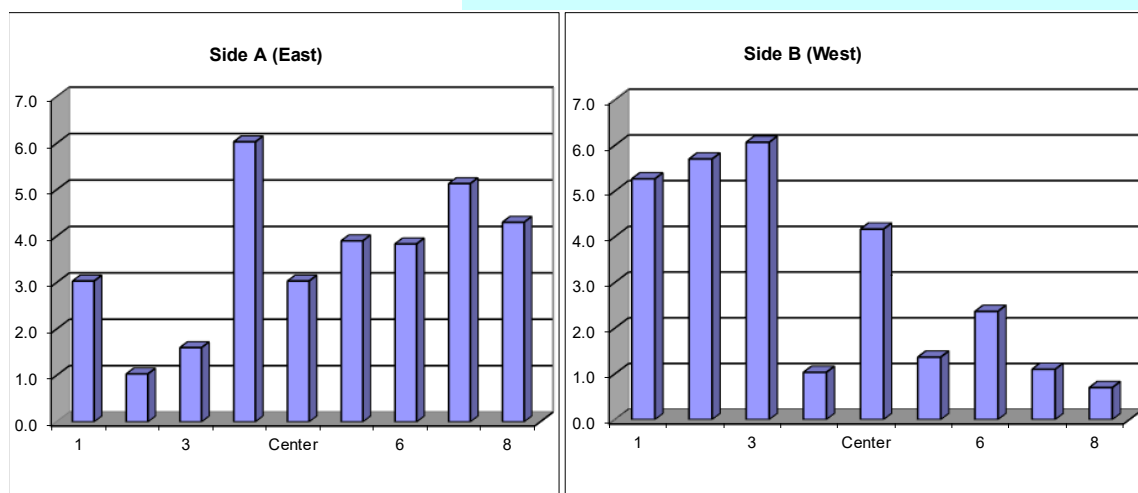
# FLOW ANGLE DATA FORM

Stack	LV-S1 (C3V)			Run No.	FA-6				
Date	5/26/2021			Fan Setting	NA Hz				
Start/End Time	9:57		10:03	Fan Configuration	Fan A				
Testers	ZDH/LCE			Stack Temp	79.7 deg F				
Stack Dia.	48		in	Units	Degrees				
Stack X-Area	1809.6		in <sup>2</sup>	Ports	A & B				
Elevation	691		ft						
Distance to disturbance	65.67		ft						
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw			deg. cw				
1	1.54	3.7	2.9	2.5	3.0	4.5	5.4	5.9	5.3
2	5.04	0.9	1.1	1.1	1.0	6.1	5.6	5.4	5.7
3	9.31	1.7	1.8	1.3	1.6	6.2	5.9	6.1	6.1
4	15.50	5.7	6.5	5.9	6.0	1.1	1.3	0.7	1.0
Center	24.00	3.1	2.9	3.1	3.0	6.3	3.3	2.9	4.2
5	32.50	4.2	3.5	4.0	3.9	1.8	1.3	1.0	1.4
6	38.69	3.9	3.5	4.1	3.8	2.7	2.5	1.9	2.4
7	42.96	5.3	5.0	5.1	5.1	2.2	0.6	0.5	1.1
8	46.96	4.2	4.2	4.5	4.3	1.2	0.9	0.0	0.7
Mean of absolute values:				3.5	3.1				
" w/o points by wall:				3.5	3.1				
Instruments Used:				Cal. Due	Grand mean ABS 3.3				
S-type pitot (ID: A100-19, 72")				Pre-test calibration; Post-test inspection.					
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary					
Digisense 20250-13 Manometer (SN: 191212877)				Pre-test inspection; post test calibration check.					

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Velocity Traverse Form



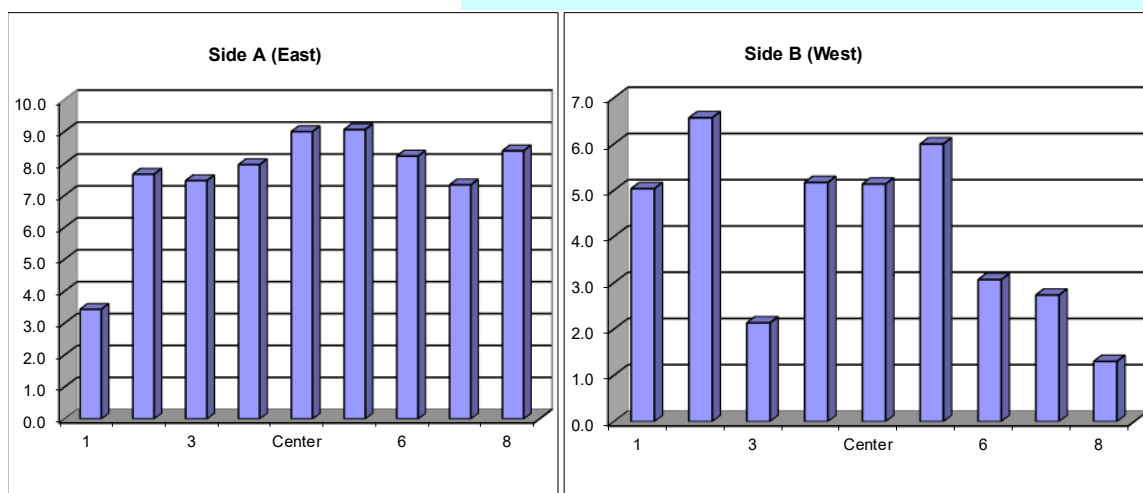
# FLOW ANGLE DATA FORM

Stack	LV-S1 (C3V)			Run No.	FA-7				
Date	5/26/2021			Fan Setting	NA Hz				
Start/End Time	11:04 11:12			Fan Configuration	Fan A				
Testers	ZDH/LCE			Stack Temp	80.3 deg F				
Stack Dia.	48 in			Units	Degrees				
Stack X-Area	1809.6 in <sup>2</sup>			Ports	A & B				
Elevation	691 ft								
Distance to disturbance	65.67 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	1.54	3.6	3.0	3.7	3.4	5.2	4.7	5.2	5.0
2	5.04	7.9	7.6	7.5	7.7	6.5	7.2	6.0	6.6
3	9.31	7.9	7.2	7.3	7.5	2.1	1.8	2.5	2.1
4	15.50	7.9	8.1	7.9	8.0	4.6	6.0	4.9	5.2
Center	24.00	8.8	8.8	9.4	9.0	4.5	5.9	5.0	5.1
5	32.50	9.3	9.0	8.9	9.1	6.0	6.3	5.7	6.0
6	38.69	8.1	8.3	8.3	8.2	3.6	2.9	2.7	3.1
7	42.96	8.2	7.0	6.8	7.3	3.5	2.2	2.5	2.7
8	46.96	7.9	9.1	8.2	8.4	1.8	1.1	1.0	1.3
Mean of absolute values:					7.6	4.1			
" " w/o points by wall:					8.1	4.4			
Instruments Used:					Cal. Due	Grand mean ABS 5.9			
						Grand mean ABS w/o wall pts 6.3			
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Digisense 20250-13 Manometer (SN: 191212877)					Pre-test inspection; post test calibration check.				

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Verlocity Traverse Form



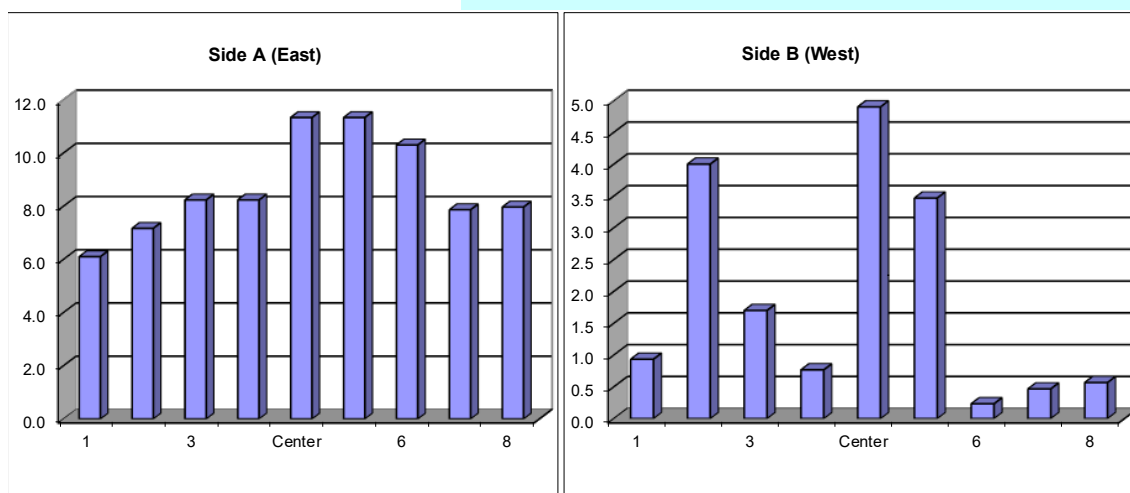
# FLOW ANGLE DATA FORM

Stack <b>LV-S1 (C3V)</b>		Run No. <b>FA-8</b>			
Date <b>5/26/2021</b>		Fan Setting <b>NA</b> Hz			
Start/End Time <b>13:15</b> <b>13:21</b>		Fan Configuration <b>Fan B</b>			
Testers <b>ZDH/LCE</b>		Stack Temp <b>80.2</b> deg F			
Stack Dia. <b>48</b> in		Units <b>Degrees</b>			
Stack X-Area <b>1809.6</b> in <sup>2</sup>		Ports <b>A &amp; B</b>			
Elevation <b>691</b> ft					
Distance to disturbance <b>65.67</b> ft					
Order -->	<b>First</b>	<b>Second</b>			
Traverse-->	<b>Side A (East)</b>		<b>Side B (West)</b>		
Trial ---->	1	2	3	Mean	
Point	Depth, in.	deg. cw			
1	1.54	5.8	6.1	6.4	6.1
2	5.04	7.7	7.0	6.8	7.2
3	9.31	8.6	8.1	8.0	8.2
4	15.50	8.1	8.3	8.3	8.2
Center	24.00	11.5	11.2	11.3	11.3
5	32.50	11.4	11.0	11.6	11.3
6	38.69	10.3	10.4	10.2	10.3
7	42.96	7.7	7.4	8.5	7.9
8	46.96	8.0	7.9	8.0	8.0
Mean of absolute values:					8.7
" " w/o points by wall:					9.2
					1.9
					2.2
Instruments Used:					Cal. Due
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary
Digisense 20250-13 Manometer (SN: 191212877)					Pre-test inspection; post test calibration check.

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Verlocity Traverse Form



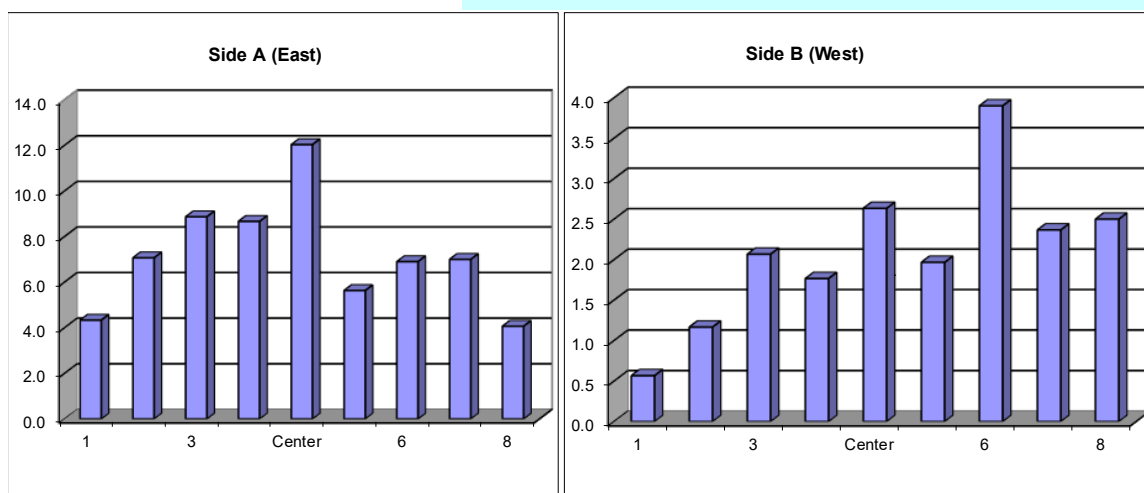
# FLOW ANGLE DATA FORM

Stack	LV-S1 (C3V)			Run No.	FA-9				
Date	5/26/2021			Fan Setting	NA Hz				
Start/End Time	14:19 14:26			Fan Configuration	Fan B				
Testers	ZDH/LCE			Stack Temp	80.9 deg F				
Stack Dia.	48 in			Units	Degrees				
Stack X-Area	1809.6 in <sup>2</sup>			Ports	A & B				
Elevation	691 ft								
Distance to disturbance	65.67 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	1.54	4.5	4.4	4.1	4.3	0.5	0.2	1.0	0.6
2	5.04	7.1	7.1	7.0	7.1	0.5	1.8	1.2	1.2
3	9.31	9.0	8.7	8.9	8.9	1.8	2.1	2.3	2.1
4	15.50	8.8	8.7	8.5	8.7	0.6	3.2	1.5	1.8
Center	24.00	12.1	12.0	12.0	12.0	2.5	2.6	2.8	2.6
5	32.50	5.3	6.0	5.6	5.6	2.3	1.5	2.1	2.0
6	38.69	6.9	6.8	7.0	6.9	3.4	4.0	4.3	3.9
7	42.96	7.3	6.7	7.0	7.0	3.4	2.6	1.1	2.4
8	46.96	3.9	4.0	4.3	4.1	2.8	2.1	2.6	2.5
Mean of absolute values:					7.2	2.1			
" w/o points by wall:					8.0	2.3			
Instruments Used:					Cal. Due	Grand mean ABS 4.6			
						Grand mean ABS w/o wall pts 5.1			
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Digisense 20250-13 Manometer (SN: 191212877)					Pre-test inspection; post test calibration check.				

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Verlocity Traverse Form



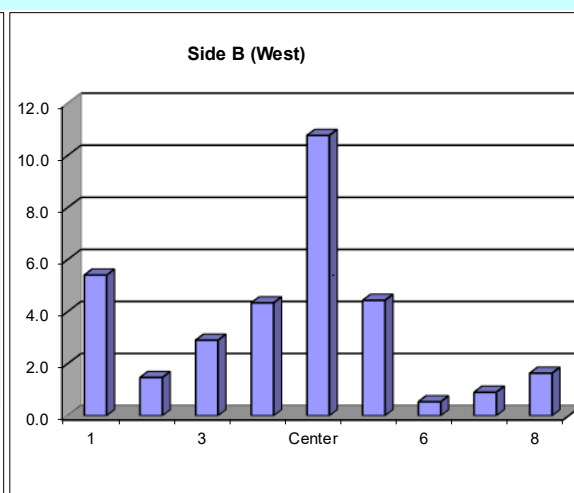
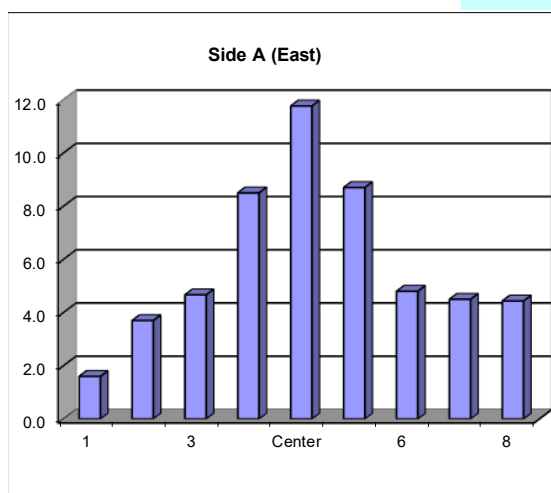
# FLOW ANGLE DATA FORM

Stack <b>LV-S1 (C3V)</b>		Run No. <b>FA-10</b>							
Date <b>5/27/2021</b>		Fan Setting <b>NA</b> Hz							
Start/End Time <b>9:32</b> <b>9:38</b>		Fan Configuration <b>B</b>							
Testers <b>ZDH/LCE</b>		Stack Temp <b>81.7</b> deg F							
Stack Dia. <b>48</b> in		Units <b>Degrees</b>							
Stack X-Area <b>1809.6</b> in <sup>2</sup>		Ports <b>A &amp; B</b>							
Elevation <b>691</b> ft									
Distance to disturbance <b>65.67</b> ft									
Order -->	<b>First</b>	<b>Second</b>							
Traverse-->	<b>Side A (East)</b>		<b>Side B (West)</b>						
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	1.54	1.4	1.6	1.8	1.6	6.5	5.4	4.3	5.4
2	5.04	4.1	3.3	3.7	3.7	1.2	1.6	1.6	1.5
3	9.31	4.0	4.7	5.3	4.7	3.3	2.9	2.5	2.9
4	15.50	8.7	8.2	8.6	8.5	4.8	4.0	4.2	4.3
Center	24.00	12.0	11.0	12.3	11.8	11.2	10.1	11.0	10.8
5	32.50	9.0	8.5	8.6	8.7	4.4	5.1	3.8	4.4
6	38.69	5.5	4.5	4.4	4.8	1.1	0.1	0.4	0.5
7	42.96	3.9	4.6	5.0	4.5	1.3	0.8	0.6	0.9
8	46.96	4.8	4.4	4.1	4.4	1.9	1.2	1.8	1.6
Mean of absolute values:					5.9	Grand mean ABS 4.7			
" " w/o points by wall:					6.7	Grand mean ABS w/o wall pts 5.1			
<b>Instruments Used:</b>					<b>Cal. Due</b>				
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Digisense 20250-13 Manometer (SN: 191212877)					Pre-test inspection; post test calibration check.				

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Velocity Traverse Form



# FLOW ANGLE DATA FORM

Stack <b>LV-S1 (C3V)</b>		Run No. <b>FA-11</b>			
Date <b>5/27/2021</b>		Fan Setting <b>NA</b> Hz			
Start/End Time <b>10:37</b> <b>10:44</b>		Fan Configuration <b>B</b>			
Testers <b>ZDH/LCE</b>		Stack Temp <b>82.8</b> deg F			
Stack Dia. <b>48</b> in		Units <b>Degrees</b>			
Stack X-Area <b>1809.6</b> in <sup>2</sup>		Ports <b>A &amp; B</b>			
Elevation <b>691</b> ft					
Distance to disturbance <b>65.67</b> ft					
Order -->	<b>First</b>	<b>Second</b>			
Traverse-->	<b>Side A (East)</b>		<b>Side B (West)</b>		
Trial ---->	1	2	3	Mean	
Point	Depth, in.	deg. cw			
1	1.54	2.0	2.4	2.5	2.3
2	5.04	6.7	6.0	5.5	6.1
3	9.31	6.0	5.9	6.0	6.0
4	15.50	7.9	7.7	8.0	7.9
Center	24.00	8.7	8.3	8.2	8.4
5	32.50	7.1	7.9	7.0	7.3
6	38.69	8.9	9.0	8.5	8.8
7	42.96	7.7	8.7	8.5	8.3
8	46.96	8.8	9.2	9.3	9.1
Mean of absolute values:					7.1
" " w/o points by wall:					7.5
					1.6
					1.7
Instruments Used:					Cal. Due
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary
Digisense 20250-13 Manometer (SN: 191212877)					Pre-test inspection; post test calibration check.

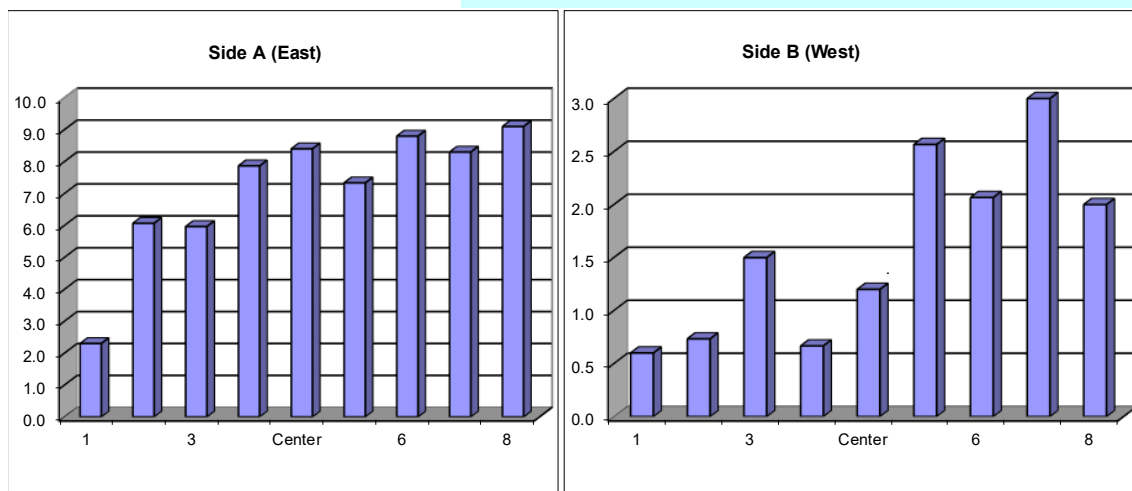
**Note:**

**Notes:**

Traverse point depth = the distance from inside stack wall to each point.

First traverse point is all the way into the stack

Approx. air velocity was derived from all points on the Verlocity Traverse Form



# FLOW ANGLE DATA FORM

Stack <b>LV-S1 (C3V)</b>		Run No. <b>FA-12</b>	
Date <b>5/27/2021</b>		Fan Setting <b>NA</b> Hz	
Start/End Time <b>11:38</b> <b>11:43</b>		Fan Configuration <b>B</b>	
Testers <b>ZDH/LCE</b>		Stack Temp <b>83.0</b> deg F	
Stack Dia. <b>48</b> in		Units <b>Degrees</b>	
Stack X-Area <b>1809.6</b> in <sup>2</sup>		Ports <b>A &amp; B</b>	
Elevation <b>691</b> ft			
Distance to disturbance <b>65.67</b> ft			

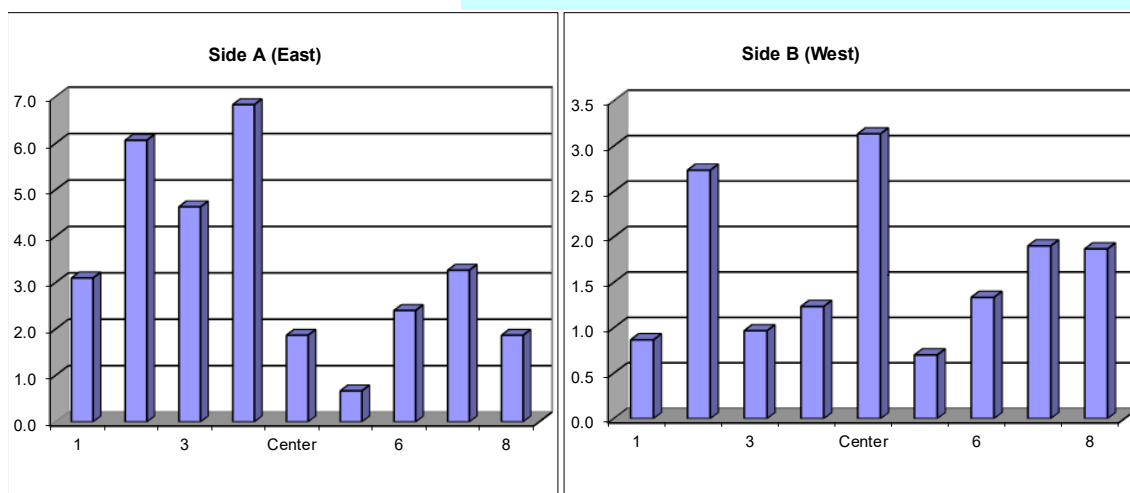
  

Order -->		First				Second			
Trial ---->		Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw			
1	1.54	3.2	2.9	3.2	3.1	0.7	0.9	1.0	0.9
2	5.04	6.7	6.0	5.5	6.1	2.6	2.6	3.0	2.7
3	9.31	4.3	5.0	4.6	4.6	1.6	1.3	0.0	1.0
4	15.50	7.3	7.1	6.1	6.8	0.5	1.3	1.9	1.2
Center	24.00	1.9	1.8	1.9	1.9	3.5	3.0	2.9	3.1
5	32.50	0.8	0.9	0.3	0.7	0.4	1.2	0.5	0.7
6	38.69	2.6	2.5	2.1	2.4	1.4	1.6	1.0	1.3
7	42.96	3.2	3.4	3.2	3.3	2.3	1.5	1.9	1.9
8	46.96	1.8	1.9	1.9	1.9	1.7	2.5	1.4	1.9
Mean of absolute values:					3.4	1.6			
" " w/o points by wall:					3.7	1.7			
Instruments Used:					Cal. Due	Grand mean ABS 2.5			
						Grand mean ABS w/o wall pts 2.7			
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Digisense 20250-13 Manometer (SN: 191212877)					Pre-test inspection; post test calibration check.				

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack  
 Approx. air velocity was derived from all points on the Velocity Traverse Form



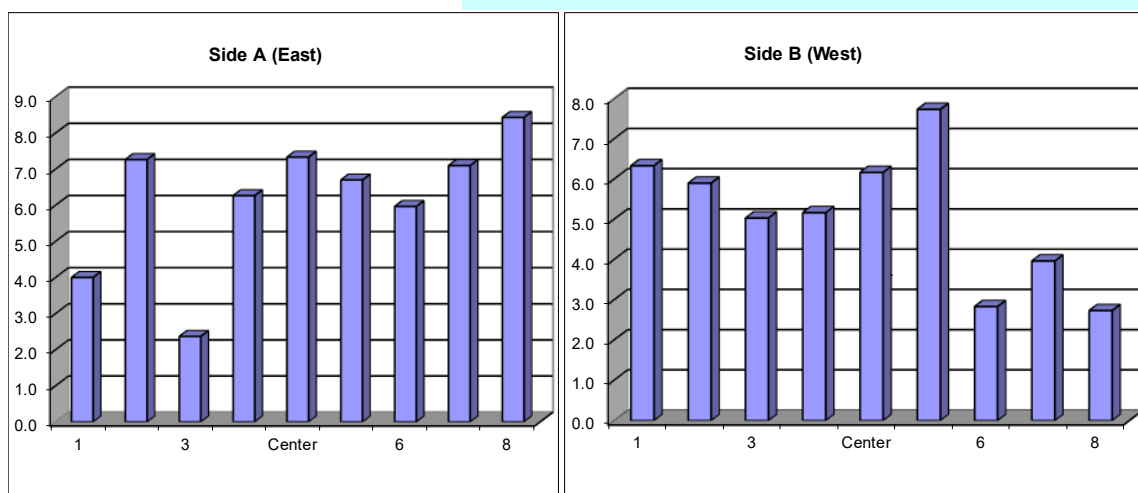
# FLOW ANGLE DATA FORM

Stack	LV-S1 (C3V)			Run No.	FA-13				
Date	5/27/2021			Fan Setting	NA Hz				
Start/End Time	12:43 12:49			Fan Configuration	Fan B				
Testers	ZDH/LCE			Stack Temp	83.6 deg F				
Stack Dia.	48 in			Units	Degrees				
Stack X-Area	1809.6 in <sup>2</sup>			Ports	A & B				
Elevation	691 ft								
Distance to disturbance	65.67 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	1.54	4.1	4.0	3.9	4.0	6.9	5.9	6.2	6.3
2	5.04	7.5	7.1	7.2	7.3	7.0	5.9	4.8	5.9
3	9.31	2.3	2.5	2.3	2.4	5.3	4.9	4.9	5.0
4	15.50	5.9	6.1	6.8	6.3	5.0	5.3	5.2	5.2
Center	24.00	7.2	7.5	7.3	7.3	6.9	6.5	5.1	6.2
5	32.50	7.0	6.6	6.5	6.7	8.8	7.7	6.7	7.7
6	38.69	6.3	6.0	5.6	6.0	2.4	3.3	2.8	2.8
7	42.96	7.4	6.9	7.0	7.1	4.5	4.3	3.1	4.0
8	46.96	8.9	8.4	8.0	8.4	4.1	2.4	1.7	2.7
Mean of absolute values:					6.2	5.1			
" " w/o points by wall:					6.1	5.3			
Instruments Used:					Cal. Due	Grand mean ABS 5.6			
						Grand mean ABS w/o wall pts 5.7			
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Digisense 20250-13 Manometer (SN: 191212877)					Pre-test inspection; post test calibration check.				

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Verlocity Traverse Form



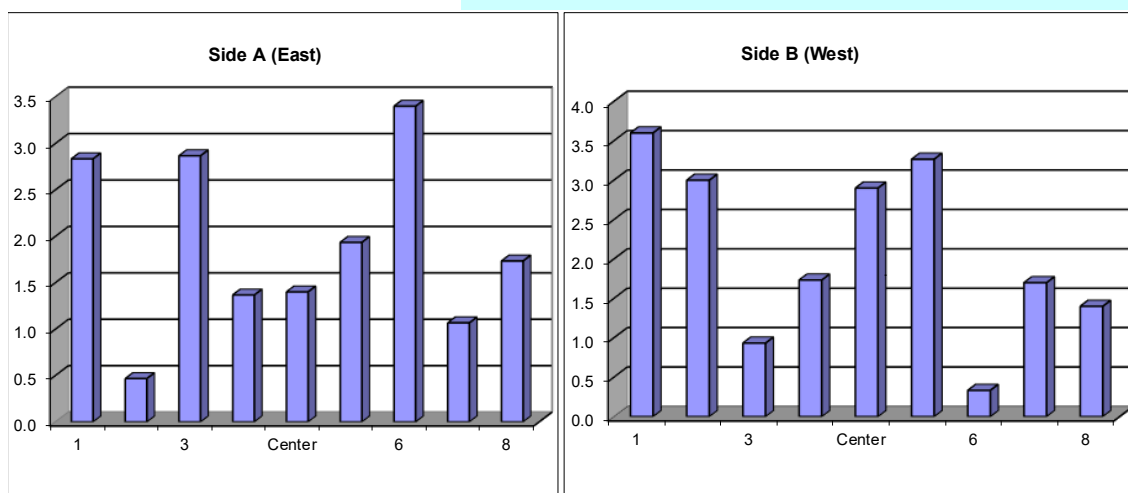
# FLOW ANGLE DATA FORM

Stack	LV-S1 (C3V)			Run No.	FA-14			
Date	5/28/2021			Fan Setting	NA Hz			
Start/End Time	9:20		9:28	Fan Configuration	Fan B			
Testers	ZDH/LCE			Stack Temp	80.1 deg F			
Stack Dia.	48	in		Units	Degrees			
Stack X-Area	1809.6	in <sup>2</sup>		Ports	A & B			
Elevation	691 ft							
Distance to disturbance	65.67 ft							
Order -->	First			Second				
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	1.54	3.1	2.8	2.6	2.8	3.6	4.0	3.2
2	5.04	0.1	0.5	0.8	0.5	3.6	2.5	2.9
3	9.31	3.3	2.7	2.6	2.9	1.3	0.8	0.7
4	15.50	1.0	1.6	1.5	1.4	1.7	1.9	1.6
Center	24.00	1.4	1.1	1.7	1.4	3.3	2.7	2.7
5	32.50	1.6	1.9	2.3	1.9	3.5	3.3	3.0
6	38.69	3.3	3.6	3.3	3.4	0.1	0.8	0.1
7	42.96	1.1	1.3	0.8	1.1	2.5	1.7	0.9
8	46.96	1.9	1.8	1.5	1.7	0.9	1.3	2.0
Mean of absolute values:					1.9	Grand mean ABS		
" " w/o points by wall:					1.8	Grand mean ABS w/o wall pts		
Instruments Used:					Cal. Due			
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary			
Digisense 20250-13 Manometer (SN: 191212877)					Pre-test inspection; post test calibration check.			

Note:

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack  
Approx. air velocity was derived from all points on the Verlocity Traverse Form



## A.2 Velocity Uniformity Data Forms

### VELOCITY TRAVERSE DATA FORM

Stack	<b>LV-S1 (C3V)</b>				Run No.	<b>VT-1</b>			
Date	<b>5/24/21</b>				Fan Configuration	<b>Fan A</b>			
Testers	<b>ZDH/LCE</b>				Fan Setting	<b>NA Hz</b>			
Stack Dia.	<b>48 in.</b>				Stack Temp	<b>79.7 deg F</b>			
Stack X-Area	<b>1809.6 in.2</b>				Start/End Time	<b>14:04 14:12</b>			
Test Port	<b>A &amp; B</b>				Center 2/3 from	<b>4.40</b>	to:	<b>43.60</b>	
Distance to disturbance	<b>65.67 ft</b>				Points in Center 2/3	<b>2</b>	to:	<b>7</b>	
Velocity units	<b>ft/min</b>								
Order -->	<b>First port</b>				<b>Second port</b>				
Traverse-->	<b>Port A (East)</b>				<b>Port B (West)</b>				
Trial ---->									
	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.								
	Velocity								
1	1.54	2,952.9	2,780.8	2,780.8	2,838.2	2,720.9	2,780.8	2,751.0	2,750.9
2	5.04	3,141.8	3,244.9	3,062.4	3,149.7	3,244.9	3,062.4	3,089.1	3,132.1
3	9.31	3,193.8	3,219.4	3,219.4	3,210.9	3,141.8	3,193.8	3,115.6	3,150.4
4	15.50	3,168.0	3,244.9	3,295.2	3,236.0	3,062.4	3,193.8	3,141.8	3,132.7
Center	24.00	3,168.0	3,219.4	3,141.8	3,176.4	3,219.4	3,168.0	3,115.6	3,167.7
5	32.50	3,320.1	3,193.8	3,193.8	3,235.9	3,168.0	3,193.8	3,115.6	3,159.1
6	38.69	3,270.2	3,295.2	3,270.2	3,278.5	3,115.6	3,141.8	3,168.0	3,141.8
7	42.96	3,219.4	3,244.9	3,141.8	3,202.0	3,062.4	3,089.1	3,089.1	3,080.2
8	46.46	3,062.4	3,035.3	2,924.9	3,007.5	2,952.9	2,952.9	2,896.7	2,934.2
Averages ----->		3,166.3	3,164.3	3,114.5	3,148.4	3,076.5	3,086.3	3,053.6	3,072.1

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3110.2		Mean	3212.8	3137.7	3175.2
Min Point	2750.9	-11.6%	Std. Dev.	42.5	28.6	52.2
Max Point	3278.5	5.4%	COV as %	1.3	0.9	1.6

Flow w/o C-Pt	38987 cfm		Cal Due
Vel Avg w/o C-Pt	3103 fpm		
	Start	Finish	
Stack temp	80.2	79.2	F
Equipment temp	75.7	75.9	F
Ambient temp	75.7	75.9	F
Stack static	0.67	0.82	mbars
Ambient pressure	987.13	986.79	mbars
Total Stack pressure	987.80	987.61	mbars
Ambient humidity	32	31	RH (%)

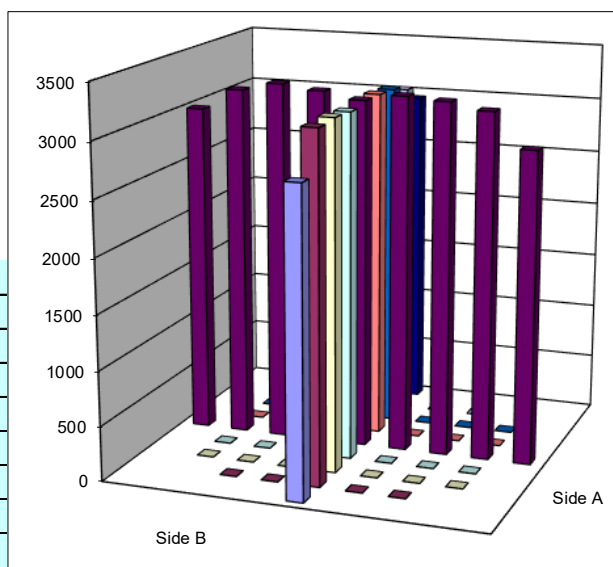
<b>Instruments Used:</b>	<b>Cal Due</b>
Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Control Co. Thermometer (SN:220435230)	Post-test verification

#### Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H<sub>2</sub>O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-2
Date	5/25/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	79.2 deg F
Stack X-Area	1809.6 in.2	Start/End Time	9:52 10:00
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port	
Traversal-->	Port A (East)	Port B (West)	
Trial ---->	1 2 3 Mean	1 2 3 Mean	
Point	Depth, in.	Velocity	Velocity
1	1.54	2,526.4 2,743.8 2,652.8 2,641.0	2,215.8 2,427.2 2,324.0 2,322.3
2	5.04	3,054.3 3,133.6 3,211.0 3,133.0	3,054.3 3,054.3 3,133.6 3,080.7
3	9.31	3,236.4 3,236.4 3,261.6 3,244.8	3,311.3 3,185.4 3,185.4 3,227.4
4	15.50	3,311.3 3,261.6 3,286.6 3,286.5	3,360.4 3,261.6 3,261.6 3,294.5
Center	24.00	3,185.4 3,185.4 3,159.6 3,176.8	3,211.0 3,185.4 3,261.6 3,219.3
5	32.50	3,286.6 3,236.4 3,286.6 3,269.9	3,159.6 3,211.0 3,185.4 3,185.3
6	38.69	3,211.0 3,211.0 3,311.3 3,244.5	3,311.3 3,236.4 3,261.6 3,269.8
7	42.96	3,236.4 3,211.0 3,159.6 3,202.3	3,185.4 3,185.4 3,159.6 3,176.8
8	46.46	2,860.6 2,945.2 3,000.2 2,935.3	2,860.6 2,831.8 2,831.8 2,841.4
Averages ----->		3,100.9 3,129.4 3,147.7 3,126.0	3,074.4 3,064.3 3,067.2 3,068.6

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3097.3		Mean	3222.5	3207.7	3215.1
Min Point	2322.3	-25.0%	Std. Dev.	54.5	70.1	60.8
Max Point	3294.5	6.4%	COV as %	1.7	2.2	1.9

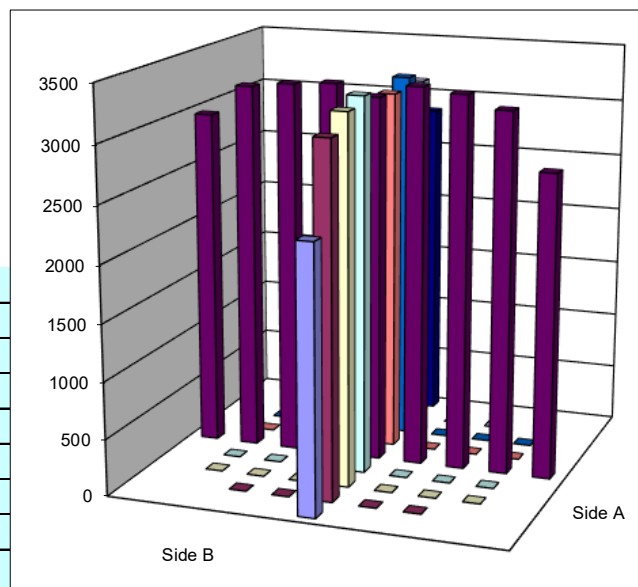
Flow w/o C-Pt	38764 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	3085 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	79.5 78.8 F	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	73.0 73.4 F		
Ambient temp	73.0 73.4 F		
Stack static	1.67 1.79 mbars		
Ambient pressure	990.18 990.18 mbars		
Total Stack pressure	991.85 991.97 mbars		
Ambient humidity	35 35 RH (%)		

## Notes:

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-3
Date	5/25/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	80.2 deg F
Stack X-Area	1809.6 in.2	Start/End Time	11:09 11:15
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		
Order -->	First port	Second port	
Traverse-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	1.54	2,104.4 2,326.5 2,218.2 2,216.4
	2	5.04	2,776.5 2,805.9 2,863.7 2,815.4
	3	9.31	2,805.9 2,835.0 2,976.1 2,872.3
	4	15.50	2,948.4 2,920.4 2,892.2 2,920.4
	Center	24.00	2,776.5 2,835.0 2,892.2 2,834.6
	5	32.50	3,003.5 2,948.4 3,003.5 2,985.1
	6	38.69	2,976.1 3,003.5 3,030.7 3,003.4
	7	42.96	2,948.4 2,920.4 2,920.4 2,929.8
	8	46.46	2,776.5 2,863.7 2,835.0 2,825.1
Averages ----->			2,790.7 2,828.8 2,848.0 2,822.5

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2856.4		Mean	2908.7	2947.8	2928.3
Min Point	2216.4	-22.4%	Std. Dev.	71.8	53.8	64.2
Max Point	3012.5	5.5%	COV as %	2.5	1.8	2.2

Flow w/o C-Pt	35877 cfm
Vel Avg w/o C-Pt	2855 fpm
	Start Finish
Stack temp	80.6 79.7 F
Equipment temp	75.0 74.5 F
Ambient temp	75.0 74.5 F
Stack static	1.79 1.67 mbars
Ambient pressure	989.84 989.84 mbars
Total Stack pressure	991.63 991.51 mbars
Ambient humidity	33 33 RH (%)

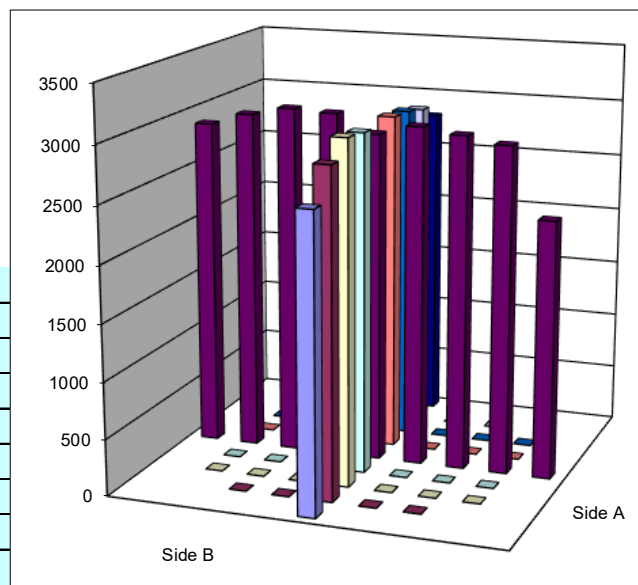
Instuments Used:	Cal Due
Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Control Co. Thermometer (SN:220435230)	Post-test verification

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-4
Date	5/25/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	79.8 deg F
Stack X-Area	1809.6 in.2	Start/End Time	13:21 13:26
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units <u>ft/min</u>			
Order -->	First port	Second port	
Traverse-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	1.54	2,464.4 2,396.8 2,327.3 2,396.2
	2	5.04	2,594.1 2,687.3 2,687.3 2,656.3
	3	9.31	2,656.7 2,747.8 2,835.9 2,746.8
	4	15.50	2,777.5 2,835.9 2,806.8 2,806.8
	Center	24.00	2,864.7 2,747.8 2,747.8 2,786.8
	5	32.50	2,864.7 2,835.9 2,835.9 2,845.5
	6	38.69	2,835.9 2,864.7 2,777.5 2,826.0
	7	42.96	2,747.8 2,717.7 2,806.8 2,757.5
	8	46.46	2,717.7 2,656.7 2,717.7 2,697.4
Averages ----->			2,724.8 2,721.2 2,727.0 2,724.3

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2715.5		Mean	2775.1	2760.2	2767.7
Min Point	2396.2	-11.8%	Std. Dev.	63.1	24.2	46.6
Max Point	2845.5	4.8%	COV as %	2.3	0.9	1.7

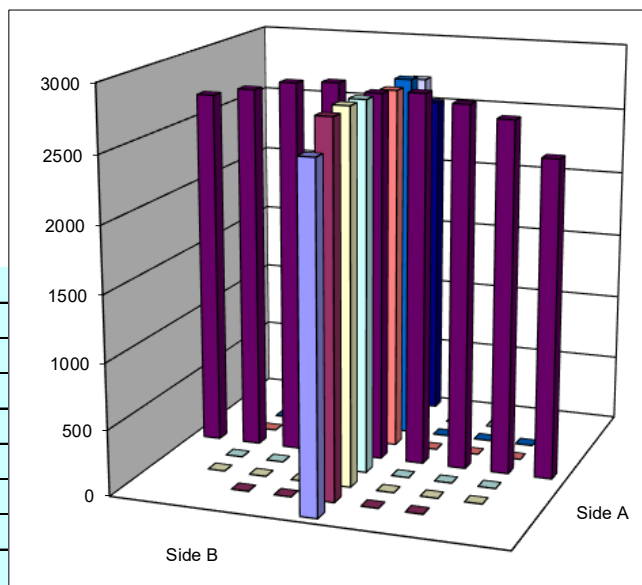
Flow w/o C-Pt	34027 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2708 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	79.8 79.8	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	74.2 74.6		
Ambient temp	74.2 74.6		
Stack static	1.67 1.12		
Ambient pressure	988.83 988.83		
Total Stack pressure	990.50 989.95		
Ambient humidity	33 33		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-5
Date	5/25/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	81.3 deg F
Stack X-Area	1809.6 in.2	Start/End Time	14:22 14:29
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean
	Point Depth, in. Velocity	Point Depth, in. Velocity
	1 1.54 2,691.0 2,660.2 2,597.6 2,649.6	1 1.54 2,660.2 2,691.0 2,721.4 2,690.9
	2 5.04 3,245.5 3,245.5 3,220.0 3,237.0	2 5.04 3,168.4 3,089.5 3,142.4 3,133.5
	3 9.31 3,220.0 3,245.5 3,320.6 3,262.0	3 9.31 3,270.7 3,220.0 3,369.8 3,286.8
	4 15.50 3,345.4 3,418.3 3,418.3 3,394.0	4 15.50 3,194.3 3,089.5 3,194.3 3,159.4
	Center 24.00 3,220.0 3,295.7 3,245.5 3,253.7	Center 24.00 3,220.0 3,168.4 3,270.7 3,219.7
	5 32.50 3,295.7 3,442.3 3,320.6 3,352.9	5 32.50 3,220.0 3,142.4 3,194.3 3,185.6
	6 38.69 3,345.4 3,394.1 3,394.1 3,377.9	6 38.69 3,270.7 3,270.7 3,245.5 3,262.3
	7 42.96 3,320.6 3,345.4 3,369.8 3,345.3	7 42.96 2,953.4 3,008.6 3,089.5 3,017.2
	8 46.46 2,953.4 3,089.5 3,168.4 3,070.5	8 46.46 3,008.6 2,953.4 2,925.3 2,962.5
Averages ----->	3,181.9 3,237.4 3,228.3 3,215.9	3,107.4 3,070.4 3,128.1 3,102.0

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3158.9		Mean	3317.5	3180.6	3249.1
Min Point	2649.6	-16.1%	Std. Dev.	64.7	90.3	103.6
Max Point	3394.0	7.4%	COV as %	2.0	2.8	3.2

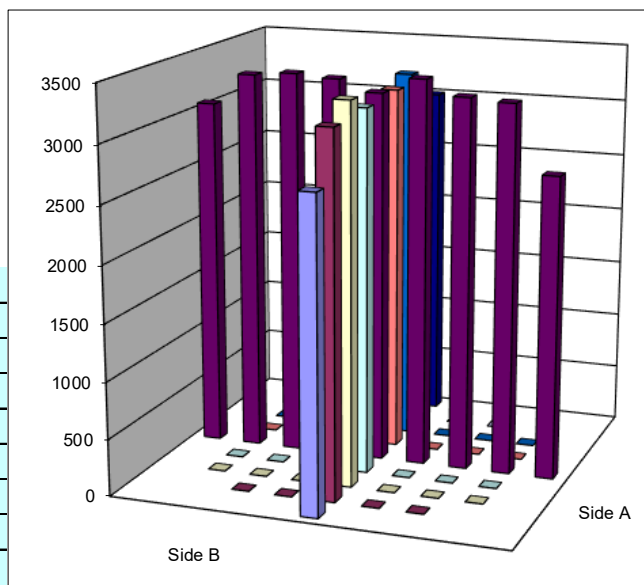
Flow w/o C-Pt	39574 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	3149 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	81.3 81.2 F	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	76.3 76.2 F		
Ambient temp	76.3 76.2 F		
Stack static	2.17 1.99 mbars		
Ambient pressure	988.15 988.15 mbars		
Total Stack pressure	990.32 990.14 mbars		
Ambient humidity	31 31 RH (%)		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-6
Date	5/26/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	79.7 deg F
Stack X-Area	1809.6 in.2	Start/End Time	9:48 9:54
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		
Order -->	First port	Second port	
Traverse-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	1.54	2,320.7 2,389.9 2,355.5 2,355.4
	2	5.04	3,103.0 3,180.9 3,076.6 3,120.2
	3	9.31	3,281.9 3,206.4 3,231.9 3,240.1
	4	15.50	3,206.4 3,281.9 3,180.9 3,223.1
	Center	24.00	3,129.2 3,129.2 3,180.9 3,146.4
	5	32.50	3,180.9 3,231.9 3,206.4 3,206.4
	6	38.69	3,257.0 3,231.9 3,206.4 3,231.8
	7	42.96	3,180.9 3,155.1 3,180.9 3,172.3
	8	46.46	3,129.2 3,023.1 3,076.6 3,076.3
Averages ----->			3,087.7 3,092.3 3,077.4 3,085.8

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3110.9		Mean	3191.5	3209.5	3200.5
Min Point	2355.4	-24.3%	Std. Dev.	46.0	52.5	48.3
Max Point	3289.6	5.7%	COV as %	1.4	1.6	1.5

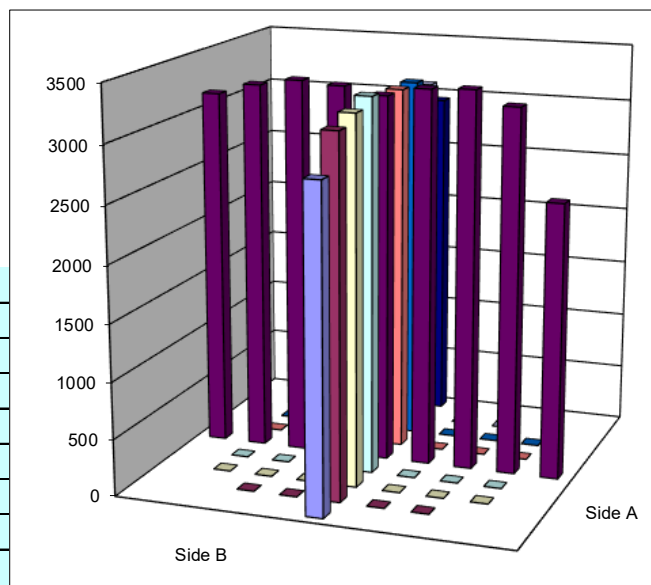
Flow w/o C-Pt	38970 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	3101 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	79.7 79.6 F	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	73.2 73.0 F		
Ambient temp	73.2 73.0 F		
Stack static	2.61 1.87 mbars		
Ambient pressure	993.57 993.23 mbars		
Total Stack pressure	996.18 995.10 mbars		
Ambient humidity	32 31 RH (%)		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-7
Date	5/26/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	80.3 deg F
Stack X-Area	1809.6 in.2	Start/End Time	10:56 11:01
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		
Order -->	First port	Second port	
Traversal-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	1.54	2,393.0 2,460.5 2,358.6 2,404.0
	2	5.04	3,027.0 3,184.9 3,159.2 3,123.7
	3	9.31	3,210.6 3,159.2 3,159.2 3,176.3
	4	15.50	3,335.5 3,286.1 3,184.9 3,268.9
	Center	24.00	3,184.9 3,210.6 3,235.9 3,210.5
	5	32.50	3,210.6 3,235.9 3,261.1 3,235.9
	6	38.69	3,310.9 3,286.1 3,184.9 3,260.7
	7	42.96	3,133.2 3,159.2 3,159.2 3,150.6
	8	46.46	3,133.2 2,972.4 2,944.8 3,016.8
Averages ----->			3,104.3 3,106.1 3,072.0 3,094.1

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3091.7		Mean	3203.8	3229.4	3216.6
Min Point	2404.0	-22.2%	Std. Dev.	55.6	39.6	48.2
Max Point	3294.4	6.6%	COV as %	1.7	1.2	1.5

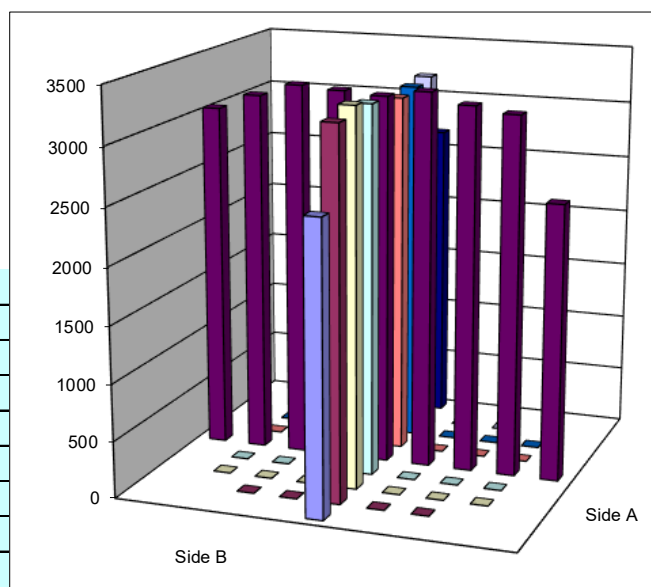
Flow w/o C-Pt	38638 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	3075 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	80.3 80.2 F	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	73.7 73.5 F		
Ambient temp	73.7 73.5 F		
Stack static	1.29 2.02 mbars		
Ambient pressure	992.55 992.55 mbars		
Total Stack pressure	993.84 994.57 mbars		
Ambient humidity	31 31 RH (%)		

## Notes:

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-8
Date	5/26/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	80.2 deg F
Stack X-Area	1809.6 in.2	Start/End Time	13:06 13:11
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean
	Point Depth, in. Velocity	Point Depth, in. Velocity
	1 1.54 2,743.7 2,683.3 2,713.7 2,713.6	1 1.54 2,743.7 2,743.7 2,652.7 2,713.3
	2 5.04 3,159.5 3,236.3 3,159.5 3,185.1	2 5.04 3,286.4 3,236.3 3,311.2 3,278.0
	3 9.31 3,261.4 3,210.9 3,210.9 3,227.7	3 9.31 3,286.4 3,311.2 3,335.9 3,311.2
	4 15.50 3,286.4 3,236.3 3,261.4 3,261.4	4 15.50 3,335.9 3,360.3 3,360.3 3,352.1
	Center 24.00 3,210.9 3,236.3 3,236.3 3,227.8	Center 24.00 3,286.4 3,261.4 3,286.4 3,278.1
	5 32.50 3,432.6 3,384.6 3,432.6 3,416.6	5 32.50 3,261.4 3,210.9 3,261.4 3,244.6
	6 38.69 3,384.6 3,432.6 3,432.6 3,416.6	6 38.69 3,286.4 3,236.3 3,159.5 3,227.4
	7 42.96 3,261.4 3,311.2 3,286.4 3,286.4	7 42.96 3,107.3 3,159.5 3,107.3 3,124.7
	8 46.46 3,159.5 3,159.5 3,185.3 3,168.1	8 46.46 2,860.4 3,000.1 2,945.1 2,935.2
Averages ----->	3,211.1 3,210.1 3,213.2 3,211.5	3,161.6 3,168.8 3,157.7 3,162.7

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3187.1		Mean	3288.8	3259.4	3274.1
Min Point	2713.3	-14.9%	Std. Dev.	92.8	72.3	81.3
Max Point	3416.6	7.2%	COV as %	2.8	2.2	2.5

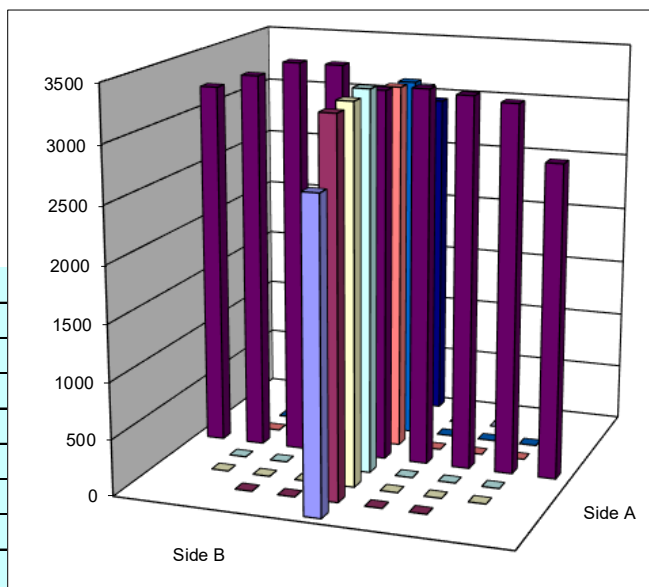
Flow w/o C-Pt	39947 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	3179 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	80.2 80.2 F	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	74.1 74.3 F		
Ambient temp	74.1 74.3 F		
Stack static	2.27 2.49 mbars		
Ambient pressure	991.53 991.53 mbars		
Total Stack pressure	993.80 994.02 mbars		
Ambient humidity	30 30 RH (%)		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-9
Date	5/26/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	80.9 deg F
Stack X-Area	1809.6 in.2	Start/End Time	14:11 14:16
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		
Order -->	First port	Second port	
Traversal-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	1.54	2,104.9 2,143.5 2,181.5 2,143.3
	2	5.04	2,949.2 3,058.4 3,189.8 3,065.8
	3	9.31	3,137.8 3,266.0 3,291.1 3,231.7
	4	15.50	3,266.0 3,340.5 3,340.5 3,315.7
	Center	24.00	3,315.9 3,389.3 3,365.0 3,356.7
	5	32.50	3,413.4 3,389.3 3,389.3 3,397.4
	6	38.69	3,365.0 3,413.4 3,389.3 3,389.2
	7	42.96	3,291.1 3,291.1 3,315.9 3,299.3
	8	46.46	2,976.9 2,806.6 2,921.2 2,901.6
Averages ----->			3,091.1 3,122.0 3,153.7 3,122.3

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3131.9		Mean	3293.7	3300.9	3297.3
Min Point	2143.3	-31.6%	Std. Dev.	115.6	67.5	91.0
Max Point	3397.4	8.5%	COV as %	3.5	2.0	2.8

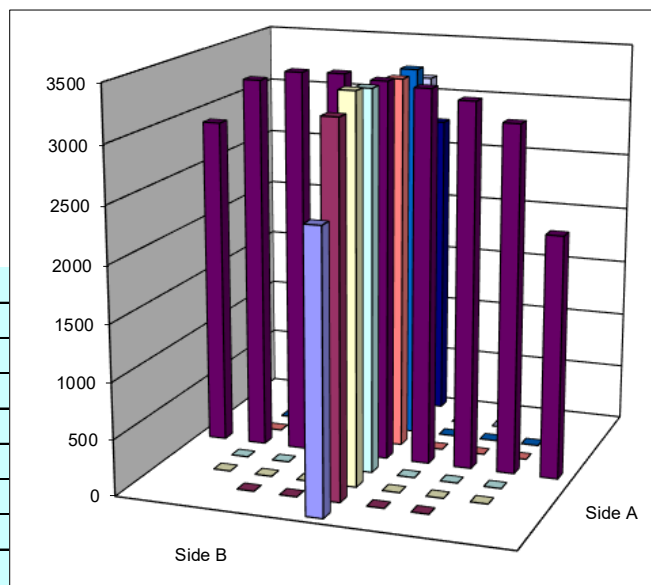
Flow w/o C-Pt	39017 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	3105 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	81.1 80.6 F	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	75.8 75.7 F		
Ambient temp	75.8 75.7 F		
Stack static	1.42 1.54 mbars		
Ambient pressure	990.86 990.86 mbars		
Total Stack pressure	992.28 992.40 mbars		
Ambient humidity	28 28 RH (%)		

## Notes:

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-10
Date	5/27/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	81.7 deg F
Stack X-Area	1809.6 in.2	Start/End Time	9:25 9:30
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean
	Point Depth, in. Velocity	Point Depth, in. Velocity
	1 1.54 2,299.7 2,506.1 2,299.7 2,368.5	1 2,405.1 2,506.1 2,603.1 2,504.8
	2 5.04 3,096.1 3,122.6 3,175.1 3,131.3	2 3,201.0 3,302.7 3,149.0 3,217.6
	3 9.31 3,327.7 3,277.6 3,302.7 3,302.7	3 3,352.4 3,352.4 3,376.9 3,360.6
	4 15.50 3,201.0 3,226.8 3,252.3 3,226.7	4 3,401.3 3,352.4 3,376.9 3,376.9
	Center 24.00 3,175.1 3,122.6 3,201.0 3,166.3	Center 3,302.7 3,277.6 3,252.3 3,277.5
	5 32.50 3,327.7 3,327.7 3,252.3 3,302.5	5 3,252.3 3,277.6 3,302.7 3,277.5
	6 38.69 3,352.4 3,201.0 3,302.7 3,285.4	6 3,302.7 3,252.3 3,252.3 3,269.1
	7 42.96 3,302.7 3,252.3 3,252.3 3,269.1	7 3,226.8 3,201.0 3,175.1 3,201.0
	8 46.46 3,042.2 3,096.1 2,987.4 3,041.9	8 2,959.6 2,874.6 2,787.1 2,873.8
Averages ----->	3,125.0 3,125.9 3,113.9 3,121.6	3,156.0 3,155.2 3,141.7 3,151.0

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3136.3		Mean	3240.6	3282.9	3261.7
Min Point	2368.5	-24.5%	Std. Dev.	68.5	65.9	68.2
Max Point	3376.9	7.7%	COV as %	2.1	2.0	2.1

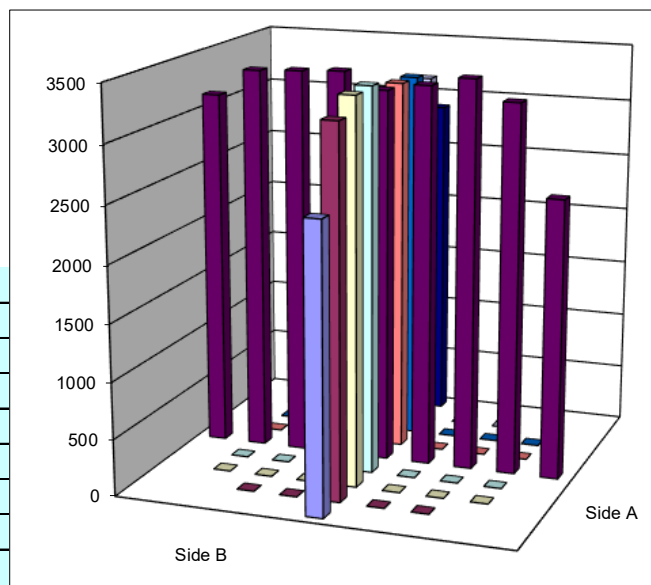
Flow w/o C-Pt	39277 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	3126 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	81.7 81.7 F	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	74.4 74.7 F		
Ambient temp	74.4 74.7 F		
Stack static	1.69 1.87 mbars		
Ambient pressure	985.10 985.10 mbars		
Total Stack pressure	986.79 986.97 mbars		
Ambient humidity	26 26 RH (%)		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-11
Date	5/27/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	82.8 deg F
Stack X-Area	1809.6 in.2	Start/End Time	10:29 10:35
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean

Point	Depth, in.	Port A (East) Velocity				Port B (West) Velocity			
1	1.54	2,475.2	2,573.6	2,668.3	2,572.3	2,819.2	2,759.8	2,729.6	
2	5.04	3,151.9	3,204.1	3,280.6	3,212.2	3,229.8	3,204.1	3,255.3	
3	9.31	3,380.1	3,229.8	3,280.6	3,296.8	3,355.4	3,330.7	3,330.7	
4	15.50	3,255.3	3,255.3	3,229.8	3,246.8	3,255.3	3,204.1	3,330.7	
Center	24.00	3,305.7	3,330.7	3,330.7	3,322.4	3,330.7	3,355.4	3,330.7	
5	32.50	3,428.7	3,355.4	3,355.4	3,379.9	3,380.1	3,404.5	3,476.7	
6	38.69	3,380.1	3,380.1	3,305.7	3,355.3	3,355.4	3,330.7	3,330.7	
7	42.96	3,255.3	3,305.7	3,204.1	3,255.0	3,305.7	3,355.4	3,355.4	
8	46.46	3,098.9	3,072.1	3,098.9	3,090.0	3,098.9	3,125.5	2,990.2	
Averages ----->		3,192.4	3,189.6	3,194.9	3,192.3	3,236.7	3,230.0	3,236.7	

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3213.4		Mean	3295.5	3324.2	3309.8
Min Point	2572.3	-19.9%	Std. Dev.	61.1	61.6	60.8
Max Point	3420.4	6.4%	COV as %	1.9	1.9	1.8

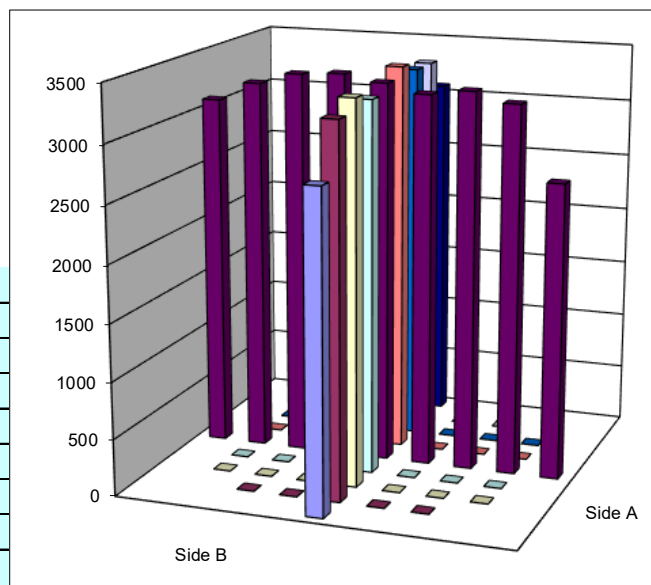
Flow w/o C-Pt	40196 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	3199 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	83.0 82.6 F	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	76.0 76.3 F		
Ambient temp	76.0 76.3 F		
Stack static	2.24 2.37 mbars		
Ambient pressure	984.76 984.76 mbars		
Total Stack pressure	987.00 987.13 mbars		
Ambient humidity	28 28 RH (%)		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-12
Date	5/27/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	83.0 deg F
Stack X-Area	1809.6 in.2	Start/End Time	11:31 11:35
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		
Order -->	First port	Second port	
Traverse-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	1.54	2,338.3 2,442.3 2,476.0 2,418.9
	2	5.04	3,230.9 3,205.1 3,205.1 3,213.7
	3	9.31	3,356.6 3,331.8 3,331.8 3,340.1
	4	15.50	3,230.9 3,205.1 3,205.1 3,213.7
	Center	24.00	3,281.8 3,331.8 3,306.9 3,306.8
	5	32.50	3,331.8 3,405.6 3,453.9 3,397.1
	6	38.69	3,405.6 3,429.8 3,477.9 3,437.8
	7	42.96	3,381.2 3,381.2 3,306.9 3,356.4
	8	46.46	3,100.0 3,205.1 3,046.0 3,117.1
Averages ----->			3,184.1 3,215.3 3,201.1 3,200.2

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3197.1		Mean	3323.7	3321.2	3322.4
Min Point	2406.6	-24.7%	Std. Dev.	85.8	85.7	82.4
Max Point	3437.8	7.5%	COV as %	2.6	2.6	2.5

Flow w/o C-Pt	39977 cfm
Vel Avg w/o C-Pt	3181 fpm
	Start Finish
Stack temp	83.1 82.8 F
Equipment temp	76.0 76.3 F
Ambient temp	76.0 76.3 F
Stack static	1.69 2.44 mbars
Ambient pressure	984.42 984.76 mbars
Total Stack pressure	986.11 987.20 mbars
Ambient humidity	30 30 RH (%)

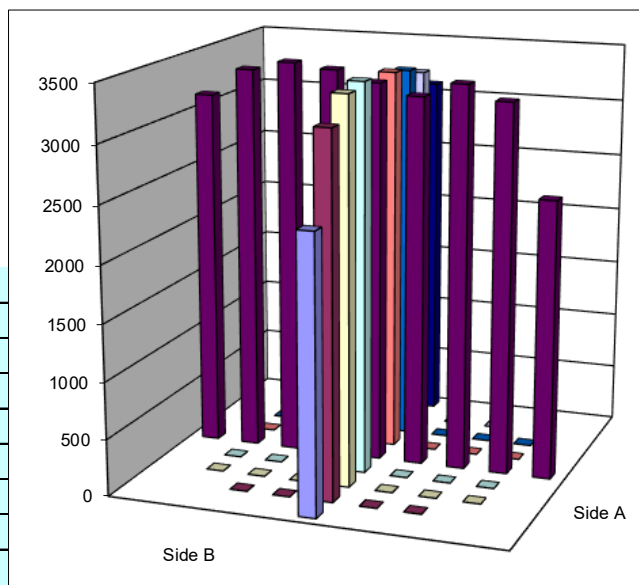
Instuments Used:	Cal Due
Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Control Co. Thermometer (SN:220435230)	Post-test verification

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S1 (C3V)	Run No.	VT-13
Date	5/27/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	83.6 deg F
Stack X-Area	1809.6 in.2	Start/End Time	12:35 12:40
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units <u>ft/min</u>			
Order -->	First port	Second port	
Traversal-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	1.54	2,792.0 3,020.2 2,821.4 2,877.9
	2	5.04	3,479.5 3,550.3 3,455.6 3,495.1
	3	9.31	3,619.6 3,455.6 3,526.9 3,534.0
	4	15.50	3,573.5 3,642.5 3,573.5 3,596.5
	Center	24.00	3,573.5 3,526.9 3,526.9 3,542.4
	5	32.50	3,573.5 3,573.5 3,550.3 3,565.8
	6	38.69	3,503.2 3,479.5 3,479.5 3,487.4
	7	42.96	3,455.6 3,431.5 3,455.6 3,447.5
	8	46.46	3,232.3 3,358.2 3,180.6 3,257.1
Averages ----->			3,422.5 3,448.7 3,396.7 3,422.6

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3418.9		Mean	3524.1	3574.7	3549.4
Min Point	2431.7	-28.9%	Std. Dev.	50.8	76.2	67.5
Max Point	3672.4	7.4%	COV as %	1.4	2.1	1.9

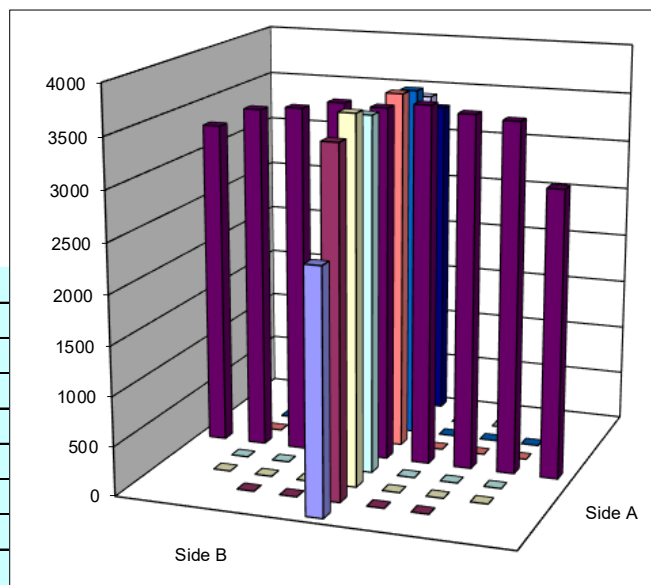
Flow w/o C-Pt	42745 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	3402 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	83.3 83.8 F	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	77.3 77.5 F		
Ambient temp	77.3 77.5 F		
Stack static	2.04 2.07 mbars		
Ambient pressure	984.76 984.76 mbars		
Total Stack pressure	986.80 986.83 mbars		
Ambient humidity	30 30 RH (%)		

## Notes:

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

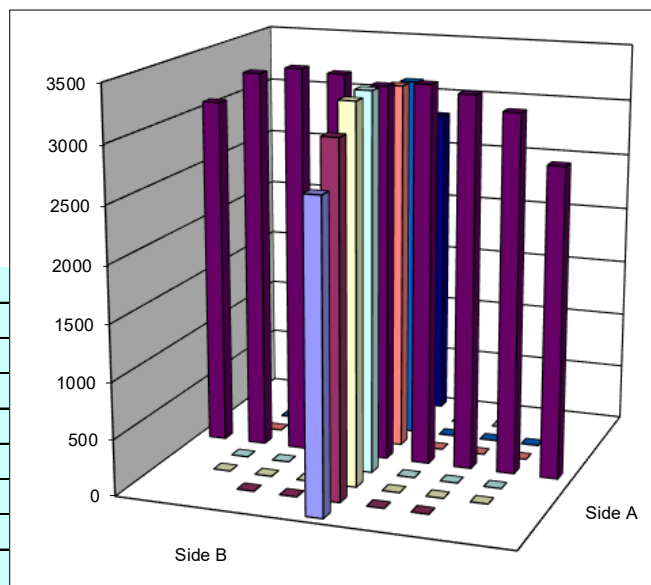
Stack	LV-S1 (C3V)	Run No.	VT-14
Date	5/28/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	48 in.	Stack Temp	80.1 deg F
Stack X-Area	1809.6 in.2	Start/End Time	9:12 9:18
Test Port	A & B	Center 2/3 from	4.40 to: 43.60
Distance to disturbance	65.67 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		
Order -->	First port	Second port	
Traversal-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	1.54	2,708.8 2,617.0 2,521.8 2,615.9
	2	5.04	3,021.9 2,994.8 3,048.7 3,021.8
	3	9.31	3,075.3 3,153.9 3,205.2 3,144.8
	4	15.50	3,205.2 3,230.5 3,179.6 3,205.1
	Center	24.00	3,128.0 3,205.2 3,179.6 3,170.9
	5	32.50	3,255.7 3,230.5 3,255.7 3,247.3
	6	38.69	3,305.4 3,255.7 3,255.7 3,272.2
	7	42.96	3,205.2 3,205.2 3,230.5 3,213.6
	8	46.46	2,883.8 2,994.8 2,967.4 2,948.7
Averages ----->			3,087.7 3,098.6 3,093.8 3,093.4

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	3106.0		Mean	3182.3	3224.9	3203.6
Min Point	2615.9	-15.8%	Std. Dev.	82.8	118.0	100.4
Max Point	3337.8	7.5%	COV as %	2.6	3.7	3.1

Flow w/o C-Pt	38818 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	3089 fpm	Standard pitot (ID A06AG 160-60, 60")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 1912128770)	12/3/2021
Stack temp	80.1 80.1 F	Control Co. Thermometer (SN:220435230)	Post-test verification
Equipment temp	72.2 72.6 F		
Ambient temp	72.2 72.6 F		
Stack static	2.04 1.64 mbars		
Ambient pressure	995.60 995.26 mbars		
Total Stack pressure	997.64 996.90 mbars		
Ambient humidity	27 27 RH (%)		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



## Appendix B – LV-S2 Stack Verification Data Sheets

### B.1 Flow Angle Data Forms

#### FLOW ANGLE DATA FORM

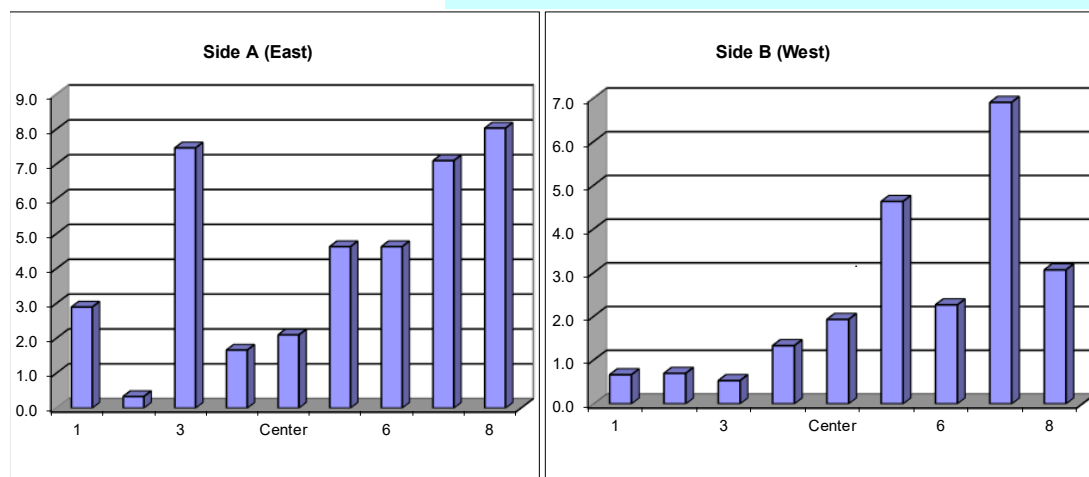
Stack	LV-S2 (C5V)	Run No.	FA-1
Date	5/24/2021	Fan Setting	NA Hz
Start/End Time	13:45 13:54	Fan Configuration	Fan A
Testers	ZDH/LCE	Stack Temp	74.7 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

Side A (East)						Side B (West)			
	1	2	3	Mean		1	2	3	Mean
Point	1	2	3			1	2	3	
Depth, in.	1.92	6.30	11.64			1.4	0.2	0.4	
	19.38	30.00	40.62			4.6	5.3	4.0	
	48.36	53.70	58.08			1.6	2.9	2.3	
deg. cw	2.8	0.2	7.9			0.9	0.8	0.3	
	3.4	0.5	6.7			0.3	2.3	7.1	
	2.5	0.3	7.8			1.7	2.3	3.1	
	2.9	0.7	7.5			2.1	4.6	2.3	
Mean	2.1	2.6	3.3			2.4	3.4	3.3	
Mean of absolute values:	4.3					2.4			
" w/o points by wall:	4.0					2.6			
Grand mean ABS						3.4			
Grand mean ABS w/o wall pts						3.3			

<b>Instuments Used:</b>	<b>Cal. Due</b>
S-type pitot (ID:A100-19, 72")	Pre-test calibration; Post-test inspection.
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)	Accuracy check prior to each use; field recalibration as necessary
Digi-sense 20250-13 Manometer (SN: 191212877)	Pre-test inspection; post test calibration check.

#### Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Form.



# FLOW ANGLE DATA FORM

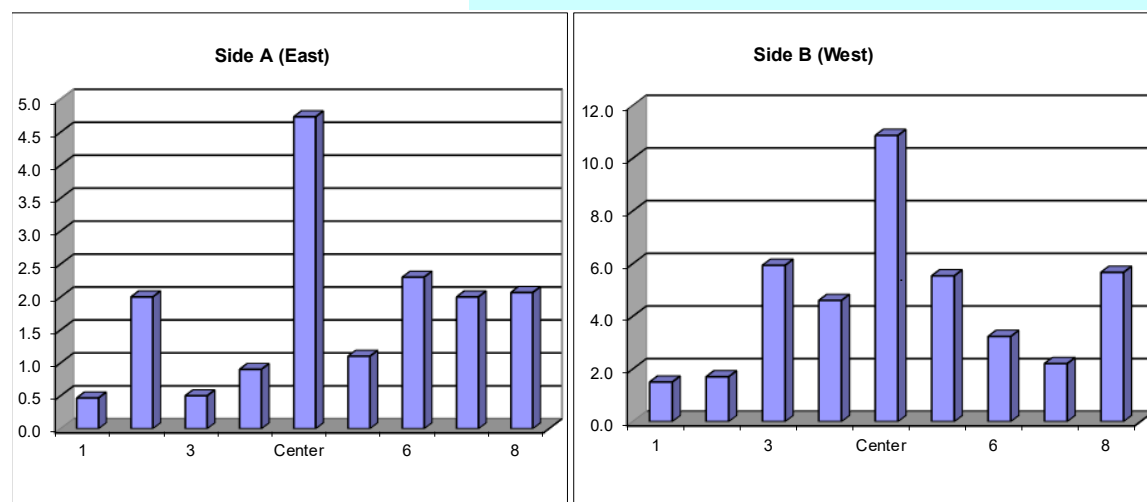
Stack	LV-S2 (C5V)	Run No.	FA-2
Date	5/25/2021	Fan Setting	NA Hz
Start/End Time	9:42 9:48	Fan Configuration	Fan A
Testers	ZDH/LCE	Stack Temp	72.2 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

		Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw			
1	1.92	0.1	1.0	0.3	0.5	2.1	0.8	1.6	1.5
2	6.30	1.8	2.2	2.0	2.0	2.2	1.9	1.0	1.7
3	11.64	0.7	0.1	0.7	0.5	5.5	6.7	5.6	5.9
4	19.38	1.0	0.9	0.8	0.9	4.4	4.8	4.6	4.6
Center	30.00	4.4	5.8	4.0	4.7	12.2	12.6	7.8	10.9
5	40.62	0.3	1.0	2.0	1.1	5.0	6.4	5.2	5.5
6	48.36	2.4	2.5	2.0	2.3	2.8	3.2	3.7	3.2
7	53.70	2.3	1.8	1.9	2.0	2.7	2.4	1.5	2.2
8	58.08	3.0	1.5	1.7	2.1	5.5	5.8	5.7	5.7
Mean of absolute values:					1.8	4.6			
" " w/o points by wall:					1.9	4.9			
						Grand mean ABS 3.2			
						Grand mean ABS w/o wall pts 3.4			

**Instruments Used:** S-type pitot (ID:A100-19, 72")  
**Cal. Due** Pre-test calibration; Post-test inspection.  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3) Accuracy check prior to each use; field recalibration as necessary  
 Digi-sense 20250-13 Manometer (SN: 191212877) Pre-test inspection; post test calibration check.

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



# FLOW ANGLE DATA FORM

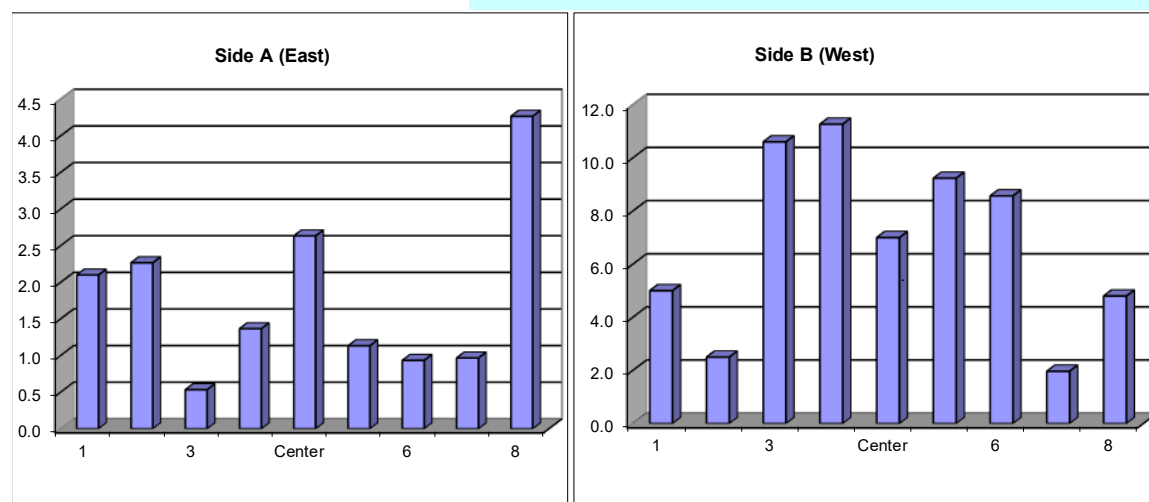
Stack	LV-S2 (C5V)	Run No.	FA-3
Date	5/25/2021	Fan Setting	NA Hz
Start/End Time	10:56 11:04	Fan Configuration	Fan A
Testers	ZDH/LCE	Stack Temp	75.3 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

Point	Depth, in.	Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
		deg. cw				deg. cw			
1	1.92	2.2	2.0	2.1	2.1	3.3	4.6	7.1	5.0
2	6.30	2.6	2.2	2.0	2.3	1.7	1.3	4.5	2.5
3	11.64	0.2	0.8	0.6	0.5	12.2	10.1	9.5	10.6
4	19.38	1.5	0.8	1.8	1.4	11.5	10.5	11.8	11.3
Center	30.00	2.4	2.6	2.9	2.6	8.2	6.6	6.2	7.0
5	40.62	1.5	1.0	0.9	1.1	9.5	9.6	8.6	9.2
6	48.36	0.9	0.8	1.1	0.9	8.5	8.6	8.6	8.6
7	53.70	1.5	0.7	0.7	1.0	1.8	1.4	2.7	2.0
8	58.08	3.4	5.0	4.4	4.3	4.5	4.5	5.4	4.8
Mean of absolute values:					1.8	6.8			
" " w/o points by wall:					1.4	7.3			
						Grand mean ABS 4.3			
						Grand mean ABS w/o wall pts 4.4			

**Instruments Used:** S-type pitot (ID:A100-19, 72")  
**Cal. Due** Pre-test calibration; Post-test inspection.  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3) Accuracy check prior to each use; field recalibration as necessary  
 Digi-sense 20250-13 Manometer (SN: 191212877) Pre-test inspection; post test calibration check.

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



# FLOW ANGLE DATA FORM

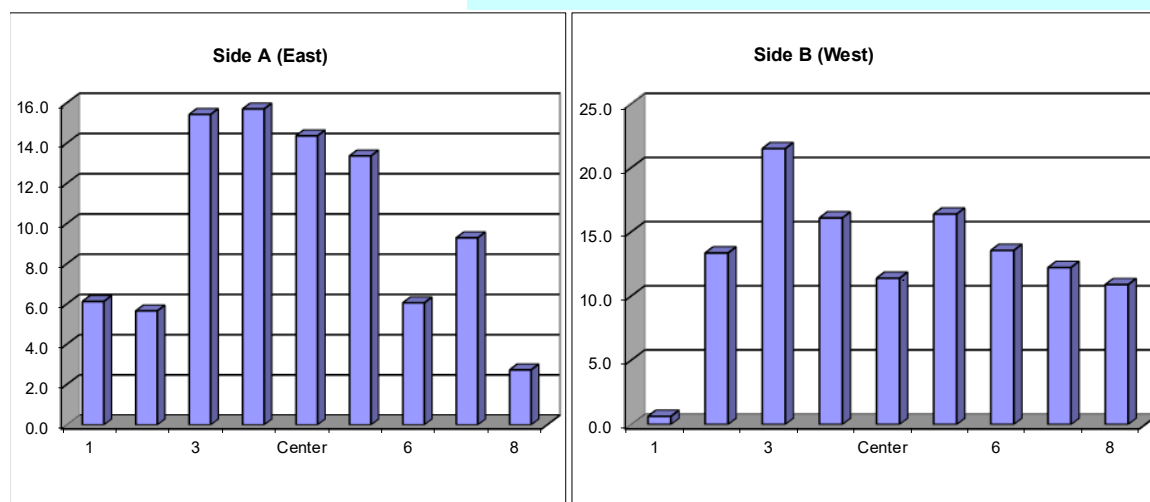
Stack	LV-S2 (C5V)	Run No.	FA-4
Date	5/25/2021	Fan Setting	NA Hz
Start/End Time	12:05 12:13	Fan Configuration	Fan A
Testers	ZDH/LCE	Stack Temp	75.7 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

		Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw			
1	1.92	6.7	6.3	5.4	6.1	0.5	0.6	0.8	0.6
2	6.30	5.6	5.9	5.5	5.7	13.9	13.0	13.2	13.4
3	11.64	15.2	15.4	15.7	15.4	21.5	21.6	21.4	21.5
4	19.38	15.6	15.4	16.1	15.7	16.3	17.0	15.0	16.1
Center	30.00	14.9	14.2	14.0	14.4	11.7	12.4	10.1	11.4
5	40.62	13.9	13.2	13.0	13.4	16.2	15.2	17.8	16.4
6	48.36	6.8	5.9	5.5	6.1	13.3	12.2	15.2	13.6
7	53.70	9.5	9.7	8.7	9.3	11.8	12.1	12.8	12.2
8	58.08	3.0	1.9	3.3	2.7	10.3	12.4	10.0	10.9
Mean of absolute values:					9.9	12.9			
" " w/o points by wall:					11.4	14.9			
						Grand mean ABS 11.4			
						Grand mean ABS w/o wall pts 13.2			

**Instruments Used:** S-type pitot (ID:A100-19, 72")  
**Cal. Due** Pre-test calibration; Post-test inspection.  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3) Accuracy check prior to each use; field recalibration as necessary  
 Digi-sense 20250-13 Manometer (SN: 191212877) Pre-test inspection; post test calibration check.

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



# FLOW ANGLE DATA FORM

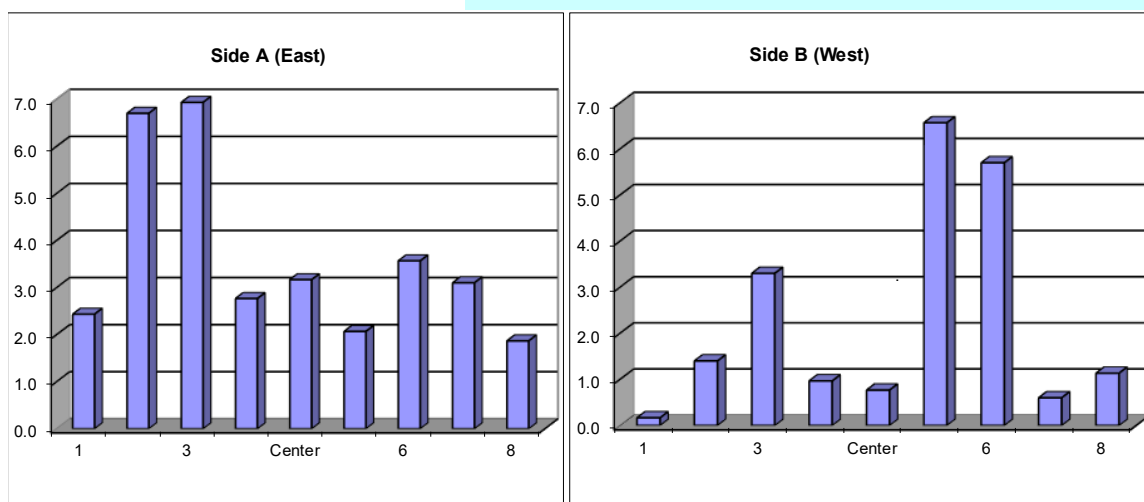
Stack	LV-S2 (C5V)	Run No.	FA-5
Date	5/25/2021	Fan Setting	NA Hz
Start/End Time	14:11 14:18	Fan Configuration	Fan A
Testers	ZDH/LCE	Stack Temp	75.6 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->	Side A (East)		Side B (West)
Trial ---->	1	2	3
	deg. cw		
Point	Depth, in.	Mean	
1	1.92	2.6	2.4
2	6.30	6.8	6.6
3	11.64	5.5	7.3
4	19.38	2.1	2.5
Center	30.00	3.8	2.9
5	40.62	2.5	1.6
6	48.36	2.5	4.0
7	53.70	4.2	4.2
8	58.08	3.2	0.7
Mean of absolute values:		3.6	2.3
" w/o points by wall:		4.0	2.8
			Grand mean ABS 3.0
			Grand mean ABS w/o wall pts 3.4

**Instruments Used:** S-type pitot (ID:A100-19, 72")  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3)  
 Digi-sense 20250-13 Manometer (SN: 191212877)

**Cal. Due** Pre-test calibration; Post-test inspection.  
 Accuracy check prior to each use; field recalibration as necessary  
 Pre-test inspection; post test calibration check.

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



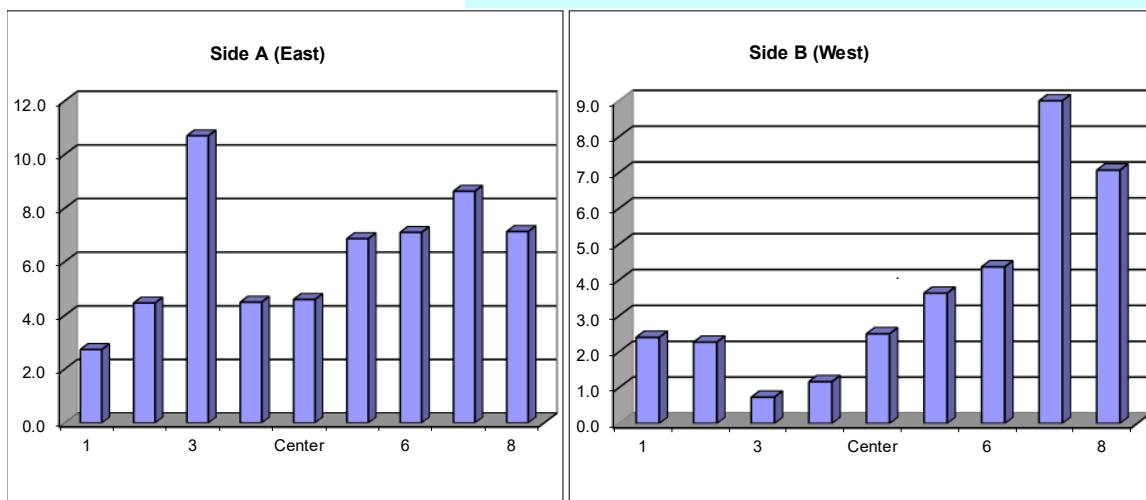
# FLOW ANGLE DATA FORM

Stack	LV-S2 (C5V)	Run No.	FA-6
Date	5/26/2021	Fan Setting	NA Hz
Start/End Time	9:37 9:44	Fan Configuration	Fan A
Testers	ZDH/LCE	Stack Temp	74.9 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

Point	Depth, in.	Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
		deg. cw				deg. cw			
1	1.92	3.0	2.7	2.5	2.7	2.4	2.1	2.7	2.4
2	6.30	4.7	4.6	4.1	4.5	1.8	1.3	3.7	2.3
3	11.64	10.7	10.9	10.5	10.7	1.0	0.4	0.8	0.7
4	19.38	4.7	4.4	4.4	4.5	1.0	0.9	1.6	1.2
Center	30.00	4.1	4.7	5.0	4.6	2.7	2.6	2.2	2.5
5	40.62	7.0	6.9	6.7	6.9	3.5	3.6	3.8	3.6
6	48.36	7.1	6.9	7.3	7.1	4.1	4.0	5.0	4.4
7	53.70	8.4	8.3	9.2	8.6	8.7	9.8	8.5	9.0
8	58.08	6.2	7.4	7.8	7.1	6.9	7.7	6.6	7.1
Mean of absolute values:					6.3	3.7			
" w/o points by wall:					6.7	3.4			
						Grand mean ABS 5.0			
						Grand mean ABS w/o wall pts 5.0			

**Instruments Used:** S-type pitot (ID:A100-19, 72")  
**Cal. Due** Pre-test calibration; Post-test inspection.  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3) Accuracy check prior to each use; field recalibration as necessary  
 Digi-sense 20250-13 Manometer (SN: 191212877) Pre-test inspection; post test calibration check.

**Notes:**  
 Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



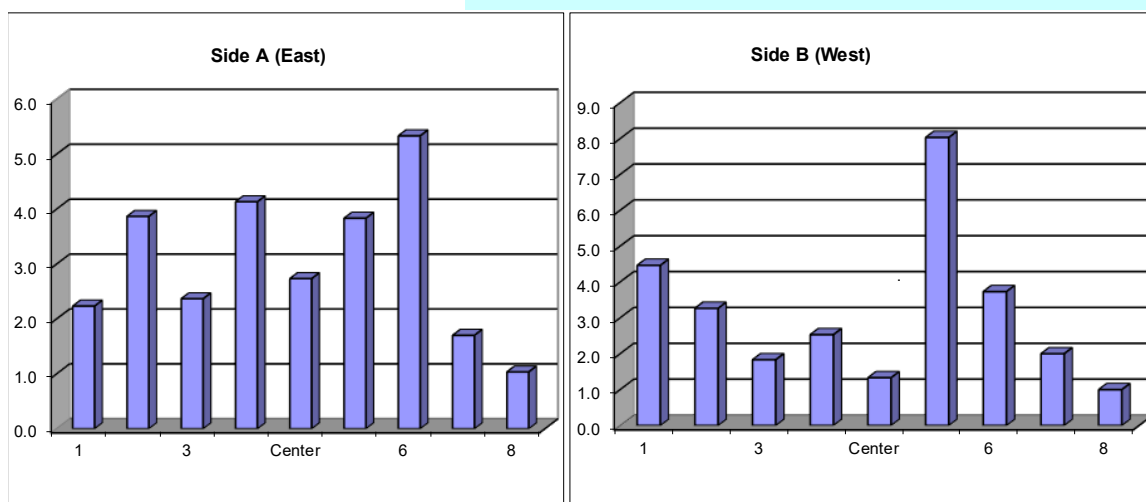
# FLOW ANGLE DATA FORM

Stack	LV-S2 (C5V)	Run No.	FA-7
Date	5/25/2021	Fan Setting	NA Hz
Start/End Time	10:44 10:51	Fan Configuration	Fan A
Testers	ZDH/LCE	Stack Temp	75.2 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

Side A (East)					Side B (West)					
	1	2	3	Mean		1	2	3	Mean	
Point	deg. cw					deg. cw				
1	1.92	2.1	2.2	2.4	2.2	5.5	3.9	4.0	4.5	
2	6.30	3.7	4.5	3.4	3.9	3.3	3.6	2.9	3.3	
3	11.64	2.2	2.9	2.0	2.4	1.9	1.5	2.1	1.8	
4	19.38	4.5	3.9	4.0	4.1	2.0	3.3	2.3	2.5	
Center	30.00	2.7	2.5	3.0	2.7	1.6	0.8	1.6	1.3	
5	40.62	4.3	4.1	3.1	3.8	10.3	7.5	6.3	8.0	
6	48.36	5.7	5.2	5.1	5.3	3.3	4.7	3.2	3.7	
7	53.70	1.4	2.2	1.5	1.7	2.1	2.7	1.2	2.0	
8	58.08	1.2	1.0	0.9	1.0	1.2	0.8	1.0	1.0	
Mean of absolute values:					3.0					3.1
" w/o points by wall:					3.4					3.2
						Grand mean ABS				3.1
						Grand mean ABS w/o wall pts				3.3

**Instruments Used:** S-type pitot (ID:A100-19, 72")  
**Cal. Due** Pre-test calibration; Post-test inspection.  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3) Accuracy check prior to each use; field recalibration as necessary  
 Digi-sense 20250-13 Manometer (SN: 191212877) Pre-test inspection; post test calibration check.

**Notes:**  
 Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



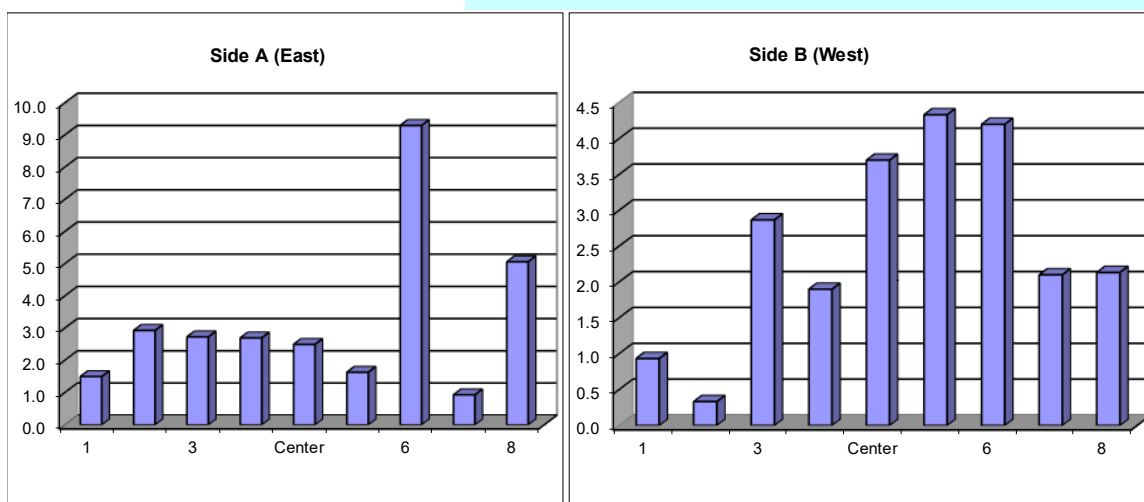
# FLOW ANGLE DATA FORM

Stack	LV-S2 (C5V)	Run No.	FA-8
Date	5/25/2021	Fan Setting	NA Hz
Start/End Time	12:56 13:02	Fan Configuration	Fan B
Testers	ZDH/LCE	Stack Temp	75.3 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

		Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw			
1	1.92	1.4	1.5	1.6	1.5	0.7	1.2	0.9	0.9
2	6.30	2.4	3.7	2.7	2.9	0.2	0.7	0.1	0.3
3	11.64	2.6	2.7	2.9	2.7	2.4	3.2	3.0	2.9
4	19.38	3.2	2.5	2.4	2.7	3.2	0.9	1.6	1.9
Center	30.00	2.5	2.3	2.7	2.5	4.0	3.6	3.5	3.7
5	40.62	1.4	1.9	1.6	1.6	4.9	4.4	3.7	4.3
6	48.36	9.5	9.7	8.7	9.3	3.7	4.4	4.5	4.2
7	53.70	0.8	1.3	0.7	0.9	2.7	2.6	1.0	2.1
8	58.08	5.3	4.5	5.4	5.1	2.9	1.9	1.6	2.1
Mean of absolute values:					3.3	2.5			
" w/o points by wall:					3.2	2.8			
						Grand mean ABS 2.9			
						Grand mean ABS w/o wall pts 3.0			

**Instruments Used:** S-type pitot (ID:A100-19, 72")  
**Cal. Due** Pre-test calibration; Post-test inspection.  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3) Accuracy check prior to each use; field recalibration as necessary  
 Digi-sense 20250-13 Manometer (SN: 191212877) Pre-test inspection; post test calibration check.

**Notes:**  
 Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



# FLOW ANGLE DATA FORM

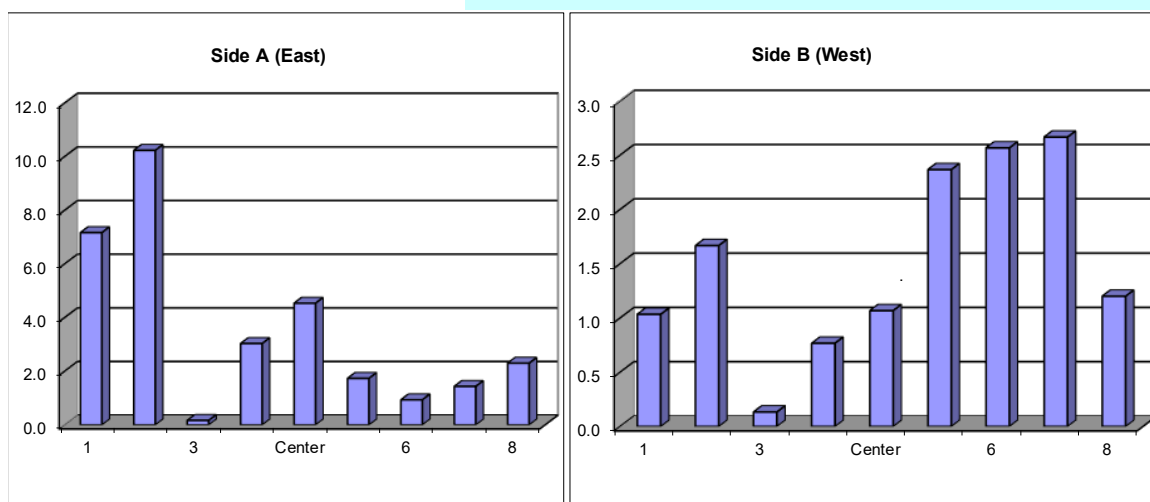
Stack	LV-S2 (C5V)	Run No.	FA-9
Date	5/26/2021	Fan Setting	NA Hz
Start/End Time	14:01 14:08	Fan Configuration	Fan B
Testers	ZDH/LCE	Stack Temp	75.8 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

Side A (East)					Side B (West)				
	1	2	3	Mean		1	2	3	Mean
Point	deg. cw					deg. cw			
1	7.5	7.0	7.0	7.2		1.6	1.1	0.4	1.0
2	10.6	10.2	9.9	10.2		1.3	1.6	2.1	1.7
3	0.0	0.3	0.2	0.2		0.3	0.0	0.1	0.1
4	19.38	3.3	3.1	2.7		1.3	0.5	0.5	0.8
Center	30.00	4.7	4.8	4.1		1.4	1.3	0.5	1.1
5	40.62	1.6	1.7	1.9		1.6	3.4	2.1	2.4
6	48.36	0.5	1.1	1.2		2.5	3.5	1.7	2.6
7	53.70	1.4	1.5	1.4		2.3	3.2	2.5	2.7
8	58.08	2.4	2.1	2.4		2.8	0.6	0.2	1.2
Mean of absolute values:	3.5					1.5			
" w/o points by wall:	3.2					1.6			
						Grand mean ABS 2.5			
						Grand mean ABS w/o wall pts 2.4			

<b>Instuments Used:</b>	<b>Cal. Due</b>
S-type pitot (ID:A100-19, 72")	Pre-test calibration; Post-test inspection.
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)	Accuracy check prior to each use; field recalibration as necessary
Digi-sense 20250-13 Manometer (SN: 191212877)	Pre-test inspection; post test calibration check.

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Form.



# FLOW ANGLE DATA FORM

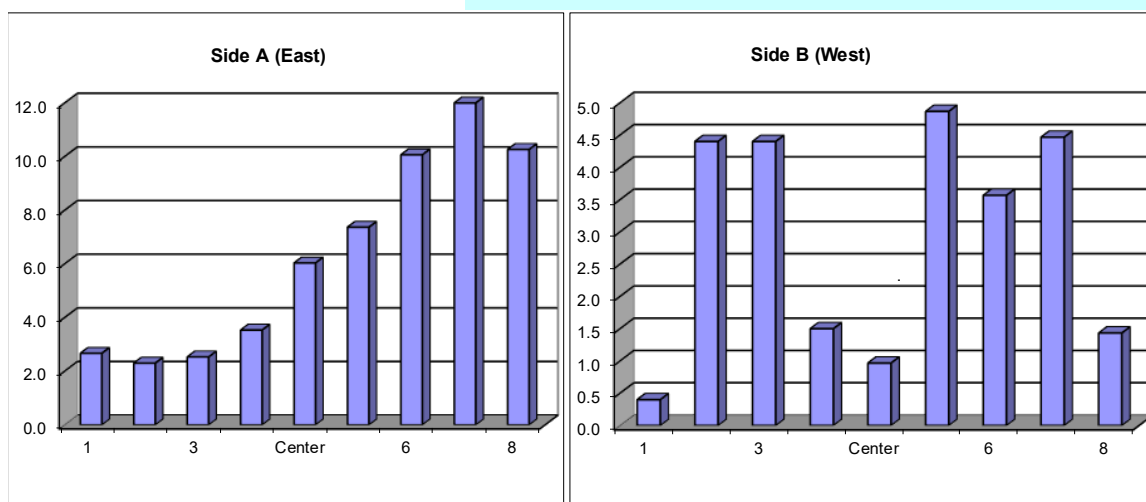
Stack	LV-S2 (C5V)	Run No.	FA-10
Date	5/27/2021	Fan Setting	NA Hz
Start/End Time	9:15 9:21	Fan Configuration	Fan B
Testers	ZDH/LCE	Stack Temp	75.9 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

		Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw			
1	1.92	2.8	2.5	2.7	2.7	0.4	0.2	0.6	0.4
2	6.30	2.1	2.5	2.3	2.3	3.5	4.8	4.9	4.4
3	11.64	2.4	2.9	2.3	2.5	5.2	4.2	3.8	4.4
4	19.38	3.7	3.3	3.6	3.5	0.1	1.7	2.7	1.5
Center	30.00	6.2	6.0	5.9	6.0	0.1	0.8	2.0	1.0
5	40.62	7.0	7.5	7.6	7.4	4.3	5.6	4.7	4.9
6	48.36	10.1	10.1	10.0	10.1	3.1	3.7	3.9	3.6
7	53.70	12.0	12.1	11.9	12.0	4.3	5.1	4.0	4.5
8	58.08	9.7	9.9	11.2	10.3	2.8	0.6	0.9	1.4
Mean of absolute values:					6.3	2.9			
" w/o points by wall:					6.3	3.5			
						Grand mean ABS 4.6			
						Grand mean ABS w/o wall pts 4.9			

**Instuments Used:** S-type pitot (ID:A100-19, 72")  
**Cal. Due** Pre-test calibration; Post-test inspection.  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3) Accuracy check prior to each use; field recalibration as necessary  
 Digi-sense 20250-13 Manometer (SN: 191212877) Pre-test inspection; post test calibration check.

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



# FLOW ANGLE DATA FORM

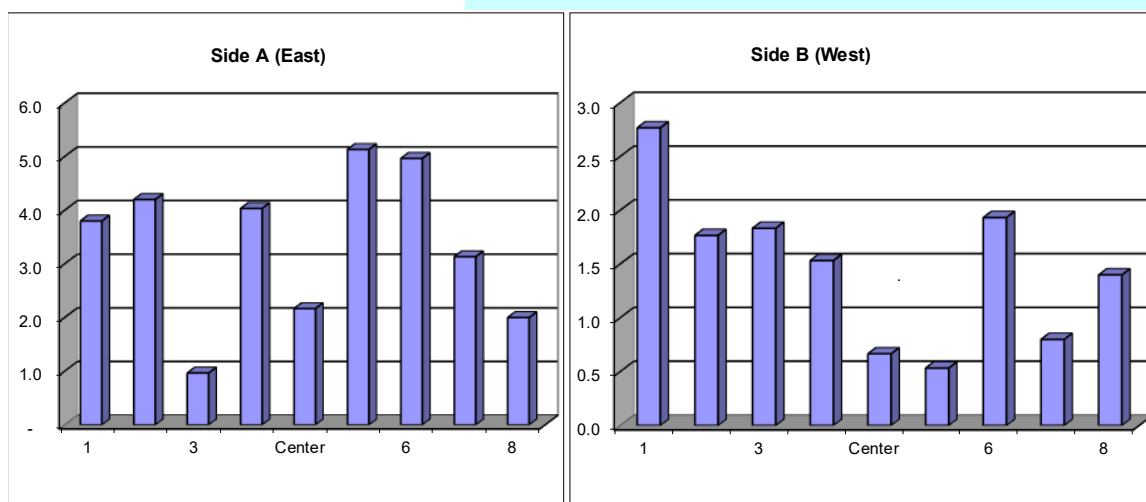
Stack	LV-S2 (C5V)	Run No.	FA-11
Date	5/27/2021	Fan Setting	NA Hz
Start/End Time	10:19 10:25	Fan Configuration	Fan B
Testers	ZDH/LCE	Stack Temp	77.0 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

Point	Depth, in.	Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
		deg. cw				deg. cw			
1	1.92	4.0	3.7	3.7	3.8	2.2	3.1	3.0	2.8
2	6.30	3.6	4.2	4.8	4.2	3.1	0.6	1.6	1.8
3	11.64	0.9	0.8	1.2	1.0	3.0	1.4	1.1	1.8
4	19.38	4.1	3.9	4.1	4.0	0.1	2.2	2.3	1.5
Center	30.00	2.8	1.9	1.8	2.2	0.2	0.7	1.1	0.7
5	40.62	5.4	5.0	5.0	5.1	0.8	0.6	0.2	0.5
6	48.36	5.2	4.6	5.1	5.0	2.0	1.8	2.0	1.9
7	53.70	2.8	3.3	3.3	3.1	0.7	0.7	1.0	0.8
8	58.08	1.7	2.2	2.1	2.0	1.1	1.6	1.5	1.4
Mean of absolute values:					3.4	1.5			
" w/o points by wall:					3.5	1.3			
						Grand mean ABS 2.4			
						Grand mean ABS w/o wall pts 2.4			

<b>Instuments Used:</b>	<b>Cal. Due</b>
S-type pitot (ID:A100-19, 72")	Pre-test calibration; Post-test inspection.
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)	Accuracy check prior to each use; field recalibration as necessary
Digi-sense 20250-13 Manometer (SN: 191212877)	Pre-test inspection; post test calibration check.

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Form.



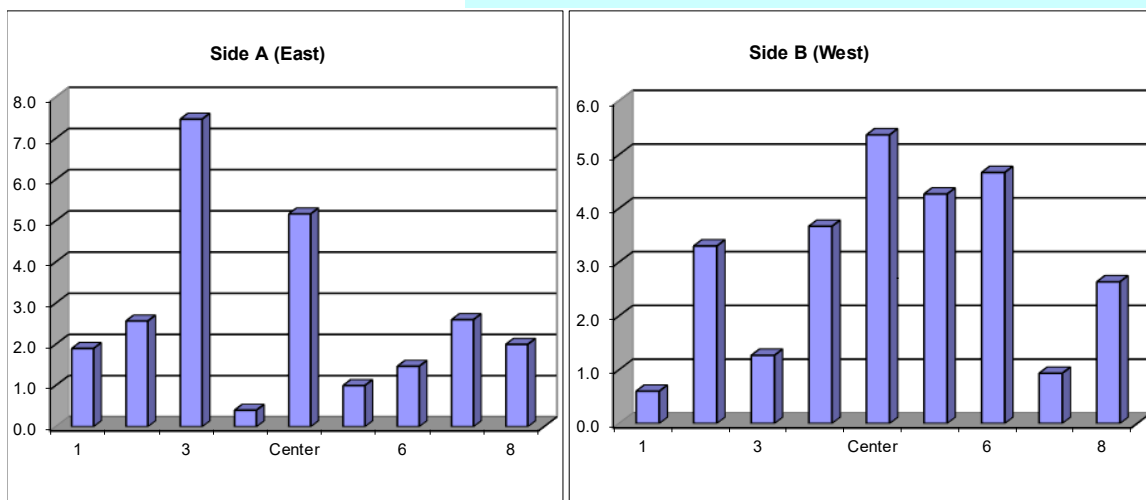
# FLOW ANGLE DATA FORM

Stack	LV-S2 (C5V)	Run No.	FA-12
Date	5/27/2021	Fan Setting	NA Hz
Start/End Time	11:19 11:25	Fan Configuration	Fan B
Testers	ZDH/LCE	Stack Temp	76.4 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

Point	Depth, in.	Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
		deg. cw				deg. cw			
1	1.92	2.2	1.9	1.6	1.9	0.6	0.8	0.4	0.6
2	6.30	2.6	2.4	2.7	2.6	3.1	3.2	3.6	3.3
3	11.64	7.5	6.9	8.0	7.5	1.0	1.2	1.6	1.3
4	19.38	0.5	0.5	0.2	0.4	4.0	3.7	3.3	3.7
Center	30.00	5.5	4.7	5.3	5.2	5.1	5.4	5.6	5.4
5	40.62	1.1	1.0	0.9	1.0	5.4	2.9	4.5	4.3
6	48.36	2.3	1.2	0.9	1.5	5.3	4.9	3.8	4.7
7	53.70	2.6	2.2	3.0	2.6	0.9	0.8	1.1	0.9
8	58.08	2.7	1.9	1.4	2.0	2.3	2.8	2.8	2.6
Mean of absolute values:					2.7	3.0			
" w/o points by wall:					3.0	3.4			
						Grand mean ABS 2.8			
						Grand mean ABS w/o wall pts 3.2			

**Instruments Used:** S-type pitot (ID:A100-19, 72")  
**Cal. Due** Pre-test calibration; Post-test inspection.  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3) Accuracy check prior to each use; field recalibration as necessary  
 Digi-sense 20250-13 Manometer (SN: 191212877) Pre-test inspection; post test calibration check.

**Notes:**  
 Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



# FLOW ANGLE DATA FORM

Stack	LV-S2 (C5V)	Run No.	FA-13
Date	5/27/2021	Fan Setting	NA Hz
Start/End Time	12:26 12:31	Fan Configuration	Fan B
Testers	ZDH/LCE	Stack Temp	77.1 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

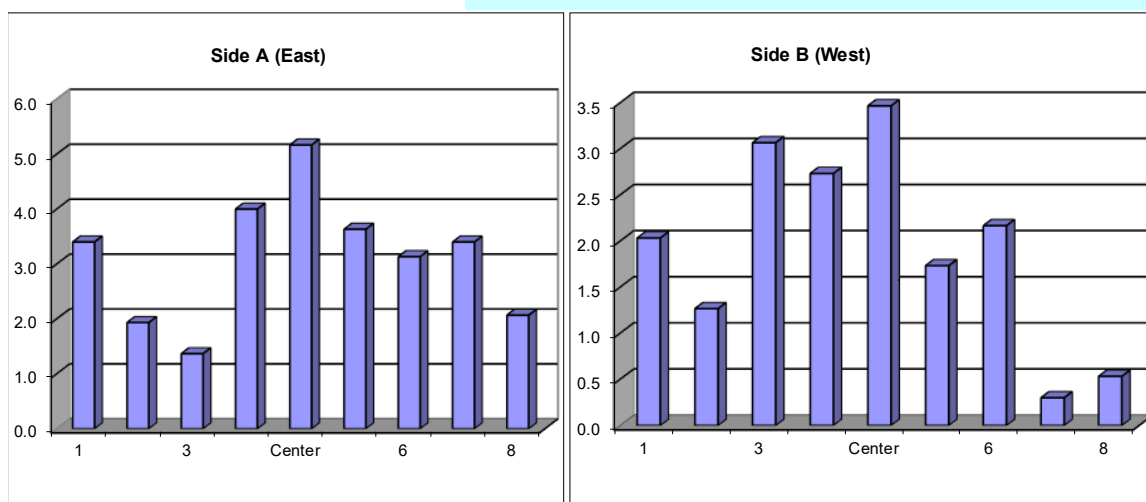
Side A (East)					Side B (West)					
	1	2	3	Mean		1	2	3	Mean	
Point	deg. cw					deg. cw				
1	1.92	3.4	3.1	3.7	3.4	2.3	1.9	1.9	2.0	
2	6.30	2.3	1.6	1.9	1.9	1.2	1.4	1.2	1.3	
3	11.64	1.3	1.1	1.7	1.4	2.8	3.2	3.2	3.1	
4	19.38	4.1	4.0	3.9	4.0	2.4	3.1	2.7	2.7	
Center	30.00	4.9	5.2	5.4	5.2	3.3	3.5	3.6	3.5	
5	40.62	3.6	3.7	3.6	3.6	2.0	1.7	1.5	1.7	
6	48.36	3.2	3.5	2.7	3.1	1.7	2.5	2.3	2.2	
7	53.70	3.6	3.3	3.3	3.4	0.2	0.2	0.5	0.3	
8	58.08	2.3	2.0	1.9	2.1	0.6	0.7	0.3	0.5	
Mean of absolute values:					3.1					1.9
" w/o points by wall:					3.2					2.1
					Grand mean ABS					2.5
					Grand mean ABS w/o wall pts					2.7

**Instuments Used:** S-type pitot (ID:A100-19, 72")  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3)  
 Digi-sense 20250-13 Manometer (SN: 191212877)

**Cal. Due** Pre-test calibration; Post-test inspection.  
 Accuracy check prior to each use; field recalibration as necessary  
 Pre-test inspection; post test calibration check.

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



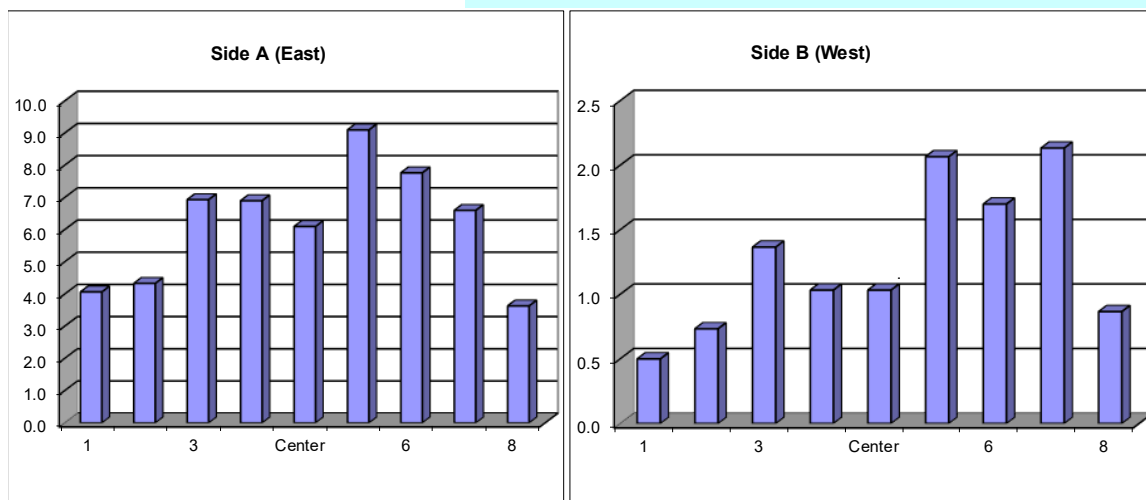
# FLOW ANGLE DATA FORM

Stack	LV-S2 (C5V)	Run No.	FA-14
Date	5/28/2021	Fan Setting	NA Hz
Start/End Time	8:59 9:07	Fan Configuration	Fan B
Testers	ZDH/LCE	Stack Temp	75.6 deg F
Stack Dia.	60 in	Units	degrees
Stack X-Area	2827.4 in <sup>2</sup>	Port	A & B
Elevation	691 ft		
Distance to disturbance	91.17 ft		
Order -->	First	Second	
Traverse-->			
Trial ---->			

Point	Depth, in.	Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
		deg. cw				deg. cw			
1	1.92	4.1	3.8	4.3	4.1	0.5	0.4	0.6	0.5
2	6.30	4.4	4.1	4.5	4.3	1.3	0.4	0.5	0.7
3	11.64	7.2	6.9	6.7	6.9	0.8	1.8	1.5	1.4
4	19.38	6.5	7.3	6.9	6.9	0.9	1.0	1.2	1.0
Center	30.00	6.3	5.7	6.3	6.1	1.0	0.9	1.2	1.0
5	40.62	9.1	8.9	9.3	9.1	2.3	1.4	2.5	2.1
6	48.36	7.3	7.9	8.1	7.8	1.9	1.3	1.9	1.7
7	53.70	6.4	7.0	6.4	6.6	0.6	2.4	3.4	2.1
8	58.08	3.3	4.1	3.5	3.6	0.7	0.9	1.0	0.9
Mean of absolute values:					6.2	1.3			
" w/o points by wall:					6.8	1.4			
						Grand mean ABS 3.7			
						Grand mean ABS w/o wall pts 4.1			

**Instuments Used:** S-type pitot (ID:A100-19, 72") Cal. Due Pre-test calibration; Post-test inspection.  
 Angle indicator SPI Tronic PRO 360 (SN 31-038-3) Accuracy check prior to each use; field recalibration as necessary  
 Digi-sense 20250-13 Manometer (SN: 191212877) Pre-test inspection; post test calibration check.

**Notes:**  
 Traverse point depth = the distance from inside stack wall to each point.  
 First traverse point is all the way into the stack.  
 Approx. air velocity was derived from all points on the Velocity Traverse Form.



## B.2 Velocity Uniformity Data Forms

### VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-1
Date	5/24/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	74.7 deg F
Stack X-Area	2827.4 in.2	Start/End Time	13:35 13:42
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->		First Port	Second Port		
Traverse-->		Port A (East)	Port B (West)		
Trial ---->		1 2 3 Mean	1 2 3 Mean		
Point	Depth, in.	Velocity			
1	1.92	1,493.1	1,453.3	1,370.1	1,438.8
2	6.30	1,606.6	1,678.1	1,712.7	1,665.8
3	11.64	2,026.5	1,997.3	2,055.2	2,026.3
4	19.38	2,026.5	2,055.2	2,026.5	2,036.1
Center	30.00	2,139.2	2,111.6	2,166.4	2,139.1
5	40.62	2,348.3	2,297.8	2,297.8	2,314.7
6	48.36	2,083.6	2,083.6	2,055.2	2,074.1
7	53.70	2,026.5	1,967.8	2,026.5	2,006.9
8	58.08	1,642.8	1,746.6	1,746.6	1,712.0
Averages ----->		1,932.6	1,932.4	1,939.7	1,934.9

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	1966.2		Mean	2037.6	2097.3	2067.4
Min Point	1438.8	-26.8%	Std. Dev.	194.8	65.0	142.9
Max Point	2314.7	17.7%	COV as %	9.6	3.1	6.9

Flow w/o C-Pt	38227 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	1947 fpm	S-type pitot (ID: A100-19, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

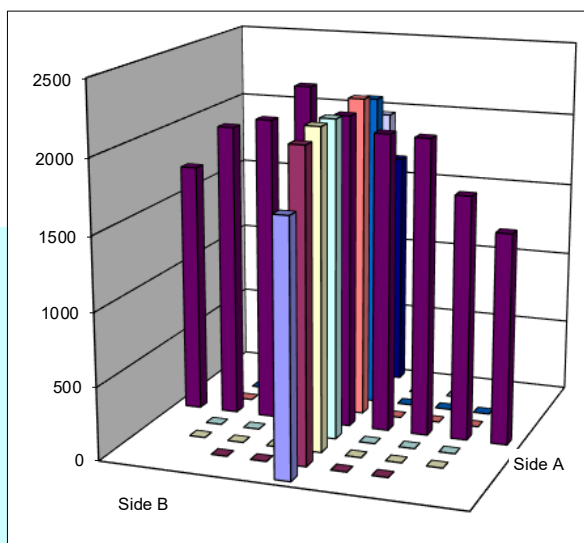
	Start	Finish	
Stack temp	75.1	74.3	F
Equipment temp	74.6	75.2	F
Ambient temp	74.6	75.3	F
Stack static	0.65	0.37	mbars
Ambient pressure	987.47	987.13	mbars
Total Stack pressure	988.12	987.50	mbars
Ambient humidity	33%	32%	RH

#### Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H<sub>2</sub>O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-2
Date	5/25/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	72.2 deg F
Stack X-Area	2827.4 in.2	Start/End Time	9:25 9:33
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,636.3	1,739.7	1,671.5	1,682.5	1,739.7	1,837.3	1,805.4	1,794.2
2	6.30	2,363.8	2,211.1	2,339.1	2,304.7	1,930.0	1,960.0	1,989.5	1,959.8
3	11.64	2,363.8	2,412.6	2,460.3	2,412.2	2,075.4	2,184.7	2,237.3	2,165.8
4	19.38	2,483.8	2,339.1	2,363.8	2,395.6	2,075.4	2,047.1	2,075.4	2,065.9
Center	30.00	2,263.2	2,237.3	2,211.1	2,237.2	2,103.2	2,047.1	2,103.2	2,084.5
5	40.62	2,211.1	2,263.2	2,237.3	2,237.2	2,103.2	2,157.8	2,103.2	2,121.4
6	48.36	2,237.3	2,211.1	2,211.1	2,219.9	2,211.1	2,130.7	2,075.4	2,139.1
7	53.70	2,211.1	2,130.7	2,157.8	2,166.5	2,075.4	1,960.0	1,989.5	2,008.3
8	58.08	1,772.8	1,868.7	1,899.6	1,847.1	1,671.5	1,600.3	1,671.5	1,647.8
Averages ----->		2,171.5	2,157.1	2,172.4	2,167.0	1,998.3	1,991.7	2,005.6	1,998.5

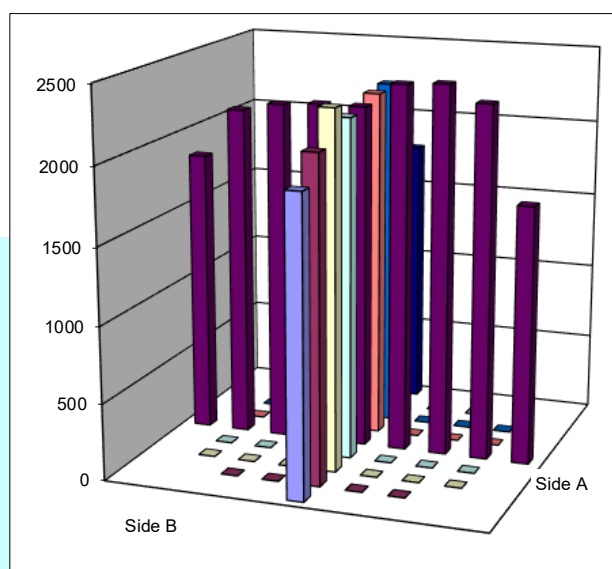
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2082.8		Mean	2281.9	2077.8	2179.9
Min Point	1647.8	-20.9%	Std. Dev.	92.7	73.4	132.9
Max Point	2412.2	15.8%	COV as %	4.1	3.5	6.1

Flow w/o C-Pt	40703 cfm
Vel Avg w/o C-Pt	2073 fpm
	Start Finish
Stack temp	73.1 71.3 F
Equipment temp	72.2 72.8 F
Ambient temp	72.2 72.8 F
Stack static	1.10 0.57 mbars
Ambient pressure	990.18 990.18 mbars
Total Stack pressure	991.28 990.75 mbars
Ambient humidity	36% 35% RH

Instuments Used:	Cal Due
S-type pitot (ID: A100-19, 72")	Post-test inspection
Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Control Co. Thermometer (SN: 220435230)	Post-test verification

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-3
Date	5/25/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	75.3 deg F
Stack X-Area	2827.4 in.2	Start/End Time	10:46 10:53
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port	Second Port						
Trial ---->		Port A (East)				Port B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	Velocity				Velocity			
1	1.92	1,492.3	1,531.1	1,605.8	1,543.1	1,811.6	1,811.6	1,843.6	1,822.3
2	6.30	1,745.7	1,779.0	1,875.2	1,800.0	1,966.8	2,082.5	2,054.2	2,034.5
3	11.64	2,082.5	2,082.5	2,110.5	2,091.8	2,165.3	2,110.5	2,192.2	2,156.0
4	19.38	2,054.2	2,110.5	2,110.5	2,091.7	2,165.3	2,110.5	2,110.5	2,128.7
Center	30.00	2,138.1	2,165.3	2,110.5	2,138.0	2,082.5	2,054.2	2,025.5	2,054.1
5	40.62	2,138.1	2,192.2	2,192.2	2,174.2	2,082.5	2,165.3	2,082.5	2,110.1
6	48.36	2,138.1	2,218.8	2,165.3	2,174.1	2,025.5	2,054.2	2,165.3	2,081.7
7	53.70	2,054.2	2,082.5	2,082.5	2,073.1	1,966.8	1,996.3	1,996.3	1,986.5
8	58.08	1,745.7	1,711.8	1,711.8	1,723.1	1,605.8	1,677.3	1,711.8	1,665.0
Averages ----->		1,954.3	1,986.0	1,996.0	1,978.8	1,985.8	2,006.9	2,020.2	2,004.3

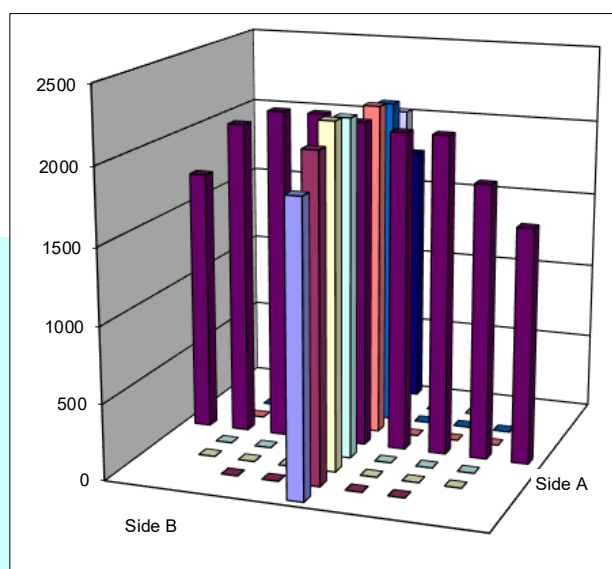
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	1991.5		Mean	2077.5	2078.8	2078.2
Min Point	1543.1	-22.5%	Std. Dev.	129.0	58.5	96.2
Max Point	2174.2	9.2%	COV as %	6.2	2.8	4.6

Flow w/o C-Pt	38847 cfm
Vel Avg w/o C-Pt	1978 fpm
	Start Finish
Stack temp	75.0 75.5 F
Equipment temp	77.9 76.1 F
Ambient temp	77.9 76.1 F
Stack static	0.22 0.12 mbars
Ambient pressure	989.50 989.84 mbars
Total Stack pressure	989.72 989.96 mbars
Ambient humidity	31% 32% RH

Instuments Used:	Cal Due
S-type pitot (ID: A100-19, 72")	Post-test inspection
Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Control Co. Thermometer (SN: 220435230)	Post-test verification

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-4
Date	5/25/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	75.7 deg F
Stack X-Area	2827.4 in.2	Start/End Time	11:56 12:01
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,678.1	1,569.7	1,606.7	1,618.2	1,712.7	1,844.6	1,780.0	1,779.1
2	6.30	1,569.7	1,569.7	1,493.2	1,544.2	1,997.4	2,083.6	2,055.3	2,045.4
3	11.64	1,967.7	2,083.6	1,997.4	2,016.3	2,193.3	2,220.0	2,220.0	2,211.1
4	19.38	2,193.3	2,166.5	2,166.5	2,175.4	2,139.2	2,166.5	2,193.3	2,166.3
Center	30.00	2,220.0	2,246.2	2,272.2	2,246.1	2,166.5	2,246.2	2,220.0	2,210.9
5	40.62	2,297.9	2,220.0	2,220.0	2,245.9	2,083.6	2,083.6	2,139.2	2,102.2
6	48.36	2,297.9	2,446.3	2,470.1	2,404.8	2,055.3	2,083.6	2,111.6	2,083.5
7	53.70	2,083.6	2,083.6	1,997.4	2,054.9	2,026.5	2,111.6	2,026.5	2,054.9
8	58.08	1,780.0	1,606.7	1,678.1	1,688.2	1,844.6	1,812.5	1,746.6	1,801.3
Averages ----->		2,009.8	1,999.2	1,989.1	1,999.3	2,024.3	2,072.5	2,054.7	2,050.5

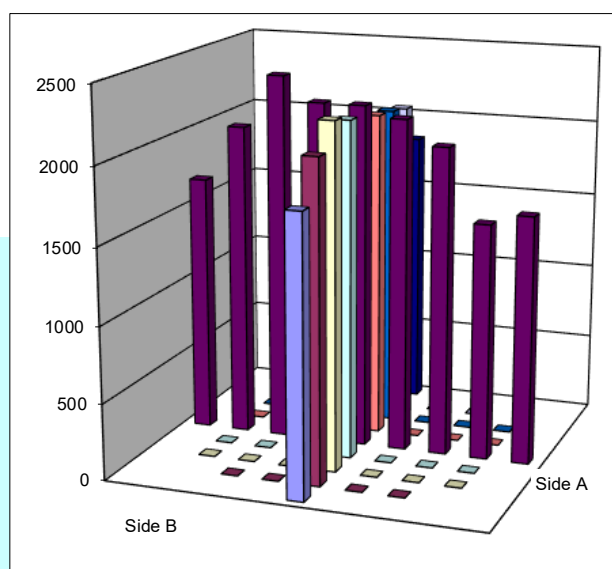
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2024.9		Mean	2098.2	2124.9	2111.6
Min Point	1544.2	-23.7%	Std. Dev.	276.6	70.7	194.5
Max Point	2404.8	18.8%	COV as %	13.2	3.3	9.2

Flow w/o C-Pt	39260 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	1999 fpm	S-type pitot (ID: A100-19, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

	Start	Finish	
Stack temp	75.7	75.6	F
Equipment temp	75.8	75.6	F
Ambient temp	75.8	75.6	F
Stack static	0.30	0.45	mbars
Ambient pressure	989.16	989.16	mbars
Total Stack pressure	989.46	989.61	mbars
Ambient humidity	33%	32%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-5
Date	5/25/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	75.6 deg F
Stack X-Area	2827.4 in.2	Start/End Time	14:04 14:09
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port	Second Port						
Trial ---->		Port A (East)				Port B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	Velocity				Velocity			
1	1.92	1,532.6	1,607.5	1,643.6	1,594.6	1,938.6	1,908.1	1,998.3	1,948.3
2	6.30	1,607.5	1,643.6	1,643.6	1,631.5	2,027.5	2,112.5	2,056.3	2,065.4
3	11.64	2,112.5	2,167.5	2,194.4	2,158.1	2,221.0	2,167.5	2,140.2	2,176.2
4	19.38	2,298.9	2,194.4	2,167.5	2,220.3	2,027.5	2,167.5	2,140.2	2,111.7
Center	30.00	2,221.0	2,140.2	2,167.5	2,176.2	2,167.5	2,056.3	2,112.5	2,112.1
5	40.62	2,221.0	2,084.6	2,194.4	2,166.7	2,112.5	2,084.6	2,167.5	2,121.5
6	48.36	2,194.4	2,140.2	2,140.2	2,158.3	1,968.7	2,027.5	2,027.5	2,007.9
7	53.70	2,167.5	2,027.5	2,027.5	2,074.1	1,968.7	1,938.6	2,056.3	1,987.8
8	58.08	1,713.5	1,813.4	1,780.7	1,769.2	1,908.1	1,813.4	1,877.0	1,866.2
Averages ----->		2,007.6	1,979.9	1,995.5	1,994.3	2,037.8	2,030.7	2,064.0	2,044.1

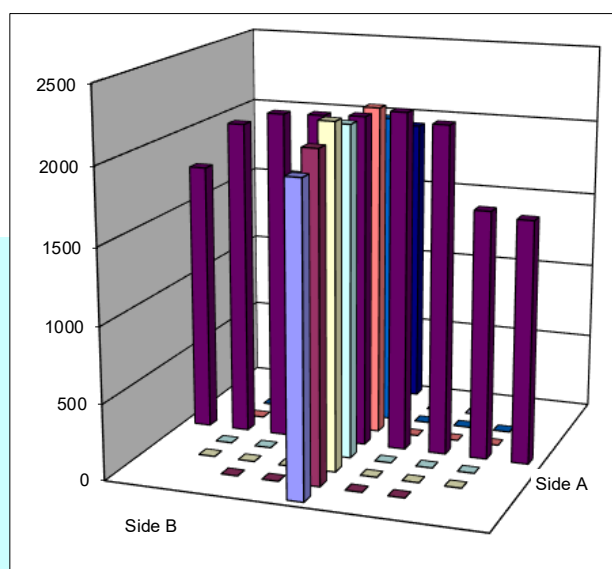
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2019.2		Mean	2083.6	2083.2	2083.4
Min Point	1594.6	-21.0%	Std. Dev.	204.0	66.9	145.9
Max Point	2220.3	10.0%	COV as %	9.8	3.2	7.0

Flow w/o C-Pt	39341 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2004 fpm	S-type pitot (ID: A100-19, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

	Start	Finish	
Stack temp	75.6	75.6	F
Equipment temp	75.0	75.8	F
Ambient temp	75.0	75.8	F
Stack static	0.52	0.22	mbars
Ambient pressure	988.15	988.15	mbars
Total Stack pressure	988.67	988.37	mbars
Ambient humidity	32%	31%	RH

**Notes:**

\_\_\_\_\_  
 Traverse point depth = the distance from the inside stack wall to each point.  
 \_\_\_\_\_  
 Side A port was always measured first.  
 \_\_\_\_\_  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-6
Date	5/26/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	74.9 deg F
Stack X-Area	2827.4 in.2	Start/End Time	9:29 9:34
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,638.5	1,638.5	1,673.7	1,650.2	1,902.2	1,902.2	1,932.6	1,912.3
2	6.30	1,932.6	1,962.6	1,932.6	1,942.6	1,932.6	1,962.6	1,992.1	1,962.4
3	11.64	2,187.5	2,160.8	2,106.0	2,151.4	2,187.5	2,187.5	2,187.5	2,187.5
4	19.38	2,214.1	2,214.1	2,187.5	2,205.2	2,078.1	2,160.8	2,133.6	2,124.2
Center	30.00	2,291.8	2,367.0	2,367.0	2,341.9	2,133.6	2,106.0	2,133.6	2,124.4
5	40.62	2,291.8	2,240.3	2,187.5	2,239.9	2,049.8	2,078.1	2,133.6	2,087.2
6	48.36	2,266.2	2,291.8	2,214.1	2,257.4	2,106.0	2,021.2	2,106.0	2,077.7
7	53.70	2,240.3	2,214.1	2,240.3	2,231.5	1,992.1	1,962.6	1,962.6	1,972.4
8	58.08	1,807.8	1,839.8	1,742.1	1,796.6	1,807.8	1,742.1	1,871.2	1,807.0
Averages ----->		2,096.7	2,103.2	2,072.3	2,090.8	2,021.1	2,013.7	2,050.3	2,028.4

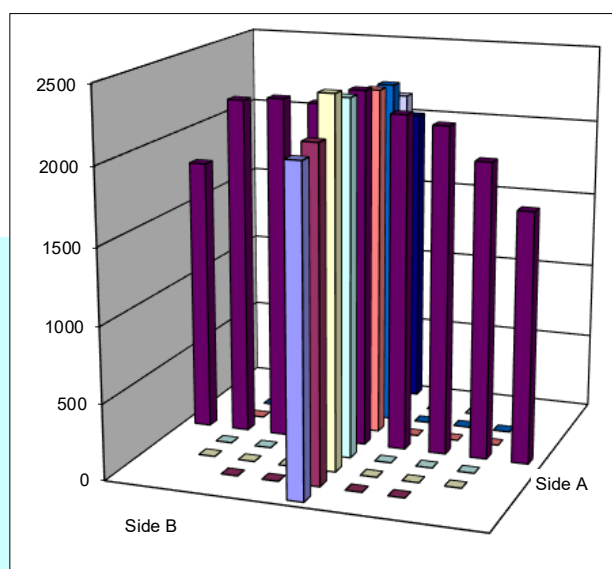
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2059.6		Mean	2195.7	2076.6	2136.1
Min Point	1650.2	-19.9%	Std. Dev.	125.5	82.5	119.3
Max Point	2341.9	13.7%	COV as %	5.7	4.0	5.6

Flow w/o C-Pt	40013 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2038 fpm	S-type pitot (ID: A100-19, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

	Start	Finish	
Stack temp	74.5	75.2	F
Equipment temp	72.3	72.7	F
Ambient temp	72.3	72.7	F
Stack static	0.12	0.87	mbars
Ambient pressure	993.23	993.57	mbars
Total Stack pressure	993.35	994.44	mbars
Ambient humidity	33%	33%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-7
Date	5/26/21	Fan Configuration	Fan A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	75.2 deg F
Stack X-Area	2827.4 in.2	Start/End Time	10:35 10:40
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

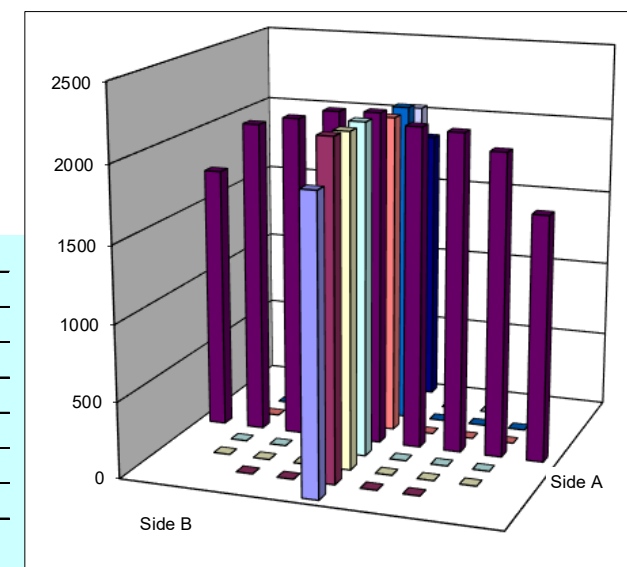
Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,603.3	1,566.4	1,674.6	1,614.8	1,840.8	1,840.8	1,840.8	1,840.8
2	6.30	1,963.6	2,051.0	1,963.6	1,992.7	2,107.2	2,107.2	2,079.3	2,097.9
3	11.64	2,107.2	2,051.0	2,134.7	2,097.6	2,107.2	2,051.0	2,079.3	2,079.1
4	19.38	2,107.2	2,079.3	2,161.9	2,116.1	2,051.0	2,079.3	2,134.7	2,088.3
Center	30.00	2,215.3	2,215.3	2,134.7	2,188.5	2,107.2	2,107.2	2,079.3	2,097.9
5	40.62	2,215.3	2,188.8	2,134.7	2,179.6	2,051.0	2,022.3	1,993.2	2,022.2
6	48.36	2,134.7	2,107.2	2,107.2	2,116.3	2,079.3	2,051.0	1,993.2	2,041.1
7	53.70	2,051.0	2,051.0	2,079.3	2,060.4	2,022.3	1,933.6	2,022.3	1,992.8
8	58.08	1,776.2	1,743.0	1,674.6	1,731.3	1,808.8	1,674.6	1,776.2	1,753.2
Averages ----->		2,019.3	2,005.9	2,007.3	2,010.8	2,019.4	1,985.2	1,999.8	2,001.5

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2006.1		Mean	2107.3	2059.9	2083.6
Min Point	1614.8	-19.5%	Std. Dev.	67.6	41.5	59.2
Max Point	2188.5	9.1%	COV as %	3.2	2.0	2.8

Flow w/o C-Pt	39054 cfm	Start	Finish	
Vel Avg w/o C-Pt	1989 fpm	74.9	75.5	F
		74.4	73.9	F
		74.4	73.9	F
Stack temp		0.32	0.27	mbars
Equipment temp		992.55	992.55	mbars
Ambient temp		992.87	992.82	mbars
Stack static		32%	31%	RH
Ambient pressure				
Total Stack pressure				
Ambient humidity				

**Notes:**

\_\_\_\_\_  
 Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-8
Date	5/26/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	75.3 deg F
Stack X-Area	2827.4 in.2	Start/End Time	12:48 12:55
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,450.9	1,567.2	1,675.4	1,564.5	1,743.8	1,777.0	1,841.7	1,787.5
2	6.30	1,841.7	1,777.0	1,841.7	1,820.1	1,964.6	2,051.9	1,964.6	1,993.7
3	11.64	1,964.6	1,904.1	1,934.5	1,934.4	2,135.7	2,135.7	2,162.9	2,144.7
4	19.38	2,135.7	2,135.7	2,162.9	2,144.7	2,189.7	2,189.7	2,189.7	2,189.7
Center	30.00	2,162.9	2,135.7	2,135.7	2,144.7	2,162.9	2,189.7	2,189.7	2,180.8
5	40.62	2,189.7	2,162.9	2,162.9	2,171.8	2,108.1	2,135.7	2,135.7	2,126.5
6	48.36	2,216.3	2,108.1	2,162.9	2,162.4	2,162.9	2,189.7	2,189.7	2,180.8
7	53.70	1,994.1	2,023.2	2,080.2	2,032.5	2,135.7	2,023.2	2,080.2	2,079.7
8	58.08	1,809.7	1,709.9	1,777.0	1,765.5	1,841.7	1,841.7	1,873.1	1,852.2
Averages ----->		1,973.9	1,947.1	1,992.6	1,971.2	2,049.4	2,059.4	2,069.7	2,059.5

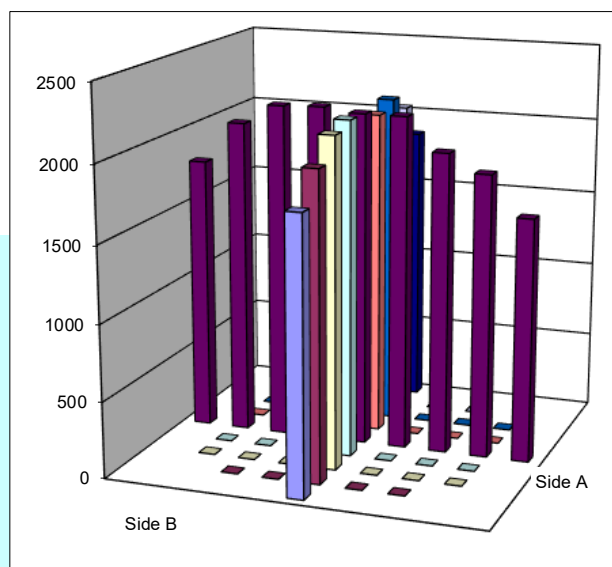
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2015.4		Mean	2058.7	2128.0	2093.3
Min Point	1564.5	-22.4%	Std. Dev.	136.3	70.8	110.3
Max Point	2189.7	8.7%	COV as %	6.6	3.3	5.3

Flow w/o C-Pt	39210 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	1997 fpm	S-type pitot (ID: A100-19, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

	Start	Finish	
Stack temp	74.9	75.6	F
Equipment temp	73.2	73.7	F
Ambient temp	73.2	73.7	F
Stack static	0.20	0.80	mbars
Ambient pressure	991.53	991.53	mbars
Total Stack pressure	991.73	992.33	mbars
Ambient humidity	31%	30%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-9
Date	5/26/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	75.8 deg F
Stack X-Area	2827.4 in.2	Start/End Time	13:53 13:58
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,711.4	1,778.5	1,530.8	1,673.5	1,874.7	1,905.7	1,874.7	1,885.1
2	6.30	2,164.7	2,191.6	2,137.5	2,164.6	2,082.0	2,082.0	2,137.5	2,100.5
3	11.64	2,137.5	2,024.9	2,218.2	2,126.9	2,164.7	2,137.5	2,137.5	2,146.6
4	19.38	2,191.6	2,137.5	2,191.6	2,173.6	2,110.0	2,137.5	2,110.0	2,119.2
Center	30.00	2,218.2	2,191.6	2,218.2	2,209.4	2,110.0	2,164.7	2,110.0	2,128.2
5	40.62	2,191.6	2,164.7	2,191.6	2,182.7	2,218.2	2,218.2	2,191.6	2,209.4
6	48.36	2,164.7	2,191.6	2,191.6	2,182.7	2,137.5	2,110.0	2,164.7	2,137.4
7	53.70	2,191.6	2,164.7	2,110.0	2,155.4	2,024.9	2,110.0	2,053.7	2,062.9
8	58.08	1,711.4	1,778.5	1,778.5	1,756.1	1,778.5	1,936.2	1,778.5	1,831.1
Averages ----->		2,075.9	2,069.3	2,063.1	2,069.4	2,055.6	2,089.1	2,062.0	2,068.9

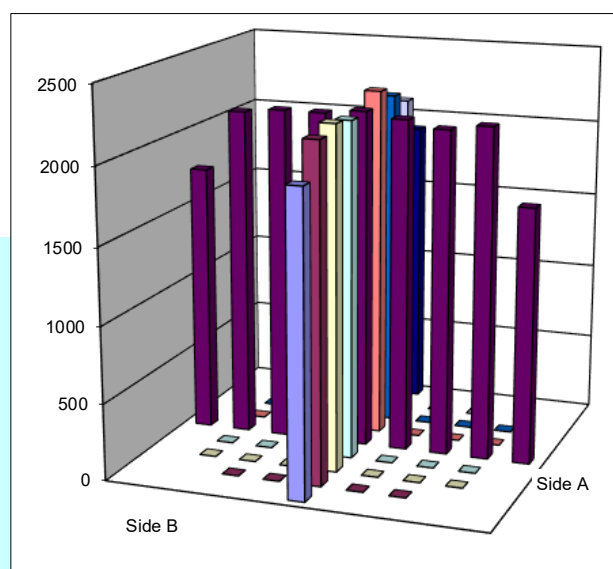
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2069.2		Mean	2170.7	2129.2	2150.0
Min Point	1673.5	-19.1%	Std. Dev.	25.7	44.9	41.3
Max Point	2209.4	6.8%	COV as %	1.2	2.1	1.9

Flow w/o C-Pt	40384 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2057 fpm	S-type pitot (ID: A100-19, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

	Start	Finish	
Stack temp	75.5	76.0	F
Equipment temp	75.6	75.7	F
Ambient temp	75.6	75.7	F
Stack static	0.05	0.77	mbars
Ambient pressure	990.86	990.86	mbars
Total Stack pressure	990.91	991.63	mbars
Ambient humidity	28%	28%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-10
Date	5/27/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	75.9 deg F
Stack X-Area	2827.4 in.2	Start/End Time	9:08 9:12
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,751.3	1,682.6	1,536.0	1,656.6	1,881.2	1,912.3	1,817.4	1,870.3
2	6.30	1,912.3	1,784.6	1,849.6	1,848.8	2,002.7	2,002.7	2,060.8	2,022.0
3	11.64	2,172.2	2,117.2	2,089.2	2,126.2	2,089.2	2,144.9	2,117.2	2,117.1
4	19.38	2,144.9	2,117.2	2,117.2	2,126.5	2,117.2	2,089.2	2,117.2	2,107.9
Center	30.00	2,199.2	2,225.9	2,225.9	2,217.0	2,117.2	2,144.9	2,144.9	2,135.7
5	40.62	2,117.2	2,089.2	2,089.2	2,098.5	2,060.8	2,089.2	2,117.2	2,089.1
6	48.36	2,117.2	2,117.2	2,144.9	2,126.5	2,089.2	2,032.0	2,002.7	2,041.3
7	53.70	2,060.8	2,089.2	2,032.0	2,060.6	2,032.0	2,089.2	2,089.2	2,070.1
8	58.08	1,881.2	1,849.6	1,784.6	1,838.5	1,817.4	1,682.6	1,717.3	1,739.1
Averages ----->		2,039.6	2,008.1	1,985.4	2,011.0	2,023.0	2,020.8	2,020.4	2,021.4

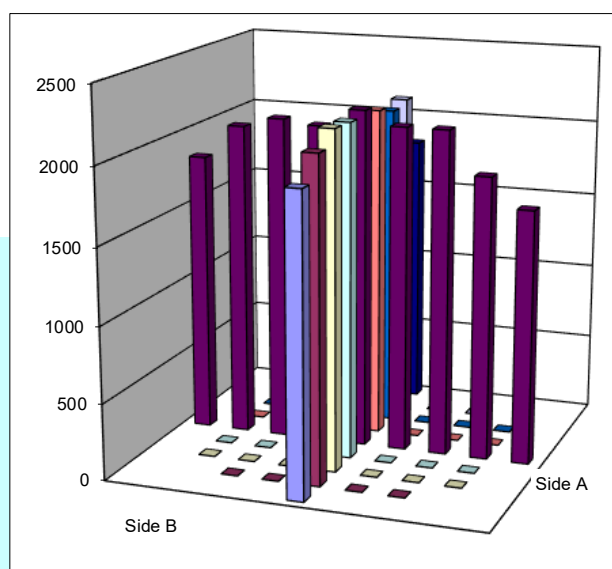
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2016.2		Mean	2086.3	2083.3	2084.8
Min Point	1656.6	-17.8%	Std. Dev.	114.8	41.3	82.9
Max Point	2217.0	10.0%	COV as %	5.5	2.0	4.0

Flow w/o C-Pt	39195 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	1996 fpm	S-type pitot (ID: A100-19, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

	Start	Finish	
Stack temp	75.7	76.1	F
Equipment temp	70.3	72.5	F
Ambient temp	70.3	72.5	F
Stack static	0.25	0.37	mbars
Ambient pressure	984.42	984.42	mbars
Total Stack pressure	984.67	984.79	mbars
Ambient humidity	29%	27%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-11
Date	5/27/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	77.0 deg F
Stack X-Area	2827.4 in.2	Start/End Time	10:11 10:17
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,575.4	1,648.7	1,684.3	1,636.1	1,718.9	1,786.4	1,753.0	1,752.8
2	6.30	1,914.1	1,786.4	1,786.4	1,829.0	2,091.2	2,033.9	2,033.9	2,053.0
3	11.64	1,914.1	1,944.8	1,974.9	1,944.6	2,119.3	2,119.3	2,147.0	2,128.5
4	19.38	2,119.3	2,091.2	2,091.2	2,100.6	2,119.3	2,091.2	2,119.3	2,109.9
Center	30.00	2,201.3	2,174.4	2,119.3	2,165.0	2,119.3	2,174.4	2,147.0	2,146.9
5	40.62	2,119.3	2,119.3	2,119.3	2,119.3	2,147.0	2,091.2	2,147.0	2,128.4
6	48.36	2,119.3	2,147.0	2,091.2	2,119.2	2,062.8	2,062.8	2,004.6	2,043.4
7	53.70	2,062.8	1,883.0	1,944.8	1,963.5	2,062.8	2,062.8	1,883.0	2,002.8
8	58.08	1,753.0	1,718.9	1,684.3	1,718.7	1,786.4	1,786.4	1,684.3	1,752.3
Averages ----->		1,975.4	1,946.0	1,944.0	1,955.1	2,025.2	2,023.1	1,991.0	2,013.1

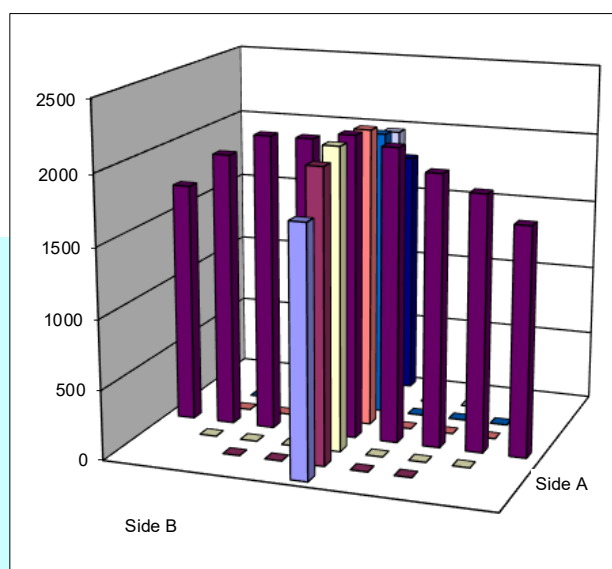
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	1984.1		Mean	2034.4	2087.6	2061.0
Min Point	1636.1	-17.5%	Std. Dev.	123.2	54.3	95.5
Max Point	2165.0	9.1%	COV as %	6.1	2.6	4.6

Flow w/o C-Pt	38536 cfm
Vel Avg w/o C-Pt	1963 fpm
	Start Finish
Stack temp	77.0 77.0 F
Equipment temp	74.6 75.4 F
Ambient temp	74.6 75.4 F
Stack static	0.40 0.12 mbars
Ambient pressure	984.42 984.76 mbars
Total Stack pressure	984.82 984.88 mbars
Ambient humidity	30% 28% RH

Instuments Used:	Cal Due
S-type pitot (ID: A100-19, 72")	Post-test inspection
Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Control Co. Thermometer (SN: 220435230)	Post-test verification

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-12
Date	5/27/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	76.4 deg F
Stack X-Area	2827.4 in.2	Start/End Time	11:12 11:17
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,752.2	1,611.8	1,752.2	1,705.4	1,818.3	1,818.3	1,850.5	1,829.0
2	6.30	1,718.1	1,818.3	1,785.6	1,774.0	2,090.2	2,032.9	2,003.7	2,042.3
3	11.64	2,146.0	2,118.3	2,090.2	2,118.1	2,118.3	2,146.0	2,173.3	2,145.9
4	19.38	2,146.0	2,146.0	2,118.3	2,136.7	2,227.0	2,146.0	2,146.0	2,173.0
Center	30.00	2,227.0	2,305.1	2,227.0	2,253.0	2,146.0	2,090.2	2,173.3	2,136.5
5	40.62	2,173.3	2,200.3	2,173.3	2,182.3	2,200.3	2,146.0	2,200.3	2,182.2
6	48.36	2,227.0	2,118.3	2,118.3	2,154.5	2,200.3	2,118.3	2,146.0	2,154.8
7	53.70	2,090.2	2,118.3	2,090.2	2,099.6	2,090.2	2,032.9	2,061.7	2,061.6
8	58.08	1,818.3	1,752.2	1,752.2	1,774.2	1,752.2	1,683.4	1,818.3	1,751.3
Averages ----->		2,033.1	2,020.9	2,011.9	2,022.0	2,071.4	2,023.8	2,063.7	2,053.0

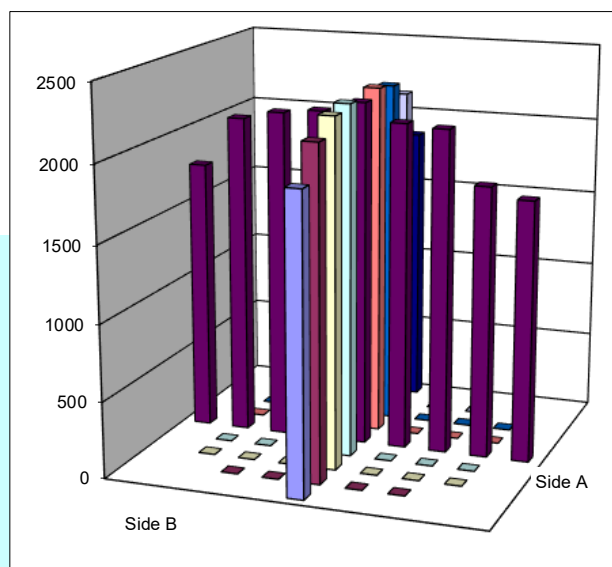
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2037.5		Mean	2102.6	2128.0	2115.3
Min Point	1705.4	-16.3%	Std. Dev.	153.3	54.5	111.3
Max Point	2253.0	10.6%	COV as %	7.3	2.6	5.3

Flow w/o C-Pt	39620 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2018 fpm	S-type pitot (ID: A100-19, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

	Start	Finish	
Stack temp	76.4	76.4	F
Equipment temp	73.9	75.0	F
Ambient temp	73.9	75.0	F
Stack static	0.40	0.45	mbars
Ambient pressure	984.08	984.42	mbars
Total Stack pressure	984.48	984.87	mbars
Ambient humidity	32%	31%	RH

**Notes:**

\_\_\_\_\_  
 Traverse point depth = the distance from the inside stack wall to each point.  
 \_\_\_\_\_  
 Side A port was always measured first.  
 \_\_\_\_\_  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-13
Date	5/27/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	77.1 deg F
Stack X-Area	2827.4 in.2	Start/End Time	12:18 12:24
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,753.3	1,786.6	1,914.5	1,818.1	1,786.6	1,819.5	1,753.3	1,786.5
2	6.30	1,883.3	1,819.5	1,786.6	1,829.8	2,091.5	2,034.2	2,091.5	2,072.4
3	11.64	2,091.5	2,091.5	2,119.6	2,100.9	2,174.7	2,119.6	2,147.3	2,147.2
4	19.38	2,119.6	2,147.3	2,147.3	2,138.0	2,174.7	2,228.3	2,228.3	2,210.4
Center	30.00	2,147.3	2,174.7	2,201.6	2,174.5	2,147.3	2,091.5	2,174.7	2,137.8
5	40.62	2,201.6	2,174.7	2,174.7	2,183.7	2,174.7	2,091.5	2,119.6	2,128.6
6	48.36	2,174.7	2,174.7	2,119.6	2,156.3	2,147.3	2,034.2	2,063.0	2,081.5
7	53.70	2,147.3	2,147.3	2,174.7	2,156.4	2,147.3	2,004.9	2,091.5	2,081.2
8	58.08	1,851.6	1,786.6	1,753.3	1,797.2	1,786.6	1,719.2	1,753.3	1,753.0
Averages ----->		2,041.1	2,033.6	2,043.5	2,039.4	2,070.1	2,015.9	2,046.9	2,044.3

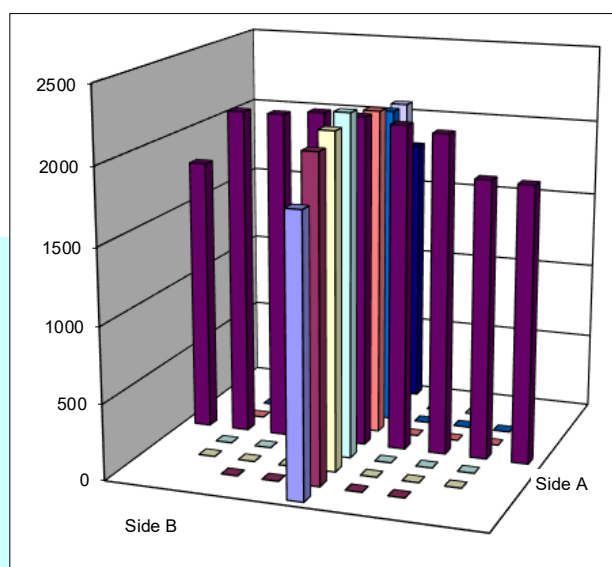
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2041.9		Mean	2105.7	2122.7	2114.2
Min Point	1753.0	-14.1%	Std. Dev.	124.6	49.2	91.4
Max Point	2210.4	8.3%	COV as %	5.9	2.3	4.3

Flow w/o C-Pt	39811 cfm
Vel Avg w/o C-Pt	2028 fpm
	Start Finish
Stack temp	77.2 76.9 F
Equipment temp	76.0 76.8 F
Ambient temp	76.0 76.8 F
Stack static	0.27 0.20 mbars
Ambient pressure	984.42 984.42 mbars
Total Stack pressure	984.69 984.62 mbars
Ambient humidity	32% 30% RH

<b>Instuments Used:</b>	<b>Cal Due</b>
S-type pitot (ID: A100-19, 72")	Post-test inspection
Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Control Co. Thermometer (SN: 220435230)	Post-test verification

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S2 (C5V)	Run No.	VT-14
Date	5/28/21	Fan Configuration	Fan B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	75.6 deg F
Stack X-Area	2827.4 in.2	Start/End Time	8:52 8:57
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	91.17 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First Port				Second Port			
Trial ---->		Port A (East)				Port B (West)			
Point	Depth, in.	1	2	3	Mean	1	2	3	Mean
1	1.92	1,806.8	1,838.7	1,774.2	1,806.6	1,806.8	1,806.8	1,741.1	1,784.9
2	6.30	1,870.2	1,961.4	1,741.1	1,857.6	1,931.5	1,901.1	1,901.1	1,911.3
3	11.64	2,104.8	2,076.9	1,991.0	2,057.6	2,104.8	2,048.7	2,048.7	2,067.4
4	19.38	2,159.5	2,186.4	2,159.5	2,168.5	2,076.9	2,104.8	2,104.8	2,095.5
Center	30.00	2,186.4	2,239.0	2,186.4	2,203.9	2,159.5	2,186.4	2,186.4	2,177.4
5	40.62	2,186.4	2,159.5	2,159.5	2,168.5	2,132.4	2,132.4	2,104.8	2,123.2
6	48.36	2,212.8	2,186.4	2,132.4	2,177.2	2,132.4	2,159.5	2,132.4	2,141.4
7	53.70	2,076.9	2,048.7	2,132.4	2,086.0	2,048.7	2,076.9	2,020.1	2,048.6
8	58.08	1,741.1	1,741.1	1,774.2	1,752.1	1,774.2	1,806.8	1,741.1	1,774.0
Averages ----->		2,038.3	2,048.7	2,005.6	2,030.9	2,018.6	2,024.8	1,997.8	2,013.7

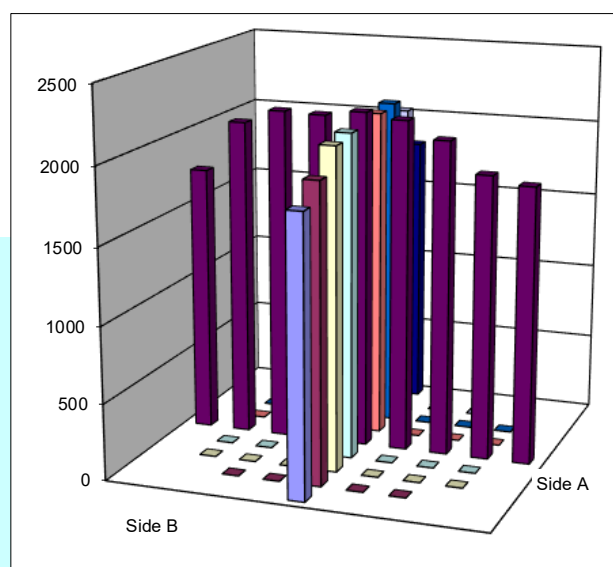
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2022.3		Mean	2102.7	2080.7	2091.7
Min Point	1752.1	-13.4%	Std. Dev.	120.3	86.6	101.3
Max Point	2203.9	9.0%	COV as %	5.7	4.2	4.8

Flow w/o C-Pt	39295 cfm	Start	Finish	
Vel Avg w/o C-Pt	2001 fpm	75.6	75.6	F
		71.6	71.8	F
		71.6	71.8	F
Stack temp		0.12	0.30	mbars
Equipment temp		995.60	995.60	mbars
Ambient temp		995.72	995.90	mbars
Stack static		28%	28%	RH
Ambient pressure				
Total Stack pressure				
Ambient humidity				

Instuments Used:	Cal Due
S-type pitot (ID: A100-19, 72")	Post-test inspection
Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Control Co. Thermometer (SN: 220435230)	Post-test verification

**Notes:**

\_\_\_\_\_  
 Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



## Appendix C – LV-S3 Stack Verification Data Sheets

### C.1 CAM Flow Angle Data Forms

#### FLOW ANGLE DATA FORM

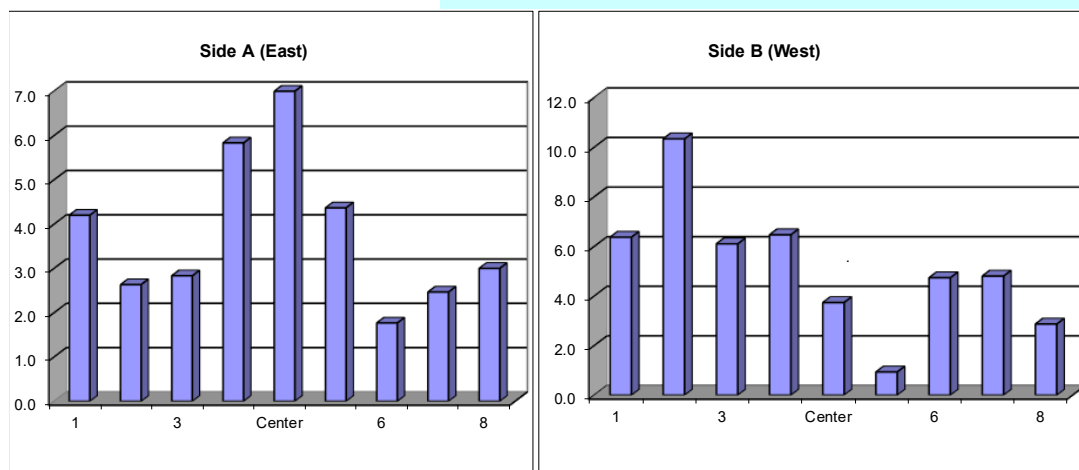
Stack	LV-S3 (LVP) CAM				Run No.	FA-1			
Date	6/21/2021				Fan Setting	NA Hz			
Start/End Time	11:29 11:40				Fan Configuration	A & B			
Testers	JPC/LCE				Stack Temp	109.7 deg F			
Stack Dia.	17 in				Units	Degrees			
Stack X-Area	227.0 in <sup>2</sup>				Port	A & B			
Elevation	691 ft								
Distance to disturbance	11.00 ft								
Order -->	First				Second				
Traverse-->									
Trial ---->									
		Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	4.6	4.3	3.7	4.2	6.3	6.4	6.4	6.4
2	1.79	2.5	2.5	2.9	2.6	10.5	10.4	10.1	10.3
3	3.30	3.9	2.6	2.0	2.8	6.0	5.8	6.5	6.1
4	5.49	5.8	5.6	6.1	5.8	5.9	6.2	7.3	6.5
Center	8.50	7.2	6.8	7.0	7.0	3.3	4.2	3.7	3.7
5	11.51	4.9	3.8	4.4	4.4	0.1	1.2	1.5	0.9
6	13.70	2.0	1.7	1.6	1.8	9.7	2.8	1.7	4.7
7	15.22	2.6	2.1	2.7	2.5	4.6	4.5	5.3	4.8
8	16.46	3.6	1.8	3.6	3.0	2.5	3.2	2.9	2.9
Mean of absolute values:					3.8	5.1			
" " w/o points by wall:					3.8	5.3			
Instruments Used:					Cal. Due	Grand mean ABS 4.5			
						Grand mean ABS w/o wall pts 4.6			
S-type pitot (ID: 2A, 24")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				

#### Notes:

Traverse point depth = the distance from inside stack wall to each point.

First traverse point is all the way into the stack.

Approx. air velocity was derived from all points on the Velocity Traverse Forms.

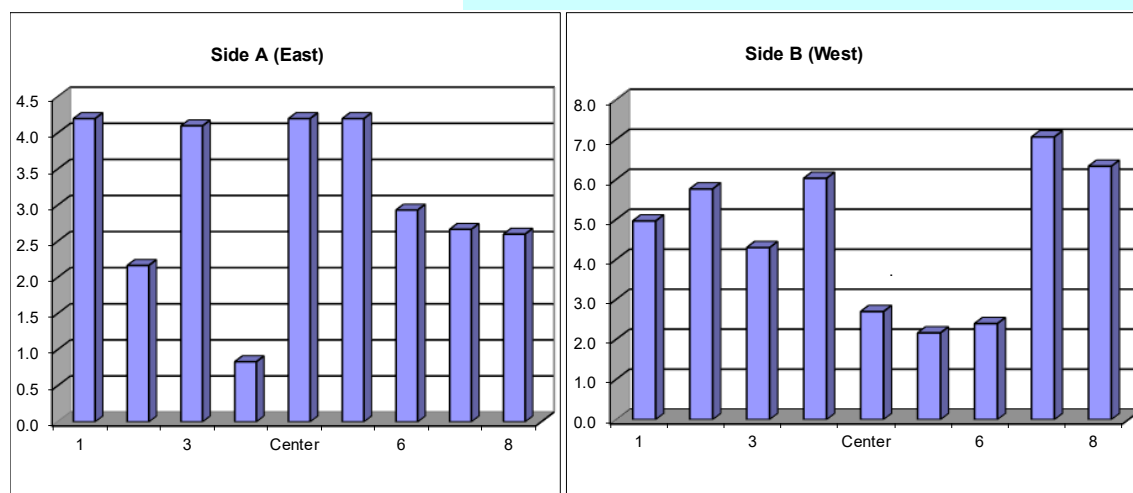


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-2				
Date	6/22/2021			Fan Setting	NA Hz				
Start/End Time	10:12 10:22			Fan Configuration	A & B				
Testers	JPC/LCE			Stack Temp	110.0 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	11.00 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	3.8	3.6	5.2	4.2	5.3	4.7	4.9	5.0
2	1.79	1.5	3.2	1.8	2.2	6.3	5.4	5.6	5.8
3	3.30	4.8	4.1	3.4	4.1	5.1	6.2	1.6	4.3
4	5.49	0.7	0.9	0.9	0.8	6.2	6.3	5.6	6.0
Center	8.50	3.2	4.6	4.8	4.2	2.3	2.8	3.0	2.7
5	11.51	4.0	4.7	3.9	4.2	2.4	1.9	2.2	2.2
6	13.70	2.8	2.7	3.3	2.9	2.8	2.4	2.0	2.4
7	15.22	2.5	2.9	2.6	2.7	7.4	6.7	7.1	7.1
8	16.46	4.8	1.6	1.4	2.6	2.7	10.1	6.2	6.3
Mean of absolute values:					3.1	4.6			
" " w/o points by wall:					3.0	4.3			
Instruments Used:					Cal. Due	Grand mean ABS 3.9			
S-type pitot (ID: 2A, 24")						Grand mean ABS w/o wall pts 3.7			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary				
					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

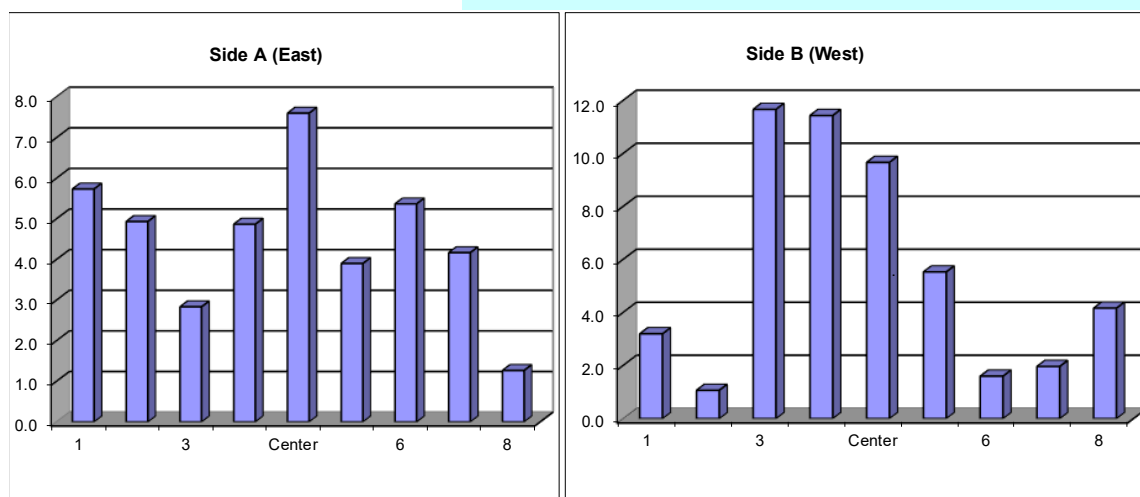


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-3			
Date	6/22/2021			Fan Setting	NA Hz			
Start/End Time	11:15 11:25			Fan Configuration	A & B			
Testers	JPC/LCE			Stack Temp	110.4 deg F			
Stack Dia.	17 in			Units	Degrees			
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B			
Elevation	691 ft							
Distance to disturbance	11.00 ft							
Order -->	First			Second				
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	0.54	6.3	5.9	5.0	5.7	2.1	4.1	3.4
2	1.79	4.2	3.1	7.5	4.9	1.4	1.0	0.8
3	3.30	3.7	2.5	2.3	2.8	12.5	10.7	11.8
4	5.49	6.1	4.0	4.5	4.9	11.7	11.5	11.1
Center	8.50	8.6	7.7	6.5	7.6	10.3	9.3	9.4
5	11.51	6.4	3.6	1.7	3.9	4.6	6.4	5.6
6	13.70	6.3	5.9	3.9	5.4	1.5	1.6	1.7
7	15.22	3.3	4.4	4.8	4.2	2.0	1.8	2.1
8	16.46	0.4	0.9	2.5	1.3	4.8	3.4	4.3
Mean of absolute values:				4.5	5.6			
" " w/o points by wall:				4.8	6.1			
Instruments Used:				Cal. Due	Grand mean ABS 5.1			
S-type pitot (ID: 2A, 24")				Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

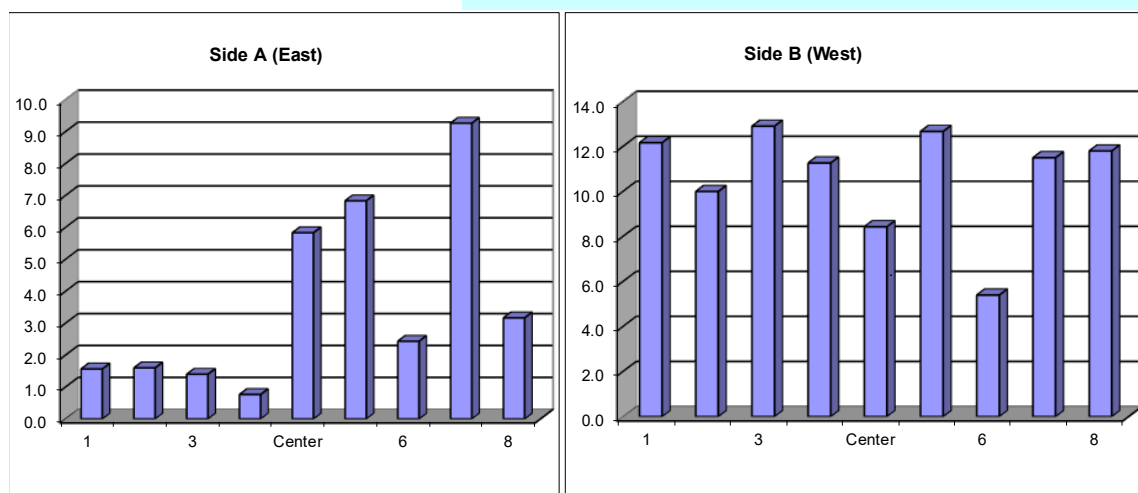


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-4				
Date	6/22/2021			Fan Setting	NA Hz				
Start/End Time	13:24 13:33			Fan Configuration	A & B				
Testers	JPC/LCE			Stack Temp	111.0 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	11.00 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	1.6	1.4	1.7	1.6	12.5	11.7	12.3	12.2
2	1.79	2.5	1.0	1.3	1.6	9.5	10.4	10.1	10.0
3	3.30	1.6	1.7	0.9	1.4	12.7	13.3	12.7	12.9
4	5.49	0.6	0.5	1.2	0.8	12.1	10.8	10.9	11.3
Center	8.50	6.0	5.4	6.1	5.8	9.1	7.9	8.3	8.4
5	11.51	7.2	7.0	6.3	6.8	12.5	12.1	13.4	12.7
6	13.70	2.7	2.6	2.0	2.4	4.9	5.8	5.5	5.4
7	15.22	9.6	9.3	8.9	9.3	11.5	11.4	11.6	11.5
8	16.46	2.6	3.3	3.6	3.2	12.6	11.8	11.0	11.8
Mean of absolute values:					3.7	10.7			
" " w/o points by wall:					4.0	10.3			
Instruments Used:					Cal. Due	Grand mean ABS 7.2			
S-type pitot (ID: 2A, 24")					Grand mean ABS w/o wall pts 7.2				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary				
					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

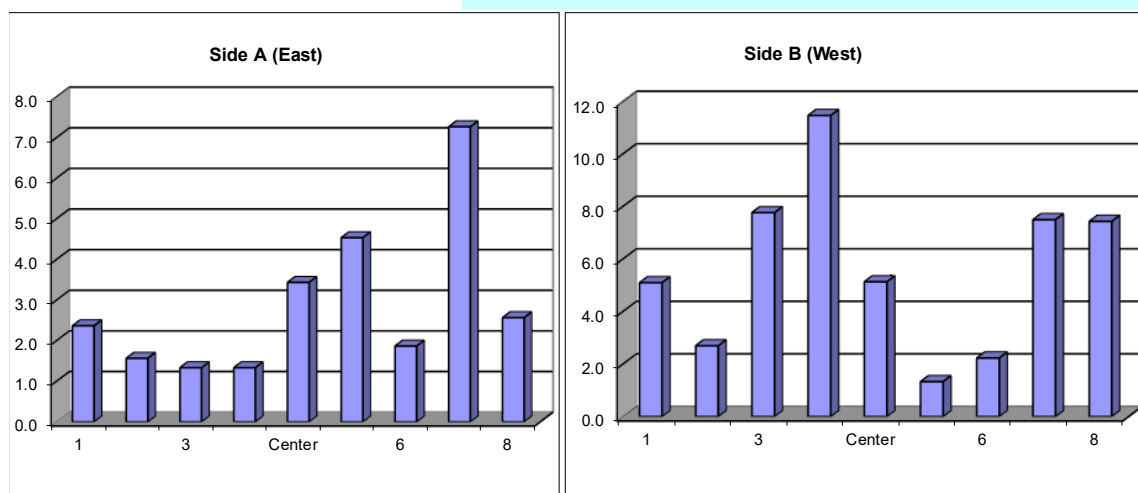


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-5				
Date	6/22/2021			Fan Setting	NA Hz				
Start/End Time	14:26 14:33			Fan Configuration	A & B				
Testers	JPC/LCE			Stack Temp	110.2 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	11.00 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	2.7	1.3	3.1	2.4	5.7	5.6	4.0	5.1
2	1.79	1.0	2.2	1.5	1.6	2.2	2.5	3.4	2.7
3	3.30	2.0	1.1	0.9	1.3	8.8	7.6	6.9	7.8
4	5.49	0.5	2.2	1.3	1.3	11.5	11.2	11.7	11.5
Center	8.50	4.3	2.9	3.1	3.4	5.4	5.2	4.8	5.1
5	11.51	4.6	5.0	4.0	4.5	0.6	1.1	2.3	1.3
6	13.70	1.1	2.4	2.1	1.9	1.5	2.7	2.5	2.2
7	15.22	7.7	7.3	6.8	7.3	8.1	7.5	6.9	7.5
8	16.46	2.7	2.4	2.6	2.6	5.4	9.6	7.3	7.4
Mean of absolute values:					2.9	5.6			
" " w/o points by wall:					3.0	5.4			
Instruments Used:					Cal. Due	Grand mean ABS 4.3			
S-type pitot (ID: 2A, 24")					Grand mean ABS w/o wall pts 4.2				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary				
					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

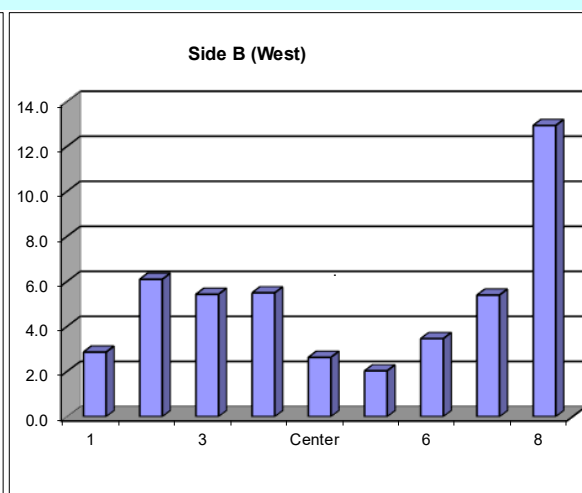
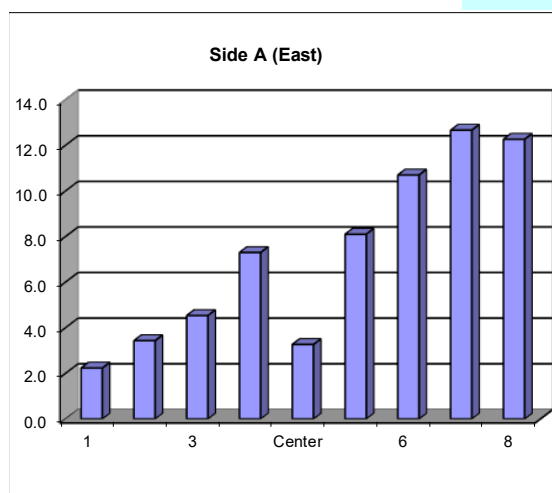


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-6			
Date	6/23/2021			Fan Setting	NA Hz			
Start/End Time	10:11 10:22			Fan Configuration	B & C			
Testers	JPC/LCE			Stack Temp	111.1 deg F			
Stack Dia.	17 in			Units	Degrees			
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B			
Elevation	691 ft							
Distance to disturbance	11.00 ft							
Order -->	First				Second			
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	0.54	2.3	2.0	2.4	2.2	2.3	3.2	3.1
2	1.79	3.1	2.9	4.3	3.4	7.0	6.3	5.0
3	3.30	4.4	3.9	5.3	4.5	6.2	5.2	4.9
4	5.49	8.8	6.3	6.8	7.3	6.2	5.3	5.0
Center	8.50	4.1	2.9	2.8	3.3	3.4	2.4	2.1
5	11.51	8.5	7.7	8.1	8.1	4.2	1.6	0.3
6	13.70	10.3	11.4	10.4	10.7	3.9	3.4	3.1
7	15.22	12.6	12.3	13.1	12.7	5.9	5.4	4.9
8	16.46	14.5	11.0	11.3	12.3	12.2	12.3	14.3
Mean of absolute values:					7.2	5.2		
" " w/o points by wall:					7.1	4.4		
Instruments Used:					Cal. Due	Grand mean ABS 6.2		
S-type pitot (ID: 2A, 24")					Pre-test calibration; Post-test inspection.			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary			
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.			

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

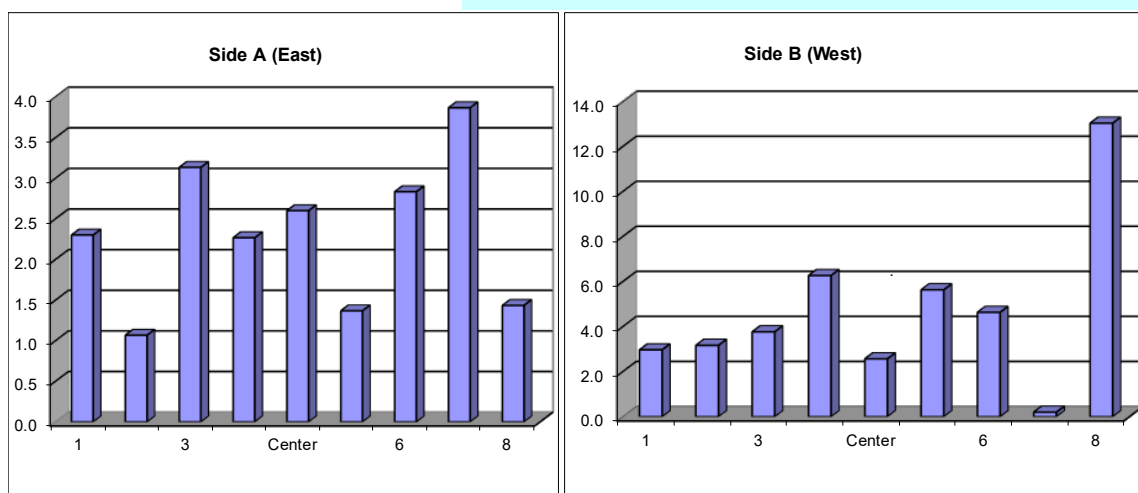


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-7				
Date	6/23/2021			Fan Setting	NA Hz				
Start/End Time	11:15 11:25			Fan Configuration	B & C				
Testers	JPC/LCE			Stack Temp	111.6 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	11.00 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	2.8	2.3	1.8	2.3	2.9	2.3	3.7	3.0
2	1.79	1.8	0.5	0.9	1.1	3.8	3.0	2.7	3.2
3	3.30	3.1	2.8	3.5	3.1	4.0	4.4	2.9	3.8
4	5.49	2.5	1.9	2.4	2.3	5.5	6.6	6.7	6.3
Center	8.50	0.4	4.1	3.3	2.6	2.2	2.2	3.3	2.6
5	11.51	1.1	0.7	2.3	1.4	5.7	6.3	4.9	5.6
6	13.70	3.0	2.1	3.4	2.8	4.6	5.3	4.0	4.6
7	15.22	5.1	3.7	2.8	3.9	0.3	0.2	0.1	0.2
8	16.46	2.0	1.3	1.0	1.4	13.5	13.0	12.6	13.0
Mean of absolute values:					2.3	4.7			
" " w/o points by wall:					2.4	3.7			
Instruments Used:					Cal. Due	Grand mean ABS 3.5			
S-type pitot (ID: 2A, 24")						Grand mean ABS w/o wall pts 3.1			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary				
					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

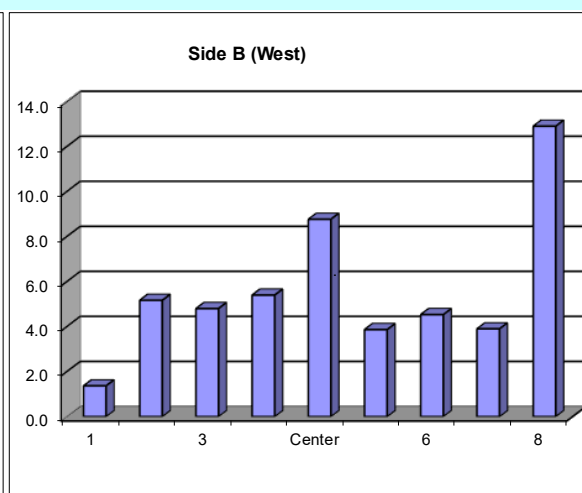
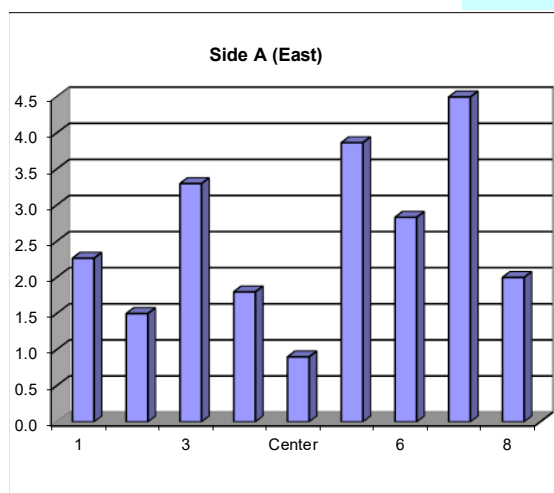


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-8				
Date	6/23/2021			Fan Setting	NA Hz				
Start/End Time	13:16 13:24			Fan Configuration	B & C				
Testers	JPC/LCE			Stack Temp	110.6 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	11.00 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	3.5	2.0	1.3	2.3	1.4	1.4	1.3	1.4
2	1.79	1.9	1.7	0.9	1.5	5.4	5.9	4.2	5.2
3	3.30	3.4	3.5	3.0	3.3	6.9	3.6	3.9	4.8
4	5.49	1.9	2.0	1.5	1.8	5.7	5.1	5.4	5.4
Center	8.50	1.0	0.9	0.8	0.9	8.4	9.2	8.7	8.8
5	11.51	5.0	3.0	3.6	3.9	4.0	3.7	3.9	3.9
6	13.70	4.5	2.1	1.9	2.8	4.0	4.6	5.0	4.5
7	15.22	4.2	5.2	4.1	4.5	3.6	4.4	3.7	3.9
8	16.46	1.9	2.1	2.0	2.0	13.4	13.0	12.3	12.9
Mean of absolute values:					2.6	5.6			
" " w/o points by wall:					2.7	5.2			
Instruments Used:					Cal. Due	Grand mean ABS 4.1			
S-type pitot (ID: 2A, 24")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

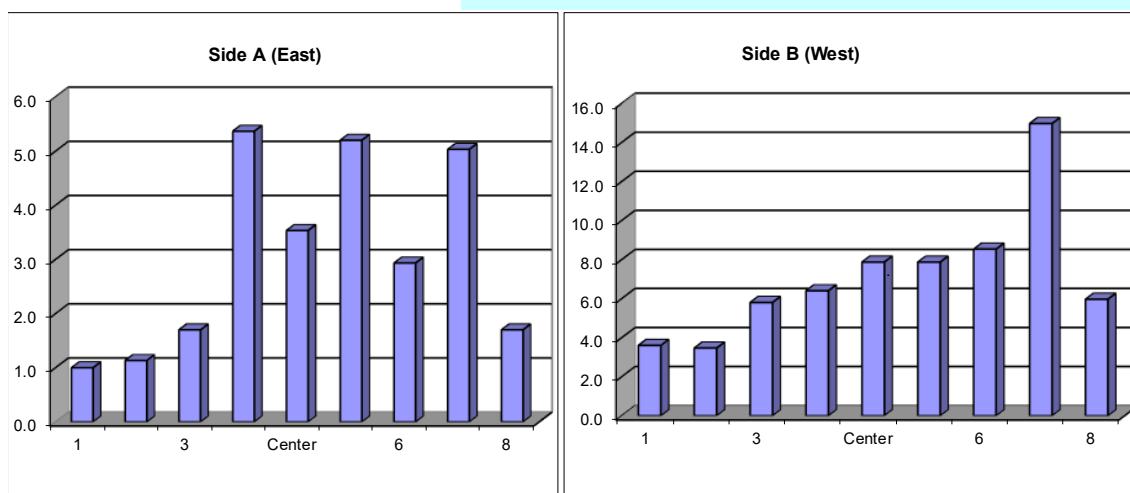


# FLOW ANGLE DATA FORM

Stack <b>LV-S3 (LVP) CAM</b>		Run No. <b>FA-9</b>							
Date <b>6/23/2021</b>		Fan Setting <b>NA</b> Hz							
Start/End Time <b>14:24</b> <b>14:34</b>		Fan Configuration <b>B &amp; C</b>							
Testers <b>JPC/LCE</b>		Stack Temp <b>110.0</b> deg F							
Stack Dia. <b>17</b> in		Units <b>Degrees</b>							
Stack X-Area <b>227.0</b> in <sup>2</sup>		Port <b>A &amp; B</b>							
Elevation <b>691</b> ft									
Distance to disturbance <b>11.00</b> ft									
Order -->	<b>First</b>	<b>Second</b>							
Traverse-->	<b>Side A (East)</b>		<b>Side B (West)</b>						
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	0.5	0.9	1.6	1.0	4.5	3.0	3.3	3.6
2	1.79	1.2	1.2	1.0	1.1	3.6	4.3	2.5	3.5
3	3.30	2.5	1.9	0.7	1.7	5.7	6.4	5.3	5.8
4	5.49	5.6	5.5	5.0	5.4	6.3	6.5	6.4	6.4
Center	8.50	3.2	3.7	3.7	3.5	7.6	8.1	7.9	7.9
5	11.51	5.1	4.9	5.6	5.2	7.3	8.4	7.9	7.9
6	13.70	2.8	2.9	3.1	2.9	8.1	8.6	8.9	8.5
7	15.22	4.0	5.9	5.2	5.0	14.7	15.2	15.0	15.0
8	16.46	2.5	1.4	1.2	1.7	6.4	6.2	5.3	6.0
Mean of absolute values:					3.1	7.2			
" " w/o points by wall:					3.6	7.8			
Instruments Used:					Cal. Due	Grand mean ABS 5.1			
S-type pitot (ID: 2A, 24")						Grand mean ABS w/o wall pts 5.7			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary				
					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

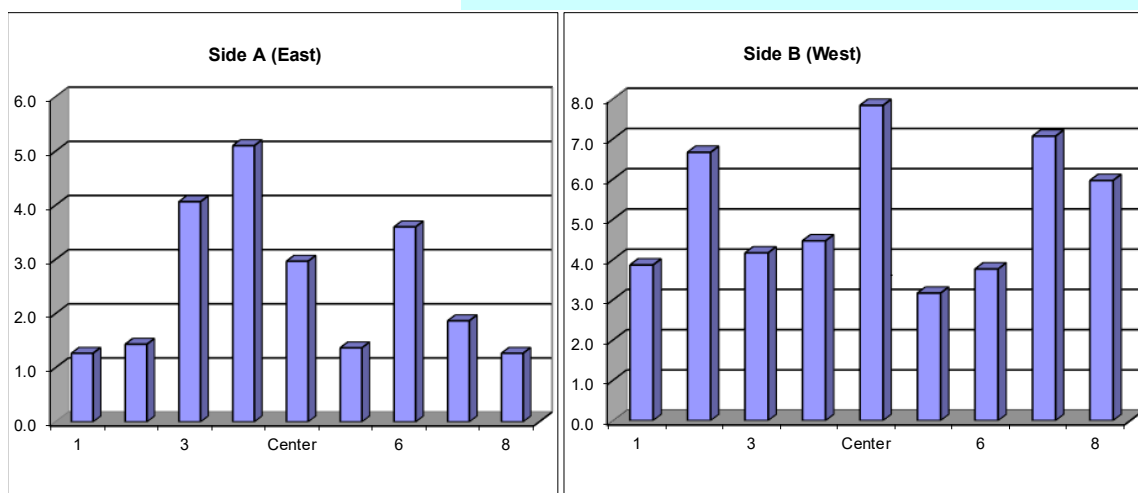


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-10			
Date	6/24/2021			Fan Setting	NA Hz			
Start/End Time	9:55		10:04	Fan Configuration	A & C			
Testers	JPC/LCE			Stack Temp	110.8 deg F			
Stack Dia.	17		in	Units	Degrees			
Stack X-Area	227.0		in <sup>2</sup>	Port	A & B			
Elevation	691		ft					
Distance to disturbance	11.00		ft					
Order -->	First			Second				
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	0.54	1.7	0.8	1.3	1.3	2.9	5.0	3.7
2	1.79	0.6	1.3	2.4	1.4	7.9	6.9	5.2
3	3.30	4.1	2.8	5.3	4.1	2.9	4.6	5.0
4	5.49	4.9	5.7	4.7	5.1	5.2	4.0	4.2
Center	8.50	3.6	2.3	3.0	3.0	7.4	7.9	8.2
5	11.51	1.9	1.5	0.7	1.4	4.2	3.5	1.8
6	13.70	3.8	3.6	3.4	3.6	3.9	4.1	3.3
7	15.22	0.9	2.4	2.3	1.9	7.1	7.2	6.9
8	16.46	0.7	0.9	2.2	1.3	5.9	6.2	5.8
Mean of absolute values:				2.5	5.2			
" " w/o points by wall:				2.9	5.3			
Instruments Used:				Cal. Due	Grand mean ABS 3.9			
S-type pitot (ID: 2A, 24")				Pre-test calibration; Post-test inspection.	Grand mean ABS w/o wall pts 4.1			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

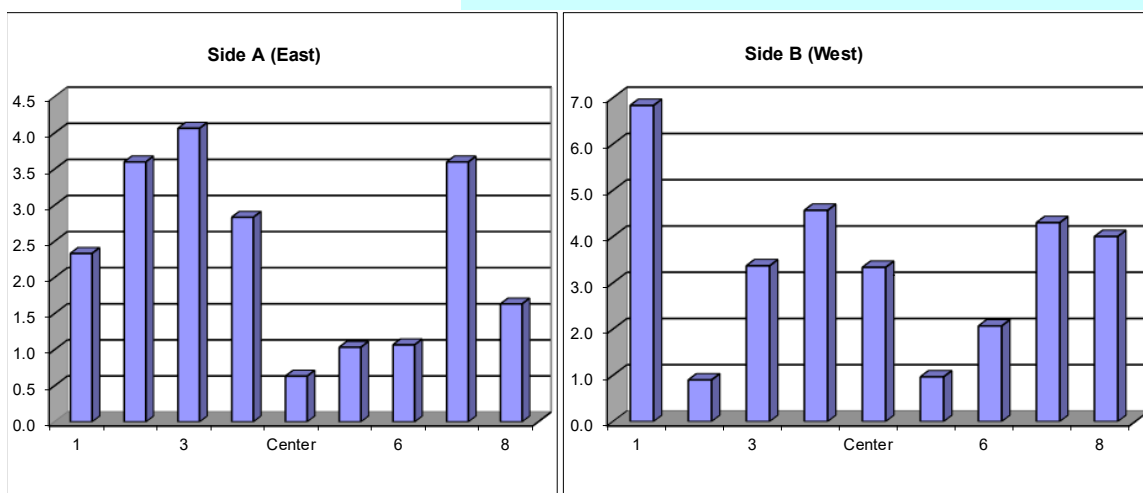


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-11				
Date	6/24/2021			Fan Setting	NA Hz				
Start/End Time	10:58 11:07			Fan Configuration	A & C				
Testers	JPC/LCE			Stack Temp	110.8 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	11.00 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	1.7	2.2	3.1	2.3	7.5	6.3	6.7	6.8
2	1.79	3.7	4.2	2.9	3.6	1.6	0.8	0.3	0.9
3	3.30	3.3	4.3	4.6	4.1	3.6	3.7	2.8	3.4
4	5.49	2.8	3.1	2.6	2.8	4.6	3.9	5.2	4.6
Center	8.50	0.6	0.3	1.0	0.6	3.7	2.9	3.4	3.3
5	11.51	0.9	1.0	1.2	1.0	1.4	0.8	0.7	1.0
6	13.70	1.9	0.6	0.7	1.1	1.9	2.2	2.1	2.1
7	15.22	1.5	5.5	3.8	3.6	4.4	4.7	3.8	4.3
8	16.46	1.0	2.5	1.4	1.6	3.4	4.6	4.0	4.0
Mean of absolute values:					2.3	3.4			
" w/o points by wall:					2.4	2.8			
Instruments Used:					Cal. Due	Grand mean ABS 2.8			
						Grand mean ABS w/o wall pts 2.6			
S-type pitot (ID: 2A, 24")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

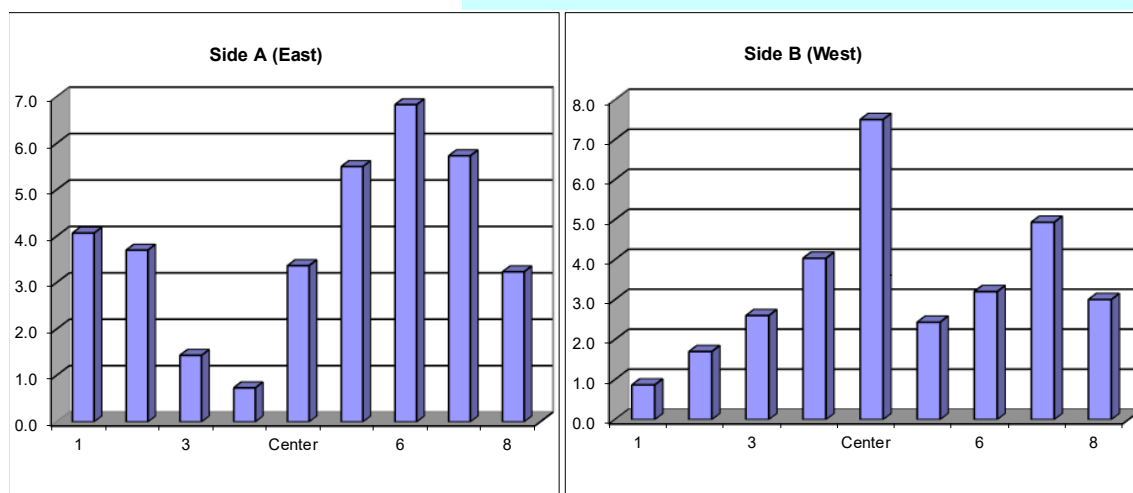


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-12				
Date	6/24/2021			Fan Setting	NA Hz				
Start/End Time	13:23 13:30			Fan Configuration	A & C				
Testers	JPC/LCE			Stack Temp	110.7 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	11.00 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	4.8	3.6	3.8		0.4	1.3	0.9	
2	1.79	3.4	4.1	3.6		2.0	1.3	1.8	
3	3.30	1.3	1.6	1.4		1.9	3.2	2.7	
4	5.49	1.0	0.7	0.5		3.1	4.2	4.8	
Center	8.50	3.1	3.6	3.4		9.1	6.8	6.6	
5	11.51	5.4	5.3	5.8		2.9	2.4	2.0	
6	13.70	6.9	7.2	6.4		3.7	3.2	2.7	
7	15.22	5.2	5.7	6.3		4.8	4.9	5.1	
8	16.46	3.0	3.6	3.1		4.0	1.7	3.3	
Mean of absolute values:				3.8	Grand mean ABS				3.6
" " w/o points by wall:				3.9	Grand mean ABS w/o wall pts				3.8
Instruments Used:				Cal. Due					
S-type pitot		(ID: 2A, 24")		Pre-test calibration; Post-test inspection.					
Angle indicator		SPI Tronic PRO 360 (SN 31-038-3)		Accuracy check prior to each use; field recalibration as necessary					
Manometer		Digisense 20250-13 (SN: 191212877)		Pre-test inspection; post test calibration check.					

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

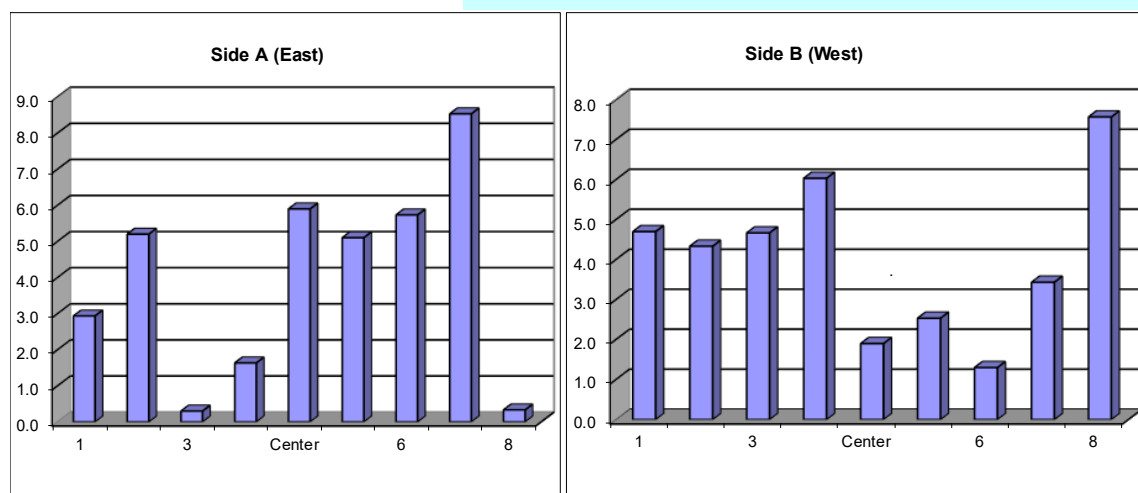


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-13				
Date	6/24/2021			Fan Setting	NA Hz				
Start/End Time	14:25		14:34	Fan Configuration	A & C				
Testers	JPC/LCE			Stack Temp	110.8 deg F				
Stack Dia.	17		in	Units	Degrees				
Stack X-Area	227.0		in <sup>2</sup>	Port	A & B				
Elevation	691 ft								
Distance to disturbance	11.00 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->									
	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	3.1	2.8	2.9	2.9	4.5	4.9	4.7	4.7
2	1.79	4.3	6.1	5.2	5.2	5.1	3.6	4.3	4.3
3	3.30	0.4	0.3	0.2	0.3	6.3	4.0	3.7	4.7
4	5.49	2.1	1.6	1.2	1.6	6.1	6.3	5.7	6.0
Center	8.50	5.7	6.1	5.9	5.9	0.8	2.0	2.9	1.9
5	11.51	5.5	5.0	4.8	5.1	3.6	2.1	1.9	2.5
6	13.70	5.9	5.3	6.0	5.7	0.3	2.5	1.1	1.3
7	15.22	9.1	7.9	8.6	8.5	3.9	3.0	3.4	3.4
8	16.46	0.3	0.6	0.1	0.3	6.1	9.2	7.4	7.6
Mean of absolute values:				4.0	Grand mean ABS				4.0
" " w/o points by wall:				4.6	Grand mean ABS w/o wall pts				4.0
Instruments Used:				Cal. Due					
S-type pitot (ID: 2A, 24")				Pre-test calibration; Post-test inspection.					
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary					
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.					

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

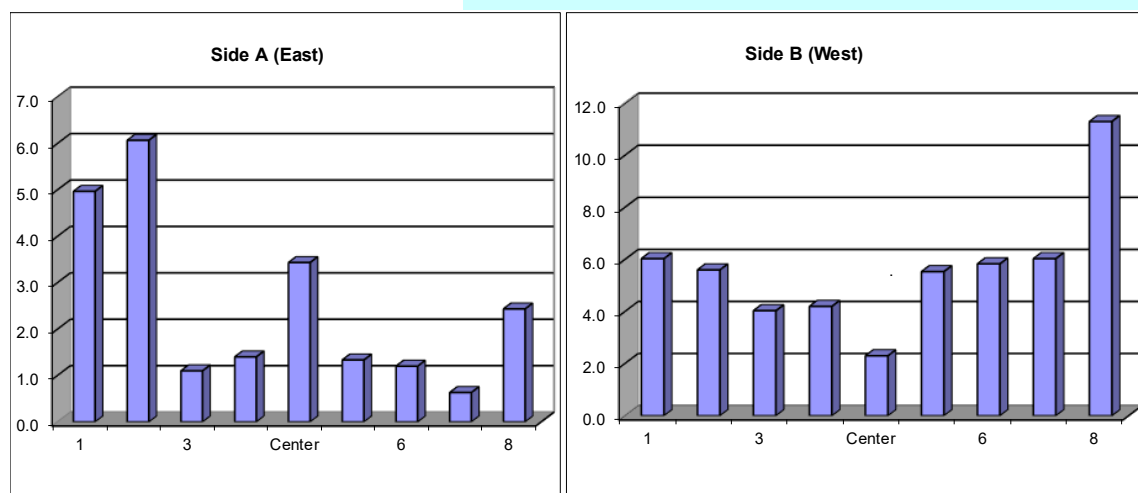


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	FA-14				
Date	6/25/2021			Fan Setting	NA Hz				
Start/End Time	9:16		9:24	Fan Configuration	A & C				
Testers	JPC/LCE			Stack Temp	110.9 deg F				
Stack Dia.	17		in	Units	Degrees				
Stack X-Area	227.0		in <sup>2</sup>	Port	A & B				
Elevation	691 ft								
Distance to disturbance	11.00 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	5.3	5.1	4.5	5.0	6.7	5.4	6.0	6.0
2	1.79	6.9	5.4	5.9	6.1	8.0	3.9	4.9	5.6
3	3.30	0.4	1.3	1.6	1.1	3.6	4.3	4.2	4.0
4	5.49	0.2	2.6	1.4	1.4	6.4	2.6	3.6	4.2
Center	8.50	4.2	3.2	2.9	3.4	2.8	3.5	0.6	2.3
5	11.51	1.8	1.3	0.9	1.3	4.7	6.3	5.6	5.5
6	13.70	0.8	0.9	1.9	1.2	5.0	6.6	5.9	5.8
7	15.22	0.6	0.5	0.8	0.6	3.2	8.3	6.6	6.0
8	16.46	3.1	1.5	2.7	2.4	11.8	9.9	12.2	11.3
Mean of absolute values:					2.5	5.7			
" w/o points by wall:					2.2	4.8			
Instruments Used:					Cal. Due	Grand mean ABS 4.1			
S-type pitot (ID: 2A, 24")						Grand mean ABS w/o wall pts 3.5			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary				
					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.



## C.2 Record Sampler (RS) Flow Angle Data Forms

### FLOW ANGLE DATA FORM

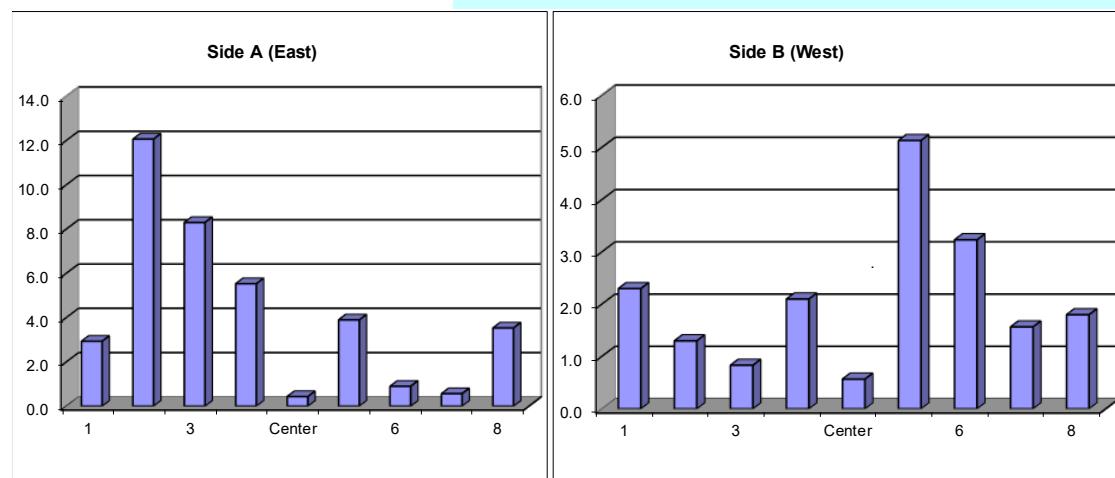
Stack	LV-S3 (LVP) RS				Run No.	FA-1			
Date	6/21/2021				Fan Setting	NA Hz			
Start/End Time	11:01 11:11				Fan Configuration	A & B			
Testers	JPC/LCE				Stack Temp	109.1 deg F			
Stack Dia.	17 in				Units	Degrees			
Stack X-Area	227.0 in <sup>2</sup>				Port	A & B			
Elevation	691 ft								
Distance to disturbance	50.08 ft								
Order -->	First				Second				
Traverse-->									
Trial ---->									

		Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	3.8	3.6	1.4	2.9	6.2	0.1	0.6	2.3
2	1.79	12.2	12.3	11.7	12.1	1.4	1.7	0.8	1.3
3	3.30	9.1	8.3	7.5	8.3	0.4	0.9	1.2	0.8
4	5.49	6.1	5.3	5.2	5.5	2.1	2.0	2.2	2.1
Center	8.50	0.1	0.7	0.5	0.4	0.7	0.8	0.2	0.6
5	11.51	3.7	4.6	3.4	3.9	4.7	5.1	5.6	5.1
6	13.70	0.7	0.6	1.4	0.9	3.6	3.2	2.9	3.2
7	15.22	0.8	0.2	0.7	0.6	0.8	1.4	2.5	1.6
8	16.46	3.5	4.3	2.8	3.5	1.7	2.1	1.6	1.8
Mean of absolute values:					4.2	2.1			
" " w/o points by wall:					4.5	2.1			
						Grand mean ABS 3.2			
						Grand mean ABS w/o wall pts 3.3			

<b>Instruments Used:</b>	<b>Cal. Due</b>
S-type pitot (ID: 2A, 24")	Pre-test calibration; Post-test inspection.
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)	Accuracy check prior to each use; field recalibration as necessary
Manometer Digisense 20250-13 (SN: 191212877)	Pre-test inspection; post test calibration check.

#### Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.



# FLOW ANGLE DATA FORM

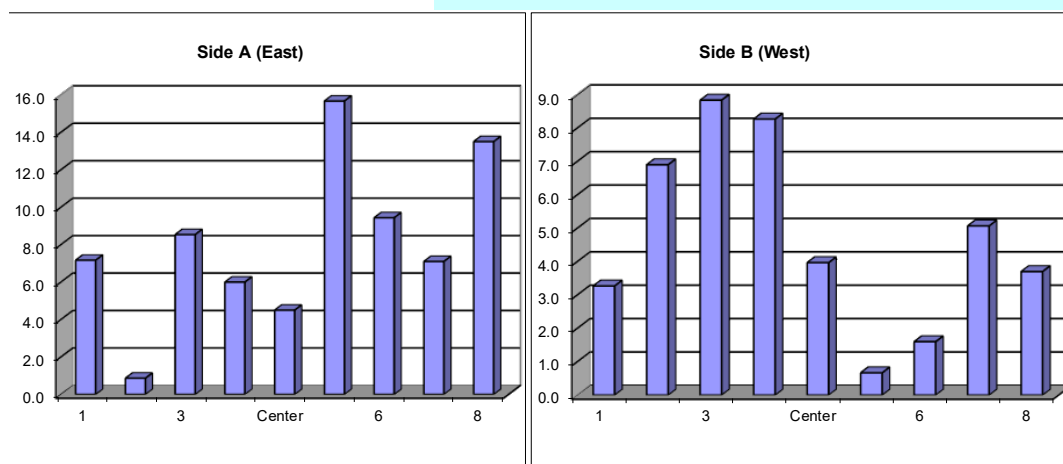
Stack	LV-S3 (LVP) RS			Run No.	FA-2			
Date	6/22/2021			Fan Setting	NA Hz			
Start/End Time	9:44 9:55			Fan Configuration	A&B			
Testers	JPC/LCE			Stack Temp	111 deg F			
Stack Dia.	17	in		Units	Degrees			
Stack X-Area	227.0	in <sup>2</sup>		Port	A & B			
Elevation	691	ft						
Distance to disturbance	50.08	ft						
Order -->	First			Second				
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw		
1	0.54	7.7	7.0	6.8	7.2	3.6	2.9	3.3
2	1.79	0.3	1.7	0.6	0.9	7.5	6.8	6.4
3	3.30	8.8	9.6	7.2	8.5	9.4	8.8	8.3
4	5.49	6.3	5.4	6.3	6.0	8.5	8.0	8.3
Center	8.50	3.4	7.3	2.8	4.5	3.2	4.8	3.9
5	11.51	14.6	16.9	15.5	15.7	0.7	1.0	0.3
6	13.70	10.1	8.7	9.5	9.4	0.9	2.2	1.7
7	15.22	6.9	7.1	7.3	7.1	5.9	4.7	4.6
8	16.46	13.4	13.1	14.0	13.5	3.9	3.4	3.8
Mean of absolute values:				8.1	4.7			
" w/o points by wall:				7.4	5.0			
Instruments Used:				Cal. Due	Grand mean ABS 6.4			
S-type pitot (ID: 2A, 24")				Pre-test calibration; Post-test inspection.	Grand mean ABS w/o wall pts 6.2			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.

First traverse point is all the way into the stack.

Approx. air velocity was derived from all points on the Velocity Traverse Forms.

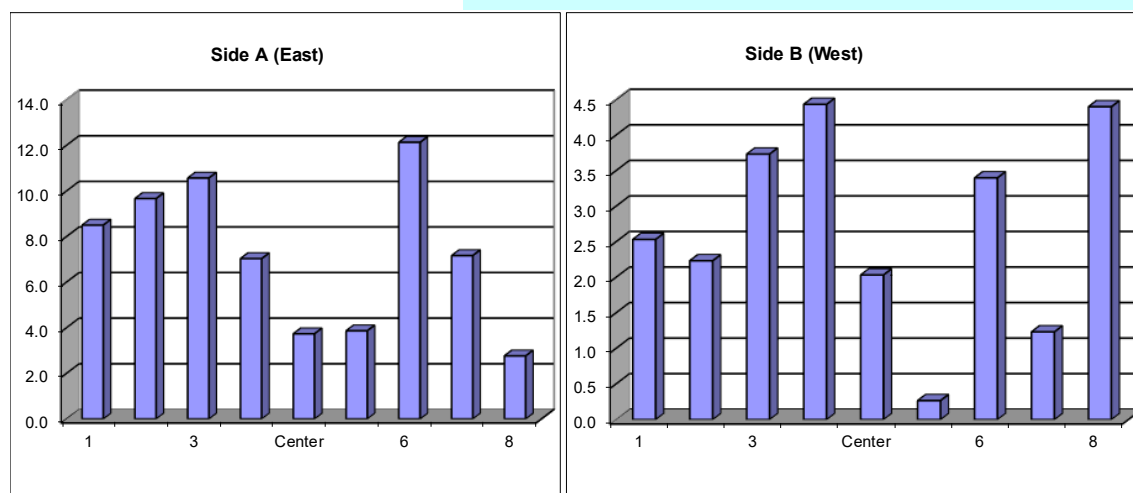


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-3				
Date	6/22/2021			Fan Setting	NA Hz				
Start/End Time	10:47		10:57	Fan Configuration	A&B				
Testers	JPC/LCE			Stack Temp	110.4 deg F				
Stack Dia.	17		in	Units	Degrees				
Stack X-Area	227.0		in <sup>2</sup>	Port	A & B				
Elevation	691 ft								
Distance to disturbance	50.08 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	9.1	6.8	9.6	8.5	1.9	2.8	2.9	2.5
2	1.79	11.6	9.4	8.0	9.7	1.7	3.3	1.7	2.2
3	3.30	9.6	12.0	10.1	10.6	3.8	3.4	4.0	3.7
4	5.49	7.4	8.6	5.1	7.0	4.3	4.4	4.6	4.4
Center	8.50	3.0	3.5	4.7	3.7	2.0	2.1	2.0	2.0
5	11.51	3.9	4.7	3.0	3.9	0.4	0.3	0.1	0.3
6	13.70	13.3	11.7	11.4	12.1	4.0	3.2	3.0	3.4
7	15.22	6.9	7.7	6.9	7.2	1.7	1.2	0.8	1.2
8	16.46	2.5	3.4	2.4	2.8	4.4	4.3	4.5	4.4
Mean of absolute values:					7.3	2.7			
" " w/o points by wall:					7.7	2.5			
Instruments Used:					Cal. Due	Grand mean ABS 5.0			
						Grand mean ABS w/o wall pts 5.1			
S-type pitot (ID: 2A, 24")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

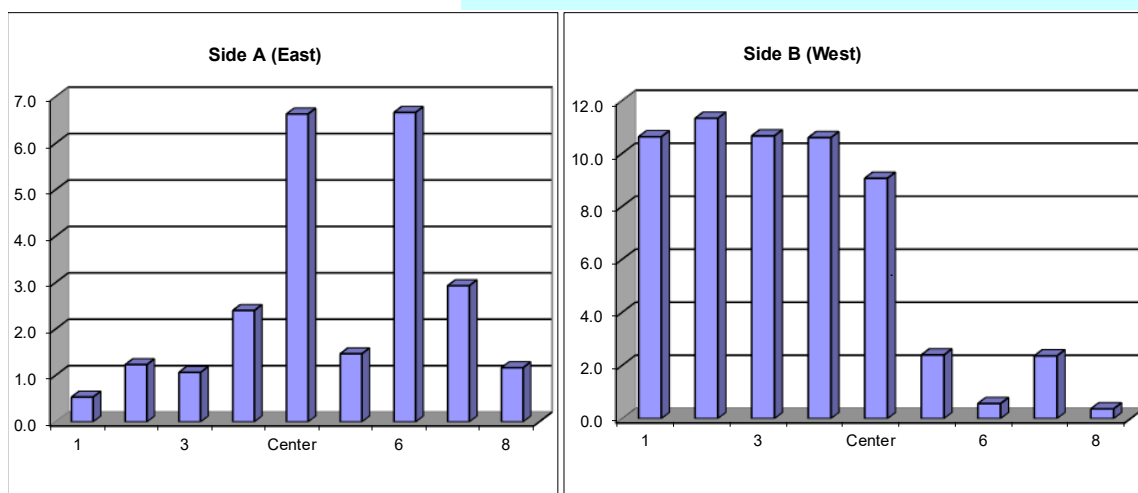


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-4				
Date	6/22/2021			Fan Setting	NA Hz				
Start/End Time	13:00 13:10			Fan Configuration	A&B				
Testers	JPC/LCE			Stack Temp	110.1 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	50.08 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	0.3	0.8	0.5	0.5	11.2	10.3	10.4	10.6
2	1.79	2.3	0.5	0.9	1.2	11.2	10.5	12.3	11.3
3	3.30	0.2	0.6	2.4	1.1	10.3	10.9	10.8	10.7
4	5.49	2.9	2.5	1.8	2.4	11.3	9.9	10.6	10.6
Center	8.50	5.2	7.1	7.6	6.6	9.4	9.1	8.7	9.1
5	11.51	2.1	1.3	1.0	1.5	2.9	2.2	2.1	2.4
6	13.70	8.5	5.6	5.9	6.7	0.5	0.7	0.5	0.6
7	15.22	2.7	2.7	3.4	2.9	2.6	2.2	2.3	2.4
8	16.46	1.3	0.9	1.3	1.2	0.3	0.7	0.1	0.4
Mean of absolute values:				2.7	6.4				
" w/o points by wall:				3.2	6.7				
Instruments Used:				Cal. Due	Grand mean ABS 4.6				
S-type pitot (ID: 2A, 24")				Pre-test calibration; Post-test inspection.					
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary					
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.					

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

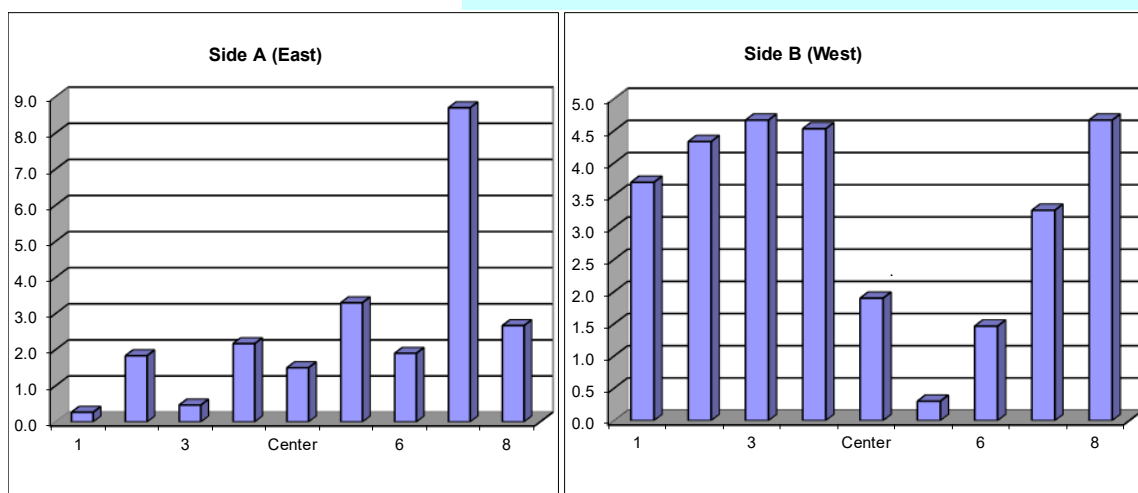


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-5				
Date	6/22/2021			Fan Setting	NA Hz				
Start/End Time	14:05 14:15			Fan Configuration	A&B				
Testers	JPC/LCE			Stack Temp	110.3 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	50.08 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	0.1	0.2	0.5	0.3	4.4	2.6	4.1	3.7
2	1.79	2.6	1.8	1.1	1.8	4.1	3.6	5.3	4.3
3	3.30	0.9	0.2	0.3	0.5	5.1	4.4	4.5	4.7
4	5.49	2.2	1.5	2.8	2.2	3.5	5.5	4.6	4.5
Center	8.50	1.7	0.9	1.9	1.5	1.9	1.7	2.1	1.9
5	11.51	2.4	3.0	4.5	3.3	0.1	0.3	0.5	0.3
6	13.70	1.8	2.1	1.8	1.9	2.9	0.8	0.7	1.5
7	15.22	9.0	8.7	8.4	8.7	2.6	2.6	4.6	3.3
8	16.46	2.7	2.4	2.9	2.7	6.2	3.8	4.0	4.7
Mean of absolute values:				2.5	Grand mean ABS				2.9
" " w/o points by wall:				2.8	Grand mean ABS w/o wall pts				2.9
Instruments Used:				Cal. Due					
S-type pitot (ID: 2A, 24")				Pre-test calibration; Post-test inspection.					
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary					
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.					

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

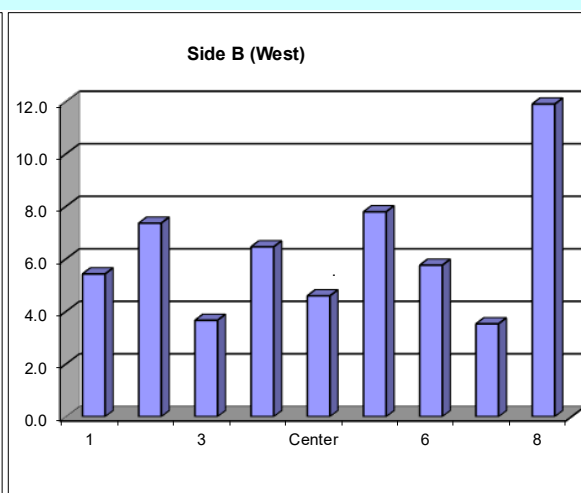
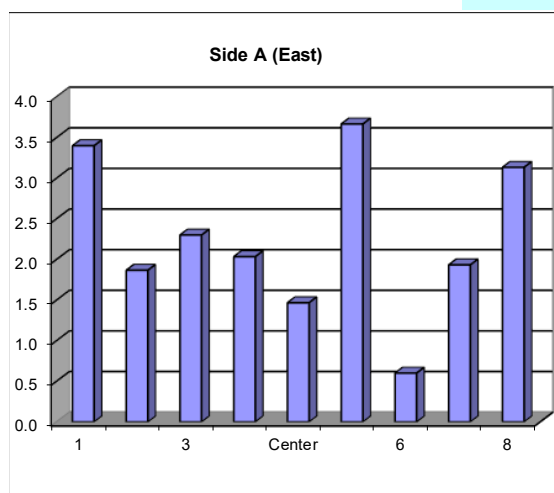


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-6			
Date	6/23/2021			Fan Setting	NA Hz			
Start/End Time	9:44		9:55	Fan Configuration	B&C			
Testers	JPC/LCE			Stack Temp	111.3 deg F			
Stack Dia.	17		in	Units	Degrees			
Stack X-Area	227.0		in <sup>2</sup>	Port	A & B			
Elevation	691 ft							
Distance to disturbance	50.08 ft							
Order -->	First			Second				
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw		
1	0.54	3.8	3.4	3.0	3.4	5.2	5.1	6.0
2	1.79	2.5	1.3	1.8	1.9	7.6	7.7	6.8
3	3.30	2.5	1.9	2.5	2.3	4.0	3.6	3.4
4	5.49	2.9	0.6	2.6	2.0	6.7	5.9	6.8
Center	8.50	1.4	1.8	1.2	1.5	5.3	4.8	3.7
5	11.51	5.5	2.2	3.3	3.7	7.1	8.0	8.3
6	13.70	0.8	0.7	0.3	0.6	5.5	5.9	5.9
7	15.22	2.4	1.8	1.6	1.9	2.9	2.4	5.3
8	16.46	3.5	3.4	2.5	3.1	12.2	11.8	11.7
Mean of absolute values:				2.3	6.3			
" " w/o points by wall:				2.0	5.6			
Instruments Used:				Cal. Due	Grand mean ABS 4.3			
S-type pitot (ID: 2A, 24")				Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

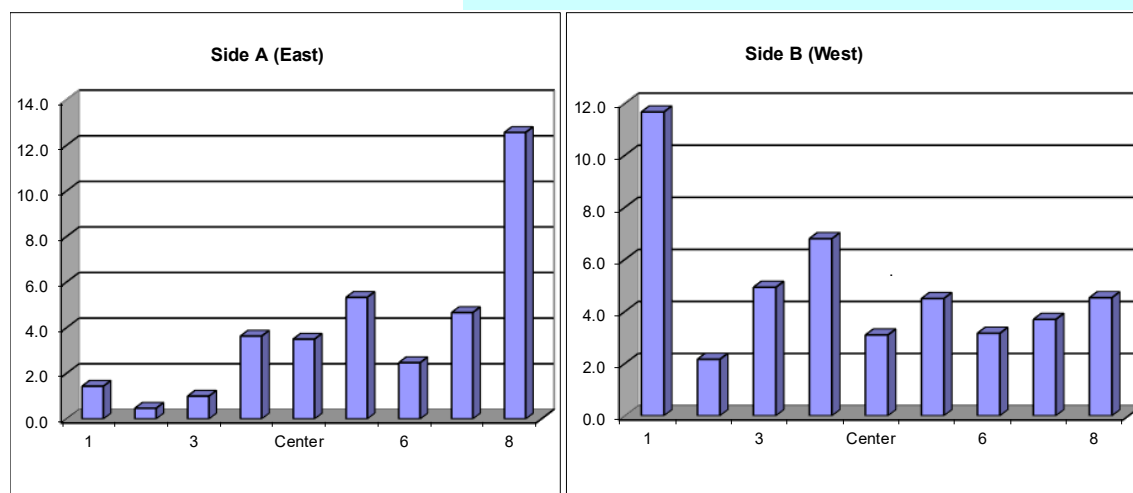


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-7				
Date	6/23/2021			Fan Setting	NA Hz				
Start/End Time	10:47 10:58			Fan Configuration	B&C				
Testers	JPC/LCE			Stack Temp	111.9 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	50.08 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	0.5	1.4	2.4	1.4	11.6	11.0	12.4	11.7
2	1.79	1.0	0.1	0.3	0.5	2.9	1.9	1.7	2.2
3	3.30	0.6	1.5	0.9	1.0	5.0	4.8	5.0	4.9
4	5.49	3.8	3.5	3.6	3.6	7.5	6.6	6.3	6.8
Center	8.50	2.8	4.4	3.3	3.5	3.0	3.5	2.8	3.1
5	11.51	6.0	4.7	5.3	5.3	4.6	4.5	4.4	4.5
6	13.70	3.0	2.1	2.3	2.5	3.2	2.9	3.4	3.2
7	15.22	1.4	6.1	6.5	4.7	3.6	4.1	3.4	3.7
8	16.46	12.2	12.6	12.9	12.6	3.9	4.0	5.7	4.5
Mean of absolute values:					3.9	5.0			
" " w/o points by wall:					3.0	4.1			
Instruments Used:					Cal. Due	Grand mean ABS 4.4			
S-type pitot (ID: 2A, 24")					Grand mean ABS w/o wall pts 3.5				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary				
					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

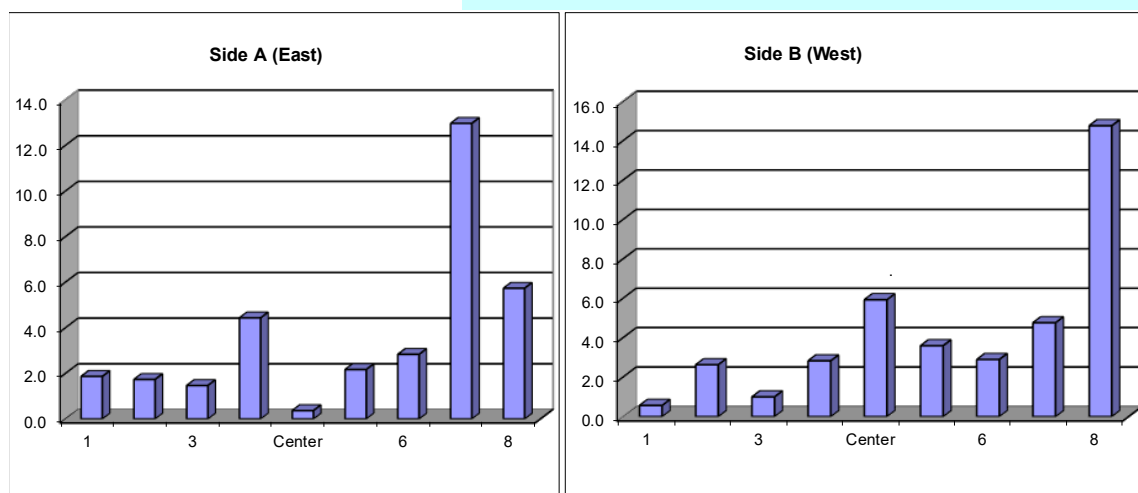


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-8			
Date	6/23/2021			Fan Setting	NA Hz			
Start/End Time	12:54		13:03	Fan Configuration	B&C			
Testers	JPC/LCE			Stack Temp	111.3 deg F			
Stack Dia.	17		in	Units	Degrees			
Stack X-Area	227.0		in <sup>2</sup>	Port	A & B			
Elevation	691		ft					
Distance to disturbance	50.08		ft					
Order -->	First			Second				
Traverse-->	Side A (East)			Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	
Point	Depth, in.	deg. cw			deg. cw			Mean
1	0.54	2.4	2.2	1.0	1.9	0.6	0.1	1.0
2	1.79	2.2	1.7	1.3	1.7	3.4	2.1	2.4
3	3.30	1.9	1.3	1.2	1.5	2.0	0.7	0.3
4	5.49	5.7	3.7	3.9	4.4	3.3	2.3	2.9
Center	8.50	0.3	0.3	0.5	0.4	6.5	5.5	5.8
5	11.51	2.8	1.9	1.8	2.2	3.4	3.7	3.7
6	13.70	3.2	2.6	2.7	2.8	2.9	3.0	2.8
7	15.22	13.4	12.3	13.2	13.0	5.0	4.9	4.4
8	16.46	6.5	4.7	6.0	5.7	14.5	15.1	14.7
Mean of absolute values:				3.7	4.3			
" " w/o points by wall:				3.7	3.4			
Instruments Used:				Cal. Due	Grand mean ABS 4.0			
S-type pitot (ID: 2A, 24")				Grand mean ABS w/o wall pts 3.5				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)				Accuracy check prior to each use; field recalibration as necessary				
				Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

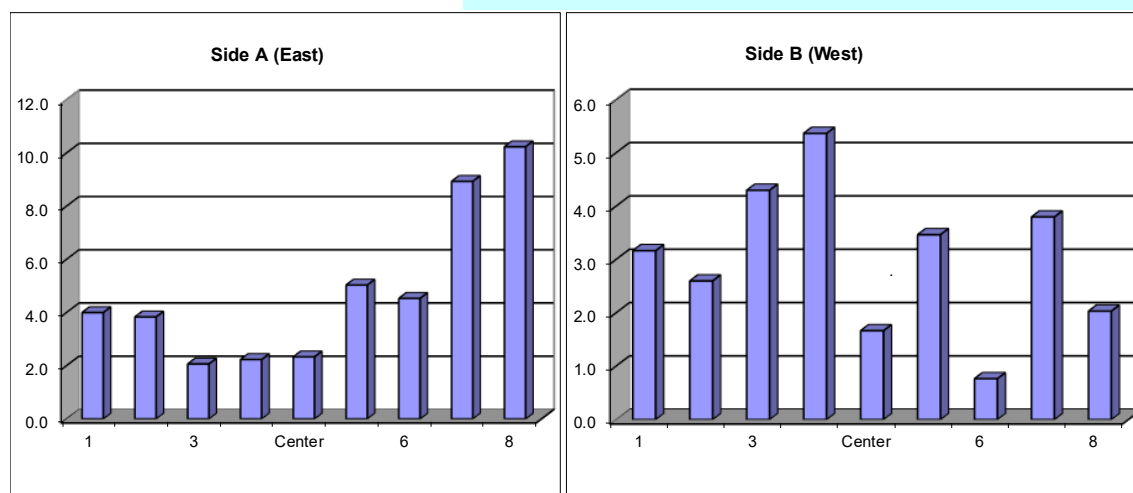


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-9				
Date	6/23/2021			Fan Setting	NA Hz				
Start/End Time	13:58 14:08			Fan Configuration	B&C				
Testers	JPC/LCE			Stack Temp	111.5 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	50.08 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	3.4	4.4	4.2	4.0	2.3	3.7	3.5	3.2
2	1.79	3.8	3.7	4.0	3.8	2.0	2.6	3.2	2.6
3	3.30	2.9	1.7	1.6	2.1	4.4	3.9	4.6	4.3
4	5.49	2.5	2.3	1.9	2.2	5.4	5.3	5.4	5.4
Center	8.50	2.5	2.2	2.3	2.3	1.2	1.7	2.1	1.7
5	11.51	5.5	5.0	4.6	5.0	4.2	3.3	2.9	3.5
6	13.70	4.7	5.0	3.9	4.5	1.4	0.5	0.4	0.8
7	15.22	8.1	9.8	8.9	8.9	4.5	3.7	3.2	3.8
8	16.46	10.6	10.2	9.9	10.2	1.7	2.0	2.4	2.0
Mean of absolute values:					4.8	3.0			
" " w/o points by wall:					4.1	3.1			
Instruments Used:					Cal. Due	Grand mean ABS 3.9			
S-type pitot (ID: 2A, 24")						Grand mean ABS w/o wall pts 3.6			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary				
					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

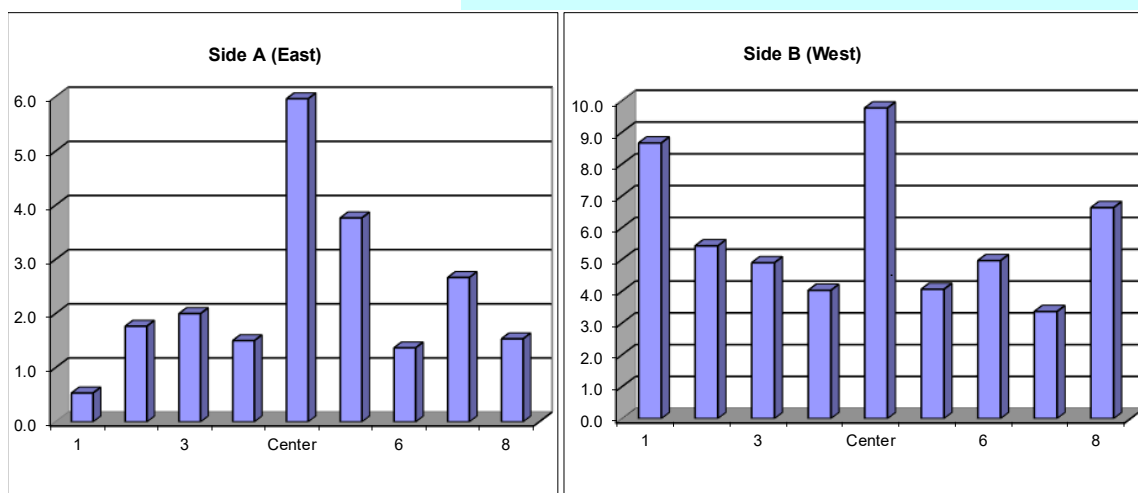


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-10				
Date	6/24/2021			Fan Setting	NA Hz				
Start/End Time	9:33		9:41	Fan Configuration	A&C				
Testers	JPC/LCE			Stack Temp	111.1 deg F				
Stack Dia.	17		in	Units	Degrees				
Stack X-Area	227.0		in <sup>2</sup>	Port	A & B				
Elevation	691 ft								
Distance to disturbance	50.08 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	0.5	0.3	0.8	0.5	8.7	8.3	9.0	8.7
2	1.79	0.3	1.3	3.7	1.8	5.0	4.7	6.6	5.4
3	3.30	3.5	1.3	1.2	2.0	5.2	4.4	5.1	4.9
4	5.49	2.0	1.0	1.5	1.5	3.6	4.1	4.4	4.0
Center	8.50	6.8	5.6	5.5	6.0	10.3	8.8	10.2	9.8
5	11.51	4.7	3.0	3.6	3.8	5.2	3.4	3.6	4.1
6	13.70	1.3	2.0	0.8	1.4	4.3	5.1	5.5	5.0
7	15.22	1.4	3.0	3.6	2.7	2.6	3.0	4.5	3.4
8	16.46	3.0	1.0	0.6	1.5	7.4	5.9	6.6	6.6
Mean of absolute values:					2.3	5.8			
" " w/o points by wall:					2.7	5.2			
Instruments Used:					Cal. Due	Grand mean ABS 4.1			
						Grand mean ABS w/o wall pts 4.0			
S-type pitot (ID: 2A, 24")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

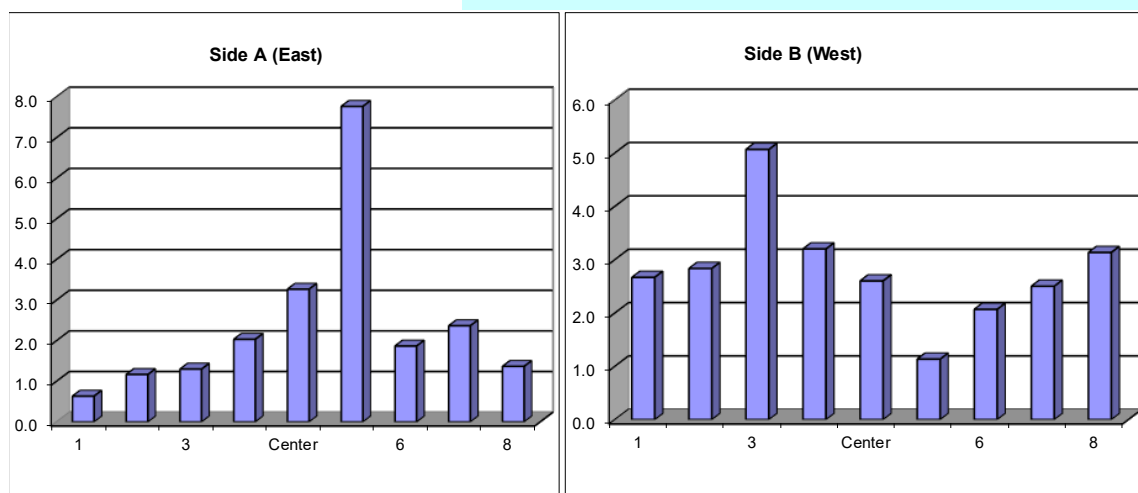


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-11				
Date	6/24/2021			Fan Setting	NA Hz				
Start/End Time	10:35 10:43			Fan Configuration	A&C				
Testers	JPC/LCE			Stack Temp	111.1 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	50.08 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	0.5	0.6	0.8	0.6	2.8	2.0	3.2	2.7
2	1.79	1.3	0.9	1.3	1.2	2.4	4.0	2.1	2.8
3	3.30	1.2	1.8	0.9	1.3	5.0	4.9	5.3	5.1
4	5.49	2.2	1.8	2.1	2.0	3.2	2.1	4.3	3.2
Center	8.50	3.7	3.3	2.8	3.3	3.1	2.4	2.3	2.6
5	11.51	7.8	8.3	7.2	7.8	0.5	1.6	1.3	1.1
6	13.70	2.8	1.9	0.9	1.9	1.9	2.3	2.0	2.1
7	15.22	2.6	2.5	2.0	2.4	3.1	2.4	2.0	2.5
8	16.46	1.7	0.9	1.5	1.4	2.0	4.7	2.7	3.1
Mean of absolute values:					2.4	2.8			
" " w/o points by wall:					2.8	2.8			
Instruments Used:					Cal. Due	Grand mean ABS 2.6			
						Grand mean ABS w/o wall pts 2.8			
S-type pitot (ID: 2A, 24")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

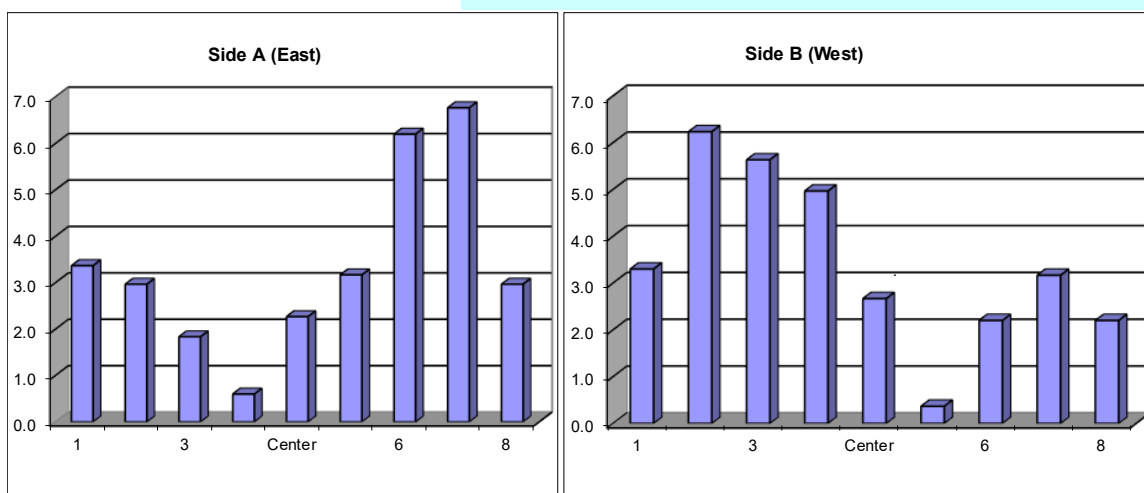


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-12				
Date	6/24/2021			Fan Setting	NA Hz				
Start/End Time	13:01 13:09			Fan Configuration	A&C				
Testers	JPC/LCE			Stack Temp	110.6 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	50.08 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	3.6	3.5	3.0	3.4	3.4	3.5	3.0	3.3
2	1.79	3.3	3.0	2.6	3.0	6.8	6.4	5.5	6.2
3	3.30	2.0	1.7	1.8	1.8	6.0	5.0	5.9	5.6
4	5.49	0.1	1.1	0.6	0.6	5.1	4.9	4.9	5.0
Center	8.50	1.6	2.5	2.7	2.3	2.9	2.6	2.5	2.7
5	11.51	3.7	2.8	3.0	3.2	0.8	0.3	0.0	0.4
6	13.70	6.3	6.2	6.1	6.2	2.7	1.9	2.0	2.2
7	15.22	6.9	6.7	6.7	6.8	2.2	3.5	3.8	3.2
8	16.46	3.0	2.6	3.3	3.0	2.8	1.4	2.4	2.2
Mean of absolute values:					3.3	3.4			
" w/o points by wall:					3.4	3.6			
Instruments Used:					Cal. Due	Grand mean ABS 3.4			
						Grand mean ABS w/o wall pts 3.5			
S-type pitot (ID: 2A, 24")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

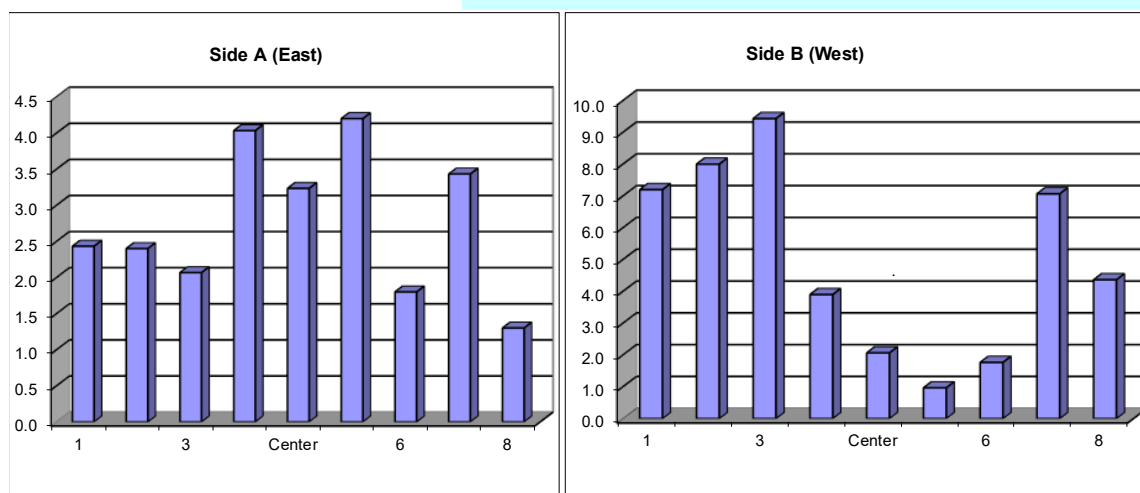


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-13				
Date	6/24/2021			Fan Setting	NA Hz				
Start/End Time	14:00 14:07			Fan Configuration	A&C				
Testers	JPC/LCE			Stack Temp	111 deg F				
Stack Dia.	17 in			Units	Degrees				
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	50.08 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	0.54	2.1	3.6	1.6	2.4	6.9	7.3	7.4	7.2
2	1.79	1.6	2.5	3.1	2.4	7.9	8.1	8.0	8.0
3	3.30	2.2	2.3	1.7	2.1	9.2	9.9	9.2	9.4
4	5.49	5.6	3.6	2.9	4.0	4.4	3.3	4.0	3.9
Center	8.50	4.1	2.3	3.3	3.2	3.6	1.7	0.9	2.1
5	11.51	5.2	3.4	4.0	4.2	0.9	1.0	1.0	1.0
6	13.70	1.9	2.7	0.8	1.8	1.4	1.6	2.3	1.8
7	15.22	2.7	4.4	3.2	3.4	6.6	7.4	7.2	7.1
8	16.46	2.0	0.9	1.0	1.3	4.2	3.9	5.0	4.4
Mean of absolute values:					2.8	5.0			
" " w/o points by wall:					3.0	4.7			
Instruments Used:					Cal. Due	Grand mean ABS 3.9			
S-type pitot (ID: 2A, 24")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

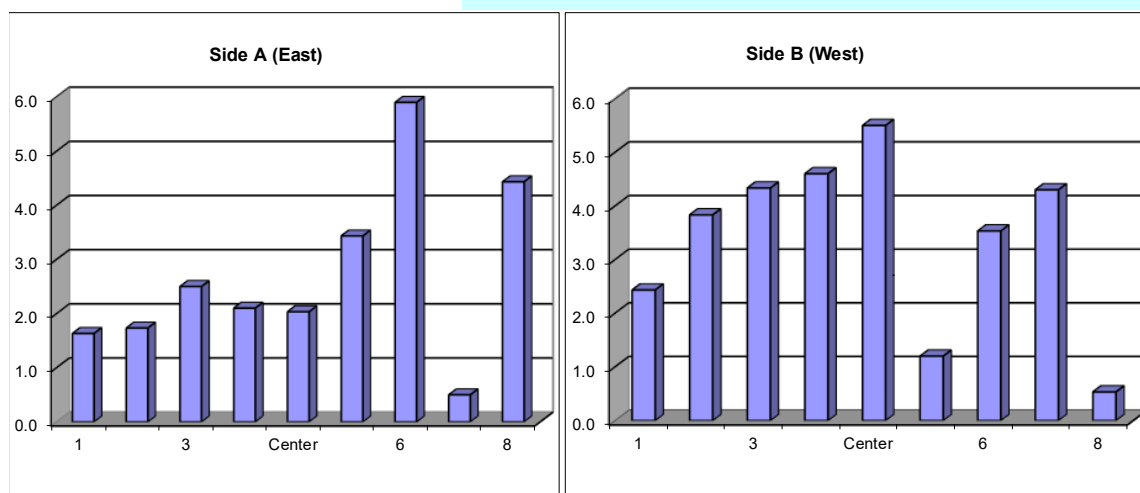


# FLOW ANGLE DATA FORM

Stack	LV-S3 (LVP) RS			Run No.	FA-14			
Date	6/25/2021			Fan Setting	NA Hz			
Start/End Time	9:00 9:07			Fan Configuration	A&C			
Testers	JPC/LCE			Stack Temp	110.6 deg F			
Stack Dia.	17 in			Units	Degrees			
Stack X-Area	227.0 in <sup>2</sup>			Port	A & B			
Elevation	691 ft							
Distance to disturbance	50.08 ft							
Order -->	First			Second				
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	0.54	2.4	0.8	1.7	1.6	1.7	2.3	3.3
2	1.79	1.8	1.9	1.5	1.7	3.2	3.6	4.7
3	3.30	2.1	2.8	2.6	2.5	5.1	3.9	4.0
4	5.49	2.3	2.1	1.9	2.1	4.8	3.8	5.2
Center	8.50	2.9	1.5	1.7	2.0	5.4	5.4	5.7
5	11.51	4.5	2.4	3.4	3.4	1.2	1.5	0.9
6	13.70	6.6	6.2	4.9	5.9	4.8	3.1	2.7
7	15.22	0.5	0.9	0.1	0.5	4.6	2.7	5.6
8	16.46	4.9	4.5	3.9	4.4	0.2	0.3	1.1
Mean of absolute values:				2.7	3.4			
" " w/o points by wall:				2.6	3.9			
Instruments Used:				Cal. Due	Grand mean ABS 3.0			
S-type pitot (ID: 2A, 24")				Pre-test calibration; Post-test inspection.	Grand mean ABS w/o wall pts 3.3			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.



## C.3 CAM Velocity Uniformity Data Forms

### VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM			Run No.	VT-1				
Date	6/21/21			Fan Configuration	A & B				
Testers	JPC/LCE			Fan Setting	NA Hz				
Stack Dia.	17 in.			Stack Temp	109.7 deg F				
Stack X-Area	227.0 in.2			Start/End Time	11:16 11:26				
Test Port	A & B			Center 2/3 from	1.56 to: 15.44				
Distance to disturbance	11.00 ft			Points in Center 2/3	2 to: 7				
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1 2 3 Mean				1 2 3 Mean				
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,822.5	2,686.9	2,709.9	2,739.8	2,392.9	2,418.7	2,366.7	2,392.8
2	1.79	2,755.5	2,686.9	2,755.5	2,732.7	2,755.5	2,755.5	2,800.3	2,770.5
3	3.30	2,800.3	2,887.9	2,866.2	2,851.5	2,909.3	2,951.8	2,930.6	2,930.6
4	5.49	3,055.4	2,972.9	3,075.7	3,034.6	2,909.3	2,972.9	2,909.3	2,930.5
Center	8.50	3,014.4	3,055.4	3,035.0	3,034.9	2,993.7	2,993.7	2,972.9	2,986.7
5	11.51	2,844.4	2,887.9	2,887.9	2,873.4	2,972.9	2,951.8	2,972.9	2,965.8
6	13.70	2,519.5	2,686.9	2,709.9	2,638.8	2,800.3	2,709.9	2,822.5	2,777.6
7	15.22	2,392.9	2,340.2	2,340.2	2,357.8	2,663.7	2,663.7	2,640.2	2,655.8
8	16.46	2,057.2	2,116.9	2,026.7	2,066.9	2,709.9	2,732.9	2,663.7	2,702.2
Averages ----->		2,695.8	2,702.4	2,711.9	2,703.4	2,789.7	2,794.5	2,786.6	2,790.3

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2746.8		Mean	2789.1	2859.6	2824.4
Min Point	2066.9	-24.8%	Std. Dev.	239.3	125.0	187.0
Max Point	3034.9	10.5%	COV as %	8.6	4.4	6.6

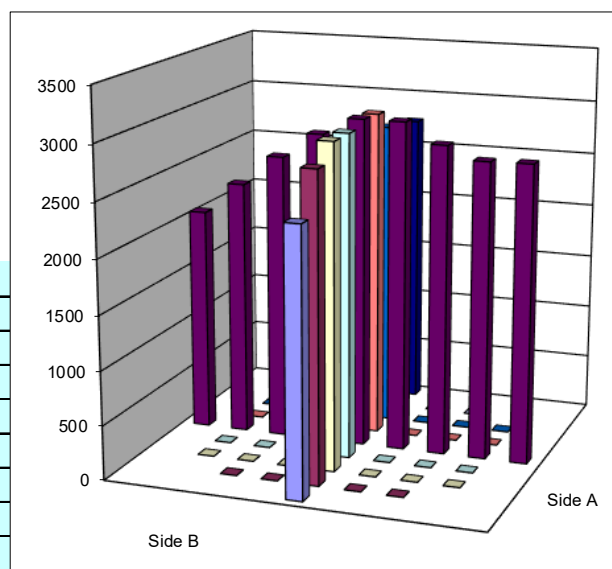
Flow w/o C-Pt	4278 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2714 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
	Start	Finish	Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	109.9	109.5	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	74.0	74.0		
Ambient temp	84.0	86.0		
Stack static	2.19	0.37		
Ambient pressure	990.86	990.86		
Total Stack pressure	993.05	991.23		
Ambient humidity	33%	33%		

#### Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H<sub>2</sub>O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-2			
Date	6/22/21				Fan Configuration	A & B			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	110.0 deg F			
Stack X-Area	227.0 in.2				Start/End Time	10:00 10:10			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,374.1	2,452.0	2,452.0	2,426.0	2,624.7	2,600.7	2,552.1	2,592.5
2	1.79	2,831.3	2,741.4	2,831.3	2,801.3	2,695.3	2,741.4	2,671.9	2,702.9
3	3.30	2,809.1	2,853.3	2,875.2	2,845.9	2,695.3	2,809.1	2,853.3	2,785.9
4	5.49	3,003.0	3,023.8	3,003.0	3,010.0	2,961.0	3,003.0	3,003.0	2,989.0
Center	8.50	3,023.8	3,023.8	3,003.0	3,016.9	3,044.4	3,023.8	3,003.0	3,023.8
5	11.51	2,896.9	2,961.0	2,896.9	2,918.2	3,064.9	2,961.0	3,003.0	3,009.6
6	13.70	2,624.7	2,576.5	2,552.1	2,584.4	2,918.4	2,918.4	2,875.2	2,904.0
7	15.22	2,374.1	2,320.7	2,426.3	2,373.7	2,718.4	2,671.9	2,576.5	2,655.6
8	16.46	2,123.4	2,063.7	2,063.7	2,083.6	2,347.6	2,374.1	2,374.1	2,365.2
Averages ----->		2,673.4	2,668.5	2,678.2	2,673.3	2,785.6	2,789.3	2,768.0	2,781.0

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2727.1		Mean	2792.9	2867.3	2830.1
Min Point	2083.6	-23.6%	Std. Dev.	236.3	152.4	194.9
Max Point	3023.8	10.9%	COV as %	8.5	5.3	6.9

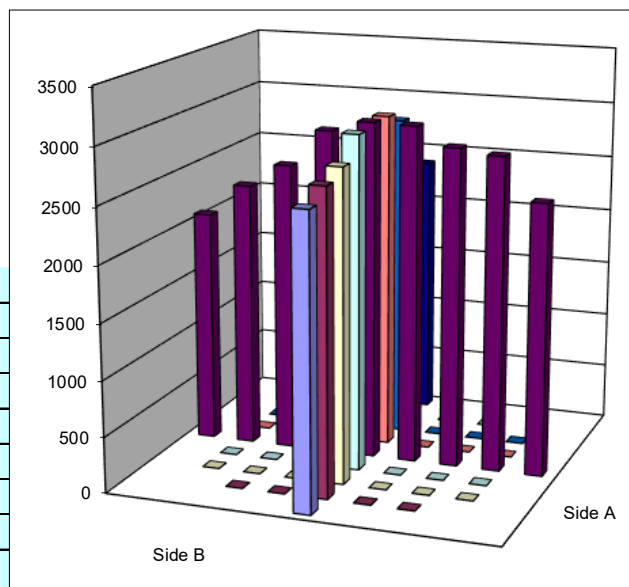
Flow w/o C-Pt	4241 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2690 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.3	109.7	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.1	76.2		
Ambient temp	91.0	91.0		
Stack static	0.57	0.52		
Ambient pressure	986.12	985.78		
Total Stack pressure	986.69	986.30		
Ambient humidity	26%	26%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-3				
Date	6/22/21				Fan Configuration	A & B				
Testers	JPC/LCE				Fan Setting	NA Hz				
Stack Dia.	17 in.				Stack Temp	110.4 deg F				
Stack X-Area	227.0 in.2				Start/End Time	11:01 11:13				
Test Port	A & B				Center 2/3 from	1.56		to: 15.44		
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7		
Velocity units <u>ft/min</u>										
Order -->	First port					Second port				
Traverse-->	Port A (East)					Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean		
Point	Depth, in.	Velocity				Velocity				
1	0.54	2,578.0	2,696.8	2,578.0	2,617.6	2,553.6	2,626.2	2,578.0	2,585.9	
2	1.79	2,788.3	2,765.7	2,832.9	2,795.6	2,742.9	2,765.7	2,626.2	2,711.6	
3	3.30	3,004.8	2,962.7	2,962.7	2,976.7	2,983.8	2,920.1	2,876.9	2,926.9	
4	5.49	3,066.7	3,025.6	3,066.7	3,053.0	3,004.8	2,962.7	2,983.8	2,983.8	
Center	8.50	3,025.6	3,025.6	2,983.8	3,011.7	3,066.7	3,025.6	3,066.7	3,053.0	
5	11.51	2,920.1	2,898.5	2,941.5	2,920.1	2,983.8	3,025.6	3,025.6	3,011.7	
6	13.70	2,602.2	2,602.2	2,650.0	2,618.1	2,876.9	2,898.5	2,920.1	2,898.5	
7	15.22	2,375.5	2,401.7	2,427.7	2,401.6	2,765.7	2,720.0	2,742.9	2,742.9	
8	16.46	2,095.0	2,267.5	2,064.8	2,142.4	2,375.5	2,401.7	2,453.4	2,410.2	
Averages ----->		2,717.3	2,738.5	2,723.1	2,726.3	2,817.1	2,816.2	2,808.2	2,813.8	

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2770.1		Mean	2825.3	2904.1	2864.7
Min Point	2142.4	-22.7%	Std. Dev.	238.7	131.5	189.6
Max Point	3053.0	10.2%	COV as %	8.4	4.5	6.6

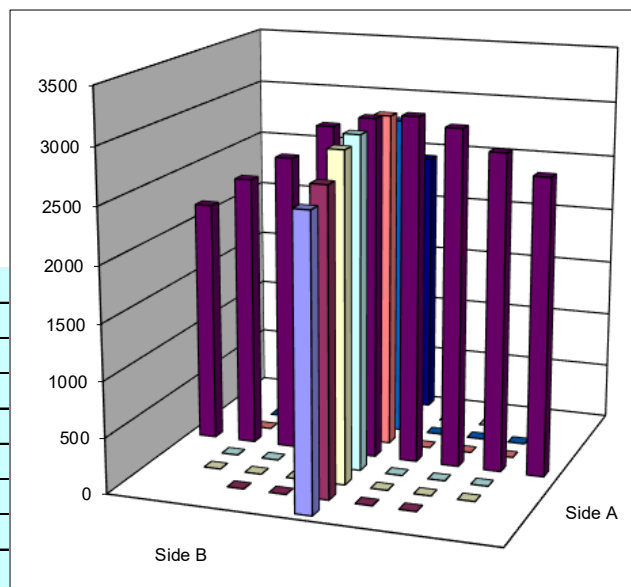
Flow w/o C-Pt	4315 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2737 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.2	110.6	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.1	76.5		
Ambient temp	93.6	94.2		
Stack static	1.00	0.22		
Ambient pressure	985.44	985.44		
Total Stack pressure	986.44	985.66		
Ambient humidity	24%	23%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-4			
Date	6/22/21				Fan Configuration	A & B			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	111.0 deg F			
Stack X-Area	227.0 in.2				Start/End Time	13:13 13:23			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,506.3	2,430.0	2,580.4	2,505.6	2,556.0	2,628.7	2,676.1	2,620.2
2	1.79	2,676.1	2,745.5	2,745.5	2,722.4	2,768.4	2,791.0	2,768.4	2,775.9
3	3.30	2,901.3	2,965.6	2,986.6	2,951.2	2,813.4	2,879.6	2,901.3	2,864.8
4	5.49	3,069.6	3,110.3	3,007.6	3,062.5	2,965.6	3,007.6	2,986.6	2,986.6
Center	8.50	2,986.6	2,965.6	3,007.6	2,986.6	3,049.0	3,069.6	3,069.6	3,062.8
5	11.51	2,879.6	2,965.6	2,944.2	2,929.8	2,944.2	2,944.2	2,965.6	2,951.3
6	13.70	2,676.1	2,699.4	2,722.6	2,699.4	2,879.6	2,857.6	2,879.6	2,872.3
7	15.22	2,404.0	2,455.7	2,404.0	2,421.2	2,699.4	2,604.7	2,676.1	2,660.1
8	16.46	2,156.0	2,156.0	2,126.7	2,146.3	2,377.7	2,430.0	2,481.1	2,429.6
Averages ----->		2,695.1	2,721.5	2,725.0	2,713.9	2,783.7	2,801.4	2,822.7	2,802.6

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2758.2		Mean	2824.7	2881.9	2853.3
Min Point	2146.3	-22.2%	Std. Dev.	223.1	135.0	179.7
Max Point	3062.8	11.0%	COV as %	7.9	4.7	6.3

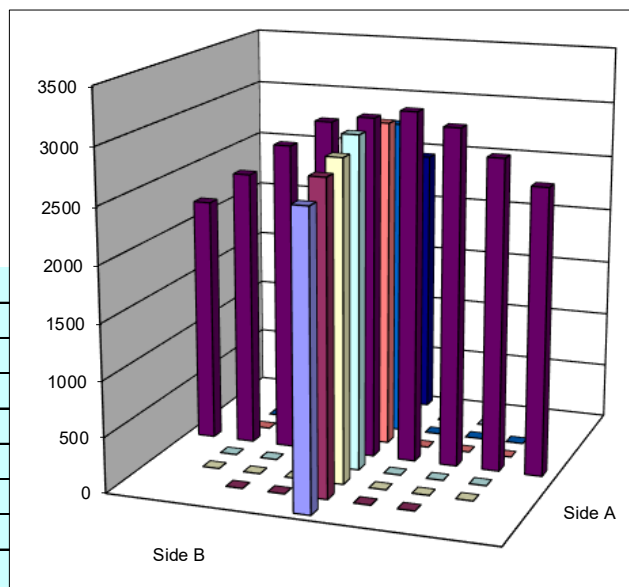
Flow w/o C-Pt	4295 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2725 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.6	111.3	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.6	76.7		
Ambient temp	97.5	97.5		
Stack static	0.45	0.30		
Ambient pressure	984.76	984.76		
Total Stack pressure	985.21	985.06		
Ambient humidity	19%	19%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-5			
Date	6/22/21				Fan Configuration	A & B			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	110.2 deg F			
Stack X-Area	227.0 in.2				Start/End Time	14:18 14:25			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,454.5	2,530.0	2,530.0	2,504.8	2,554.7	2,579.1	2,402.7	2,512.2
2	1.79	2,856.3	2,721.2	2,834.2	2,803.9	2,698.0	2,744.1	2,789.6	2,743.9
3	3.30	2,921.4	2,985.2	2,899.8	2,935.5	2,834.2	2,767.0	2,744.1	2,781.8
4	5.49	3,068.1	3,026.9	3,006.1	3,033.7	2,921.4	2,985.2	2,942.8	2,949.8
Center	8.50	3,047.6	3,068.1	3,006.1	3,040.6	3,006.1	2,985.2	3,026.9	3,006.1
5	11.51	2,985.2	2,834.2	2,921.4	2,913.6	2,985.2	3,026.9	2,985.2	2,999.1
6	13.70	2,603.4	2,674.7	2,627.3	2,635.1	2,899.8	2,878.1	2,878.1	2,885.3
7	15.22	2,428.8	2,479.9	2,376.5	2,428.4	2,721.2	2,744.1	2,698.0	2,721.1
8	16.46	2,154.9	2,240.6	2,154.9	2,183.5	2,505.0	2,428.8	2,376.5	2,436.8
Averages ----->		2,724.4	2,729.0	2,706.3	2,719.9	2,791.7	2,793.2	2,760.4	2,781.8

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2750.8		Mean	2827.3	2869.6	2848.4
Min Point	2183.5	-20.6%	Std. Dev.	225.0	120.8	174.9
Max Point	3040.6	10.5%	COV as %	8.0	4.2	6.1

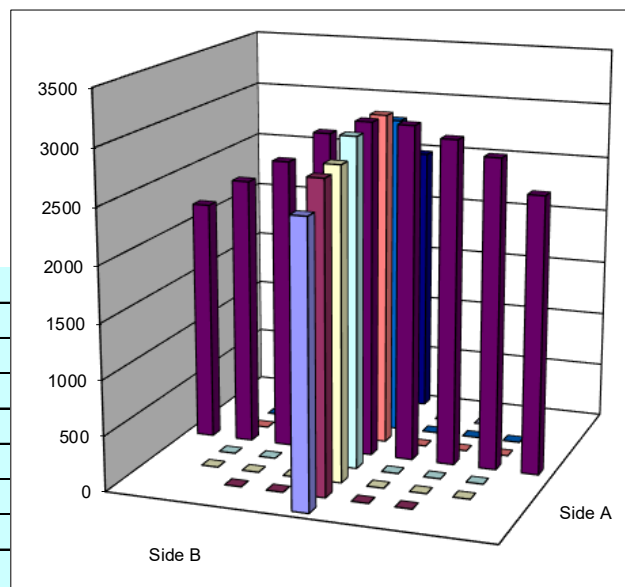
Flow w/o C-Pt	4282 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2717 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	109.4	111.0	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	77.1	76.3		
Ambient temp	98.6	98.7		
Stack static	0.65	0.50		
Ambient pressure	984.42	984.08		
Total Stack pressure	985.07	984.58		
Ambient humidity	19%	19%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-6			
Date	6/23/21				Fan Configuration	B & C			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	111.1 deg F			
Stack X-Area	227.0 in.2				Start/End Time	9:58 10:08			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,426.5	2,477.6	2,502.7	2,468.9	2,502.7	2,576.7	2,477.6	2,519.0
2	1.79	2,741.6	2,672.1	2,741.6	2,718.4	2,718.7	2,741.6	2,718.7	2,726.3
3	3.30	2,940.0	2,918.6	2,982.4	2,947.0	2,786.9	2,741.6	2,809.3	2,779.3
4	5.49	3,065.2	3,065.2	3,044.7	3,058.3	2,940.0	2,918.6	2,961.3	2,940.0
Center	8.50	2,961.3	3,003.3	3,044.7	3,003.1	3,003.3	2,982.4	3,003.3	2,996.3
5	11.51	2,961.3	3,044.7	2,897.1	2,967.7	2,982.4	3,003.3	2,940.0	2,975.2
6	13.70	2,695.5	2,672.1	2,695.5	2,687.7	2,875.4	2,875.4	2,918.6	2,889.8
7	15.22	2,400.5	2,477.6	2,552.3	2,476.8	2,764.4	2,786.9	2,718.7	2,756.7
8	16.46	2,181.9	2,153.0	2,153.0	2,162.6	2,452.2	2,452.2	2,400.5	2,435.0
Averages ----->		2,708.2	2,720.5	2,734.9	2,721.2	2,780.7	2,786.5	2,772.0	2,779.7

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2750.5		Mean	2837.0	2866.2	2851.6
Min Point	2162.6	-21.4%	Std. Dev.	212.9	111.0	163.8
Max Point	3058.3	11.2%	COV as %	7.5	3.9	5.7

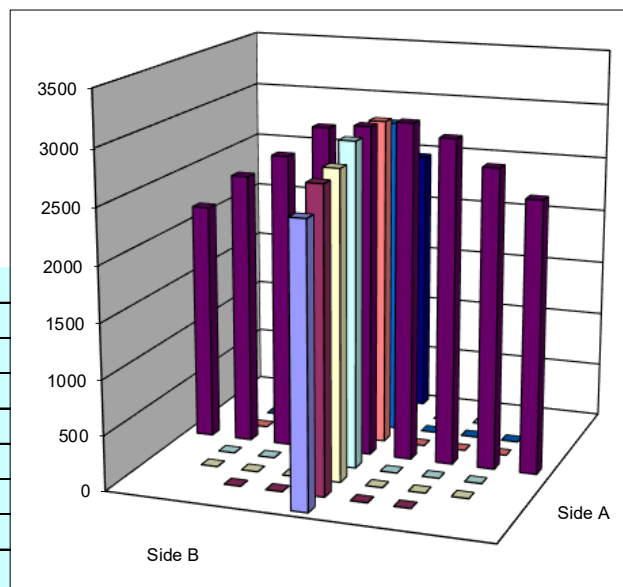
Flow w/o C-Pt	4286 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2719 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.9	111.3	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	78.2	77.9		
Ambient temp	84.8	84.9		
Stack static	0.47	0.37		
Ambient pressure	987.81	987.81		
Total Stack pressure	988.28	988.18		
Ambient humidity	29%	27%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-7			
Date	6/23/21				Fan Configuration	B & C			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	111.6 deg F			
Stack X-Area	227.0 in.2				Start/End Time	11:01 11:13			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,478.5	2,553.2	2,503.6	2,511.7	2,478.5	2,503.6	2,577.6	2,519.9
2	1.79	2,810.2	2,765.3	2,810.2	2,795.3	2,787.9	2,742.6	2,719.6	2,750.0
3	3.30	2,919.7	2,962.3	2,898.1	2,926.7	2,876.4	2,810.2	2,810.2	2,832.3
4	5.49	3,045.7	3,025.2	3,025.2	3,032.0	2,898.1	2,941.1	2,941.1	2,926.8
Center	8.50	3,045.7	3,045.7	3,066.3	3,052.6	2,962.3	3,025.2	2,983.4	2,990.3
5	11.51	2,832.5	2,941.1	2,919.7	2,897.8	2,941.1	2,941.1	2,983.4	2,955.2
6	13.70	2,649.6	2,673.1	2,649.6	2,657.4	2,765.3	2,810.2	2,832.5	2,802.7
7	15.22	2,427.3	2,503.6	2,478.5	2,469.8	2,719.6	2,696.5	2,696.5	2,704.2
8	16.46	2,124.4	2,124.4	2,239.3	2,162.7	2,401.4	2,427.3	2,375.2	2,401.3
Averages ----->		2,703.7	2,732.7	2,732.3	2,722.9	2,759.0	2,766.4	2,768.8	2,764.7

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2743.8		Mean	2833.1	2851.6	2842.4
Min Point	2162.7	-21.2%	Std. Dev.	210.1	108.3	160.9
Max Point	3052.6	11.3%	COV as %	7.4	3.8	5.7

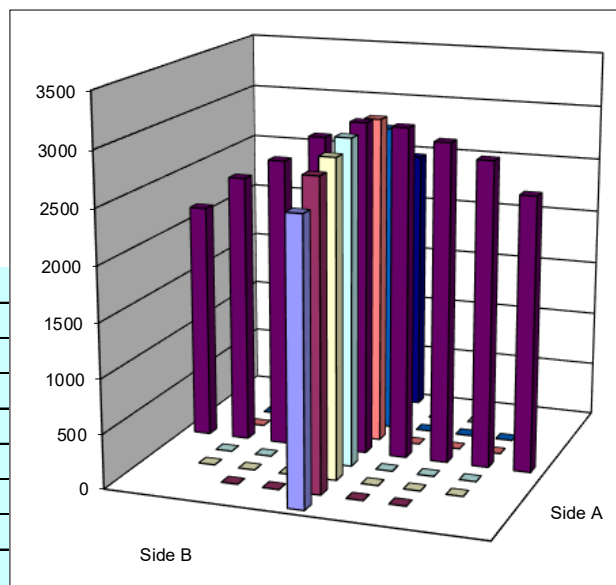
Flow w/o C-Pt	4270 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2709 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	112.8	110.3	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	78.8	77.4		
Ambient temp	87.8	88.1		
Stack static	0.60	0.42		
Ambient pressure	987.81	987.81		
Total Stack pressure	988.41	988.23		
Ambient humidity	25%	25%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-8			
Date	6/23/21				Fan Configuration	B & C			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	110.6 deg F			
Stack X-Area	227.0 in.2				Start/End Time	13:06 13:14			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,502.6	2,477.4	2,502.6	2,494.2	2,624.8	2,576.6	2,600.8	2,600.7
2	1.79	2,695.4	2,718.6	2,695.4	2,703.1	2,672.0	2,741.5	2,764.3	2,725.9
3	3.30	2,831.4	2,831.4	2,853.5	2,838.7	2,764.3	2,831.4	2,831.4	2,809.0
4	5.49	3,044.6	3,003.1	3,003.1	3,016.9	2,940.0	2,940.0	2,982.2	2,954.0
Center	8.50	2,982.2	3,044.6	3,023.9	3,016.9	2,982.2	2,982.2	3,023.9	2,996.1
5	11.51	2,853.5	2,853.5	2,875.3	2,860.7	3,023.9	2,918.5	2,982.2	2,974.9
6	13.70	2,502.6	2,576.6	2,576.6	2,552.0	2,786.8	2,875.3	2,853.5	2,838.5
7	15.22	2,400.4	2,477.4	2,502.6	2,460.2	2,695.4	2,718.6	2,718.6	2,710.8
8	16.46	2,123.5	2,123.5	2,093.9	2,113.6	2,426.4	2,400.4	2,400.4	2,409.1
Averages ----->		2,659.6	2,678.5	2,680.8	2,672.9	2,768.4	2,776.1	2,795.2	2,779.9

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2726.4		Mean	2778.4	2858.5	2818.4
Min Point	2113.6	-22.5%	Std. Dev.	217.0	118.2	172.9
Max Point	3016.9	10.7%	COV as %	7.8	4.1	6.1

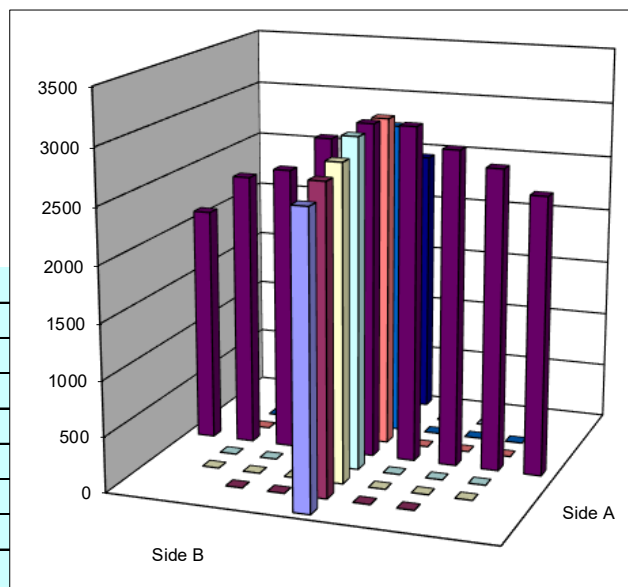
Flow w/o C-Pt	4242 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2691 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.7	110.5	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.9	77.7		
Ambient temp	94.2	94.5		
Stack static	0.32	0.30		
Ambient pressure	987.13	987.13		
Total Stack pressure	987.45	987.43		
Ambient humidity	19%	19%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-9			
Date	6/23/21				Fan Configuration	B & C			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	110.0 deg F			
Stack X-Area	227.0 in.2				Start/End Time	14:10 14:22			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,425.5	2,425.5	2,476.6	2,442.6	2,647.6	2,551.3	2,476.6	2,558.5
2	1.79	2,763.3	2,763.3	2,763.3	2,763.3	2,694.5	2,763.3	2,763.3	2,740.3
3	3.30	2,917.5	2,830.4	2,874.3	2,874.0	2,785.8	2,830.4	2,830.4	2,815.5
4	5.49	3,002.0	2,960.0	3,002.0	2,988.0	2,917.5	2,938.9	2,938.9	2,931.7
Center	8.50	3,022.9	3,022.9	3,002.0	3,015.9	2,981.1	2,938.9	3,002.0	2,974.0
5	11.51	2,938.9	2,917.5	2,852.4	2,902.9	2,917.5	2,960.0	2,960.0	2,945.8
6	13.70	2,575.7	2,671.1	2,647.6	2,631.5	2,852.4	2,830.4	2,960.0	2,880.9
7	15.22	2,451.2	2,501.7	2,451.2	2,468.0	2,717.6	2,694.5	2,740.5	2,717.5
8	16.46	2,122.8	2,181.0	2,152.1	2,151.9	2,399.6	2,551.3	2,476.6	2,475.8
Averages ----->		2,691.1	2,697.0	2,691.3	2,693.1	2,768.2	2,784.3	2,794.3	2,782.2

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2737.7		Mean	2806.2	2858.0	2832.1
Min Point	2151.9	-21.4%	Std. Dev.	199.1	102.1	154.3
Max Point	3015.9	10.2%	COV as %	7.1	3.6	5.4

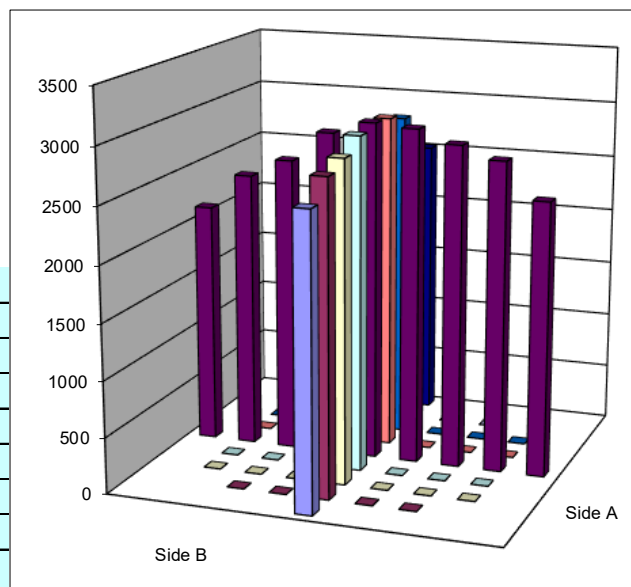
Flow w/o C-Pt	4265 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2706 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.2	109.7	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	75.9	77.3		
Ambient temp	96.1	96.2		
Stack static	0.40	0.42		
Ambient pressure	986.79	986.46		
Total Stack pressure	987.19	986.88		
Ambient humidity	18%	18%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM	Run No.	VT-10
Date	6/24/21	Fan Configuration	A & C
Testers	JPC/LCE	Fan Setting	NA Hz
Stack Dia.	17 in.	Stack Temp	110.8 deg F
Stack X-Area	227.0 in.2	Start/End Time	9:45 9:53
Test Port	A & B	Center 2/3 from	1.56 to: 15.44
Distance to disturbance	11.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		
Order -->	First port	Second port	
Traverse-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	0.54	2,471.8 2,420.9 2,395.0 2,429.2
	2	1.79	2,712.4 2,757.9 2,689.3 2,719.8
	3	3.30	2,954.4 2,911.8 2,933.2 2,933.1
	4	5.49	3,017.1 3,017.1 3,037.6 3,023.9
	Center	8.50	3,058.1 3,078.4 3,078.4 3,071.6
	5	11.51	2,890.4 2,933.2 2,890.4 2,904.7
	6	13.70	2,618.8 2,618.8 2,735.2 2,657.6
	7	15.22	2,446.5 2,496.9 2,446.5 2,463.3
	8	16.46	2,147.9 2,205.2 2,118.7 2,157.3
Averages ----->			2,701.9 2,715.6 2,702.7 2,706.7

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2761.0		Mean	2824.9	2890.0	2857.5
Min Point	2157.3	-21.9%	Std. Dev.	219.2	123.4	174.2
Max Point	3078.3	11.5%	COV as %	7.8	4.3	6.1

Flow w/o C-Pt	4290 cfm
Vel Avg w/o C-Pt	2722 fpm
	Start Finish
Stack temp	111.5 110.0 F
Equipment temp	77.3 77.4 F
Ambient temp	86.5 86.9 F
Stack static	0.37 0.35 mbars
Ambient pressure	991.87 991.87 mbars
Total Stack pressure	992.24 992.22 mbars
Ambient humidity	26% 26% RH

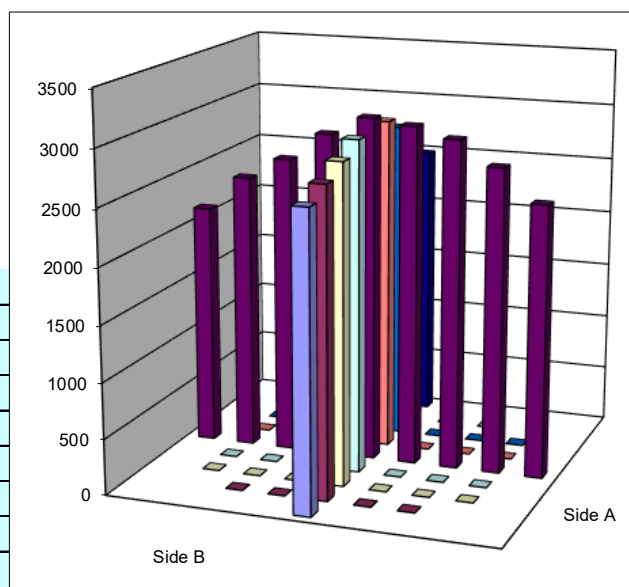
Instuments Used:	Cal Due
S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Control Co. Thermometer (SN: 220435230)	Post-test verification

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-11			
Date	6/24/21				Fan Configuration	A & C			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	110.8 deg F			
Stack X-Area	227.0 in.2				Start/End Time	10:46 10:56			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,394.9	2,368.7	2,420.8	2,394.8	2,496.9	2,521.6	2,546.2	2,521.6
2	1.79	2,570.6	2,618.7	2,594.8	2,594.7	2,735.1	2,757.8	2,802.6	2,765.2
3	3.30	2,824.8	2,824.8	2,846.8	2,832.1	2,824.8	2,890.3	2,846.8	2,854.0
4	5.49	3,078.3	3,057.9	3,098.5	3,078.2	2,975.3	2,975.3	2,954.3	2,968.3
Center	8.50	3,078.3	3,098.5	3,078.3	3,085.0	3,017.0	2,996.2	2,996.2	3,003.1
5	11.51	2,933.1	2,975.3	2,933.1	2,947.1	2,890.3	2,996.2	3,017.0	2,967.8
6	13.70	2,757.8	2,665.9	2,618.7	2,680.8	2,846.8	2,824.8	2,846.8	2,839.5
7	15.22	2,496.9	2,394.9	2,446.4	2,446.0	2,735.1	2,712.3	2,712.3	2,719.9
8	16.46	2,028.4	2,147.8	2,118.6	2,098.3	2,315.5	2,496.9	2,394.9	2,402.4
Averages ----->		2,684.8	2,683.6	2,684.0	2,684.1	2,759.6	2,796.8	2,790.8	2,782.4

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2733.3		Mean	2809.2	2874.0	2841.6
Min Point	2098.3	-23.2%	Std. Dev.	245.8	109.2	185.8
Max Point	3085.0	12.9%	COV as %	8.7	3.8	6.5

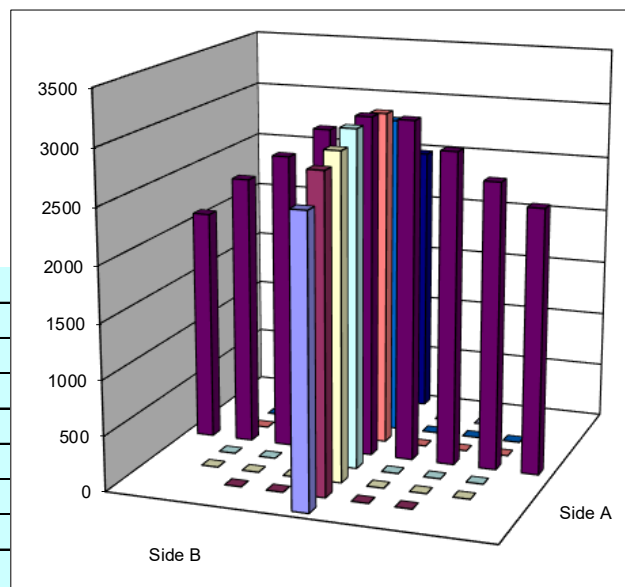
Flow w/o C-Pt	4247 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2694 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.9	110.6	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.3	76.9		
Ambient temp	88.7	88.9		
Stack static	0.45	0.42		
Ambient pressure	991.87	991.87		
Total Stack pressure	992.32	992.29		
Ambient humidity	24%	24%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM	Run No.	VT-12
Date	6/24/21	Fan Configuration	A & C
Testers	JPC/LCE	Fan Setting	NA Hz
Stack Dia.	17 in.	Stack Temp	110.7 deg F
Stack X-Area	227.0 in.2	Start/End Time	13:13 13:20
Test Port	A & B	Center 2/3 from	1.56 to: 15.44
Distance to disturbance	11.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		
Order -->	First port	Second port	
Traverse-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	0.54	2,395.7 2,395.7 2,369.5 2,387.0
	2	1.79	2,595.7 2,713.2 2,713.2 2,674.1
	3	3.30	2,891.3 2,891.3 2,847.9 2,876.8
	4	5.49	3,038.6 2,997.3 3,038.6 3,024.8
	Center	8.50	3,059.1 3,018.0 3,018.0 3,031.7
	5	11.51	2,955.4 2,934.1 2,955.4 2,948.3
	6	13.70	2,758.8 2,619.7 2,736.1 2,704.9
	7	15.22	2,369.5 2,472.6 2,421.6 2,421.2
	8	16.46	2,059.7 2,119.4 2,148.6 2,109.2
Averages ----->			2,680.4 2,684.6 2,694.3 2,686.4

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2726.6		Mean	2811.7	2832.3	2822.0
Min Point	2109.2	-22.6%	Std. Dev.	223.4	112.7	170.4
Max Point	3031.7	11.2%	COV as %	7.9	4.0	6.0

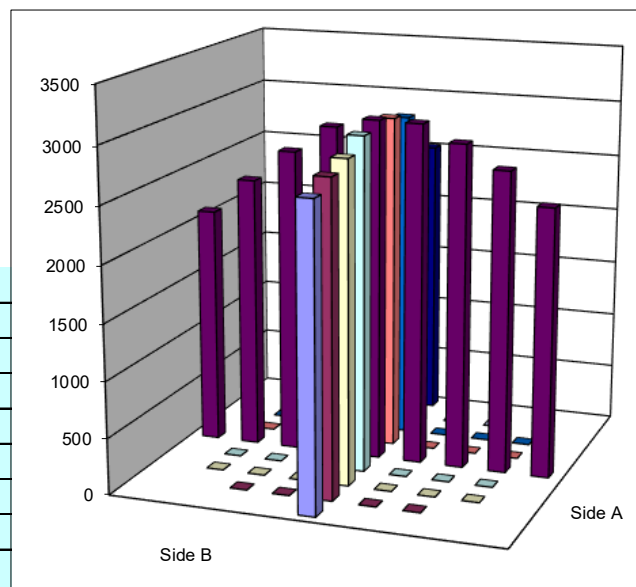
Flow w/o C-Pt	4244 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2692 fpm	S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification
Stack temp	111.3	110	F
Equipment temp	76.4	76.7	F
Ambient temp	93.3	93.4	F
Stack static	0.37	0.42	mbars
Ambient pressure	991.20	990.86	mbars
Total Stack pressure	991.57	991.28	mbars
Ambient humidity	21%	21%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-13			
Date	6/24/21				Fan Configuration	A & C			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	110.8 deg F			
Stack X-Area	227.0 in.2				Start/End Time	14:15 14:23			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traversal-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,473.4	2,523.4	2,498.5	2,498.4	2,343.8	2,370.3	2,396.5	2,370.2
2	1.79	2,644.1	2,644.1	2,620.4	2,636.2	2,736.9	2,759.7	2,782.2	2,759.6
3	3.30	2,913.7	2,935.0	2,935.0	2,927.9	2,892.2	2,826.7	2,826.7	2,848.5
4	5.49	3,018.9	2,956.3	2,956.3	2,977.2	2,935.0	2,977.3	2,977.3	2,963.2
Center	8.50	3,018.9	2,998.2	3,018.9	3,012.0	2,998.2	2,956.3	2,998.2	2,984.2
5	11.51	2,935.0	2,913.7	2,892.2	2,913.6	2,935.0	2,956.3	3,018.9	2,970.1
6	13.70	2,667.6	2,667.6	2,691.0	2,675.4	2,848.7	2,935.0	2,826.7	2,870.1
7	15.22	2,498.5	2,548.0	2,473.4	2,506.6	2,691.0	2,759.7	2,759.7	2,736.8
8	16.46	2,120.0	2,120.0	2,149.3	2,129.8	2,448.0	2,498.5	2,422.4	2,456.3
Averages ----->		2,698.9	2,700.7	2,692.8	2,697.5	2,758.8	2,782.2	2,778.7	2,773.2

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2735.3		Mean	2807.0	2876.1	2841.5
Min Point	2129.8	-22.1%	Std. Dev.	197.4	101.6	155.0
Max Point	3012.0	10.1%	COV as %	7.0	3.5	5.5

Flow w/o C-Pt	4260 cfm
Vel Avg w/o C-Pt	2703 fpm
	Start Finish
Stack temp	110.7 110.8 F
Equipment temp	76.9 77.2 F
Ambient temp	94.4 94.7 F
Stack static	0.52 0.40 mbars
Ambient pressure	990.52 990.52 mbars
Total Stack pressure	991.04 990.92 mbars
Ambient humidity	20% 20% RH

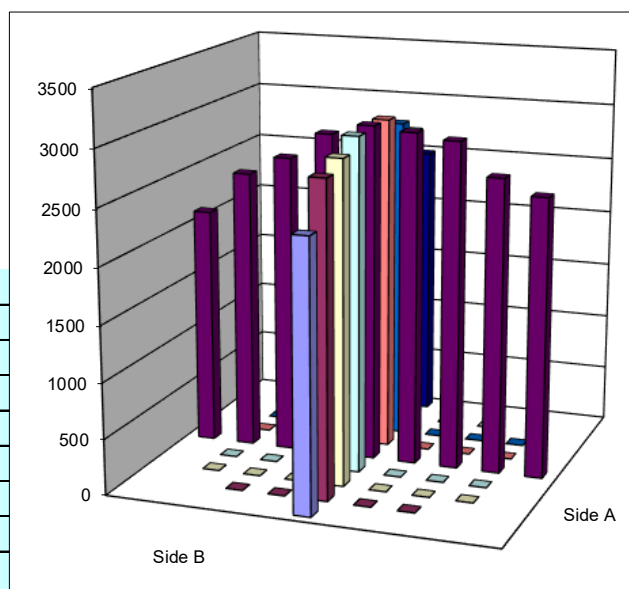
Instuments Used:	Cal Due
S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Control Co. Thermometer (SN: 220435230)	Post-test verification

## Notes:

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) CAM				Run No.	VT-14				
Date	6/25/21				Fan Configuration	A & C				
Testers	JPC/LCE				Fan Setting	NA Hz				
Stack Dia.	17 in.				Stack Temp	110.9 deg F				
Stack X-Area	227.0 in.2				Start/End Time	9:08 9:14				
Test Port	A & B				Center 2/3 from	1.56		to: 15.44		
Distance to disturbance	11.00 ft				Points in Center 2/3	2		to: 7		
Velocity units <u>ft/min</u>										
Order -->	First port					Second port				
Traverse-->	Port A (East)					Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean		
Point	Depth, in.	Velocity				Velocity				
1	0.54	2,469.4	2,494.5	2,494.5	2,486.2	2,519.3	2,568.3	2,494.5	2,527.4	
2	1.79	2,616.2	2,663.4	2,686.7	2,655.4	2,777.8	2,709.7	2,709.7	2,732.4	
3	3.30	2,822.2	2,930.4	2,887.6	2,880.1	2,822.2	2,800.0	2,844.1	2,822.1	
4	5.49	2,972.5	3,014.1	3,034.7	3,007.1	2,930.4	2,930.4	2,930.4	2,930.4	
Center	8.50	2,993.4	3,055.1	3,014.1	3,020.9	2,993.4	2,972.5	3,014.1	2,993.3	
5	11.51	2,844.1	2,887.6	2,866.0	2,865.9	2,909.1	2,993.4	2,951.6	2,951.3	
6	13.70	2,592.4	2,592.4	2,686.7	2,623.8	2,822.2	2,909.1	2,844.1	2,858.5	
7	15.22	2,519.3	2,469.4	2,469.4	2,486.0	2,519.3	2,686.7	2,639.9	2,615.3	
8	16.46	2,174.6	2,203.1	2,231.2	2,203.0	2,313.3	2,469.4	2,444.1	2,408.9	
Averages ----->		2,667.1	2,701.1	2,707.9	2,692.0	2,734.1	2,782.2	2,763.6	2,760.0	

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2726.0		Mean	2791.3	2843.3	2817.3
Min Point	2203.0	-19.2%	Std. Dev.	205.1	133.4	168.4
Max Point	3020.9	10.8%	COV as %	7.3	4.7	6.0

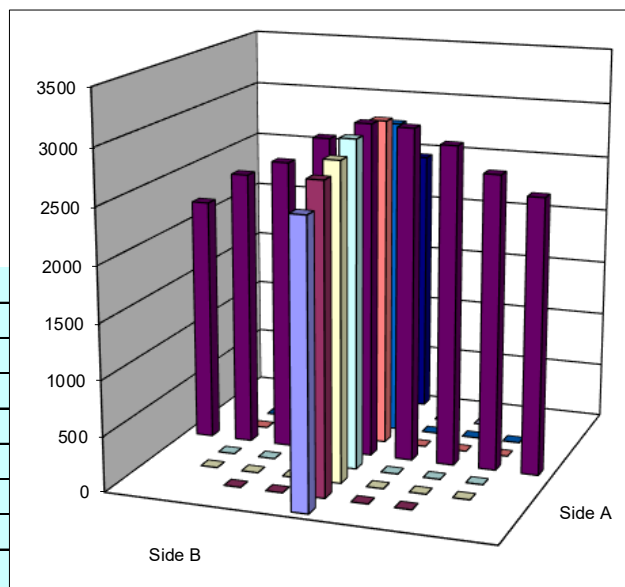
Flow w/o C-Pt	4241 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2691 fpm		S-type pitot (ID: 2A, 24")	Pre-test calibration, Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	111.0	110.7	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.0	76.3		
Ambient temp	88.7	88.9		
Stack static	0.45	0.40		
Ambient pressure	993.91	993.91		
Total Stack pressure	994.36	994.31		
Ambient humidity	33%	33%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



## C.4 Record Sampler Velocity Uniformity Data Forms

### VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) RS	Run No.	VT-1
Date	6/21/21	Fan Configuration	A&B
Testers	JPC/LCE	Fan Setting	NA Hz
Stack Dia.	17 in.	Stack Temp	109.1 deg F
Stack X-Area	227.0 in.2	Start/End Time	10:26 10:46
Test Port	A & B	Center 2/3 from	1.56 to: 15.44
Distance to disturbance	50.08 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order --> First Second

Traverse--> Side A (East) Side B (West)

		Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	Velocity				Velocity			
1	0.54	1,992.1	1,810.6	1,857.7	1,886.8	2,526.7	2,560.6	2,691.9	2,593.1
2	1.79	2,492.3	2,422.0	2,457.4	2,457.2	2,627.1	2,659.7	2,659.7	2,648.8
3	3.30	2,723.8	2,594.0	2,627.1	2,648.3	2,526.7	2,526.7	2,691.9	2,581.8
4	5.49	2,755.3	2,723.8	2,691.9	2,723.7	2,691.9	2,755.3	2,691.9	2,713.1
Center	8.50	2,847.7	2,877.8	2,877.8	2,867.8	2,659.7	2,691.9	2,817.3	2,723.0
5	11.51	2,786.4	2,755.3	2,755.3	2,765.7	2,691.9	2,786.4	2,786.4	2,754.9
6	13.70	2,691.9	2,594.0	2,627.1	2,637.7	2,492.3	2,560.6	2,526.7	2,526.5
7	15.22	2,457.4	2,457.4	2,492.3	2,469.0	2,198.0	2,236.9	2,158.3	2,197.7
8	16.46	2,312.7	2,236.9	2,158.3	2,236.0	1,810.6	1,857.7	1,903.5	1,857.2
Averages ----->		2,562.2	2,496.9	2,505.0	2,521.4	2,469.4	2,515.1	2,547.5	2,510.7

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2516.0		Mean	2652.8	2592.3	2622.5
Min Point	1857.2	-26.2%	Std. Dev.	150.7	192.1	168.8
Max Point	2867.8	14.0%	COV as %	5.7	7.4	6.4

Flow w/o C-Pt	3911 cfm	Instruments Used:	Cal Due
Vel Avg w/o C-Pt	2481 fpm	Standard pitot (ID: HStd1, 36")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

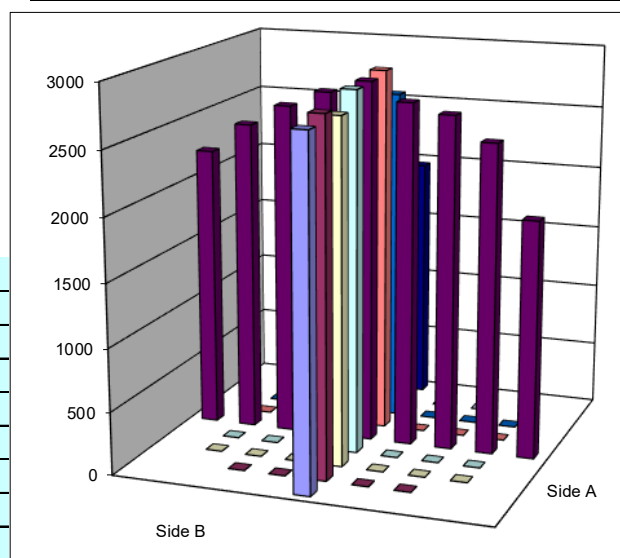
	Start	Finish	
Stack temp	109.4	108.7	F
Equipment temp	74.0	74.0	F
Ambient temp	83.0	83.0	F
Stack static	1.67	2.07	mbars
Ambient pressure	991.20	991.20	mbars
Total Stack pressure	992.87	993.27	mbars
Ambient humidity	33%	33%	RH

**Notes:**

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H<sub>2</sub>O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) RS	Run No.	VT-2	
Date	6/22/21	Fan Configuration	A&B	
Testers	JPC/LCE	Fan Setting	NA Hz	
Stack Dia.	17 in.	Stack Temp	111.0 deg F	
Stack X-Area	227.0 in.2	Start/End Time	9:30 9:42	
Test Port	A & B	Center 2/3 from	1.56 to: 15.44	
Distance to disturbance	50.08 ft	Points in Center 2/3	2 to: 7	
Velocity units	ft/min			
Order -->	First	Second		
Traversal-->	Side A (East)		Side B (West)	
Trial ---->	1	2	3	Mean
Point	Depth, in.	Velocity		Mean
1	0.54	2,206.6	2,042.9	1,999.9
2	1.79	2,502.0	2,467.0	2,604.3
3	3.30	2,766.1	2,637.4	2,702.5
4	5.49	2,828.3	2,797.4	2,828.3
Center	8.50	2,858.9	2,889.1	2,889.1
5	11.51	2,828.3	2,797.4	2,734.5
6	13.70	2,734.5	2,670.2	2,604.3
7	15.22	2,467.0	2,536.5	2,502.0
8	16.46	2,206.6	2,206.6	2,166.9
Averages ----->		2,599.8	2,560.5	2,559.1

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2591.3		Mean	2697.4	2703.4	2700.4
Min Point	2083.1	-19.6%	Std. Dev.	144.0	149.8	141.2
Max Point	2879.0	11.1%	COV as %	5.3	5.5	5.2

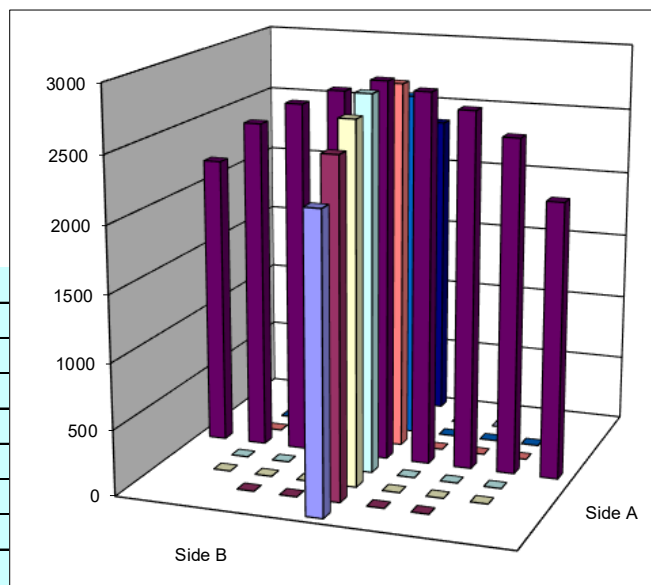
Flow w/o C-Pt	4028 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2555 fpm	Standard pitot (ID: HStd1, 36")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	111.8 110.2 F	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	79.3 76.9 F		
Ambient temp	90.0 90.0 F		
Stack static	2.54 2.61 mbars		
Ambient pressure	986.12 986.12 mbars		
Total Stack pressure	988.66 988.73 mbars		
Ambient humidity	28% 28% RH		

## Notes:

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) RS				Run No.	VT-3			
Date	6/22/21				Fan Configuration	A&B			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	110.4 deg F			
Stack X-Area	227.0 in.2				Start/End Time	10:32 10:45			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	50.08 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First				Second				
Traversal-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,285.3	2,360.2	2,246.9	2,297.4	2,285.3	2,360.2	2,360.2	2,335.2
2	1.79	2,605.6	2,468.3	2,468.3	2,514.1	2,537.9	2,638.9	2,605.6	2,594.1
3	3.30	2,767.6	2,767.6	2,605.6	2,713.6	2,735.9	2,798.9	2,735.9	2,756.9
4	5.49	2,860.4	2,829.9	2,798.9	2,829.7	2,860.4	2,860.4	2,860.4	2,860.4
Center	8.50	2,829.9	2,860.4	2,920.6	2,870.3	2,890.7	2,920.6	2,920.6	2,910.6
5	11.51	2,798.9	2,890.7	2,860.4	2,850.0	2,860.4	2,890.7	2,798.9	2,850.0
6	13.70	2,704.0	2,671.6	2,735.9	2,703.8	2,671.6	2,704.0	2,671.6	2,682.4
7	15.22	2,537.9	2,432.8	2,537.9	2,502.9	2,605.6	2,572.0	2,537.9	2,571.8
8	16.46	2,285.3	2,168.0	2,207.8	2,220.3	2,246.9	2,246.9	2,323.1	2,272.3
Averages ----->		2,630.5	2,605.5	2,598.0	2,611.4	2,632.7	2,665.8	2,646.0	2,648.2

<b>All</b>	<u>ft/min</u>	<u>Dev. from mean</u>	<b>Center 2/3</b>	<u>Side</u>	<u>Bottom</u>	<b>All</b>
Mean	2629.8		Mean	2712.1	2746.6	2729.3
Min Point	2220.3	-15.6%	Std. Dev.	153.3	134.5	139.7
Max Point	2910.6	10.7%	COV as %	5.7	4.9	<b>5.1</b>

Flow w/o C-Pt	4094 cfm	<b>Instuments Used:</b>	<b>Cal Due</b>
Vel Avg w/o C-Pt	2597 fpm	Standard pitot (ID: HStd1, 36")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

	Start	Finish	
Stack temp	111.3	109.4	F
Equipment temp	76.6	76.3	F
Ambient temp	91.4	91.2	F
Stack static	0.60	0.87	mbars
Ambient pressure	985.78	985.78	mbars
Total Stack pressure	986.38	986.65	mbars
Ambient humidity	26%	26%	RH

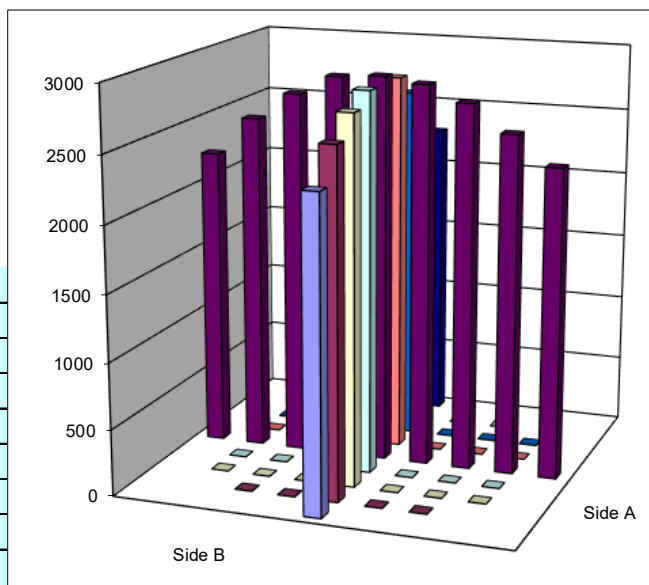
  

**Notes:**

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

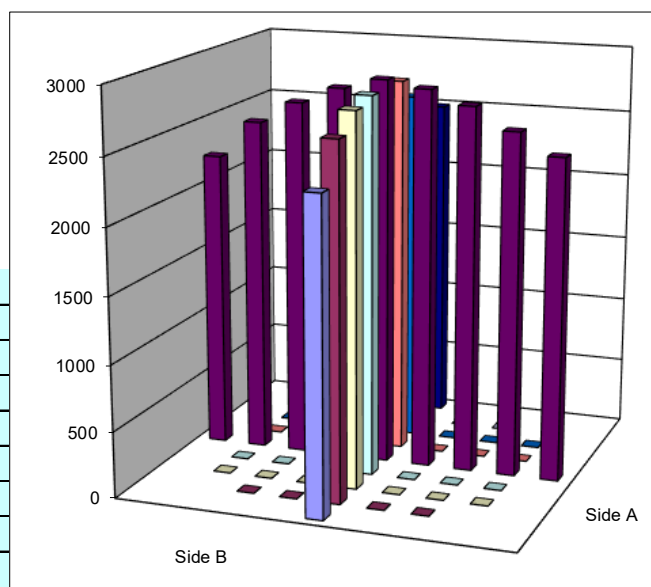
Stack	LV-S3 (LVP) RS				Run No.	VT-4			
Date	6/22/21				Fan Configuration	A&B			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	110.1 deg F			
Stack X-Area	227.0 in.2				Start/End Time	12:48 12:58			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	50.08 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First				Second				
Traversal-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,397.2	2,397.2	2,468.8	2,421.1	2,360.6	2,360.6	2,247.3	2,322.8
2	1.79	2,572.4	2,639.3	2,538.4	2,583.4	2,639.3	2,606.1	2,639.3	2,628.2
3	3.30	2,736.5	2,799.4	2,704.4	2,746.8	2,736.5	2,768.1	2,799.4	2,768.0
4	5.49	2,891.2	2,799.4	2,860.9	2,850.5	2,768.1	2,830.3	2,860.9	2,819.8
Center	8.50	2,921.2	2,891.2	2,891.2	2,901.2	2,860.9	2,921.2	2,860.9	2,881.0
5	11.51	2,768.1	2,799.4	2,891.2	2,819.5	2,860.9	2,799.4	2,799.4	2,819.9
6	13.70	2,704.4	2,639.3	2,736.5	2,693.4	2,606.1	2,704.4	2,639.3	2,649.9
7	15.22	2,538.4	2,503.8	2,538.4	2,526.8	2,397.2	2,468.8	2,538.4	2,468.1
8	16.46	2,285.7	2,168.4	2,285.7	2,246.6	2,538.4	2,360.6	2,503.8	2,467.6
Averages ----->		2,646.1	2,626.4	2,657.3	2,643.3	2,640.9	2,646.6	2,654.3	2,647.3

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2645.3		Mean	2731.7	2719.3	2725.5
Min Point	2246.6	-15.1%	Std. Dev.	139.2	144.3	136.3
Max Point	2901.2	9.7%	COV as %	5.1	5.3	5.0

Flow w/o C-Pt	4121 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2615 fpm		Standard pitot (ID: HStd1, 36")	Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.2	109.9	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.0	76.8		
Ambient temp	97.3	97.4		
Stack static	0.55	0.52		
Ambient pressure	985.10	985.10		
Total Stack pressure	985.65	985.62		
Ambient humidity	19%	19%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) RS	Run No.	VT-5
Date	6/22/21	Fan Configuration	A&B
Testers	JPC/LCE	Fan Setting	NA Hz
Stack Dia.	17 in.	Stack Temp	110.3 deg F
Stack X-Area	227.0 in.2	Start/End Time	13:52 14:02
Test Port	A & B	Center 2/3 from	1.56 to: 15.44
Distance to disturbance	50.08 ft	Points in Center 2/3	2 to: 7

Velocity units ft/min

Order -->		First	Second						
Trial ---->		Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,469.7	2,434.1	2,361.5	2,421.8	2,209.0	2,209.0	2,209.0	2,209.0
2	1.79	2,607.0	2,504.7	2,573.4	2,561.7	2,539.3	2,469.7	2,504.7	2,504.5
3	3.30	2,705.4	2,769.1	2,607.0	2,693.8	2,737.4	2,539.3	2,705.4	2,660.7
4	5.49	2,831.3	2,831.3	2,861.9	2,841.5	2,800.3	2,800.3	2,861.9	2,820.9
Center	8.50	2,831.3	2,892.2	2,831.3	2,851.6	2,922.2	2,861.9	2,861.9	2,882.0
5	11.51	2,922.2	2,861.9	2,831.3	2,871.8	2,800.3	2,769.1	2,737.4	2,768.9
6	13.70	2,705.4	2,673.1	2,673.1	2,683.8	2,705.4	2,673.1	2,705.4	2,694.6
7	15.22	2,607.0	2,573.4	2,539.3	2,573.2	2,573.4	2,539.3	2,573.4	2,562.0
8	16.46	2,324.3	2,286.5	2,286.5	2,299.1	2,469.7	2,286.5	2,361.5	2,372.6
Averages ----->		2,667.1	2,647.4	2,618.4	2,644.3	2,639.7	2,572.0	2,613.4	2,608.4

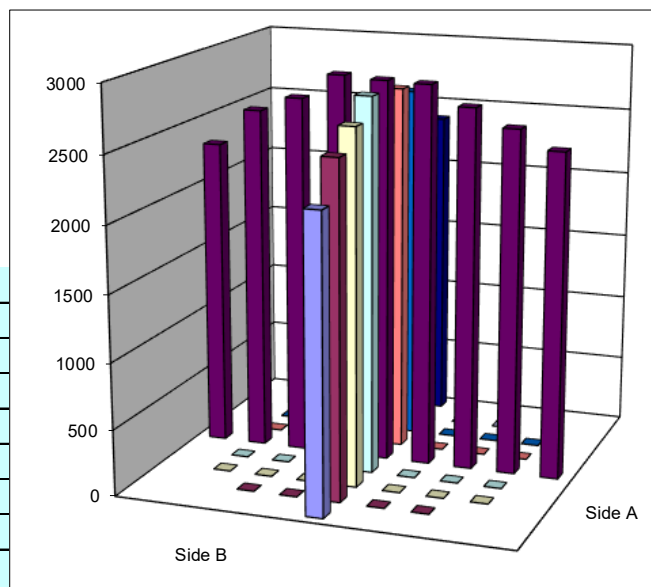
All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2626.3		Mean	2725.4	2699.1	2712.2
Min Point	2209.0	-15.9%	Std. Dev.	131.3	136.2	129.3
Max Point	2882.0	9.7%	COV as %	4.8	5.0	4.8

Flow w/o C-Pt	4092 cfm	Cal Due	
Vel Avg w/o C-Pt	2596 fpm	Standard pitot (ID: HStd1, 36")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

	Start	Finish	
Stack temp	110.7	109.9	F
Equipment temp	76.0	77.1	F
Ambient temp	98.3	98.3	F
Stack static	0.82	0.75	mbars
Ambient pressure	984.76	984.42	mbars
Total Stack pressure	985.58	985.17	mbars
Ambient humidity	19%	19%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) RS	Run No.	VT-6
Date	6/23/21	Fan Configuration	B&C
Testers	JPC/LCE	Fan Setting	NA Hz
Stack Dia.	17 in.	Stack Temp	111.3 deg F
Stack X-Area	227.0 in.2	Start/End Time	9:30 9:40
Test Port	A & B	Center 2/3 from	1.56 to: 15.44
Distance to disturbance	50.08 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		
Order -->	First	Second	
Traversal-->	Side A (East)	Side B (West)	
Trial ---->	1 2 3 Mean	1 2 3 Mean	
Point	Depth, in.	Velocity	Velocity
1	0.54	2,323.1 2,207.9 2,207.9 2,246.3	2,360.3 2,396.9 2,323.1 2,360.1
2	1.79	2,538.0 2,572.1 2,503.5 2,537.9	2,572.1 2,538.0 2,538.0 2,549.4
3	3.30	2,767.7 2,799.0 2,671.7 2,746.1	2,704.1 2,829.9 2,704.1 2,746.1
4	5.49	2,671.7 2,799.0 2,767.7 2,746.1	2,860.5 2,829.9 2,860.5 2,850.3
Center	8.50	2,736.1 2,860.5 2,829.9 2,808.9	2,860.5 2,920.7 2,860.5 2,880.6
5	11.51	2,736.1 2,920.7 2,860.5 2,839.1	2,890.8 2,799.0 2,799.0 2,829.6
6	13.70	2,799.0 2,572.1 2,671.7 2,680.9	2,767.7 2,704.1 2,704.1 2,725.3
7	15.22	2,503.5 2,638.9 2,538.0 2,560.1	2,572.1 2,605.7 2,538.0 2,571.9
8	16.46	2,323.1 2,360.3 2,285.4 2,323.0	2,247.0 2,168.1 2,207.9 2,207.7
Averages ----->		2,599.8 2,636.7 2,592.9 2,609.8	2,648.4 2,643.6 2,615.0 2,635.7

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2622.7		Mean	2702.7	2736.2	2719.4
Min Point	2207.7	-15.8%	Std. Dev.	116.6	132.1	121.0
Max Point	2880.6	9.8%	COV as %	4.3	4.8	4.4

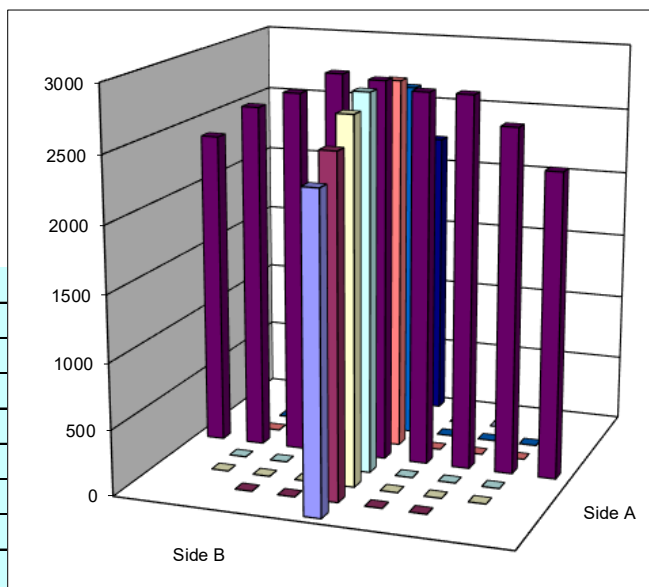
Flow w/o C-Pt	4090 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2595 fpm	Standard pitot (ID: HStd1, 36")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	111.5 111.1 F	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.5 77.3 F		
Ambient temp	84.2 84.7 F		
Stack static	0.17 0.35 mbars		
Ambient pressure	987.81 987.81 mbars		
Total Stack pressure	987.98 988.16 mbars		
Ambient humidity	30% 29% RH		

## Notes:

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

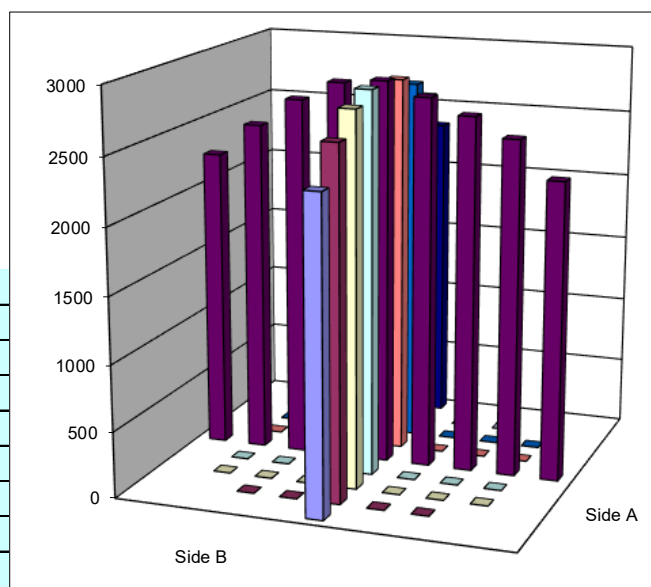
Stack	LV-S3 (LVP) RS				Run No.	VT-7			
Date	6/23/21				Fan Configuration	B&C			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	111.9 deg F			
Stack X-Area	227.0 in.2				Start/End Time	10:32 10:43			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	50.08 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First				Second				
Traversal-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,208.8	2,247.9	2,286.4	2,247.7	2,324.2	2,361.3	2,286.4	2,324.0
2	1.79	2,539.1	2,504.6	2,539.1	2,527.6	2,672.8	2,539.1	2,573.3	2,595.1
3	3.30	2,672.8	2,640.1	2,705.3	2,672.7	2,831.2	2,737.3	2,737.3	2,768.6
4	5.49	2,769.0	2,800.2	2,800.2	2,789.8	2,831.2	2,861.8	2,861.8	2,851.6
Center	8.50	2,892.1	2,892.1	2,892.1	2,892.1	2,892.1	2,861.8	2,831.2	2,861.7
5	11.51	2,861.8	2,831.2	2,892.1	2,861.7	2,800.2	2,831.2	2,831.2	2,820.9
6	13.70	2,705.3	2,737.3	2,705.3	2,716.0	2,705.3	2,769.0	2,737.3	2,737.2
7	15.22	2,539.1	2,504.6	2,469.5	2,504.4	2,640.1	2,606.9	2,539.1	2,595.4
8	16.46	2,208.8	2,286.4	2,286.4	2,260.5	2,361.3	2,247.9	2,324.2	2,311.2
Averages ----->		2,599.6	2,604.9	2,619.6	2,608.1	2,673.2	2,646.3	2,635.8	2,651.7

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2629.9		Mean	2709.2	2747.2	2728.2
Min Point	2247.7	-14.5%	Std. Dev.	152.5	112.7	130.3
Max Point	2892.1	10.0%	COV as %	5.6	4.1	4.8

Flow w/o C-Pt	4097 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2599 fpm		Standard pitot (ID: HStd1, 36")	Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	111.7	112.0	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.7	77.3		
Ambient temp	86.7	87.2		
Stack static	0.30	0.37		
Ambient pressure	987.81	987.81		
Total Stack pressure	988.11	988.18		
Ambient humidity	26%	26%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

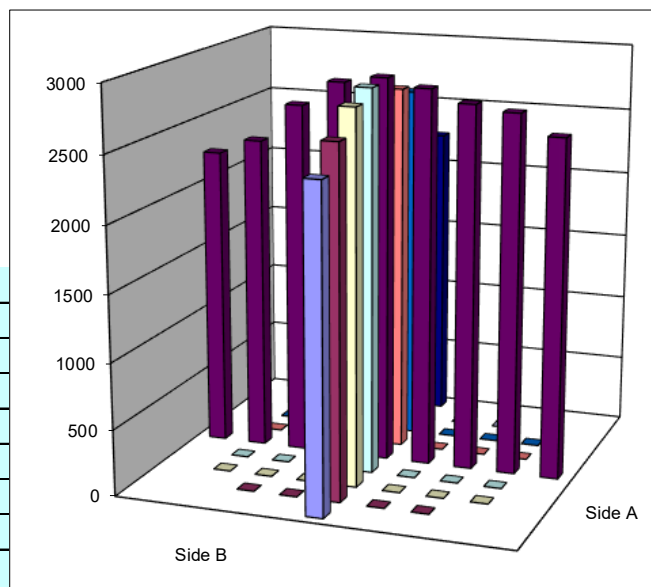
Stack	LV-S3 (LVP) RS				Run No.	VT-8				
Date	6/23/21				Fan Configuration	B&C				
Testers	JPC/LCE				Fan Setting	NA Hz				
Stack Dia.	17 in.				Stack Temp	111.3 deg F				
Stack X-Area	227.0 in.2				Start/End Time	12:42 12:52				
Test Port	A & B				Center 2/3 from	1.56		to: 15.44		
Distance to disturbance	50.08 ft				Points in Center 2/3	2		to: 7		
Velocity units <u>ft/min</u>										
Order -->	First				Second					
Traversal-->	Side A (East)				Side B (West)					
Trial ---->	1	2	3	Mean	1	2	3	Mean		
Point	Depth, in.	Velocity				Velocity				
1	0.54	2,605.7	2,572.2	2,468.6	2,548.8	2,397.0	2,397.0	2,433.0	2,409.0	
2	1.79	2,767.8	2,639.0	2,704.1	2,703.6	2,639.0	2,538.0	2,639.0	2,605.3	
3	3.30	2,736.1	2,736.1	2,767.8	2,746.6	2,767.8	2,799.0	2,799.0	2,788.6	
4	5.49	2,830.0	2,830.0	2,860.6	2,840.2	2,830.0	2,890.9	2,890.9	2,870.6	
Center	8.50	2,890.9	2,890.9	2,920.8	2,900.8	2,890.9	2,920.8	2,860.6	2,890.7	
5	11.51	2,890.9	2,799.0	2,860.6	2,850.2	2,799.0	2,767.8	2,704.1	2,757.0	
6	13.70	2,671.7	2,605.7	2,704.1	2,660.5	2,704.1	2,704.1	2,639.0	2,682.4	
7	15.22	2,323.2	2,397.0	2,397.0	2,372.4	2,572.2	2,468.6	2,605.7	2,548.8	
8	16.46	2,246.9	2,323.2	2,207.9	2,259.4	2,086.3	2,323.2	2,285.4	2,231.6	
Averages ----->		2,662.6	2,643.7	2,654.6	2,653.6	2,631.8	2,645.5	2,650.8	2,642.7	

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2648.1		Mean	2724.9	2734.8	2729.8
Min Point	2231.6	-15.7%	Std. Dev.	177.6	129.3	149.3
Max Point	2900.8	9.5%	COV as %	6.5	4.7	5.5

Flow w/o C-Pt	4125 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2617 fpm		Standard pitot (ID: HStd1, 36")	Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	111.1	111.4	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	77.1	77.2		
Ambient temp	93.4	93.8		
Stack static	0.52	0.45		
Ambient pressure	987.47	987.47		
Total Stack pressure	987.99	987.92		
Ambient humidity	19%	19%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) RS				Run No.	VT-9			
Date	6/23/21				Fan Configuration	B&C			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	111.5 deg F			
Stack X-Area	227.0 in.2				Start/End Time	13:45 13:55			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	50.08 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First				Second				
Traversal-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,087.1	2,286.3	2,247.8	2,207.0	2,397.8	2,433.9	2,433.9	2,421.9
2	1.79	2,469.4	2,573.1	2,539.0	2,527.2	2,539.0	2,573.1	2,606.7	2,572.9
3	3.30	2,737.1	2,831.0	2,768.8	2,779.0	2,705.2	2,768.8	2,768.8	2,747.6
4	5.49	2,800.1	2,800.1	2,768.8	2,789.7	2,891.9	2,891.9	2,861.7	2,881.8
Center	8.50	2,921.8	2,891.9	2,891.9	2,901.9	2,861.7	2,861.7	2,921.8	2,881.7
5	11.51	2,800.1	2,831.0	2,831.0	2,820.7	2,831.0	2,831.0	2,831.0	2,831.0
6	13.70	2,672.7	2,705.2	2,639.9	2,672.6	2,672.7	2,768.8	2,639.9	2,693.8
7	15.22	2,504.4	2,539.0	2,469.4	2,504.3	2,324.0	2,361.2	2,397.8	2,361.0
8	16.46	2,286.3	2,286.3	2,247.8	2,273.5	2,168.9	2,208.7	2,168.9	2,182.2
Averages ----->		2,586.6	2,638.2	2,600.5	2,608.4	2,599.1	2,633.2	2,625.6	2,619.3

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2613.9		Mean	2713.6	2710.0	2711.8
Min Point	2182.2	-16.5%	Std. Dev.	151.2	189.7	164.8
Max Point	2901.9	11.0%	COV as %	5.6	7.0	6.1

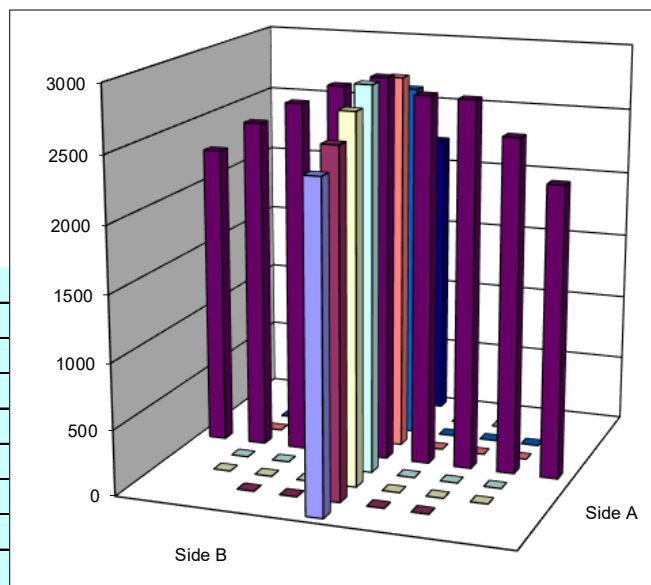
Flow w/o C-Pt	4065 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2579 fpm		Standard pitot (ID: HStd1, 36")	Post-test inspection
Stack temp	Start	Finish	Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Equipment temp	111.3	111.6	Control Co. Thermometer (SN: 220435230)	Post-test verification
Ambient temp	77.4	77.4		
Stack static	95.4	95.4		
Ambient pressure	0.35	0.52		
Total Stack pressure	987.13	987.13		
Ambient humidity	987.48	987.65		
	18%	18%		

## Notes:

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) RS				Run No.	VT-10			
Date	6/24/21				Fan Configuration	A&C			
Testers	JPC/LCE				Fan Setting	NA		Hz	
Stack Dia.	17 in.				Stack Temp	111.1		deg F	
Stack X-Area	227.0 in.2				Start/End Time	9:21		9:31	
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	50.08 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First				Second				
Traversal-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,462.9	2,462.9	2,497.9	2,474.6	2,497.9	2,497.9	2,462.9	2,486.2
2	1.79	2,599.8	2,599.8	2,633.0	2,610.9	2,599.8	2,665.7	2,665.7	2,643.7
3	3.30	2,761.5	2,729.9	2,792.7	2,761.4	2,761.5	2,792.7	2,823.5	2,792.6
4	5.49	2,854.1	2,854.1	2,884.3	2,864.2	2,884.3	2,884.3	2,914.2	2,894.3
Center	8.50	2,854.1	2,943.8	2,914.2	2,904.0	2,854.1	2,914.2	2,884.3	2,884.2
5	11.51	2,854.1	2,792.7	2,761.5	2,802.8	2,943.8	2,792.7	2,823.5	2,853.4
6	13.70	2,729.9	2,729.9	2,665.7	2,708.5	2,665.7	2,633.0	2,698.0	2,665.6
7	15.22	2,532.3	2,391.6	2,497.9	2,473.9	2,391.6	2,427.5	2,462.9	2,427.3
8	16.46	2,122.8	2,163.2	2,202.9	2,163.0	2,280.2	2,241.9	2,241.9	2,254.7
Averages ----->		2,641.3	2,629.8	2,650.0	2,640.4	2,653.2	2,650.0	2,664.1	2,655.8

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2648.1		Mean	2732.2	2737.3	2734.8
Min Point	2163.0	-18.3%	Std. Dev.	149.9	169.7	153.8
Max Point	2904.0	9.7%	COV as %	5.5	6.2	5.6

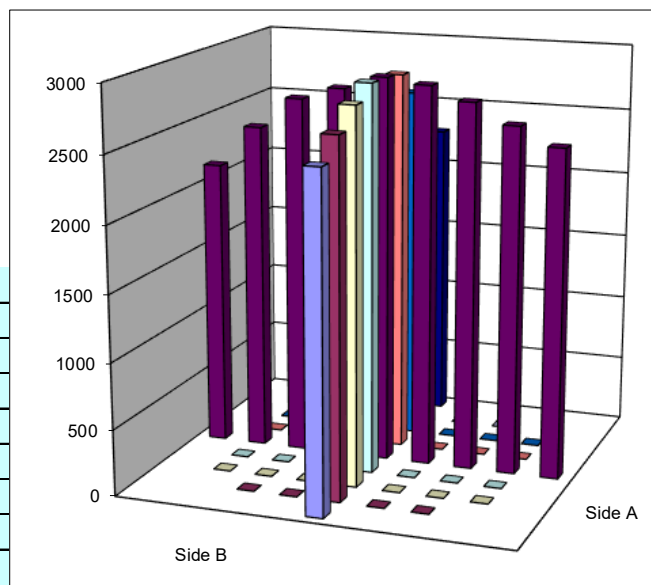
Flow w/o C-Pt	4126 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2617 fpm		Standard pitot (ID: HStd1, 36")	Post-test inspection
Stack temp	Start	Finish	Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Equipment temp	111.4	110.8	Control Co. Thermometer (SN: 220435230)	Post-test verification
Ambient temp	75.2	75.4		
Stack static	84.3	84.4		
Ambient pressure	0.37	0.25		
Total Stack pressure	991.87	991.87		
Ambient humidity	992.24	992.12		
	29%	29%		

## Notes:

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) RS				Run No.	VT-11				
Date	6/24/21				Fan Configuration	A&C				
Testers	JPC/LCE				Fan Setting	NA		Hz		
Stack Dia.	17 in.				Stack Temp	111.1		deg F		
Stack X-Area	227.0 in.2				Start/End Time	10:24		10:33		
Test Port	A & B				Center 2/3 from	1.56		to: 15.44		
Distance to disturbance	50.08 ft				Points in Center 2/3	2		to: 7		
Velocity units <u>ft/min</u>										
Order -->	First				Second					
Traversal-->	Side A (East)				Side B (West)					
Trial ---->	1	2	3	Mean	1	2	3	Mean		
Point	Depth, in.	Velocity				Velocity				
1	0.54	2,391.2	2,462.6	2,391.2	2,415.0	2,354.7	2,391.2	2,354.7	2,366.9	
2	1.79	2,632.6	2,665.3	2,565.9	2,621.3	2,697.7	2,565.9	2,632.6	2,632.1	
3	3.30	2,729.5	2,792.3	2,761.1	2,761.0	2,792.3	2,823.2	2,823.2	2,812.9	
4	5.49	2,823.2	2,883.9	2,853.7	2,853.6	2,853.7	2,823.2	2,853.7	2,843.5	
Center	8.50	2,883.9	2,883.9	2,853.7	2,873.8	2,853.7	2,792.3	2,913.7	2,853.2	
5	11.51	2,853.7	2,792.3	2,823.2	2,823.0	2,665.3	2,853.7	2,761.1	2,760.0	
6	13.70	2,697.7	2,761.1	2,697.7	2,718.8	2,729.5	2,665.3	2,632.6	2,675.8	
7	15.22	2,565.9	2,497.5	2,565.9	2,543.1	2,599.5	2,565.9	2,599.5	2,588.3	
8	16.46	2,279.9	2,279.9	2,241.6	2,267.1	2,317.6	2,354.7	2,241.6	2,304.6	
Averages ----->		2,650.9	2,668.8	2,639.3	2,653.0	2,651.5	2,648.4	2,645.9	2,648.6	

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2650.8		Mean	2742.1	2738.0	2740.0
Min Point	2267.1	-14.5%	Std. Dev.	123.4	106.5	110.8
Max Point	2873.8	8.4%	COV as %	4.5	3.9	4.0

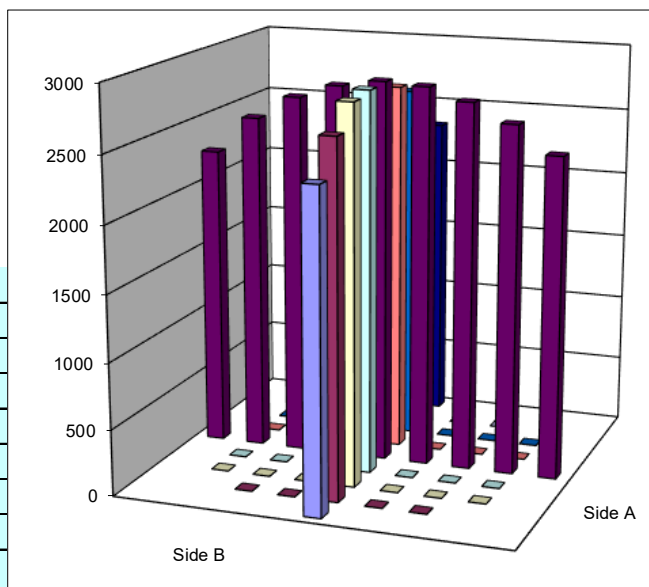
Flow w/o C-Pt	4136 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2624 fpm		Standard pitot (ID: HStd1, 36")	Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.7	111.4	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	75.2	77.2		
Ambient temp	88.9	89.3		
Stack static	0.45	0.55		
Ambient pressure	991.87	991.87		
Total Stack pressure	992.32	992.42		
Ambient humidity	25%	25%		

## Notes:

Traversal point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) RS				Run No.	VT-12			
Date	6/24/21				Fan Configuration	A&C			
Testers	JPC/LCE				Fan Setting	NA		Hz	
Stack Dia.	17 in.				Stack Temp	110.6		deg F	
Stack X-Area	227.0 in.2				Start/End Time	12:48		12:59	
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	50.08 ft				Points in Center 2/3	2		to: 7	
Velocity units	ft/min								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,391.0	2,426.9	2,391.0	2,403.0	2,391.0	2,531.7	2,462.3	2,461.7
2	1.79	2,565.8	2,665.2	2,599.3	2,610.1	2,632.4	2,599.3	2,697.4	2,643.0
3	3.30	2,822.9	2,760.9	2,760.9	2,781.6	2,792.1	2,792.1	2,792.1	2,792.1
4	5.49	2,853.5	2,792.1	2,853.5	2,833.1	2,853.5	2,883.7	2,883.7	2,873.6
Center	8.50	2,883.7	2,853.5	2,913.6	2,883.6	2,883.7	2,883.7	2,853.5	2,873.6
5	11.51	2,883.7	2,822.9	2,883.7	2,863.4	2,822.9	2,822.9	2,853.5	2,833.1
6	13.70	2,665.2	2,729.4	2,632.4	2,675.6	2,632.4	2,697.4	2,729.4	2,686.4
7	15.22	2,497.3	2,462.3	2,531.7	2,497.1	2,462.3	2,462.3	2,391.0	2,438.6
8	16.46	2,081.1	2,122.4	2,162.7	2,122.1	2,081.1	2,122.4	2,162.7	2,122.1
Averages ----->		2,627.1	2,626.2	2,636.5	2,629.9	2,616.8	2,644.0	2,647.3	2,636.0

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2633.0		Mean	2734.9	2734.4	2734.6
Min Point	2122.1	-19.4%	Std. Dev.	145.0	158.1	145.7
Max Point	2883.6	9.5%	COV as %	5.3	5.8	5.3

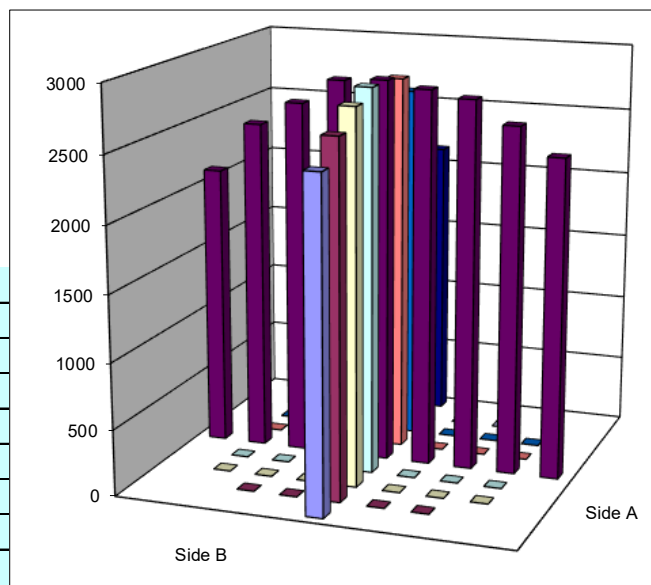
Flow w/o C-Pt	4102 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2602 fpm		Standard pitot (ID: HStd1, 36")	Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.7	110.4	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.4	76.5		
Ambient temp	93.2	93.3		
Stack static	0.37	0.55		
Ambient pressure	991.20	991.20		
Total Stack pressure	991.57	991.75		
Ambient humidity	21%	21%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

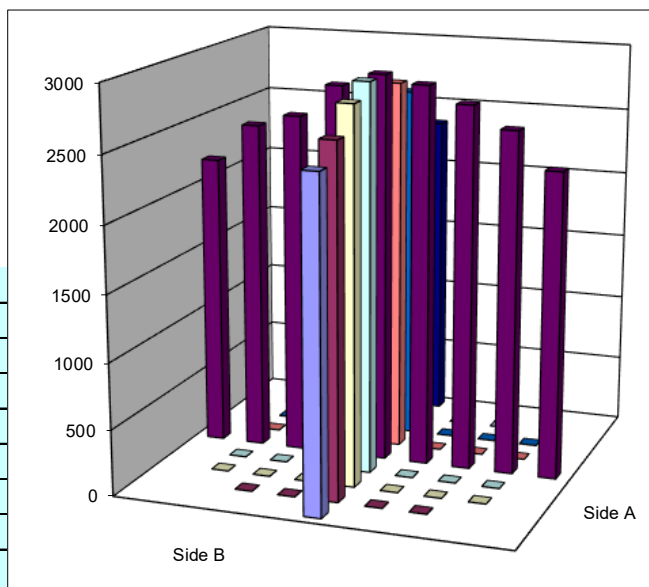
Stack	LV-S3 (LVP) RS				Run No.	VT-13			
Date	6/24/21				Fan Configuration	A&C			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	111.0 deg F			
Stack X-Area	227.0 in.2				Start/End Time	13:50 13:58			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	50.08 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First				Second				
Traversal-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,163.8	2,355.7	2,392.2	2,303.9	2,498.6	2,428.1	2,392.2	2,439.7
2	1.79	2,567.0	2,600.6	2,567.0	2,578.2	2,600.6	2,567.0	2,600.6	2,589.4
3	3.30	2,762.3	2,730.7	2,730.7	2,741.2	2,762.3	2,793.5	2,793.5	2,783.1
4	5.49	2,854.9	2,854.9	2,885.1	2,865.0	2,854.9	2,915.0	2,885.1	2,885.0
Center	8.50	2,944.6	2,915.0	2,915.0	2,924.9	2,885.1	2,885.1	2,885.1	2,885.1
5	11.51	2,824.3	2,854.9	2,793.5	2,824.2	2,698.7	2,824.3	2,793.5	2,772.2
6	13.70	2,567.0	2,600.6	2,567.0	2,578.2	2,698.7	2,666.5	2,600.6	2,655.3
7	15.22	2,498.6	2,498.6	2,463.6	2,486.9	2,567.0	2,533.1	2,567.0	2,555.7
8	16.46	2,163.8	2,203.6	2,242.6	2,203.3	2,280.9	2,318.6	2,318.6	2,306.0
Averages ----->		2,594.0	2,623.8	2,617.4	2,611.8	2,649.6	2,659.0	2,648.4	2,652.4

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2632.1		Mean	2714.1	2732.2	2723.2
Min Point	2203.3	-16.3%	Std. Dev.	167.6	134.4	146.3
Max Point	2924.9	11.1%	COV as %	6.2	4.9	5.4

Flow w/o C-Pt	4095 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2598 fpm		Standard pitot (ID: HStd1, 36")	Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	111.2	110.7	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.7	76.8		
Ambient temp	94.0	94.1		
Stack static	0.45	0.57		
Ambient pressure	990.86	990.86		
Total Stack pressure	991.31	991.43		
Ambient humidity	20%	20%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.  
 Side A port was always measured first.  
 Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-S3 (LVP) RS				Run No.	VT-14			
Date	6/25/21				Fan Configuration	A&C			
Testers	JPC/LCE				Fan Setting	NA Hz			
Stack Dia.	17 in.				Stack Temp	110.6 deg F			
Stack X-Area	227.0 in.2				Start/End Time	8:52 8:58			
Test Port	A & B				Center 2/3 from	1.56		to: 15.44	
Distance to disturbance	50.08 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	0.54	2,494.0	2,494.0	2,595.8	2,527.9	2,276.7	2,387.8	2,387.8	2,350.8
2	1.79	2,459.1	2,628.9	2,661.5	2,583.2	2,595.8	2,595.8	2,628.9	2,606.8
3	3.30	2,757.3	2,788.3	2,725.7	2,757.1	2,757.3	2,788.3	2,788.3	2,778.0
4	5.49	2,788.3	2,849.7	2,849.7	2,829.2	2,849.7	2,909.7	2,849.7	2,869.7
Center	8.50	2,849.7	2,879.8	2,939.2	2,889.5	2,879.8	2,939.2	2,909.7	2,909.5
5	11.51	2,849.7	2,788.3	2,849.7	2,829.2	2,788.3	2,693.8	2,757.3	2,746.5
6	13.70	2,693.8	2,562.4	2,661.5	2,639.2	2,661.5	2,693.8	2,693.8	2,683.1
7	15.22	2,494.0	2,494.0	2,459.1	2,482.4	2,459.1	2,528.4	2,459.1	2,482.2
8	16.46	2,036.3	2,119.5	2,159.8	2,105.2	2,314.3	2,314.3	2,238.4	2,289.0
Averages ----->		2,602.5	2,622.8	2,655.8	2,627.0	2,620.3	2,650.1	2,634.8	2,635.1

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2631.0		Mean	2715.7	2725.1	2720.4
Min Point	2105.2	-20.0%	Std. Dev.	150.3	148.8	143.8
Max Point	2909.5	10.6%	COV as %	5.5	5.5	5.3

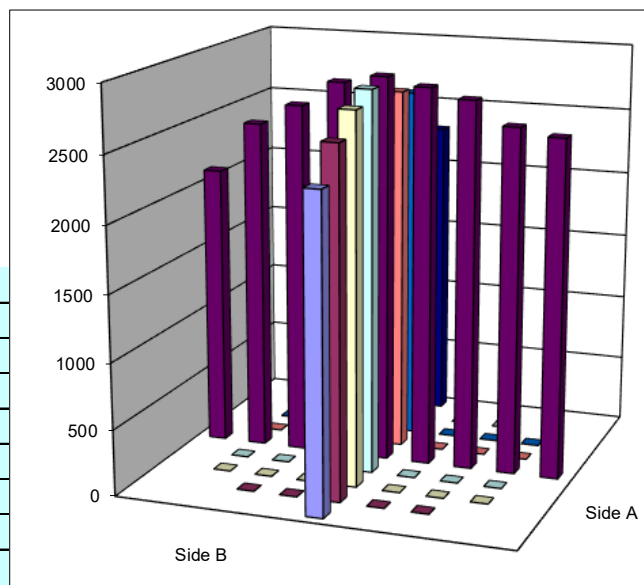
Flow w/o C-Pt	4094 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2597 fpm		Standard pitot (ID: HStd1, 36")	Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	110.4	110.8	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	77.5	75.4		
Ambient temp	88.4	88.6		
Stack static	0.42	0.57		
Ambient pressure	993.91	993.91		
Total Stack pressure	994.33	994.48		
Ambient humidity	33%	33%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

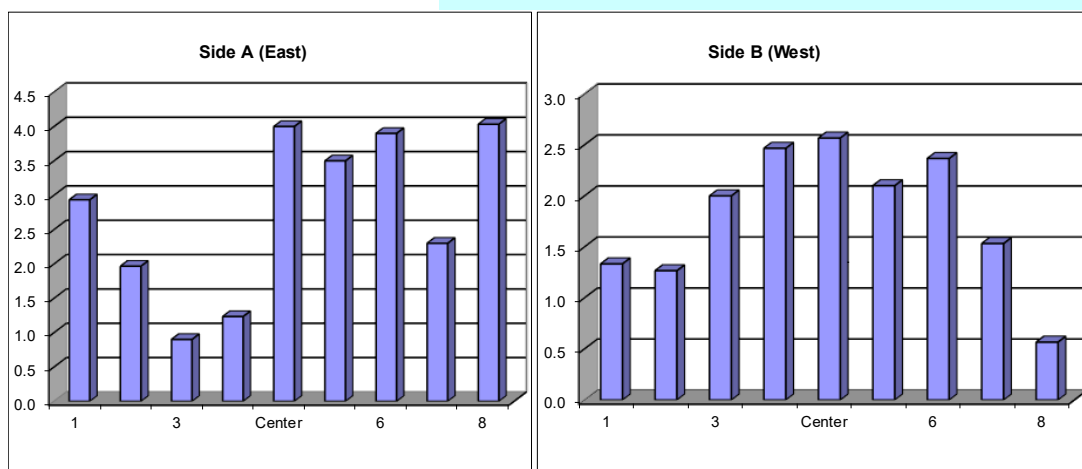
Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



## Appendix D – LV-C2 Stack Verification Data Sheets

### D.1 Flow Angle Data Forms

FLOW ANGLE DATA FORM									
Stack	LV-C2 (C2V)				Run No.	FA-1			
Date	5/24/2021				Fan Setting	NA Hz			
Start/End Time	14:49 14:56				Fan Configuration	A			
Testers	ZDH/LCE				Stack Temp	81.3 deg F			
Stack Dia.	60 in				Units	Degrees			
Stack X-Area	2827.4 in <sup>2</sup>				Port	A & B			
Elevation	691 ft								
Distance to disturbance	51.00 ft								
Order -->	First				Second				
Traverse-->									
Trial ---->									
		Side A (East)				Side B (West)			
		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw			
1	1.92	2.8	2.9	3.1	2.9	1.3	1.3	1.4	1.3
2	6.30	2.3	2.0	1.6	2.0	1.2	1.8	0.8	1.3
3	11.64	1.2	0.2	1.3	0.9	1.7	2.4	1.9	2.0
4	19.38	1.4	0.9	1.4	1.2	2.3	2.6	2.5	2.5
Center	30.00	3.7	4.2	4.1	4.0	2.2	2.3	3.2	2.6
5	40.62	3.1	4.1	3.3	3.5	2.2	2.4	1.7	2.1
6	48.36	2.2	3.8	5.7	3.9	5.3	1.0	0.8	2.4
7	53.70	3.2	3.0	0.7	2.3	1.1	1.5	2.0	1.5
8	58.08	4.1	4.2	3.8	4.0	0.6	0.8	0.3	0.6
Mean of absolute values:					2.8	1.8			
" " w/o points by wall:					2.5	2.0			
						Grand mean ABS 2.3			
						Grand mean ABS w/o wall pts 2.3			
<b>Instruments Used:</b>					<b>Cal. Due</b>				
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				
<b>Notes:</b>									
Traverse point depth = the distance from inside stack wall to each point.									
First traverse point is all the way into the stack.									
Approx. air velocity was derived from all points on the Velocity Traverse Forms.									

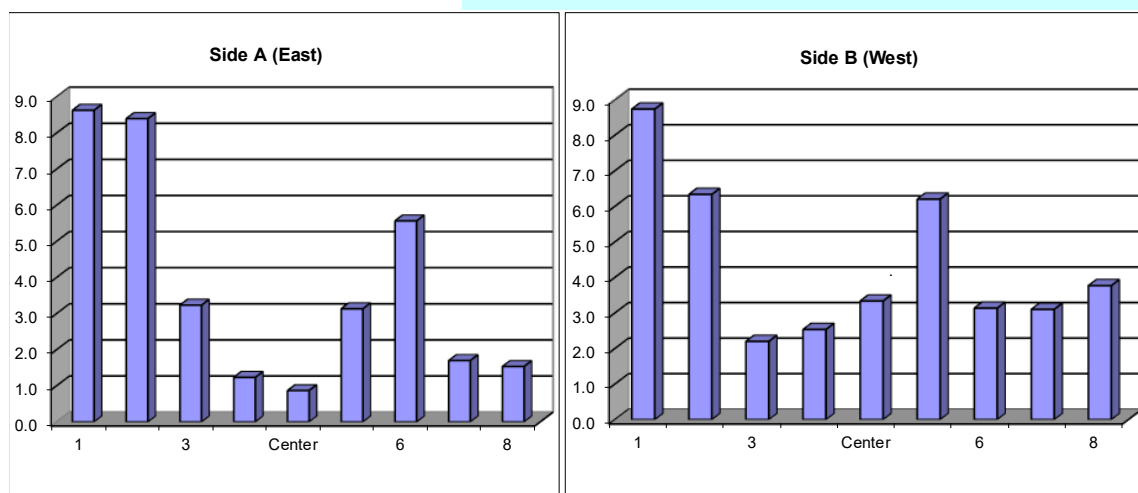


# FLOW ANGLE DATA FORM

Stack	LV-C2 (C2V)			Run No.	FA-2			
Date	5/25/2021			Fan Setting	NA Hz			
Start/End Time	10:27 10:35			Fan Configuration	A+B			
Testers	ZDH/LCE			Stack Temp	77.3 deg F			
Stack Dia.	60 in			Units	Degrees			
Stack X-Area	2827.4 in <sup>2</sup>			Port	A & B			
Elevation	691 ft							
Distance to disturbance	51.00 ft							
Order -->	First				Second			
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	1.92	9.0	8.0	8.9	8.6	7.3	9.8	9.1
2	6.30	9.9	8.2	7.1	8.4	6.5	6.2	6.3
3	11.64	3.7	3.1	2.9	3.2	2.4	2.6	1.6
4	19.38	1.3	1.3	1.1	1.2	3.3	2.3	2.0
Center	30.00	0.7	1.0	0.9	0.9	1.9	3.2	4.9
5	40.62	3.8	3.0	2.6	3.1	6.2	6.2	6.2
6	48.36	6.7	5.3	4.7	5.6	3.1	3.1	3.2
7	53.70	1.8	0.3	3.0	1.7	3.2	2.8	3.3
8	58.08	1.1	1.5	2.0	1.5	4.6	3.8	2.9
Mean of absolute values:				3.8	4.4			
" " w/o points by wall:				3.4	3.8			
Instruments Used:				Cal. Due	Grand mean ABS 4.1			
					Grand mean ABS w/o wall pts 3.6			
S-type pitot	(ID: A100-19, 72")			Pre-test calibration; Post-test inspection.				
Angle indicator	SPI Tronic PRO 360 (SN 31-038-3)			Accuracy check prior to each use; field recalibration as necessary				
Manometer	Digisense 20250-13 (SN: 191212877)			Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.



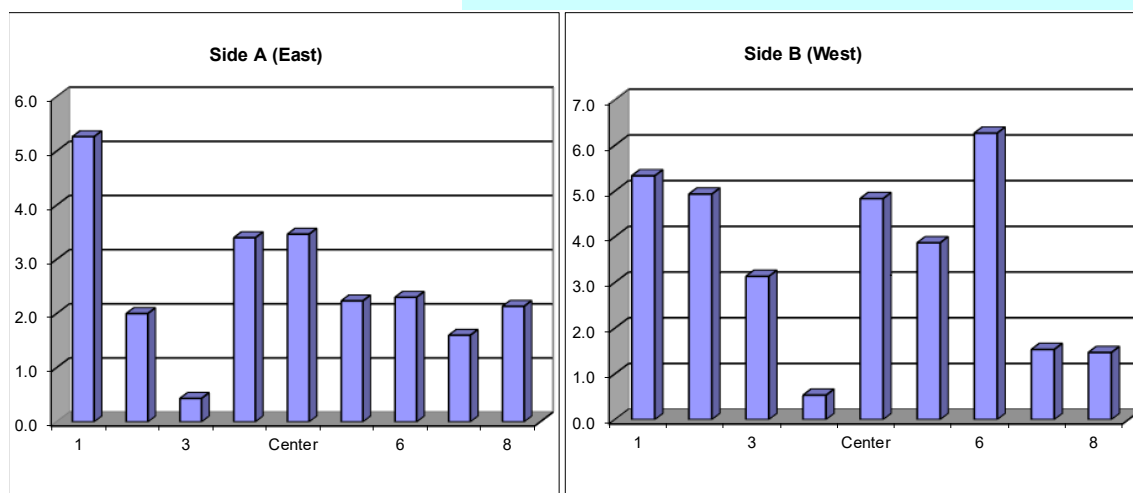


# FLOW ANGLE DATA FORM

Stack	LV-C2 (C2V)			Run No.	FA-4			
Date	5/25/2021			Fan Setting	NA Hz			
Start/End Time	13:49 13:56			Fan Configuration	A+B			
Testers	ZDH/LCE			Stack Temp	78.4 deg F			
Stack Dia.	60 in			Units	Degrees			
Stack X-Area	2827.4 in <sup>2</sup>			Port	A & B			
Elevation	691 ft							
Distance to disturbance	51.00 ft							
Order -->	First			Second				
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw		
1	1.92	5.5	5.2	5.1	5.3	6.0	5.2	4.8
2	6.30	2.3	2.0	1.7	2.0	5.0	5.0	4.8
3	11.64	0.0	0.3	1.0	0.4	3.0	3.2	3.2
4	19.38	3.7	3.8	2.7	3.4	1.1	0.4	0.1
Center	30.00	3.8	3.4	3.2	3.5	6.1	4.7	3.7
5	40.62	3.4	2.0	1.3	2.2	5.2	3.7	2.7
6	48.36	2.6	2.4	1.9	2.3	6.3	6.1	6.4
7	53.70	1.7	1.6	1.5	1.6	1.8	1.5	1.3
8	58.08	2.0	2.1	2.3	2.1	1.9	1.2	1.3
Mean of absolute values:					2.5	3.5		
" " w/o points by wall:					2.2	3.6		
Instruments Used:					Cal. Due	Grand mean ABS 3.0		
						Grand mean ABS w/o wall pts 2.9		
S-type pitot	(ID: A100-19, 72")			Pre-test calibration; Post-test inspection.				
Angle indicator	SPI Tronic PRO 360 (SN 31-038-3)			Accuracy check prior to each use; field recalibration as necessary				
Manometer	Digisense 20250-13 (SN: 191212877)			Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

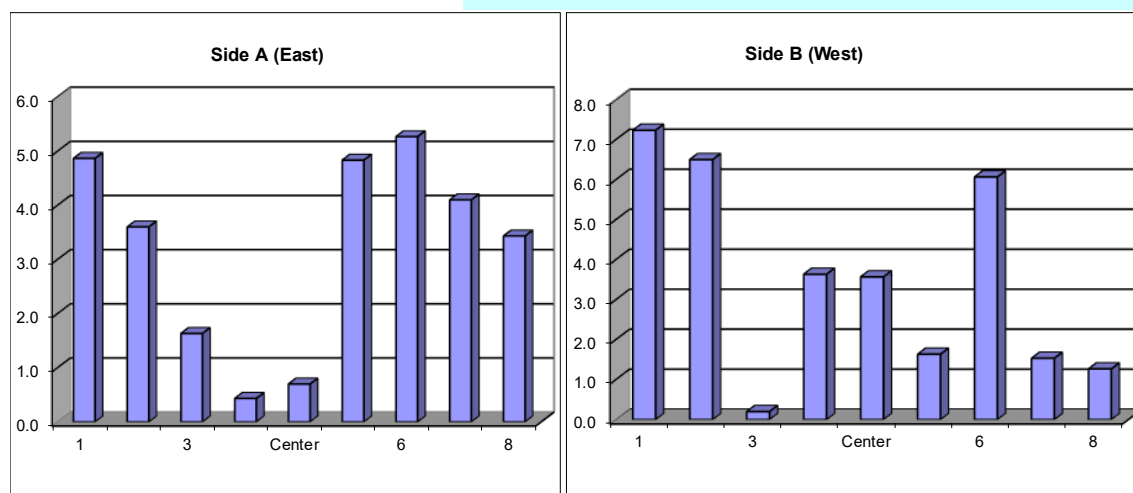


# FLOW ANGLE DATA FORM

Stack	LV-C2 (C2V)			Run No.	FA-5				
Date	5/25/2021			Fan Setting	NA Hz				
Start/End Time	14:53		15:00	Fan Configuration	A+B				
Testers	ZDH/LCE			Stack Temp	79.2 deg F				
Stack Dia.	60		in	Units	Degrees				
Stack X-Area	2827.4		in <sup>2</sup>	Port	A & B				
Elevation	691 ft								
Distance to disturbance	51.00 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	1.92	5.3	4.8	4.5	4.9	7.0	7.3	7.4	7.2
2	6.30	3.8	3.6	3.4	3.6	7.4	6.1	6.0	6.5
3	11.64	2.2	1.2	1.5	1.6	0.3	0.2	0.1	0.2
4	19.38	0.4	0.7	0.2	0.4	4.0	3.4	3.5	3.6
Center	30.00	0.2	1.4	0.5	0.7	3.4	3.8	3.5	3.6
5	40.62	5.5	4.6	4.4	4.8	2.0	1.7	1.2	1.6
6	48.36	5.4	5.3	5.1	5.3	6.3	6.2	5.7	6.1
7	53.70	4.7	3.8	3.8	4.1	1.8	1.0	1.8	1.5
8	58.08	4.1	3.1	3.1	3.4	2.3	1.5	0.0	1.3
Mean of absolute values:					3.2	3.5			
" " w/o points by wall:					2.9	3.3			
Instruments Used:					Cal. Due	Grand mean ABS 3.4			
S-type pitot (ID: A100-19, 72")					Grand mean ABS w/o wall pts 3.1				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary				
					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

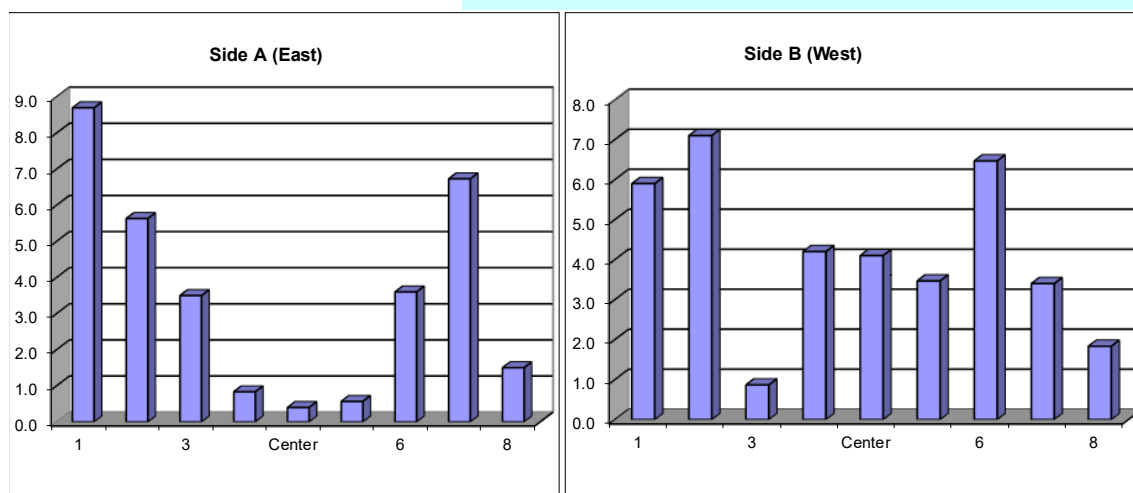


# FLOW ANGLE DATA FORM

Stack	(LV-C2) C2V			Run No.	FA-6			
Date	5/26/2021			Fan Setting	NA Hz			
Start/End Time	10:18 10:25			Fan Configuration	A+B			
Testers	ZDH/LCE			Stack Temp	77.8 deg F			
Stack Dia.	60 in			Units	Degrees			
Stack X-Area	2827.4 in <sup>2</sup>			Port	A & B			
Elevation	691 ft							
Distance to disturbance	51.00 ft							
Order -->	First				Second			
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	1.92	9.0	8.6	8.5	8.7	6.2	5.4	6.1
2	6.30	5.5	5.5	5.9	5.6	8.2	6.6	6.5
3	11.64	3.6	3.4	3.5	3.5	0.4	1.1	1.1
4	19.38	1.1	0.4	1.0	0.8	4.9	4.2	3.5
Center	30.00	0.3	0.1	0.8	0.4	5.5	3.2	3.6
5	40.62	0.4	0.5	0.8	0.6	3.6	3.7	3.1
6	48.36	3.7	4.1	3.0	3.6	6.6	6.9	5.9
7	53.70	7.3	6.8	6.1	6.7	2.9	4.6	2.7
8	58.08	3.2	0.2	1.1	1.5	1.5	1.6	2.4
Mean of absolute values:				3.5	4.1			
" " w/o points by wall:				3.0	4.2			
Instruments Used:				Cal. Due	Grand mean ABS 3.8			
S-type pitot (ID: A100-19, 72")				Pre-test calibration; Post-test inspection.	Grand mean ABS w/o wall pts 3.6			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

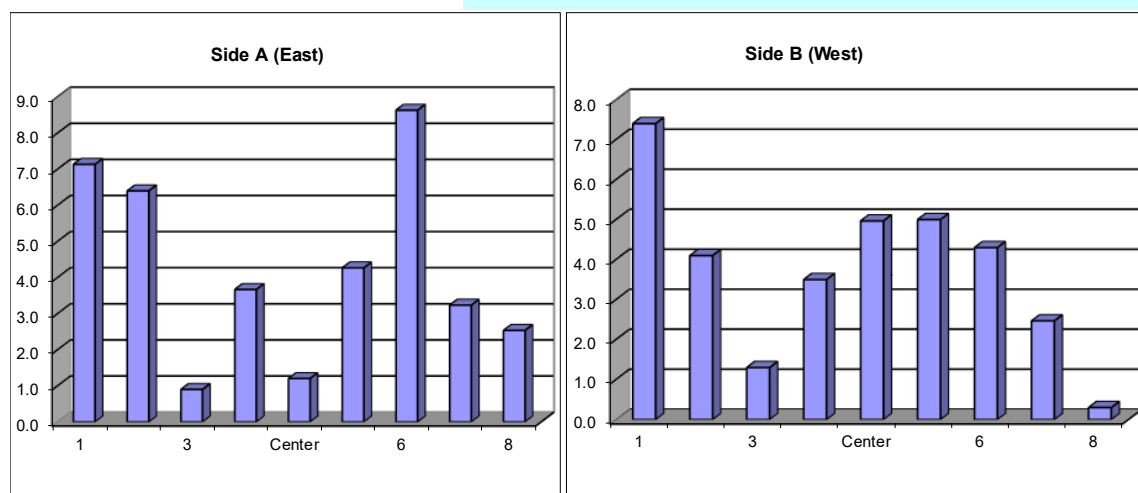


# FLOW ANGLE DATA FORM

Stack	LV-C2 (C2V)			Run No.	FA-7				
Date	5/26/2021			Fan Setting	NA Hz				
Start/End Time	11:27 11:34			Fan Configuration	A+B				
Testers	ZDH/LCE			Stack Temp	76.3 deg F				
Stack Dia.	60 in			Units	Degrees				
Stack X-Area	2827.4 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	51.00 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	1.9	7.7	7.0	6.7	7.1	7.7	7.8	6.7	7.4
2	6.3	6.6	6.3	6.3	6.4	4.3	4.2	3.8	4.1
3	11.6	1.2	0.7	0.8	0.9	0.9	1.1	1.9	1.3
4	19.4	3.8	3.7	3.5	3.7	4.4	2.9	3.2	3.5
Center	30.0	1.2	1.1	1.3	1.2	5.4	5.1	4.4	5.0
5	40.6	5.0	4.7	3.1	4.3	4.9	5.0	5.1	5.0
6	48.4	9.1	8.8	8.0	8.6	4.6	4.1	4.2	4.3
7	53.7	4.3	3.5	1.9	3.2	2.7	2.4	2.3	2.5
8	58.1	2.4	2.9	2.3	2.5	0.1	0.8	0.0	0.3
Mean of absolute values:					4.2	3.7			
" " w/o points by wall:					4.0	3.7			
Instruments Used:					Cal. Due	Grand mean ABS 4.0			
S-type pitot (ID: A100-19, 72")					Grand mean ABS w/o wall pts 3.9				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Pre-test calibration; Post-test inspection.				
Manometer Digisense 20250-13 (SN: 191212877)					Accuracy check prior to each use; field recalibration as necessary				
					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

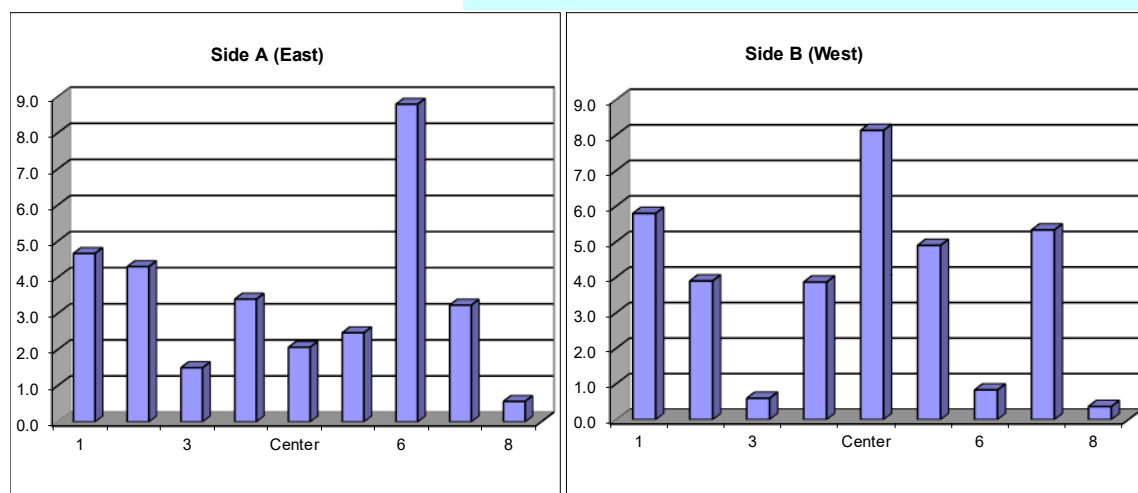


# FLOW ANGLE DATA FORM

Stack	(LV-C2) C2V			Run No.	FA-8				
Date	5/26/2021			Fan Setting	NA Hz				
Start/End Time	13:35 13:41			Fan Configuration	A+B				
Testers	ZDH/LCE			Stack Temp	78.7 deg F				
Stack Dia.	60 in			Units	Degrees				
Stack X-Area	2827.4 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	51.00 ft								
Order -->	First				Second				
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	1.92	4.7	4.5	4.8	4.7	5.5	6.0	5.9	5.8
2	6.30	4.9	4.0	4.0	4.3	3.9	3.7	4.1	3.9
3	11.64	1.5	1.5	1.5	1.5	0.6	0.6	0.6	0.6
4	19.38	3.8	3.3	3.1	3.4	3.9	3.8	3.9	3.9
Center	30.00	2.6	2.0	1.6	2.1	8.0	8.4	8.0	8.1
5	40.62	2.9	2.6	1.9	2.5	5.3	4.6	4.8	4.9
6	48.36	8.8	8.5	9.1	8.8	1.6	0.5	0.4	0.8
7	53.70	4.2	2.9	2.6	3.2	5.6	6.3	4.1	5.3
8	58.08	0.5	0.8	0.4	0.6	0.6	0.2	0.3	0.4
Mean of absolute values:					3.4	3.7			
" " w/o points by wall:					3.7	3.9			
Instruments Used:					Cal. Due	Grand mean ABS 3.6			
						Grand mean ABS w/o wall pts 3.8			
S-type pitot	(ID: A100-19, 72")			Pre-test calibration; Post-test inspection.					
Angle indicator	SPI Tronic PRO 360 (SN 31-038-3)			Accuracy check prior to each use; field recalibration as necessary					
Manometer	Digisense 20250-13 (SN: 191212877)			Pre-test inspection; post test calibration check.					

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

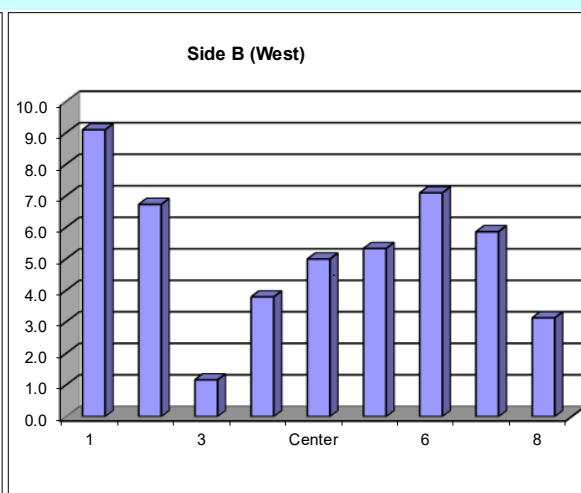
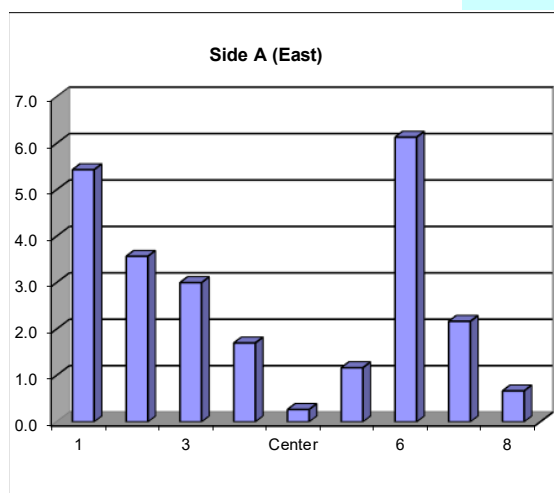


# FLOW ANGLE DATA FORM

Stack	LV-C2 (C2V)			Run No.	FA-9				
Date	5/26/2021			Fan Setting	NA Hz				
Start/End Time	14:39 14:45			Fan Configuration	A+B				
Testers	ZDH/LCE			Stack Temp	79.4 deg F				
Stack Dia.	60 in			Units	Degrees				
Stack X-Area	2827.4 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	51 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	1.92	5.9	5.7	4.7	5.4	9.2	9.1	9.0	9.1
2	6.30	4.5	3.5	2.7	3.6	7.2	6.7	6.3	6.7
3	11.64	3.0	2.9	3.1	3.0	0.7	0.9	1.9	1.2
4	19.38	1.7	1.5	1.9	1.7	4.1	3.8	3.5	3.8
Center	30.00	0.5	0.0	0.3	0.3	5.8	4.8	4.4	5.0
5	40.62	1.5	0.9	1.1	1.2	5.6	5.5	4.9	5.3
6	48.36	6.5	6.3	5.6	6.1	7.3	7.0	7.0	7.1
7	53.70	1.7	2.6	2.2	2.2	5.3	6.1	6.2	5.9
8	58.08	0.8	0.7	0.5	0.7	3.1	3.8	2.5	3.1
Mean of absolute values:					2.7	5.2			
" " w/o points by wall:					2.6	5.0			
Instruments Used:					Cal. Due	Grand mean ABS 4.0			
						Grand mean ABS w/o wall pts 3.8			
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

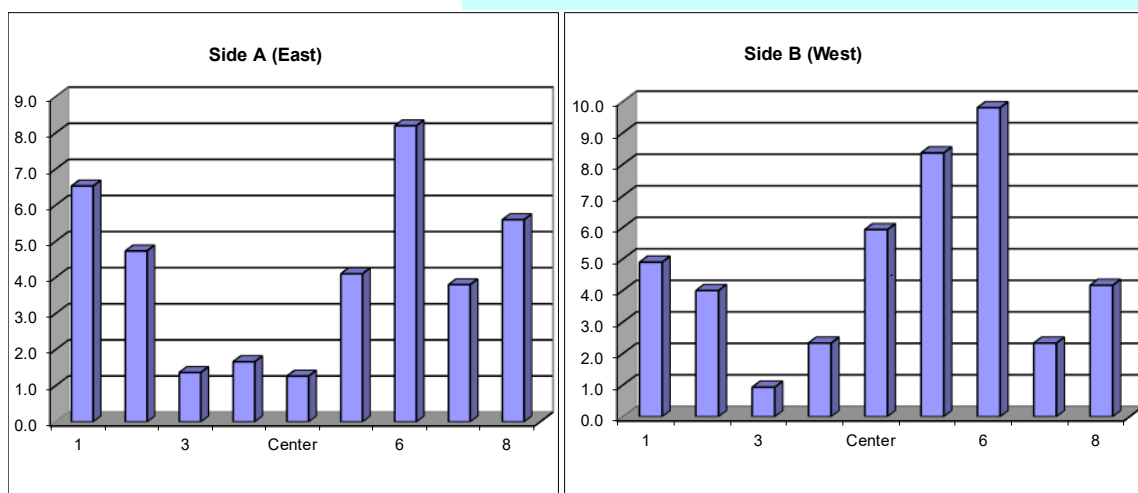


# FLOW ANGLE DATA FORM

Stack	LV-C2 (C2V)			Run No.	FA-10				
Date	5/27/2021			Fan Setting	NA Hz				
Start/End Time	8:56		9:02	Fan Configuration	A+B				
Testers	ZDH/LCE			Stack Temp	78.4 deg F				
Stack Dia.	60		in	Units	Degrees				
Stack X-Area	2827.4		in <sup>2</sup>	Port	A & B				
Elevation	691 ft								
Distance to disturbance	51.00 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw			deg. cw				
1	1.9	6.2	6.4	7.0	6.5	4.7	5.2	4.8	4.9
2	6.3	4.7	4.8	4.7	4.7	3.8	3.9	4.3	4.0
3	11.6	1.0	0.8	2.3	1.4	1.1	1.0	0.7	0.9
4	19.4	1.3	1.9	1.8	1.7	2.4	2.2	2.4	2.3
Center	30.0	1.4	1.0	1.4	1.3	6.3	5.8	5.7	5.9
5	40.6	5.1	4.5	2.7	4.1	8.8	8.3	8.0	8.4
6	48.4	9.2	8.0	7.4	8.2	9.9	9.7	9.8	9.8
7	53.7	3.4	4.1	3.9	3.8	2.5	1.8	2.7	2.3
8	58.1	4.9	6.1	5.8	5.6	4.8	4.3	3.4	4.2
Mean of absolute values:				4.1	4.8				
" " w/o points by wall:				3.6	4.8				
Instruments Used:				Cal. Due	Grand mean ABS 4.4				
S-type pitot (ID: A100-19, 72")				Pre-test calibration; Post-test inspection.	Grand mean ABS w/o wall pts 4.2				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary					
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.					

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

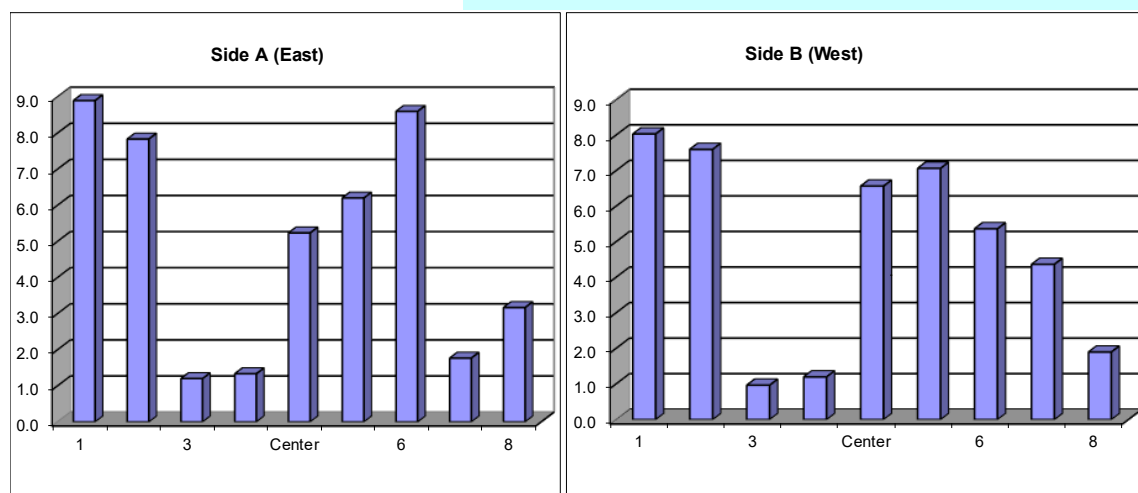


# FLOW ANGLE DATA FORM

Stack	LV-C2 (C2V)			Run No.	FA-11				
Date	5/27/2021			Fan Setting	NA Hz				
Start/End Time	9:58		10:05	Fan Configuration	A & B				
Testers	ZDH/LCE			Stack Temp	79.3 deg F				
Stack Dia.	60		in	Units	Degrees				
Stack X-Area	2827.4		in <sup>2</sup>	Port	A & B				
Elevation	691 ft								
Distance to disturbance	51.00 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	1.92	8.8	8.7	9.2	8.9	7.9	8.1	8.1	8.0
2	6.30	8.6	7.7	7.2	7.8	7.5	7.7	7.6	7.6
3	11.64	2.2	0.4	1.0	1.2	0.5	1.3	1.1	1.0
4	19.38	1.5	1.4	1.1	1.3	1.3	1.0	1.3	1.2
Center	30.00	5.6	4.9	5.2	5.2	6.1	6.8	6.8	6.6
5	40.62	7.5	5.6	5.5	6.2	7.2	7.1	6.9	7.1
6	48.36	9.2	8.7	7.9	8.6	4.7	5.3	6.1	5.4
7	53.70	1.5	1.0	2.8	1.8	5.2	4.1	3.8	4.4
8	58.08	5.6	1.7	2.2	3.2	2.0	2.6	1.1	1.9
Mean of absolute values:					4.9	4.8			
" " w/o points by wall:					4.6	4.7			
Instruments Used:					Cal. Due	Grand mean ABS 4.9			
						Grand mean ABS w/o wall pts 4.7			
S-type pitot	(ID: A100-19, 72")			Pre-test calibration; Post-test inspection.					
Angle indicator	SPI Tronic PRO 360 (SN 31-038-3)			Accuracy check prior to each use; field recalibration as necessary					
Manometer	Digisense 20250-13 (SN: 191212877)			Pre-test inspection; post test calibration check.					

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

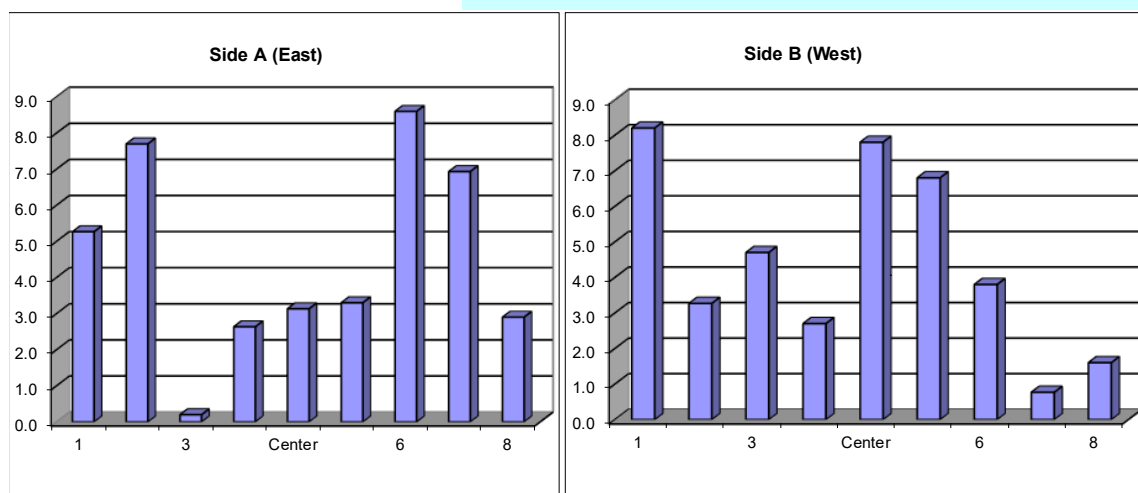


# FLOW ANGLE DATA FORM

Stack	LV-C2 (C2V)			Run No.	FA-12			
Date	5/27/2021			Fan Setting	NA Hz			
Start/End Time	10:57		11:03	Fan Configuration	A+B			
Testers	ZDH/LCE			Stack Temp	80.1 deg F			
Stack Dia.	60		in	Units	Degrees			
Stack X-Area	2827.4		in <sup>2</sup>	Port	A & B			
Elevation	691 ft							
Distance to disturbance	51.00 ft							
Order -->	First			Second				
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw				deg. cw		
1	1.9	5.3	4.8	5.7	5.3	8.4	7.8	8.4
2	6.3	7.3	7.8	8.0	7.7	3.3	3.3	3.2
3	11.6	0.1	0.2	0.3	0.2	5.0	4.6	4.5
4	19.4	2.6	3.2	2.1	2.6	2.7	2.8	2.6
Center	30.0	3.4	3.3	2.7	3.1	8.1	7.7	7.6
5	40.6	3.8	3.1	3.0	3.3	6.9	6.6	6.9
6	48.4	9.8	8.6	7.4	8.6	4.4	3.2	3.8
7	53.7	6.5	7.4	6.9	6.9	0.7	0.6	1.0
8	58.1	4.3	3.2	1.2	2.9	2.1	1.9	0.8
Mean of absolute values:					4.5	Grand mean ABS		
" " w/o points by wall:					4.6	Grand mean ABS w/o wall pts		
Instruments Used:					Cal. Due			
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.			
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary			
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.			

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

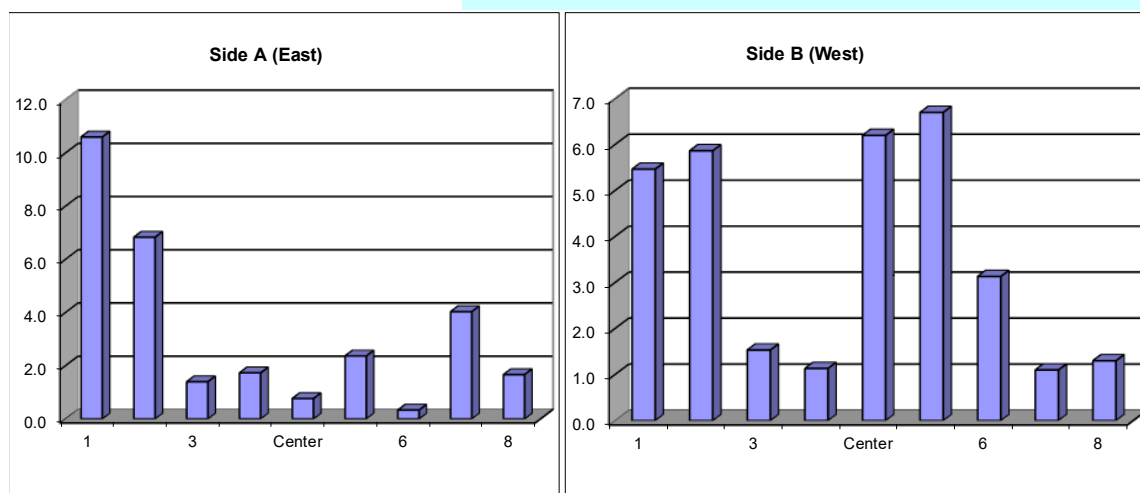


# FLOW ANGLE DATA FORM

Stack	LV-C2 (C2V)			Run No.	FA-13			
Date	5/27/2021			Fan Setting	NA Hz			
Start/End Time	12:04 12:10			Fan Configuration	A+B			
Testers	ZDH/LCE			Stack Temp	79.7 deg F			
Stack Dia.	60 in			Units	Degrees			
Stack X-Area	2827.4 in <sup>2</sup>			Port	A & B			
Elevation	691 ft							
Distance to disturbance	51.00 ft							
Order -->	First			Second				
Traverse-->	Side A (East)				Side B (West)			
Trial ---->	1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	deg. cw			deg. cw			
1	1.92	11.4	10.1	10.3	10.6	5.4	5.5	5.5
2	6.30	6.9	7.0	6.6	6.8	6.2	5.9	5.9
3	11.64	1.9	1.4	0.9	1.4	1.8	1.1	1.7
4	19.38	2.6	2.3	0.3	1.7	0.1	1.7	1.6
Center	30.00	0.9	0.8	0.6	0.8	6.6	6.2	5.8
5	40.62	2.7	2.4	2.0	2.4	7.1	6.7	6.3
6	48.36	0.2	0.5	0.3	0.3	3.3	3.2	2.9
7	53.70	3.8	4.2	4.1	4.0	2.5	0.3	0.5
8	58.08	2.6	1.0	1.4	1.7	1.4	1.1	1.4
Mean of absolute values:				3.3	3.6			
" " w/o points by wall:				2.5	3.7			
Instruments Used:				Cal. Due	Grand mean ABS 3.5			
S-type pitot (ID: A100-19, 72")				Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)				Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)				Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.

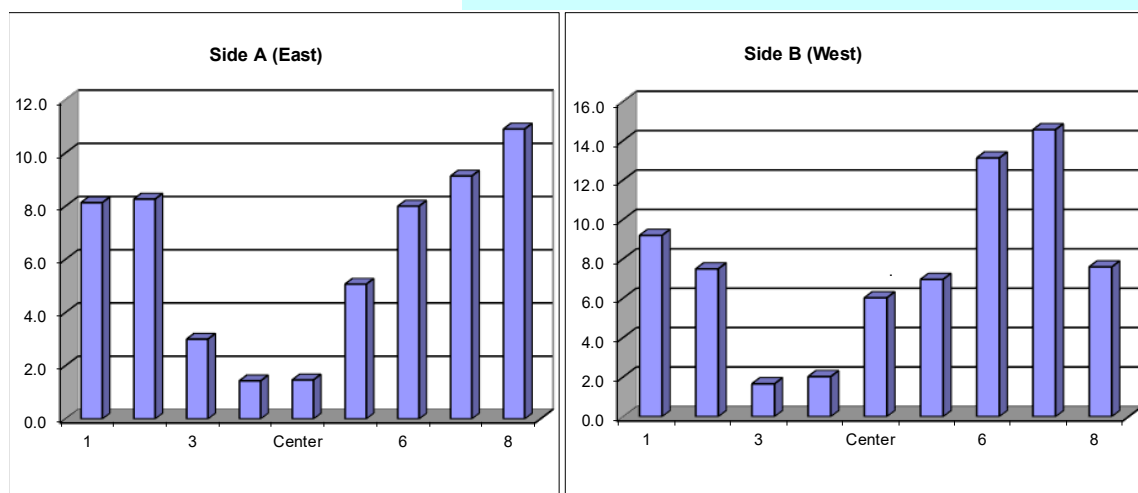


# FLOW ANGLE DATA FORM

Stack	LV-C2 (C2V)			Run No.	FA-14				
Date	5/28/2021			Fan Setting	NA Hz				
Start/End Time	9:40 9:48			Fan Configuration	B				
Testers	ZDH/LCE			Stack Temp	78.3 deg F				
Stack Dia.	60 in			Units	Degrees				
Stack X-Area	2827.4 in <sup>2</sup>			Port	A & B				
Elevation	691 ft								
Distance to disturbance	51.00 ft								
Order -->	First			Second					
Traverse-->	Side A (East)				Side B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	deg. cw				deg. cw			
1	1.92	8.0	8.1	8.3	8.1	9.2	9.1	9.3	9.2
2	6.30	8.0	8.3	8.5	8.3	8.0	7.7	6.8	7.5
3	11.64	3.1	3.0	2.9	3.0	1.2	2.0	1.8	1.7
4	19.38	1.4	1.5	1.4	1.4	1.9	1.7	2.5	2.0
Center	30.00	1.8	1.6	1.0	1.5	5.6	6.1	6.4	6.0
5	40.62	5.8	3.6	5.8	5.1	6.7	6.9	7.3	7.0
6	48.36	8.0	8.0	8.0	8.0	12.8	14.2	12.4	13.1
7	53.70	8.6	8.4	10.4	9.1	15.5	14.2	14.0	14.6
8	58.08	12.2	11.1	9.4	10.9	7.1	8.4	7.3	7.6
Mean of absolute values:					6.2	7.6			
" " w/o points by wall:					5.2	7.4			
Instruments Used:					Cal. Due	Grand mean ABS 6.9			
						Grand mean ABS w/o wall pts 6.3			
S-type pitot (ID: A100-19, 72")					Pre-test calibration; Post-test inspection.				
Angle indicator SPI Tronic PRO 360 (SN 31-038-3)					Accuracy check prior to each use; field recalibration as necessary				
Manometer Digisense 20250-13 (SN: 191212877)					Pre-test inspection; post test calibration check.				

## Notes:

Traverse point depth = the distance from inside stack wall to each point.  
First traverse point is all the way into the stack.  
Approx. air velocity was derived from all points on the Velocity Traverse Forms.



## D.2 Velocity Uniformity Data Forms

### VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-1
Date	5/24/21	Fan Configuration	A
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	81.3 deg F
Stack X-Area	2827.4 in.2	Start/End Time	14:38 14:45
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->		First port				Second port			
Traverse-->		Port A (East)				Port B (West)			
Trial ---->		1	2	3	Mean	1	2	3	Mean
Point	Depth, in.	Velocity				Velocity			
1	1.92	2,389.4	2,414.2	2,389.4	2,397.7	2,389.4	2,313.6	2,414.2	2,372.4
2	6.30	2,414.2	2,487.0	2,463.0	2,454.7	2,287.7	2,339.2	2,389.4	2,338.8
3	11.64	2,510.8	2,510.8	2,487.0	2,502.9	2,126.1	2,126.1	2,287.7	2,179.9
4	19.38	2,438.7	2,438.7	2,414.2	2,430.6	2,487.0	2,487.0	2,364.5	2,446.2
Center	30.00	2,603.9	2,534.4	2,438.7	2,525.7	2,510.8	2,510.8	2,463.0	2,494.9
5	40.62	2,580.9	2,510.8	2,557.8	2,549.8	2,463.0	2,534.4	2,487.0	2,494.8
6	48.36	2,438.7	2,414.2	2,389.4	2,414.1	2,510.8	2,557.8	2,603.9	2,557.5
7	53.70	2,339.2	2,364.5	2,339.2	2,347.6	2,463.0	2,463.0	2,364.5	2,430.2
8	58.08	2,153.8	2,069.4	2,126.1	2,116.4	1,857.2	1,825.0	1,889.0	1,857.1
Averages ----->		2,430.0	2,416.0	2,400.5	2,415.5	2,343.9	2,350.8	2,362.6	2,352.4

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2384.0		Mean	2460.8	2420.3	2440.5
Min Point	1857.1	-22.1%	Std. Dev.	70.5	125.9	100.3
Max Point	2557.5	7.3%	COV as %	2.9	5.2	4.1

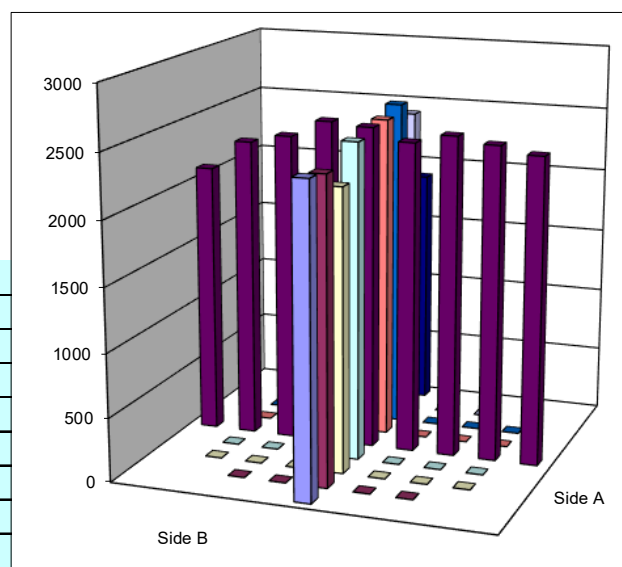
Flow w/o C-Pt	46499 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2368 fpm	S-type (ID: A10019, 72")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	80.8 81.7 F	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.8 75.4 F		
Ambient temp	76.8 75.3 F		
Stack static	-0.77 0.57 mbars		
Ambient pressure	986.46 986.46 mbars		
Total Stack pressure	985.69 987.03 mbars		
Ambient humidity	31% 30% RH		

#### Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-2
Date	5/25/21	Fan Configuration	A+B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	77.3 deg F
Stack X-Area	2827.4 in.2	Start/End Time	10:18 10:25
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean

Point	Depth, in.	Port A (East) Velocity				Port B (West) Velocity			
1	1.92	2,543.0	2,566.0	2,519.8	2,542.9	2,566.0	2,611.4	2,678.1	
2	6.30	2,764.5	2,678.1	2,721.7	2,721.4	2,700.0	2,588.8	2,633.9	
3	11.64	2,678.1	2,656.1	2,633.9	2,656.0	2,543.0	2,656.1	2,678.1	
4	19.38	2,611.4	2,496.3	2,566.0	2,557.9	2,588.8	2,519.8	2,633.9	
Center	30.00	2,566.0	2,633.9	2,588.8	2,596.2	2,566.0	2,588.8	2,611.4	
5	40.62	2,721.7	2,678.1	2,611.4	2,670.4	2,678.1	2,656.1	2,633.9	
6	48.36	2,611.4	2,656.1	2,678.1	2,648.6	2,721.7	2,678.1	2,743.2	
7	53.70	2,656.1	2,611.4	2,678.1	2,648.6	2,678.1	2,611.4	2,656.1	
8	58.08	2,168.7	2,195.6	2,168.7	2,177.7	2,168.7	2,141.4	2,141.4	
Averages ----->		2,591.2	2,574.6	2,574.1	2,580.0	2,578.9	2,561.4	2,601.1	

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2580.2		Mean	2642.7	2636.5	2639.6
Min Point	2150.5	-16.7%	Std. Dev.	52.5	44.9	47.1
Max Point	2721.4	5.5%	COV as %	2.0	1.7	1.8

Flow w/o C-Pt	50632 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2579 fpm	S-type (ID: A10019, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

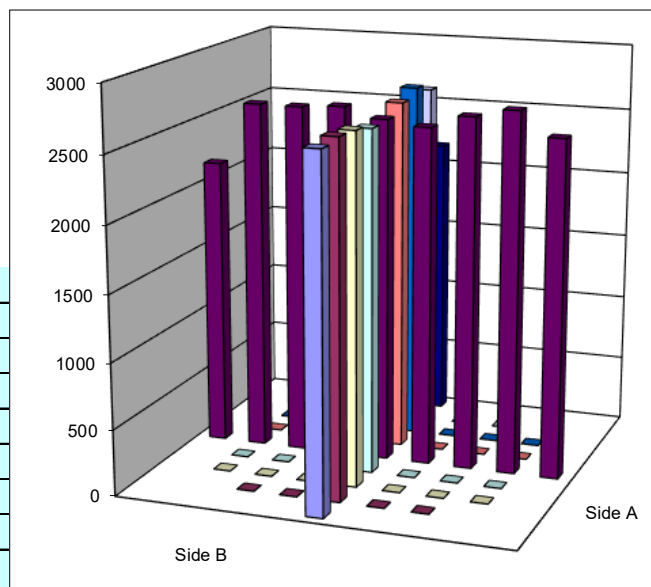
	Start	Finish	
Stack temp	77.6	76.9	F
Equipment temp	73.7	72.3	F
Ambient temp	73.7	72.3	F
Stack static	0.25	1.29	mbars
Ambient pressure	989.84	989.50	mbars
Total Stack pressure	990.09	990.79	mbars
Ambient humidity	34%	35%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-3
Date	5/25/21	Fan Configuration	A+B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	77.7 deg F
Stack X-Area	2827.4 in.2	Start/End Time	11:30 11:36
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		
Order -->	First port	Second port	
Traverse-->	Port A (East)		Port B (West)
Trial ---->	1	2	3
	Point	Depth, in.	Velocity
	1	1.92	2,679.6 2,701.4 2,567.4 2,649.4
	2	6.30	2,612.8 2,635.2 2,657.5 2,635.2
	3	11.64	2,612.8 2,635.2 2,612.8 2,620.3
	4	19.38	2,450.1 2,474.0 2,474.0 2,466.0
	Center	30.00	2,701.4 2,723.1 2,723.1 2,715.8
	5	40.62	2,679.6 2,766.0 2,701.4 2,715.6
	6	48.36	2,766.0 2,723.1 2,723.1 2,737.4
	7	53.70	2,590.2 2,567.4 2,612.8 2,590.1
	8	58.08	2,196.8 2,196.8 2,114.8 2,169.5
Averages ----->			2,587.7 2,602.5 2,576.3 2,588.8

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2572.0		Mean	2640.1	2613.4	2626.7
Min Point	2169.5	-15.6%	Std. Dev.	95.0	42.8	72.1
Max Point	2737.4	6.4%	COV as %	3.6	1.6	2.7

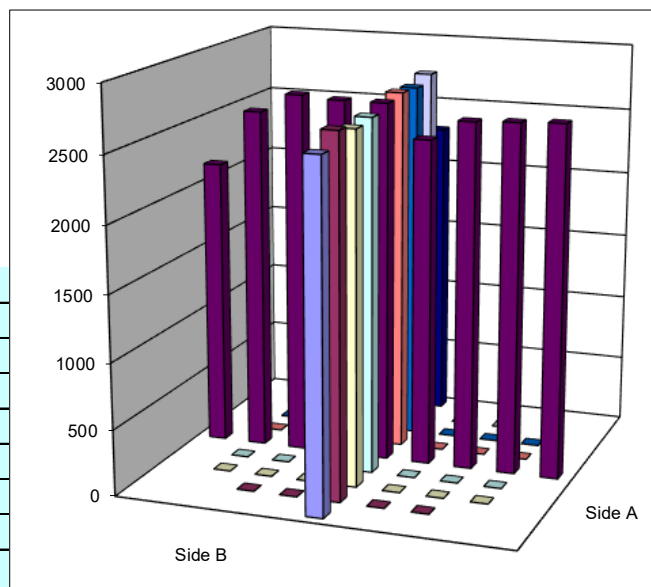
Flow w/o C-Pt	50265 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2560 fpm	S-type (ID: A10019, 72")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	77.4 77.9 F	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	74.9 76.6 F		
Ambient temp	74.9 76.6 F		
Stack static	0.95 0.70 mbars		
Ambient pressure	989.50 989.16 mbars		
Total Stack pressure	990.45 989.86 mbars		
Ambient humidity	32% 30% RH		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-4
Date	5/25/21	Fan Configuration	A+B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	78.4 deg F
Stack X-Area	2827.4 in.2	Start/End Time	13:43 13:47
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7
Velocity units <u>ft/min</u>			
Order -->	First port	Second port	
Traverse-->	Port A (East)		Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean	
Point	Depth, in.	Velocity	
1	1.92	2,571.0 2,616.5 2,616.5 2,601.3	2,429.4 2,524.6 2,683.3 2,545.8
2	6.30	2,524.6 2,571.0 2,661.2 2,585.6	2,748.5 2,661.2 2,616.5 2,675.4
3	11.64	2,705.2 2,616.5 2,683.3 2,668.3	2,661.2 2,616.5 2,616.5 2,631.4
4	19.38	2,661.2 2,638.9 2,638.9 2,646.3	2,571.0 2,661.2 2,638.9 2,623.7
Center	30.00	2,593.8 2,501.2 2,593.8 2,562.9	2,661.2 2,661.2 2,638.9 2,653.8
5	40.62	2,683.3 2,638.9 2,705.2 2,675.8	2,705.2 2,616.5 2,748.5 2,690.1
6	48.36	2,616.5 2,748.5 2,547.9 2,637.6	2,661.2 2,705.2 2,705.2 2,690.5
7	53.70	2,547.9 2,616.5 2,616.5 2,593.6	2,616.5 2,616.5 2,593.8 2,608.9
8	58.08	2,380.2 2,330.1 2,380.2 2,363.5	2,330.1 2,252.9 2,304.7 2,295.9
Averages ----->		2,587.1 2,586.5 2,604.8 2,592.8	2,598.2 2,590.6 2,616.3 2,601.7

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2597.3		Mean	2624.3	2653.4	2638.9
Min Point	2295.9	-11.6%	Std. Dev.	43.7	33.0	40.2
Max Point	2690.5	3.6%	COV as %	1.7	1.2	1.5

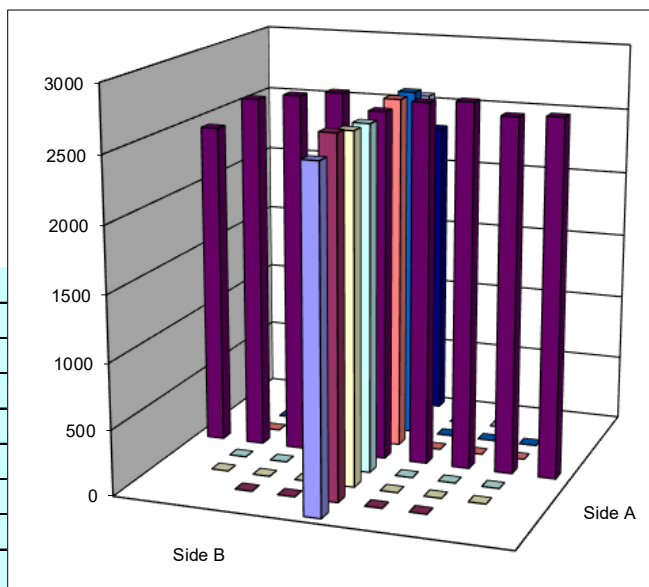
Flow w/o C-Pt	50970 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2596 fpm	S-type (ID: A10019, 72")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	78.6 78.2 F	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	75.6 75.2 F		
Ambient temp	75.6 75.2 F		
Stack static	0.25 0.27 mbars		
Ambient pressure	988.49 988.49 mbars		
Total Stack pressure	988.74 988.76 mbars		
Ambient humidity	31% 30% RH		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-5
Date	5/25/21	Fan Configuration	A+B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	79.2 deg F
Stack X-Area	2827.4 in.2	Start/End Time	14:45 14:51
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean
	Point Depth, in. Velocity	Point Depth, in. Velocity
	1 1.92 2,431.6 2,455.8 2,550.3 2,479.3	1 1.92 2,596.3 2,618.9 2,641.4 2,618.8
	2 6.30 2,596.3 2,641.4 2,663.7 2,633.8	2 6.30 2,663.7 2,641.4 2,663.7 2,656.3
	3 11.64 2,618.9 2,663.7 2,641.4 2,641.3	3 11.64 2,641.4 2,618.9 2,550.3 2,603.5
	4 19.38 2,663.7 2,596.3 2,573.3 2,611.1	4 19.38 2,596.3 2,618.9 2,618.9 2,611.4
	Center 30.00 2,663.7 2,641.4 2,618.9 2,641.3	Center 30.00 2,685.8 2,772.5 2,685.8 2,714.7
	5 40.62 2,618.9 2,596.3 2,618.9 2,611.4	5 40.62 2,596.3 2,663.7 2,641.4 2,633.8
	6 48.36 2,685.8 2,618.9 2,663.7 2,656.1	6 48.36 2,527.0 2,618.9 2,618.9 2,588.3
	7 53.70 2,618.9 2,685.8 2,663.7 2,656.1	7 53.70 2,550.3 2,255.0 2,281.0 2,362.1
	8 58.08 2,382.5 2,332.3 2,332.3 2,349.1	8 58.08 2,228.6 2,332.3 2,382.5 2,314.5
Averages ----->	2,586.7 2,581.3 2,591.8 2,586.6	2,565.1 2,571.2 2,564.9 2,567.0

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2576.8		Mean	2635.9	2595.7	2615.8
Min Point	2314.5	-10.2%	Std. Dev.	18.7	111.2	79.4
Max Point	2714.7	5.4%	COV as %	0.7	4.3	3.0

Flow w/o C-Pt	50347 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2564 fpm	S-type (ID: A10019, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

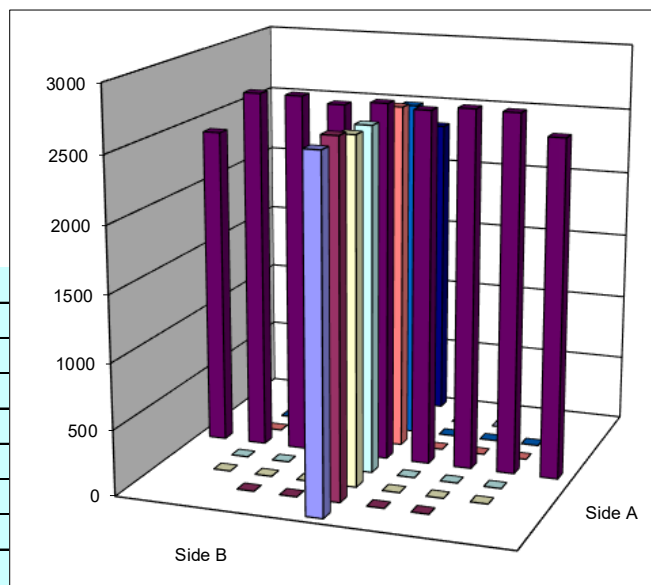
	Start	Finish	
Stack temp	79.0	79.3	F
Equipment temp	76.6	75.3	F
Ambient temp	76.5	75.3	F
Stack static	0.10	0.52	mbars
Ambient pressure	988.15	987.81	mbars
Total Stack pressure	988.25	988.33	mbars
Ambient humidity	28%	29%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	(LV-C2) C2V				Run No.	VT-6			
Date	5/26/21				Fan Configuration	A+B			
Testers	ZDH/LCE				Fan Setting	NA		Hz	
Stack Dia.	60 in.				Stack Temp	77.8		deg F	
Stack X-Area	2827.4 in.2				Start/End Time	10:11		10:16	
Test Port	A & B				Center 2/3 from	5.51		to: 54.49	
Distance to disturbance	51.00 ft				Points in Center 2/3	2		to: 7	
Velocity units	ft/min								
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	1.92	2,493.9	2,422.2	2,517.3	2,477.8	2,563.5	2,563.5	2,608.8	2,578.6
2	6.30	2,517.3	2,675.5	2,697.4	2,630.1	2,517.3	2,540.5	2,653.4	2,570.4
3	11.64	2,631.3	2,675.5	2,631.3	2,646.0	2,631.3	2,653.4	2,608.8	2,631.2
4	19.38	2,653.4	2,697.4	2,675.5	2,675.4	2,586.3	2,563.5	2,608.8	2,586.2
Center	30.00	2,608.8	2,563.5	2,653.4	2,608.6	2,631.3	2,653.4	2,675.5	2,653.4
5	40.62	2,586.3	2,631.3	2,675.5	2,631.0	2,761.8	2,675.5	2,719.0	2,718.8
6	48.36	2,675.5	2,586.3	2,653.4	2,638.4	2,563.5	2,586.3	2,631.3	2,593.7
7	53.70	2,740.5	2,608.8	2,675.5	2,675.0	2,586.3	2,517.3	2,540.5	2,548.0
8	58.08	2,298.0	2,083.7	2,055.3	2,145.7	2,193.5	2,111.7	2,193.5	2,166.2
Averages ----->		2,578.3	2,549.4	2,581.6	2,569.8	2,559.4	2,540.6	2,582.2	2,560.7

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2565.2		Mean	2643.5	2614.5	2629.0
Min Point	2145.7	-16.4%	Std. Dev.	24.5	58.1	45.4
Max Point	2718.8	6.0%	COV as %	0.9	2.2	1.7

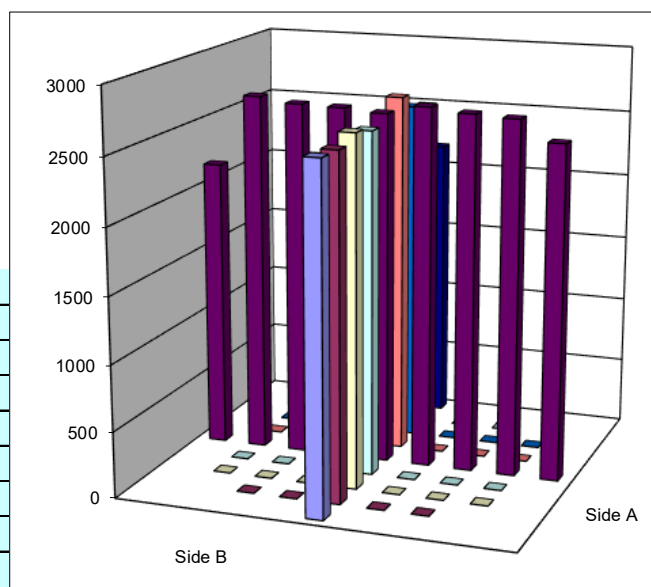
Flow w/o C-Pt	50207 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2557 fpm		S-type (ID: A10019, 72")	Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	78.1	77.5	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	73.5	73.3		
Ambient temp	73.5	73.3		
Stack static	0.95	0.12		
Ambient pressure	992.89	992.89		
Total Stack pressure	993.84	993.01		
Ambient humidity	31%	31%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-7
Date	5/26/21	Fan Configuration	A+B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	76.3 deg F
Stack X-Area	2827.4 in.2	Start/End Time	11:19 11:24
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean
	Point Depth, in. Velocity	Point Depth, in. Velocity
	1 1.92 2,537.9 2,716.2 2,628.6 2,627.6	1 1.92 2,467.7 2,419.8 2,443.9 2,443.8
	2 6.30 2,694.6 2,694.6 2,628.6 2,672.6	2 6.30 2,560.9 2,672.8 2,650.8 2,628.2
	3 11.64 2,628.6 2,583.7 2,628.6 2,613.7	3 11.64 2,560.9 2,606.2 2,606.2 2,591.1
	4 19.38 2,583.7 2,650.8 2,628.6 2,621.0	4 19.38 2,514.8 2,560.9 2,537.9 2,537.9
	Center 30.00 2,694.6 2,650.8 2,606.2 2,650.5	Center 30.00 2,560.9 2,628.6 2,672.8 2,620.8
	5 40.62 2,606.2 2,694.6 2,583.7 2,628.2	5 40.62 2,801.2 2,694.6 2,650.8 2,715.5
	6 48.36 2,672.8 2,716.2 2,606.2 2,665.1	6 48.36 2,716.2 2,694.6 2,628.6 2,679.8
	7 53.70 2,737.7 2,537.9 2,628.6 2,634.8	7 53.70 2,606.2 2,628.6 2,606.2 2,613.7
	8 58.08 2,217.8 2,270.0 2,217.8 2,235.2	8 58.08 2,164.4 2,270.0 2,217.8 2,217.4
Averages ----->	2,597.1 2,612.8 2,573.0 2,594.3	2,550.3 2,575.1 2,557.2 2,560.9

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2577.6		Mean	2640.8	2626.7	2633.8
Min Point	2217.4	-14.0%	Std. Dev.	22.4	57.9	42.8
Max Point	2715.5	5.4%	COV as %	0.8	2.2	1.6

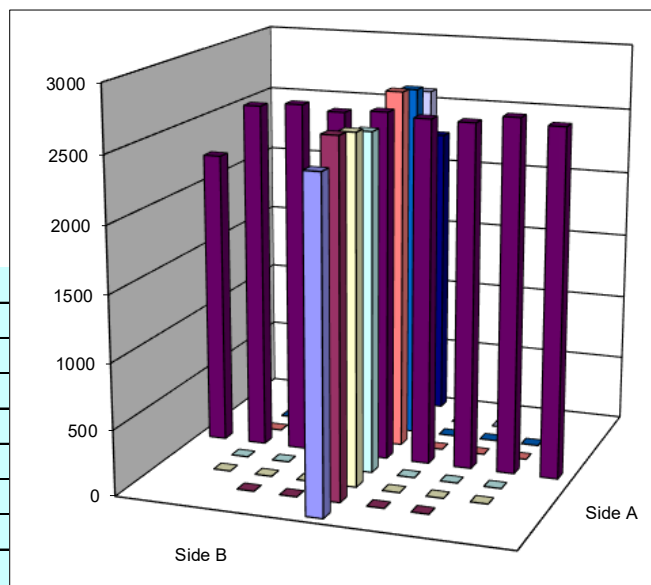
Flow w/o C-Pt	50469 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2570 fpm	S-type (ID: A10019, 72")	Post-test inspection
Start Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	76.0 76.5 F	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	73.8 72.5 F		
Ambient temp	73.8 72.5 F		
Stack static	0.70 0.67 mbars		
Ambient pressure	991.87 991.87 mbars		
Total Stack pressure	992.57 992.54 mbars		
Ambient humidity	30% 30% RH		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	(LV-C2) C2V				Run No.	VT-8			
Date	5/26/21				Fan Configuration	A+B			
Testers	ZDH/LCE				Fan Setting	NA		Hz	
Stack Dia.	60 in.				Stack Temp	78.7		deg F	
Stack X-Area	2827.4 in.2				Start/End Time	13:28		13:32	
Test Port	A & B				Center 2/3 from	5.51		to: 54.49	
Distance to disturbance	51.00 ft				Points in Center 2/3	2		to: 7	
Velocity units <u>ft/min</u>									
Order -->	First port				Second port				
Traverse-->	Port A (East)				Port B (West)				
Trial ---->	1	2	3	Mean	1	2	3	Mean	
Point	Depth, in.	Velocity				Velocity			
1	6.88	2,401.7	2,426.0	2,450.2	2,426.0	2,474.0	2,567.5	2,544.5	2,528.7
2	11.25	2,544.5	2,590.3	2,567.5	2,567.4	2,635.3	2,567.5	2,567.5	2,590.1
3	16.63	2,635.3	2,657.6	2,679.6	2,657.5	2,590.3	2,544.5	2,612.9	2,582.6
4	24.38	2,635.3	2,612.9	2,635.3	2,627.8	2,567.5	2,544.5	2,635.3	2,582.4
Center	35.00	2,657.6	2,590.3	2,612.9	2,620.2	2,635.3	2,744.7	2,723.2	2,701.1
5	45.63	2,635.3	2,612.9	2,657.6	2,635.2	2,657.6	2,635.3	2,590.3	2,627.7
6	53.38	2,679.6	2,723.2	2,635.3	2,679.4	2,723.2	2,701.5	2,679.6	2,701.4
7	58.75	2,657.6	2,679.6	2,723.2	2,686.8	2,657.6	2,590.3	2,635.3	2,627.7
8	63.13	2,196.8	2,377.0	2,377.0	2,316.9	2,142.6	2,142.6	2,115.0	2,133.4
Averages ----->		2,560.4	2,585.5	2,593.2	2,579.7	2,564.8	2,559.8	2,567.1	2,563.9

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2571.8		Mean	2639.2	2630.4	2634.8
Min Point	2133.4	-17.0%	Std. Dev.	40.6	52.1	45.1
Max Point	2701.4	5.0%	COV as %	1.5	2.0	1.7

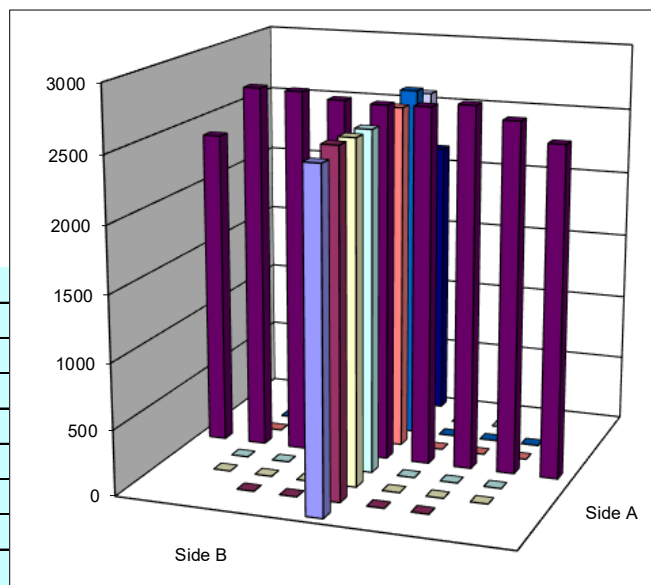
Flow w/o C-Pt	50279 cfm		Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2561 fpm		S-type (ID: A10019, 72")	Post-test inspection
Start	Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	78.5	78.9	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	74.7	74.0		
Ambient temp	74.7	74.0		
Stack static	0.27	2.04		
Ambient pressure	990.86	990.86		
Total Stack pressure	991.13	992.90		
Ambient humidity	29%	28%		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-9
Date	5/26/21	Fan Configuration	A+B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	79.4 deg F
Stack X-Area	2827.4 in.2	Start/End Time	14:32 14:36
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean

Point	Depth, in.	Port A (East) Velocity				Port B (West) Velocity			
1	1.92	2,524.8	2,548.1	2,453.6	2,508.8	2,571.1	2,705.3	2,548.1	2,608.2
2	6.30	2,727.1	2,661.4	2,748.7	2,712.4	2,639.1	2,639.1	2,705.3	2,661.2
3	11.64	2,639.1	2,616.6	2,616.6	2,624.1	2,571.1	2,770.0	2,639.1	2,660.1
4	19.38	2,548.1	2,571.1	2,571.1	2,563.4	2,571.1	2,594.0	2,477.6	2,547.6
Center	30.00	2,705.3	2,594.0	2,661.4	2,653.6	2,639.1	2,571.1	2,727.1	2,645.8
5	40.62	2,791.3	2,748.7	2,616.6	2,718.8	2,683.5	2,661.4	2,616.6	2,653.8
6	48.36	2,683.5	2,727.1	2,661.4	2,690.6	2,812.3	2,833.3	2,770.0	2,805.2
7	53.70	2,683.5	2,748.7	2,639.1	2,690.4	2,501.3	2,683.5	2,705.3	2,630.0
8	58.08	2,253.0	2,330.2	2,405.1	2,329.4	2,226.7	2,405.1	2,405.1	2,345.6
Averages ----->		2,617.3	2,616.2	2,597.1	2,610.2	2,579.5	2,651.4	2,621.6	2,617.5

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2613.8		Mean	2664.8	2657.7	2661.2
Min Point	2329.4	-10.9%	Std. Dev.	55.6	76.2	64.2
Max Point	2805.2	7.3%	COV as %	2.1	2.9	2.4

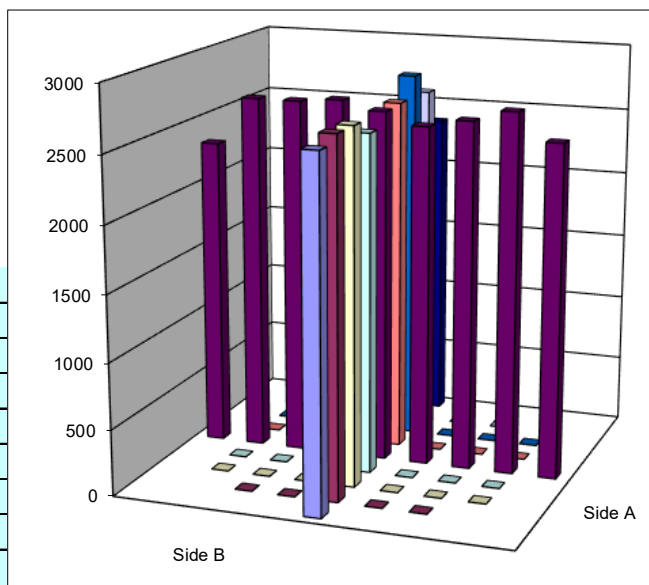
Flow w/o C-Pt	51235 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2609 fpm	S-type (ID: A10019, 72")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	78.8 79.9 F	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	76.0 76.1 F		
Ambient temp	76.0 76.1 F		
Stack static	0.03 0.05 mbars		
Ambient pressure	990.52 990.18 mbars		
Total Stack pressure	990.55 990.23 mbars		
Ambient humidity	26% 25% RH		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-10
Date	5/27/21	Fan Configuration	A+B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	78.4 deg F
Stack X-Area	2827.4 in.2	Start/End Time	8:50 8:54
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean

Point	Depth, in.	Port A (East) Velocity				Port B (West) Velocity			
1	1.92	2,505.9	2,482.1	2,433.9	2,474.0	2,552.7	2,359.8	2,409.5	2,440.6
2	6.30	2,666.2	2,621.4	2,598.7	2,628.8	2,688.3	2,621.4	2,621.4	2,643.7
3	11.64	2,621.4	2,775.1	2,666.2	2,687.6	2,575.8	2,710.3	2,666.2	2,650.8
4	19.38	2,552.7	2,621.4	2,529.4	2,567.8	2,598.7	2,621.4	2,575.8	2,598.6
Center	30.00	2,643.9	2,598.7	2,598.7	2,613.8	2,688.3	2,775.1	2,710.3	2,724.6
5	40.62	2,666.2	2,621.4	2,732.1	2,673.2	2,688.3	2,666.2	2,688.3	2,681.0
6	48.36	2,710.3	2,775.1	2,753.7	2,746.3	2,666.2	2,598.7	2,621.4	2,628.8
7	53.70	2,621.4	2,688.3	2,710.3	2,673.3	2,688.3	2,688.3	2,666.2	2,681.0
8	58.08	2,121.8	2,230.7	2,230.7	2,194.4	2,177.0	2,309.0	2,230.7	2,238.9
Averages ----->		2,567.8	2,601.6	2,583.8	2,584.4	2,591.5	2,594.5	2,576.7	2,587.5

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2586.0		Mean	2655.8	2658.3	2657.1
Min Point	2194.4	-15.1%	Std. Dev.	57.8	41.1	48.2
Max Point	2746.3	6.2%	COV as %	2.2	1.5	1.8

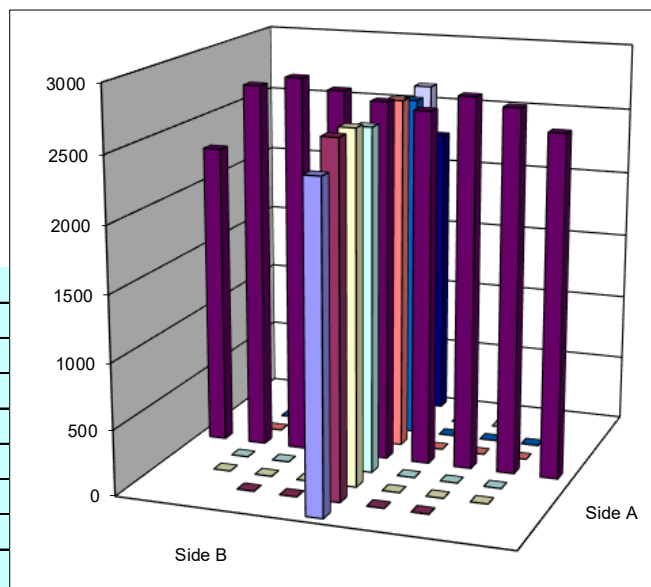
Flow w/o C-Pt	50571 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2576 fpm	S-type (ID: A10019, 72")	Post-test inspection
Start	Finish	Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	77.9 78.8 F	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	72.6 71.3 F		
Ambient temp	72.6 71.3 F		
Stack static	0.12 0.25 mbars		
Ambient pressure	984.76 984.76 mbars		
Total Stack pressure	984.88 985.01 mbars		
Ambient humidity	25% 26% RH		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-11
Date	5/27/21	Fan Configuration	A+B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	79.3 deg F
Stack X-Area	2827.4 in.2	Start/End Time	9:51 9:55
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean

Point	Depth, in.	Port A (East) Velocity				Port B (West) Velocity			
1	1.92	2,644.7	2,553.5	2,599.5	2,599.2	2,482.9	2,576.6	2,553.5	
2	6.30	2,689.2	2,711.1	2,689.2	2,696.5	2,599.5	2,689.2	2,622.2	
3	11.64	2,732.9	2,732.9	2,667.0	2,711.0	2,599.5	2,622.2	2,644.7	
4	19.38	2,530.2	2,553.5	2,622.2	2,568.6	2,458.9	2,576.6	2,553.5	
Center	30.00	2,599.5	2,622.2	2,576.6	2,599.4	2,622.2	2,599.5	2,622.2	
5	40.62	2,622.2	2,622.2	2,599.5	2,614.6	2,667.0	2,711.1	2,689.2	
6	48.36	2,711.1	2,689.2	2,667.0	2,689.1	2,553.5	2,599.5	2,622.2	
7	53.70	2,644.7	2,644.7	2,599.5	2,629.6	2,599.5	2,576.6	2,599.5	
8	58.08	2,283.9	2,309.7	2,204.7	2,266.1	2,122.5	2,065.9	2,231.5	
Averages ----->		2,606.5	2,604.3	2,580.6	2,597.1	2,522.8	2,557.5	2,570.9	

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2573.8		Mean	2644.1	2610.9	2627.5
Min Point	2139.9	-16.9%	Std. Dev.	54.8	48.8	52.7
Max Point	2711.0	5.3%	COV as %	2.1	1.9	2.0

Flow w/o C-Pt	50454 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2570 fpm	S-type (ID: A10019, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

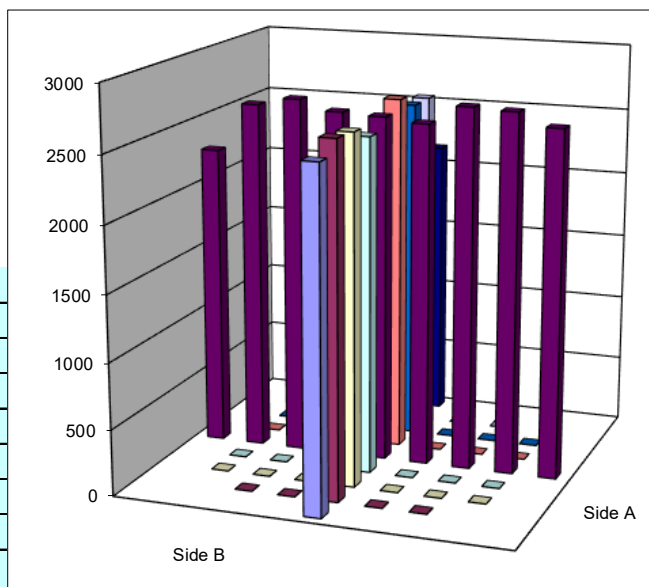
	Start	Finish	
Stack temp	79.1	79.5	F
Equipment temp	75.0	73.7	F
Ambient temp	75.0	73.7	F
Stack static	1.37	0.57	mbars
Ambient pressure	985.10	985.10	mbars
Total Stack pressure	986.47	985.67	mbars
Ambient humidity	28%	29%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-12
Date	5/27/21	Fan Configuration	A+B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	80.1 deg F
Stack X-Area	2827.4 in.2	Start/End Time	10:52 10:56
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean
	Point Depth, in. Velocity	Point Depth, in. Velocity
	1 1.92 2,533.2 2,509.7 2,579.7 2,540.9	1 1.92 2,647.9 2,556.5 2,461.8 2,555.4
	2 6.30 2,485.8 2,556.5 2,533.2 2,525.2	2 6.30 2,533.2 2,579.7 2,625.3 2,579.4
	3 11.64 2,579.7 2,647.9 2,602.6 2,610.1	3 11.64 2,556.5 2,625.3 2,625.3 2,602.4
	4 19.38 2,556.5 2,647.9 2,625.3 2,609.9	4 19.38 2,413.1 2,509.7 2,579.7 2,500.8
	Center 30.00 2,647.9 2,625.3 2,579.7 2,617.7	Center 30.00 2,670.3 2,533.2 2,602.6 2,602.0
	5 40.62 2,670.3 2,602.6 2,602.6 2,625.2	5 40.62 2,670.3 2,736.2 2,714.3 2,706.9
	6 48.36 2,647.9 2,625.3 2,579.7 2,617.7	6 48.36 2,692.4 2,757.9 2,692.4 2,714.2
	7 53.70 2,556.5 2,533.2 2,533.2 2,541.0	7 53.70 2,692.4 2,602.6 2,579.7 2,624.9
	8 58.08 2,260.5 2,180.3 2,207.3 2,216.0	8 58.08 2,125.0 2,125.0 2,039.4 2,096.5
Averages ----->	2,548.7 2,547.6 2,538.2 2,544.8	2,555.7 2,558.5 2,546.8 2,553.6

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2549.2		Mean	2592.4	2618.7	2605.5
Min Point	2096.5	-17.8%	Std. Dev.	41.1	74.1	59.2
Max Point	2714.2	6.5%	COV as %	1.6	2.8	2.3

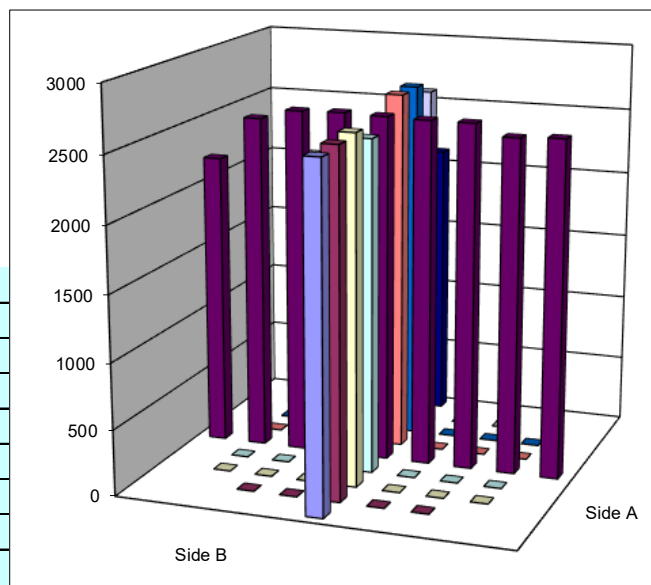
Flow w/o C-Pt	49905 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2542 fpm	S-type (ID: A10019, 72")	Post-test inspection
Start Finish		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
Stack temp	79.9 80.2 F	Control Co. Thermometer (SN: 220435230)	Post-test verification
Equipment temp	75.2 72.8 F		
Ambient temp	75.2 72.8 F		
Stack static	0.37 0.27 mbars		
Ambient pressure	984.76 984.76 mbars		
Total Stack pressure	985.13 985.03 mbars		
Ambient humidity	30% 33% RH		

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-13	
Date	5/27/21	Fan Configuration	A+B	
Testers	ZDH/LCE	Fan Setting	NA Hz	
Stack Dia.	60 in.	Stack Temp	79.7 deg F	
Stack X-Area	2827.4 in.2	Start/End Time	11:58 12:02	
Test Port	A & B	Center 2/3 from	5.51 to: 54.49	
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7	
Velocity units	ft/min			
Order -->	First port	Second port		
Traverse-->	Port A (East)		Port B (West)	
Trial ---->	1	2	3	Mean
	Point	Depth, in.	Velocity	
	1	1.92	2,437.0	2,461.2
	2	6.30	2,509.0	2,555.9
	3	11.64	2,713.7	2,602.0
	4	19.38	2,509.0	2,412.5
	Center	30.00	2,647.2	2,624.7
	5	40.62	2,602.0	2,579.1
	6	48.36	2,555.9	2,691.7
	7	53.70	2,602.0	2,602.0
	8	58.08	2,067.8	2,286.1
Averages ----->			2,516.0	2,535.0

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2541.6		Mean	2588.8	2592.5	2590.6
Min Point	2177.8	-14.3%	Std. Dev.	69.4	51.0	58.5
Max Point	2654.4	4.4%	COV as %	2.7	2.0	2.3

Flow w/o C-Pt	49674 cfm	Cal Due	
Vel Avg w/o C-Pt	2530 fpm	Cal Due	
Start	Finish		
Stack temp	79.1	80.2	F
Equipment temp	76.1	75.1	F
Ambient temp	76.1	75.1	F
Stack static	0.25	0.27	mbars
Ambient pressure	984.42	984.76	mbars
Total Stack pressure	984.67	985.03	mbars
Ambient humidity	31%	32%	RH

## Notes:

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

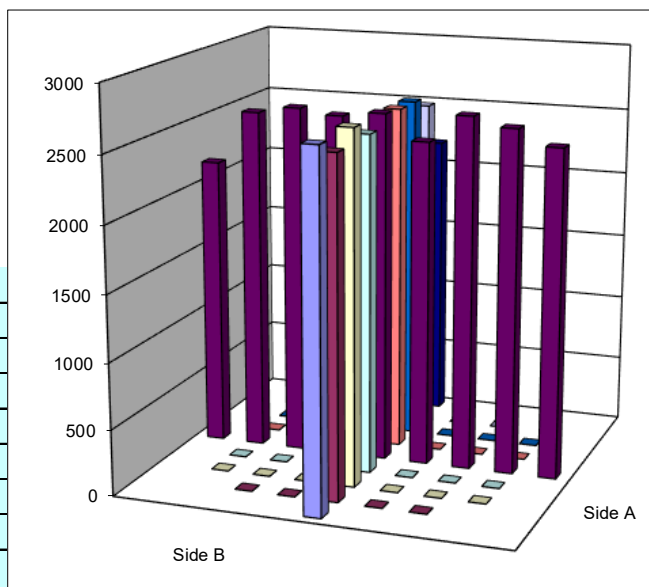
Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.

Instruments Used:

S-type (ID: A10019, 72") Post-test inspection

Digi-sense 20250-13 Manometer (SN: 191212877) 12/3/2021

Control Co. Thermometer (SN: 220435230) Post-test verification



# VELOCITY TRAVERSE DATA FORM

Stack	LV-C2 (C2V)	Run No.	VT-14
Date	5/28/21	Fan Configuration	B
Testers	ZDH/LCE	Fan Setting	NA Hz
Stack Dia.	60 in.	Stack Temp	78.3 deg F
Stack X-Area	2827.4 in.2	Start/End Time	9:34 9:38
Test Port	A & B	Center 2/3 from	5.51 to: 54.49
Distance to disturbance	51.00 ft	Points in Center 2/3	2 to: 7
Velocity units	ft/min		

Order -->	First port	Second port
Traverse-->	Port A (East)	Port B (West)
Trial ---->	1 2 3 Mean	1 2 3 Mean

Point	Depth, in.	Port A (East) Velocity				Port B (West) Velocity			
1	1.92	2,716.9	2,651.4	2,584.2	2,650.8	2,738.4	2,759.7	2,673.4	2,723.8
2	6.30	2,738.4	2,695.2	2,716.9	2,716.8	2,738.4	2,738.4	2,716.9	2,731.2
3	11.64	2,420.4	2,371.5	2,515.4	2,435.7	2,538.5	2,606.8	2,651.4	2,598.9
4	19.38	2,515.4	2,296.1	2,296.1	2,369.2	2,515.4	2,396.0	2,396.0	2,435.8
Center	30.00	2,491.9	2,296.1	2,584.2	2,457.4	2,584.2	2,538.5	2,561.5	2,561.4
5	40.62	2,396.0	2,346.6	2,396.0	2,379.6	2,538.5	2,538.5	2,584.2	2,553.8
6	48.36	2,584.2	2,584.2	2,651.4	2,606.6	2,651.4	2,843.3	2,759.7	2,751.5
7	53.70	2,561.5	2,468.3	2,491.9	2,507.2	2,606.8	2,606.8	2,695.2	2,636.3
8	58.08	2,296.1	2,491.9	2,468.3	2,418.8	2,296.1	2,218.3	2,296.1	2,270.2
Averages ----->		2,524.5	2,466.8	2,522.7	2,504.7	2,578.6	2,582.9	2,592.7	2,584.8

All	ft/min	Dev. from mean	Center 2/3	Side	Bottom	All
Mean	2544.7		Mean	2496.1	2609.8	2553.0
Min Point	2270.2	-10.8%	Std. Dev.	126.4	109.1	127.9
Max Point	2751.5	8.1%	COV as %	5.1	4.2	5.0

Flow w/o C-Pt	50052 cfm	Instuments Used:	Cal Due
Vel Avg w/o C-Pt	2549 fpm	S-type (ID: A10019, 72")	Post-test inspection
		Digi-sense 20250-13 Manometer (SN: 191212877)	12/3/2021
		Control Co. Thermometer (SN: 220435230)	Post-test verification

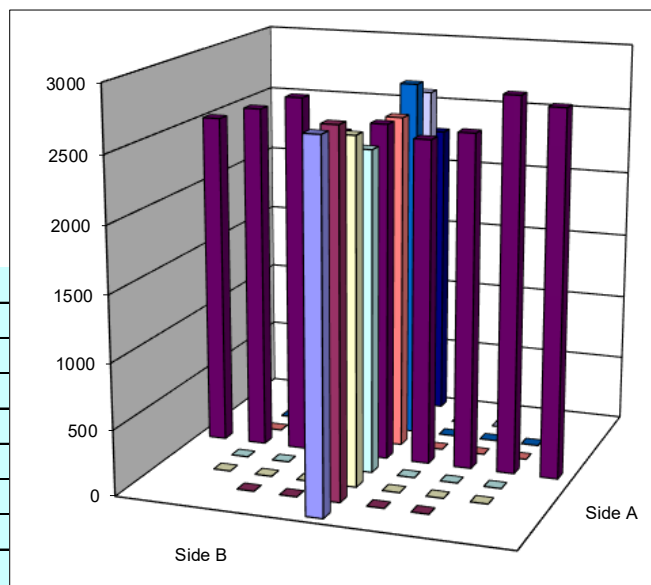
	Start	Finish	
Stack temp	77.0	79.5	F
Equipment temp	72.9	70.7	F
Ambient temp	72.9	70.7	F
Stack static	0.27	0.15	mbars
Ambient pressure	995.60	995.60	mbars
Total Stack pressure	995.87	995.75	mbars
Ambient humidity	26%	25%	RH

**Notes:**

Traverse point depth = the distance from the inside stack wall to each point.

Side A port was always measured first.

Direct measurements of differential pressure (in. H2O) were recorded using a digital manometer. Differential pressures were converted to the stack gas velocities (afpm) based on recorded total stack pressure, stack temperature and density of air for each run.



## Appendix E – LAW Stack Verification Document Summary

The following table provides a summary of the documents produced by Pacific Northwest National Laboratory (PNNL) during LAW Verification Test activities.

Document Title	Document Number	Notes
LAW Verification Test Input Document	Attachment to WTP/RPP-MOA-PNNL-01019, Rev. 0	Test input document to provide information to Bison Engineering Inc. (Bison) and Waste Treatment Completion Company (WTCC) concerning the verification tests. Transmitted as an attachment to a memo.
WTP LAW Stack Verification Tests of Velocity Uniformity and Flow Angle Provided by Bechtel National, Inc.	TDP-WTPSP-946	Test Data Package to contain the data sheets collected by Bison
Qualification of LAW Stack Verification Testing Data Collected by Bison Engineering	DQP-WTPSP-0005 Rev. 0	Data Qualification Plan to describe the qualification of the data from WTCC
Qualification of LAW Stack Verification Testing Data Collected by Bison Engineering	N/A	Data Qualification Evaluation to assess whether the data from WTCC are acceptable using data corroboration method
Qualification of LAW Stack Verification Testing Data Collected by Bison Engineering	DQR-WTPSP-0005 Rev. 0	Data Qualification Report to document the results of the data evaluation(s)
LAW Stack Verification Testing Observation Forms	TDP-WTPSP-945	Test Data Package to contain the observation forms PNNL staff used when observing Bison tests
Determine Air Velocity Uniformity of LV-C2, LV-S2, LV-S2, and LV-S3	CCP-WTPSP-1380, Rev. 0	Calculation package to document and review equations and calculations performed to determine velocity uniformity
Determination of Flow Angles in LV-C2, LV-S1, LV-S2, and LV-S3 (CAM and RS) Stacks	CCP-WTPSP-1381, Rev. 0	Calculation package to document and review equations and calculations performed to determine flow angle
Determine the product of the hydraulic diameter and the mean velocity of LAW Stacks	CCP-WTPSP-1384, Rev. 0	Calculation package to document and review equations and calculations performed to determine DV values for the Bison tests and the scale model tests.

# **Pacific Northwest National Laboratory**

902 Battelle Boulevard  
P.O. Box 999  
Richland, WA 99354  
1-888-375-PNNL (7665)

***[www.pnnl.gov](http://www.pnnl.gov)***