0 201800138

Great Lakes Works
Environmental Dept.
No. 1 Quality Drive
Ecorse, Michigan 48229

October 26, 2018

MDEQ Air Quality Division
Cadillac District Office
120 West Chapin St
Cadillac, MI 49601

Ms. Wilhemina McLemore, Supervisor
Department of Environmental Quality
Air Quality Division
Cadillac Place, Suite 2-300
3058 West Grand Boulevard
Detroit, Michigan 48202-6058

Re: **UNITED STATES STEEL CORPORATION – GREAT LAKES WORKS**
ROP 199600132d, SRN A7809

Subject: **Submittal of Rule 216 Minor Modification – Table E-01.08, Section III.A.2**

Dear Ms. McLemore:

United States Steel, Great Lakes Works, is submitting the C-001 and M-001 forms requesting a minor modification to ROP Permit Number 199600132d. The requested change is to update Table E-01.08, Section III.A.2, pressure drop range for the No. 5 Pickle Line Fume Scrubber from 3-10 to 1-10 inches of water column based upon the September 27, 2018 Compliance Test for the Pickle Line Scrubber. The scrubber successfully demonstrated compliance with ROP 199600132d with an overall DP of 1.5 – 1.8 inches of water column during testing.

This change will not cause non-compliance with the HCl 18 ppm and 1.64 lb/hr emission limits and will not result in any increase in emissions. This change is effective November 1, 2018.

If you have any questions, please contact me at (313) 749-3900.

Sincerely,

Alexis Piscitelli
Director, Environmental
Great Lakes Works
United States Steel

201800138

Michigan Department Of Environmental Quality - Air Quality Division

RENEWABLE OPERATING PERMIT APPLICATION
C-001: CERTIFICATION

This information is required by Article II, Chapter 1, part 55 (Air Pollution Control) of P.A. 451 of 1994, as amended, and the Federal Clean Air Act of 1990. Failure to obtain a permit required by Part 55 may result in penalties and/or imprisonment. Please type or print clearly.

This form is completed and included as part of RO Permit initial and renewal applications, notifications of change, amendments, modifications, and additional information.

Form Type **C-001**	SRN A7809

Stationary Source Name UNITED STATES STEEL CORPORATION, GREAT LAKES WORKS	
City ECORSE	County WAYNE

SUBMITTAL CERTIFICATION INFORMATION

1. Type of Submittal *Check only one box.*

☐ Initial Application (Rule 210) ☒ Notification/Administrative Amendment/Modification (Rules 215/216)

☐ Renewal (Rule 210) ☐ Other, describe on AI-001

2. If this RO Permit has more than one Section, list the Section(s) that this Certification applies to:

SECTION 1_____

3. Submittal Media

☒ E-mail ☐ FTP ☐ Disk ☒ Paper

4. Operator's Additional Information ID - Create an Additional Information (AI) ID that is used to provide supplemental information on AI-001 regarding a submittal.

AI

This form must be signed and dated by the Responsible Official.

5. Name and Title of the Responsible Official. *Print or type.*

Bruce Black, Plant Manager - Ironmaking & Rolling

As a Responsible Official, I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this submittal are true, accurate and complete.

B. L. Black — 10/26/18

Signature of Responsible Official — Date

201800138

RECEIVED
DEQ/AQD
OCT 29 2018
MACOMB
WAYNE
FILE

Michigan Department of Environmental Quality
Air Quality Division

RENEWABLE OPERATING PERMIT
M-001: RULE 215 CHANGE NOTIFICATION
RULE 216 AMENDMENT/MODIFICATION APPLICATION

This information is required by Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, and the Federal Clean Air Act of 1990. Failure to obtain a permit required by Part 55 may result in penalties and/or imprisonment.

1. SRN A7809	2. ROP Number 199600132d	3. County Wayne
4. Stationary Source Name	United States Steel Corporation Great Lakes Works	
5. Location Address	1 Quality Drive	6. City Ecorse

7. Submittal Type - *The submittal must meet the criteria for the box checked below. Check only one box. Attach a mark-up of the affected ROP pages for applications for Rule 216 changes.*

- ☐ **Rule 215(1) Notification of change.** *Complete Items 7 – 10.*
- ☐ **Rule 215(2) Notification of change.** *Complete Items 7 – 10.*
- ☐ **Rule 215(3) Notification of change.** *Complete Items 7 – 11.*
- ☐ **Rule 216(1)(a)(i)-(iv) Administrative Amendment.** *Complete Items 7 – 10.*
- ☐ **Rule 216(1)(a)(v) Administrative Amendment.** *Complete Items 7 – 13. Results of testing, monitoring & recordkeeping must be submitted. See detailed instructions.*
- ☒ **Rule 216(2) Minor Modification.** *Complete Items 7 – 12.*
- ☐ **Rule 216(3) Significant Modification.** *Complete Items 7 – 12 and provide any additional information needed on ROP application forms. See detailed instructions.*
- ☐ **Rule 216(4) State-Only Modification.** *Complete Items 7 – 12.*

8. Effective date of the change. (MM/DD/YYYY) *See detailed instructions.* 11/1/2018	9. Change in emissions? ☐ Yes ☒ No

10. Description of Change - *Describe any changes or additions to the ROP, including any changes in emissions and/or pollutants that will occur. If additional space is needed, complete an Additional Information form (AI-001).*

Change ROP, Table E-01.08, Section III.A.2 pressure drop range for Pickle Line Scrubber from 3-10 to 1-10 inches of water column. This change will not cause non-compliance with the HCl 18 ppm and 1.64 lb/hr emission limits and will not result in any increase in emissions.

See attached September 2018 Compliance Test and associated documents.

11. New Source Review Permit(s) to Install (PTI) associated with this application? ☐ Yes ☒ No

If Yes, enter the PTI Number(s) ____-____ ____-____ ____-____ ____-____ ____-____

12. Compliance Status - *A narrative compliance plan, including a schedule for compliance, must be submitted using an AI-001 if any of the following are checked No.*

a. Is the change identified above in compliance with the associated applicable requirement(s)? ☒ Yes ☐ No

b. Will the change identified above continue to be in compliance with the associated applicable requirement(s)? ☒ Yes ☐ No

c. If the change includes a future applicable requirement(s), will timely compliance be achieved? ☒ Yes ☐ No

13. Operator's Additional Information ID - *Create an Additional Information (AI) ID for the associated AI-001 form used to provide supplemental information.* **AI**

14. Contact Name	Telephone No.	E-mail Address
Nathan Ganhs	313-749-3857	naganhs@uss.com

15. This submittal also updates the ROP renewal application submitted on ____/____/____ ☐ Yes ☒ N/A
(If yes, a mark-up of the affected pages of the ROP must be attached.)

201800138

M-001 Instructions

NOTE: A CERTIFICATION FORM (C-001) SIGNED BY A RESPONSIBLE OFFICIAL MUST ACCOMPANY ALL SUBMITTALS

20180038

No. 5 Pickle Line Hydrogen Chloride Emission Test Report

Prepared for:

United States Steel Corporation

Ecorse, Michigan

United States Steel Corporation
Great Lakes Works
No. 1 Quality Drive
Ecorse, Michigan 48829

Project No. 049AS-470744
October 18, 2018

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073
(248) 548-8070

BTEC Inc.

Executive Summary

BT Environmental Consulting, Inc. (BTEC) was retained by United States Steel Corporation Great Lakes Works (U. S. Steel) to conduct an evaluation of the hydrogen chloride (HCl) concentrations and emissions from the No. 5 Pickle Line Scrubber inlet and exhaust stacks. The scrubber is located at the U. S. Steel facility in Ecorse, Michigan. The evaluation consisted of triplicate 60-minute test runs at each sampling location.

The results of the Hydrogen Chloride test program are summarized by the following table.

Executive Summary Table E-1
Test Program Results Summary
No. 5 Pickle Line Scrubber
September 27, 2018

Unit	Emission Rates		Permit Limit	
	HCl (lb/hr)	HCl (PPMV, dry)	HCl (lb/hr)	HCl (PPMV, dry)
Pickle Line - Inlet	87.37	1,665.9		
Pickle Line - Outlet	0.21	4.1	1.64	18

BTEC Inc.

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

BTEC Inc.

1.0 Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by United States Steel Corporation Great Lakes Works (U. S. Steel) to conduct an evaluation of the hydrogen chloride (HCl) concentrations and emissions from the No. 5 Pickle Line Scrubber inlet and exhaust stacks. The scrubber is located at the U. S. Steel facility in Ecorse, Michigan. The evaluation consisted of triplicate 60-minute test runs at each sampling location. US EPA Methods 1, 2, 3, 4 and 26A were utilized to perform the study.

The No. 5 Pickle Line Scrubber was tested for a compliance demonstration required by Permit No. 199600132d. BTEC personnel Mr. Matt Young, Mr. Mason Sakshaug, Mr. David Trahan, and Mr. Ben Durham performed the testing on September 27, 2018. Mr. Nathan Ganhs of U. S. Steel assisted in the study by coordinating the testing and documenting the scrubber operating parameters.

The purpose of this document is to summarize the sampling and analytical methodologies utilized and the results of the emissions test program. Section 2.0 provides a description of the process tested. Sections 3.0 and 4.0 summarize the sampling and analytical methods utilized as well as the results of the emissions test program. Overall results for the emissions test program are summarized by Table 1. Detailed results for each source are presented in Tables 2-3.

All testing was performed in accordance with BTEC test plan 049AS-470744.

2.0 Process Description

The pickling process uses a mineral acid (hydrochloric acid) to remove metal oxides formed when steel is hot rolled and cooled in the presence of oxygen. It is necessary to remove these oxides to provide a smooth clean surface for use as hot roll steel and/or to perform subsequent cold forming operations.

The No. 5 Pickle Line at U. S. Steel consists of three pickle tubs in series. The fresh acid solution is introduced in the 3rd pickle tank. The acid solution then cascades from the 3rd tank to the 1st tank in a direction counter to the direction of the metal strip. By this countercurrent arrangement, the cleanest strip near the process exit is treated by the freshest acid, ensuring that the steel strip is as free of oxide scale as possible.

The No. 5 Pickle Line Scrubber captures and removes acid mist and vapors from the process line. All pickle line tubs are completely covered with capture hoods to evacuate the acid mist and fumes. Ductwork carries the fumes to the packed bed scrubber rated at 16,950 ACFM. The fumes are moved through the scrubber by an I.D. fan.

The water flow monitor calibration was last completed on January 18, 2018.

BTEC Inc.

3.0 Sampling and Analytical Methodologies

Sampling and analytical methodologies for the emissions test program can be separated into two categories as follows:

(1) Measurement of exhaust gas velocity, molecular weight, and moisture content; and,
(2) Sampling and analysis of exhaust gases for HCl concentrations and emissions.

Sections 3.1 and 3.2 summarize the methodologies used to evaluate exhaust gas parameters for each of the aforementioned categories.

3.1 Exhaust Gas Velocity, Molecular Weight, and Moisture Content

Measurement of exhaust gas velocity, molecular weight, and moisture content were conducted using the following reference test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

Method 1 - *"Location of the Sampling Site and Sampling Points"*
Method 2 - *"Determination of Stack Gas Velocity and Volumetric Flowrate"*
Method 3 - *"Determination of Molecular Weight of Dry Stack Gas (Fyrite)"*
Method 4 - *"Determination of Moisture Content in Stack Gases"*

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Method 1 and Method 2 (see Figure 1 for a traverse point diagram). An S-type pitot tube with a thermocouple assembly, calibrated in accordance with Method 2, Section 4.1.1, was used to measure exhaust gas velocity pressures (using a manometer) and temperatures during testing. The S-type pitot tube dimensions were within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) was assigned. Flowrates were not performed on the inlet stack.

Molecular weight was determined according to USEPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." The equipment used for this evaluation consisted of a one-way squeeze bulb with connecting tubing and a set of Fyrite® combustion gas analyzers. Carbon dioxide and oxygen content were analyzed using the Fyrite® procedure.

Exhaust gas moisture content was evaluated utilizing USEPA Method 4, "Determination of Moisture Content in Stack Gases." Exhaust gas was extracted as part of the Method 26A sampling trains (see Figure 2 for a schematic of the sampling train). Exhaust gas was extracted and passed through (i) two impingers, each with 100 ml of 0.1N H_2SO_4, (ii) a third impinger that was empty and (iii) a fourth impinger filled with silica gel. Exhaust gas moisture content was then determined gravimetrically.

BTEC Inc.

3.2 Hydrogen Chloride Concentrations

Measurement of HCl concentrations was conducted using the following reference test methods codified at 40 CFR 60, Appendix A:

- Method 26A - *"Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources (isokinetic method)"*

The Method 26A sampling train consists of: (1) a heated borosilicate or quartz probe liner; (2) a heated borosilicate or quartz glass filter holder containing a pre-weighed 110-mm diameter washed teflon filter with Teflon filter support; (3) a set of two Greensburg-Smith (GS) impingers each of which contained 100 ml of 0.1 Normal Sulfuric Acid (0.1 N H_2SO_4), (4) a modified GS impinger that was empty as a knock out impinger, (5) a modified GS impinger containing a known weight of silica gel desiccant; (6) a length of sample line, and (7) a Nutech control case equipped with a pump, dry gas meter, and calibrated orifice. Figure 2 provides an illustration of the Method 26A sample train. The sampling at the inlet stack was performed non-isokinetically and flowrates were not measured.

After completion of the final leak test for each test run, the impinger train was carefully disassembled. The liquid volume of each impinger was measured gravimetrically and any volume increase was noted on field sheets. The impinger catch solution was then transferred to pre-cleaned sample containers. The impingers were then triple rinsed with deionized water (DI H_2O), and the rinses added to the H_2SO_4 sample containers. The back-half of the filter holder was rinsed and added to the H_2SO_4 sample container. The containers were labeled with the test number, test location, test date, and the level of liquid was marked on the outside of each container. Immediately after recovery, the sample containers were placed in a sealed cooler for storage.

The samples were submitted to the contract laboratory. Chain of Custody (COC) forms for the field samples were completed on-site. Maxxam Analytics' laboratories located in Mississauga, Ontario, Canada performed the analysis. All appropriate QA/QC measures were strictly adhered to. Results of the laboratory tests are included in Appendix C.

BTEC Inc.

4.0 Test Results

Table 1
Test Program Results Summary
No. 5 Pickle Line Scrubber
September 27, 2018

Unit	Emission Rates		Permit Limit	
	HCl (lb/hr)	HCl (PPMV, dry)	HCl (lb/hr)	HCl (PPMV, dry)
Pickle Line - Inlet	87.37	1,665.9		
Pickle Line - Outlet	0.21	4.1	1.64	18

Overall results of the emissions test program are summarized by Table 1. Detailed results for each source are presented in Tables 2-3. Field and computer-generated data sheets are provided in Appendix A. Equipment calibration information and U. S. Steel process documentation is presented in Appendix B and laboratory analytical reports are provided as Appendix C. Example calculations for equations used to determine emission rates are presented in Appendix D. Process data is presented in Appendix E.

BTEC Inc.

MEASUREMENT UNCERTAINTY STATEMENT

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, Montrose Air Quality Services, LLC, (MAQS) personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, MAQS personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of our Quality Manual and ASTM D 7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

Limitations

All testing performed was done in conformance to the ASTM D7036-04 standard. The information and opinions rendered in this report are exclusively for use by United States Steel Corporation. BTEC will not distribute or publish this report without United States Steel Corporation's consent except as required by law or court order. BTEC accepts responsibility for the competent performance of its duties in executing the assignment and preparing reports in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages.

This report was prepared by: _____

Todd Wessel
Client Project Manager

This report was reviewed by: _____

Brandon Chase
QA/QC Manager

Tables

Table 2
Pickle Line Inlet HCl Emission Rates

Company	US Steel			
Source Designation	Pickle Inlet			
Test Date	9/27/2018	9/27/2018	9/27/2018	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	78.5	83.0	86.5	82.7
Meter Pressure - Pm (in. Hg)	29.7	29.7	29.7	29.7
Measured Sample Volume (Vm)	47.0	47.6	47.8	47.5
Sample Volume (Vm-Std ft3)	45.5	45.7	45.6	45.6
Sample Volume (Vm-Std m3)	1.29	1.30	1.29	1.29
Condensate Volume (Vw-std)	10.184	10.326	9.760	10.090
Gas Density (Ps(std) lbs/ft3) (wet)	0.0694	0.0694	0.0696	0.0695
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	3.86	3.89	3.85	3.87
Total weight of sampled gas (m g lbs) (dry)	3.39	3.41	3.40	3.40
Stack Data				
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	26.9	26.8	26.9	26.9
Stack Gas Specific Gravity (Gs)	0.927	0.927	0.930	0.928
Percent Moisture (Bws)	18.29	18.41	17.63	18.11
Water Vapor Volume (fraction)	0.1829	0.1841	0.1763	0.1811
Pressure - Ps ("Hg)	29.6	29.6	29.6	29.6
Area of Stack (ft2)	5.6	5.6	5.6	5.6
Exhaust Gas Flowrate				
	Inlet flows not performed. Flows are assumed equal to the exhaust.			
Flowrate ft^3(Actual)	11,305	11,292	11,365	11,321
Flowrate ft^3 (Standard Wet)	10,123	10,085	10,180	10,129
Flowrate ft^3 (Standard Dry)	8,971	8,902	8,825	8,900
Flowrate m^3 (standard dry)	254	252	250	252
Total HCl Weight (ug)				
Total	3,607,757	3,535,137	3,006,794	3,383,229
Total HCl Concentration				
lb/1000 lb (wet)	2.058	2.003	1.721	1.928
lb/1000 lb (dry)	2.346	2.286	1.951	2.194
mg/dscm (dry)	2,801.1	2,728.8	2,329.0	2,619.6
PPM (dry)	1,794.1	1,733.6	1,469.9	1,665.9
Total HCl Emission Rate				
lb/ hr	94.12	90.99	76.99	87.37

Rev. 14.0
3-20-15 BC

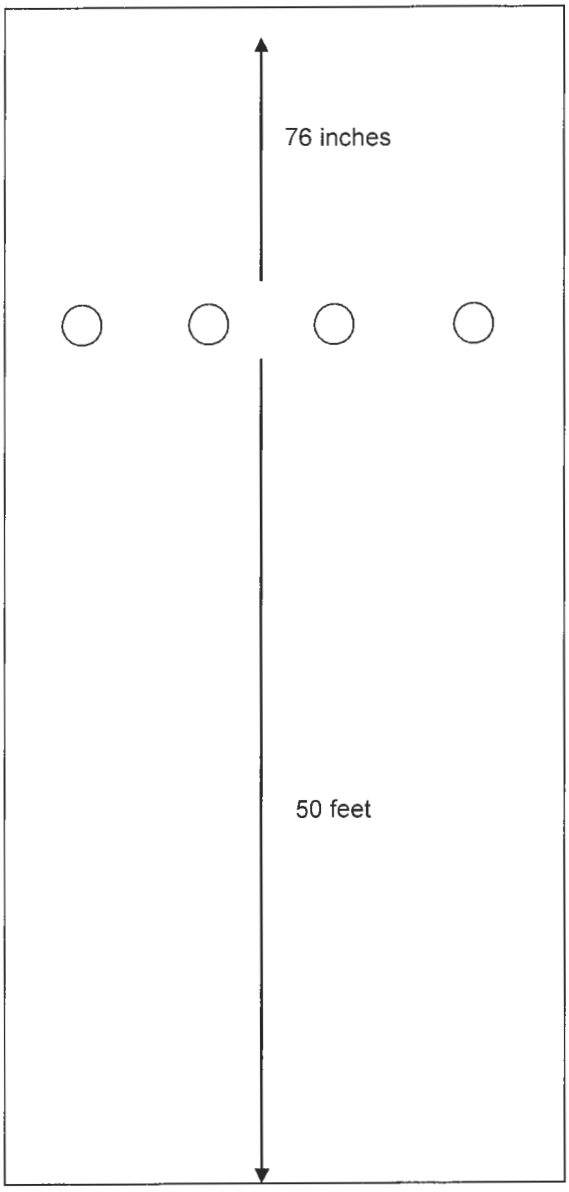
Table 3
Pickle Line Exhuast HCl Emission Rates

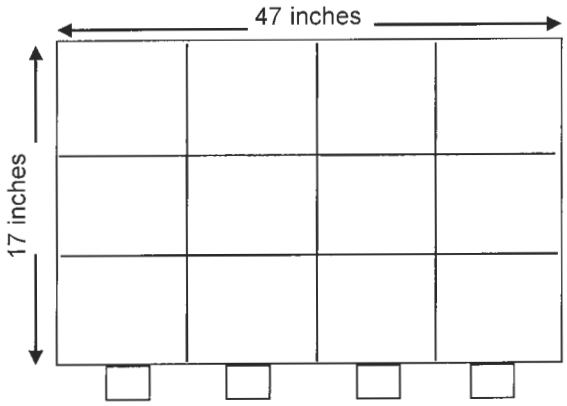
Company	**USS**			
Source Designation	**Pickle Out**			
Test Date	**9/27/2018**	**9/27/2018**	**9/27/2018**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	67.5	82.0	86.5	78.7
Meter Pressure - Pm (in. Hg)	29.6	29.6	29.6	29.6
Measured Sample Volume (Vm)	53.9	55.7	56.0	55.2
Sample Volume (Vm-Std ft3)	53.2	53.6	53.5	53.4
Sample Volume (Vm-Std m3)	1.51	1.52	1.51	1.51
Condensate Volume (Vw-std)	6.837	7.120	8.204	7.387
Gas Density (Ps(std) lbs/ft3) (wet)	0.0713	0.0712	0.0708	0.0711
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	4.29	4.33	4.37	4.33
Total weight of sampled gas (m g lbs) (dry)	3.97	3.99	3.98	3.98
Nozzle Size - An (sq. ft.)	0.000552	0.000552	0.000552	0.000552
Isokinetic Variation - I	99.5	100.9	101.6	100.7
Stack Data				
Average Stack Temperature - Ts (F)	120.3	121.8	120.2	120.8
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	27.6	27.6	27.4	27.5
Stack Gas Specific Gravity (Gs)	0.953	0.952	0.946	0.950
Percent Moisture (Bws)	11.38	11.73	13.30	12.14
Water Vapor Volume (fraction)	0.1138	0.1173	0.1330	0.1214
Pressure - Ps ("Hg)	29.4	29.4	29.4	29.4
Average Stack Velocity -Vs (ft/sec)	34.0	33.9	34.1	34.0
Area of Stack (ft2)	5.5	5.5	5.5	5.5
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	11,305	11,292	11,365	11,321
Flowrate ft^3 (Standard Wet)	10,123	10,085	10,180	10,129
Flowrate ft^3 (Standard Dry)	8,971	8,902	8,825	8,900
Flowrate m^3 (standard dry)	254	252	250	252
Total HCl Weight (ug)				
Total	8,849	9,067	9,938	9,285
Total HCl Concentration				
lb/1000 lb (wet)	0.005	0.005	0.005	0.005
lb/1000 lb (dry)	0.005	0.005	0.005	0.005
mg/dscm (dry)	5.9	6.0	6.6	6.1
PPM	3.9	4.0	4.3	4.1
Total HCl Emission Rate				
lb/ hr	0.20	0.20	0.22	0.21

Rev. 14.0
3-20-15 BC

Figures

BTEC Inc.





Not to Scale

Points	Distance "
1	2.8
2	8.5
3	14.2

Figure 1

Site: **No. 5 Pickle Line Exhaust** **US Steel** **Ecorse, Michigan**	**Sampling Date:** **September 27, 2018**	**BT Environmental Consulting, Inc.** **4949 Fernlee Ave** **Royal Oak, Michigan**

BTEC Inc.

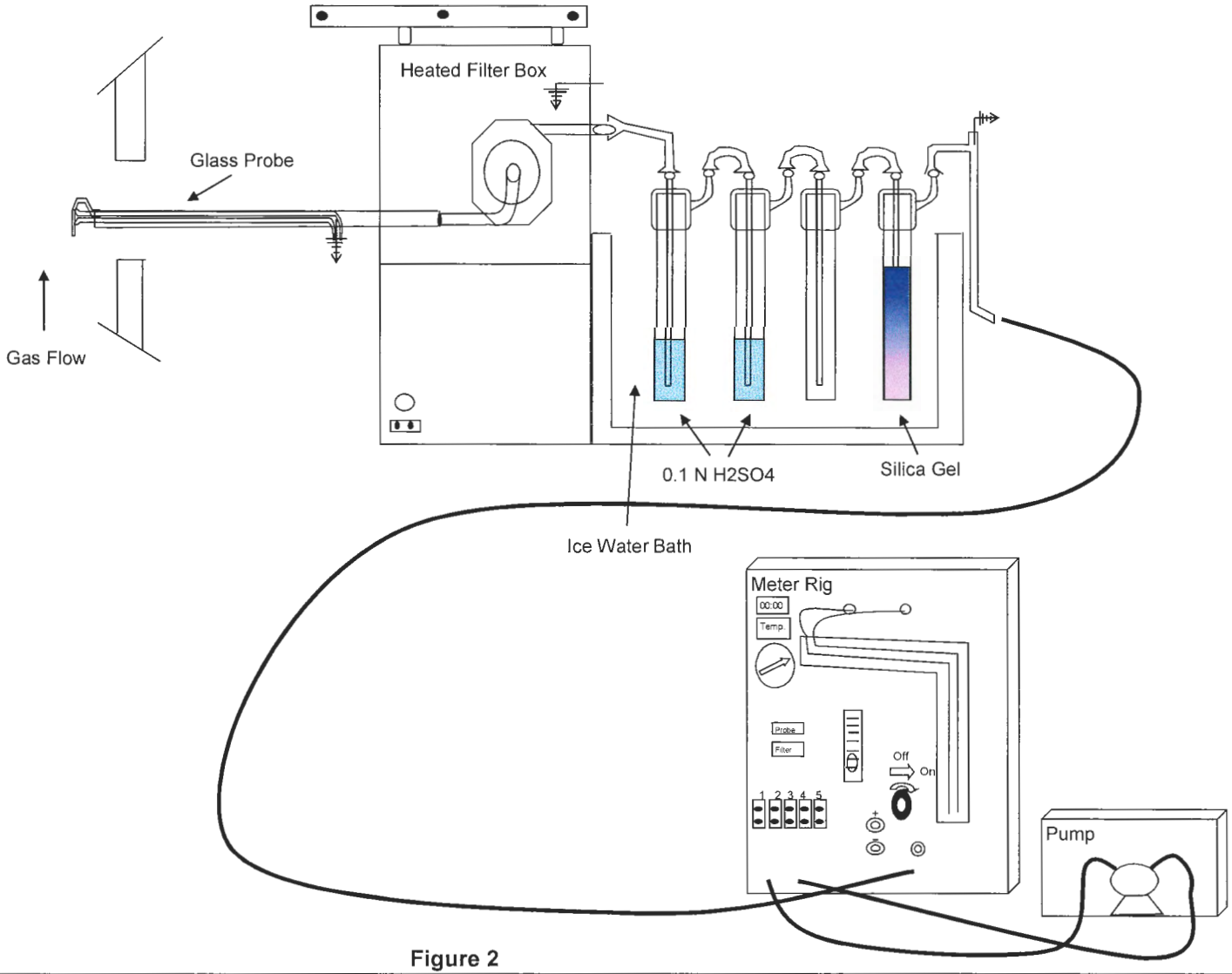


Figure 2

Site:	Sampling Date:	
USEPA Method 26A Sampling Train United States Steel Ecorse, MI	September 27, 2018	BT Environmental Consulting, Inc. 4949 Fernlee Ave Royal Oak, Michigan

20180158

Appendix A
Field and Computer Generated Raw Data and Field Notes

Company	US Steel				
Source Designation	Pickle Inlet				
Test Date	9/27/2018	**Assumed Moisture (Bws)**		**Barometric Pressure at Sea Level ("Hg)**	30.14
Test Number	1	**Condensate Volume (Vlc)**	198	**Site elevation (ft)**	540
Operator	MS	**Silica Gel Weight Gain (Vlc)**	18	**Port Elevation Above Ground(ft)**	10
Filter Number		**Nozzle Diameter (in.)**			
Barometric Pressure (Pb)	29.59	**Leak Rate Initial**	0.00 15"		
Stack Static Pressure (Pg)		**Leak Rate Final**	0.00 4"		
Stack Dimensions 1 (in.)	32	**Traverse points**			
***Stack Dimensions 2 (in.)**		**Pitot Corr. Factor (Cp)**			
Pitot Tube Number		**Meter Corr. Factor (Y)**	0.994		
Meter Number	MB9	**Fyrite Results (%)**			
Computer Number	21	**CO2**	0		
Delta ΔH@	1.86	**O2**	20.9		

Traverse Point Number	Sampling Time (Minutes) ø	Clock Time (24 hour)	Sampling Train Vac. ("Hg)	Stack Temp. (F) Ts	Velocity Pres. ("H2O) ΔPs	Desired Orifice Differential ("H2O) ΔH	Actual Orifice Differential ("H2O) ΔH	Sample Volume (cubic feet) Vm	Dry Gas Meter Temp. Inlet (F) Tm	Dry Gas Meter Temp. Outlet (F) Tm	Last Impinger Temperature (F)	Probe Temperature (F)	Filter Box Temperature (F)	Filter Box Exit Temperature (F)	Expected DGM (cubic feet)	Isokinetic Variation %
1	0	8:28	3				2.00	730.300	74	74	61					#VALUE!
2	5		3				2.00	734.10	77	74	56					#VALUE!
3	10		3				2.00	738.06	80	74	55					#VALUE!
4	15		3				2.00	742.03	82	74	60					#VALUE!
5	20		3				2.00	745.97	82	75	61					#VALUE!
6	25		3				2.00	749.88	83	75	64					#VALUE!
7	30		3				2.00	753.80	83	76	64					#VALUE!
8	35		3				2.00	757.70	84	76	65					#VALUE!
9	40		3				2.00	761.60	84	76	64					#VALUE!
10	45		3				2.00	765.55	84	76	61					#VALUE!
11	50		3				2.00	769.45	84	77	60					#VALUE!
12	55		3				2.00	773.36	84	77	60					#VALUE!
	60	9:28						777.26								
Average	60			#DIV/0!	#DIV/0!	#DIV/0!	2.00	46.960	81.8	75.3	60.9	#DIV/0!	#DIV/0!	#DIV/0!		#VALUE!
									78.54							

Rev. 14.0
3-20-15 BC

Company	US Steel				
Source Designation	Pickle Inlet				
Test Date	9/27/2018	**Assumed Moisture (Bws)**		**Barometric Pressure at Sea Level ("Hg)**	30.14
Test Number	2	**Condensate Volume (Vlc)**	208	**Site elevation (ft)**	540
Operator	MS	**Silica Gel Weight Gain (Vlc)**	11	**Port Elevation Above Ground(ft)**	10
Filter Number		**Nozzle Diameter (in.)**			
Barometric Pressure (Pb)	29.59	**Leak Rate Initial**	0.00 15"		
Stack Static Pressure (Pg)		**Leak Rate Final**	0.00 4"		
Stack Dimensions 1 (in.)	32	**Traverse points**			
***Stack Dimensions 2 (in.)**		**Pitot Corr. Factor (Cp)**			
Pitot Tube Number		**Meter Corr. Factor (Y)**	0.994		
Meter Number	MB9	**Fyrite Results (%)**			
Computer Number	21	**CO2**	0		
Delta ΔH@	1.86	**O2**	20.9		

Traverse Point Number	Sampling Time (Minutes) ø	Clock Time (24 hour)	Sampling Train Vac. ("Hg)	Stack Temp. (F) Ts	Velocity Pres. ("H2O) ΔPs	Desired Orifice Differential ("H2O) ΔH	Actual Orifice Differential ("H2O) ΔH	Sample Volume (cubic feet) Vm	Dry Gas Meter Temp. Inlet (F) Tm	Dry Gas Meter Temp. Outlet (F) Tm	Last Impinger Temperature (F)	Probe Temperature (F)	Filter Box Temperature (F)	Filter Box Exit Temperature (F)	Expected DGM (cubic feet)	Isokinetic Variation %
1	0	9:52	3				2.00	777.510	79	77	67					#VALUE!
2	5		3				2.00	781.40	82	78	63					#VALUE!
3	10		3				2.00	785.30	85	78	60					#VALUE!
4	15		3				2.00	789.30	86	79	60					#VALUE!
5	20		3				2.00	793.30	87	79	61					#VALUE!
6	25		3				2.00	797.30	87	80	62					#VALUE!
7	30		3				2.00	801.27	88	80	63					#VALUE!
8	35		3				2.00	805.20	88	81	64					#VALUE!
9	40		3				2.00	809.15	88	81	64					#VALUE!
10	45		3				2.00	813.17	88	81	65					#VALUE!
11	50		3				2.00	816.96	88	81	64					#VALUE!
12	55		3				2.00	821.02	89	81	62					#VALUE!
	60	10:52						825.13								
Average	60			#DIV/0!	#DIV/0!	#DIV/0!	2.00	47.620	86.3	79.7	62.9	#DIV/0!	#DIV/0!	#DIV/0!		#VALUE!
										82.96						

Rev. 14.0
3-20-15 BC

Company	US Steel				
Source Designation	Pickle Inlet				
Test Date	9/27/2018	**Assumed Moisture (Bws)**		**Barometric Pressure at Sea Level ("Hg)**	30.14
Test Number	3	**Condensate Volume (Vlc)**	198	**Site elevation (ft)**	540
Operator	MS	**Silica Gel Weight Gain (Vlc)**	9	**Port Elevation Above Ground(ft)**	10
Filter Number		**Nozzle Diameter (in.)**			
Barometric Pressure (Pb)	29.59	**Leak Rate Initial**	0.00 15"		
Stack Static Pressure (Pg)		**Leak Rate Final**	0.00 3"		
Stack Dimensions 1 (in.)	32	**Traverse points**			
***Stack Dimensions 2 (in.)**		**Pitot Corr. Factor (Cp)**			
Pitot Tube Number		**Meter Corr. Factor (Y)**	0.994		
Meter Number	MB9	**Fyrite Results (%)**			
Computer Number	21	**CO2**	0		
Delta ΔH@	1.86	**O2**	20.9		

Traverse Point Number	Sampling Time (Minutes) ø	Clock Time (24 hour)	Sampling Train Vac. ("Hg)	Stack Temp. (F) Ts	Velocity Pres. ("H2O) ΔPs	Desired Orifice Differential ("H2O) ΔH	Actual Orifice Differential ("H2O) ΔH	Sample Volume (cubic feet) Vm	Dry Gas Meter Temp. Inlet (F) Tm	Dry Gas Meter Temp. Outlet (F) Tm	Last Impinger Temperature (F)	Probe Temperature (F)	Filter Box Temperature (F)	Filter Box Exit Temperature (F)	Expected DGM (cubic feet)	Isokinetic Variation %
1	0	11:23	2				2.00	825.300	83	82	66					#VALUE!
2	5		2				2.00	829.25	86	82	62					#VALUE!
3	10		2				2.00	833.25	89	83	58					#VALUE!
4	15		2				2.00	837.20	89	83	59					#VALUE!
5	20		2				2.00	841.15	90	84	58					#VALUE!
6	25		2				2.00	845.06	90	84	58					#VALUE!
7	30		2				2.00	849.04	91	84	58					#VALUE!
8	35		2				2.00	853.00	91	84	58					#VALUE!
9	40		2				2.00	857.04	91	84	58					#VALUE!
10	45		2				2.00	861.05	91	84	59					#VALUE!
11	50		2				2.00	865.05	91	85	60					#VALUE!
12	55		2				2.00	869.06	91	85	60					#VALUE!
	60	12:23						873.07								
Average	60			#DIV/0!	#DIV/0!	#DIV/0!	2.00	47.770	89.4	83.7	59.5	#DIV/0!	#DIV/0!	#DIV/0!		#VALUE!
										86.54						

Rev. 14.0
3-20-15 BC

Company	USS				
Source Designation	Pickle Out				
Test Date	9/27/2018	**Assumed Moisture (Bws)**	13	**Barometric Pressure at Sea Level ("Hg)**	30.14
Test Number	1	**Condensate Volume (Vlc)**	131	**Site elevation (ft)**	580
Operator	DT / BD	**Silica Gel Weight Gain (Vlc)**	14	**Port Elevation Above Ground(ft)**	100
Filter Number		**Nozzle Diameter (in.)**	0.318		
Barometric Pressure (Pb)	29.46	**Leak Rate Initial**	.000 @ 15"		
Stack Static Pressure (Pg)	-0.19	**Leak Rate Final**	.000 @ 6"		
Stack Dimensions 1 (in.)	17	**Traverse points**	3 x 4		
***Stack Dimensions 2 (in.)**	47	**Pitot Corr. Factor (Cp)**	0.84		
Pitot Tube Number	3' C	**Meter Corr. Factor (Y)**	0.997		
Meter Number	7	**Fyrite Results (%)**			
Computer Number	13	**CO2**	0		
Delta ΔH@	1.77	**O2**	20.9		

Traverse Point Number	Sampling Time (Minutes) ø	Clock Time (24 hour)	Sampling Train Vac. ("Hg)	Stack Temp. (F) Ts	Velocity Pres. ("H2O) ΔPs	Desired Orifice Differential ("H2O) ΔH	Actual Orifice Differential ("H2O) ΔH	Sample Volume (cubic feet) Vm	Dry Gas Meter Temp. Inlet (F) Tm	Dry Gas Meter Temp. Outlet (F) Tm	Last Impinger Temperature (F)	Probe Temperature (F)	Filter Box Temperature (F)	Filter Box Exit Temperature (F)	Expected DGM (cubic feet)	Isokinetic Variation %
1	0	8:28	4	120	0.33	2.56	2.50	798.110	55	53	56	260	257		802.55	100.0
2	5		4	121	0.32	2.49	2.44	802.55	63	54	53	257	258		806.96	101.9
3	10		3.5	121	0.26	2.02	1.99	807.04	70	55	53	253	258		811.05	102.5
	15	8:43						811.15								
1	15	8:44	4.5	121	0.35	2.72	2.68	811.15	73	58	57	260	258		815.83	102.4
2	20		4.5	120	0.35	2.72	2.69	815.93	75	60	55	260	259		820.63	102.1
3	25		4	120	0.30	2.33	2.31	820.72	78	61	60	259	258		825.09	101.1
	30	8:59						825.13								
1	30	9:01	4.5	120	0.36	2.80	2.78	825.13	73	63	60	262	259		829.90	99.8
2	35		4	119	0.33	2.56	2.56	829.88	79	64	58	258	256		834.48	100.8
3	40		4	120	0.30	2.33	2.33	834.51	81	66	58	258	258		838.91	101.2
	45	9:16						838.96								
1	45	9:18	4	120	0.32	2.49	2.48	838.96	76	67	60	260	258		843.49	100.6
2	50		4	121	0.31	2.41	2.41	843.51	80	67	57	261	258		847.98	98.8
3	55		4	121	0.24	1.87	1.87	847.92	82	68	59	261	260		851.86	102.9
	60	9:33						851.98								
Average	60			120.3	0.31	2.44	2.42	53.870	73.8	61.3	57.2	259.1	258.1	#DIV/0!		101.2
								67.54								

Rev. 14.0
3-20-15 BC

Company	USS				
Source Designation	Pickle Out				
Test Date	9/27/2018	**Assumed Moisture (Bws)**	13	**Barometric Pressure at Sea Level ("Hg)**	30.14
Test Number	2	**Condensate Volume (Vlc)**	136	**Site elevation (ft)**	580
Operator	DT / BD	**Silica Gel Weight Gain (Vlc)**	15	**Port Elevation Above Ground(ft)**	100
Filter Number		**Nozzle Diameter (in.)**	0.318		
Barometric Pressure (Pb)	29.46	**Leak Rate Initial**	.000 @ 15"		
Stack Static Pressure (Pg)	-0.19	**Leak Rate Final**	.000 @ 6"		
Stack Dimensions 1 (in.)	17	**Traverse points**	3 x 4		
***Stack Dimensions 2 (in.)**	47	**Pitot Corr. Factor (Cp)**	0.84		
Pitot Tube Number	3' C	**Meter Corr. Factor (Y)**	0.997		
Meter Number	7	**Fyrite Results (%)**			
Computer Number	13	**CO2**	0		
Delta ΔH@	1.77	**O2**	20.9		

Traverse Point Number	Sampling Time (Minutes) ø	Clock Time (24 hour)	Sampling Train Vac. ("Hg)	Stack Temp. (F) Ts	Velocity Pres. ("H2O) ΔPs	Desired Orifice Differential ("H2O) ΔH	Actual Orifice Differential ("H2O) ΔH	Sample Volume (cubic feet) Vm	Dry Gas Meter Temp. Inlet (F) Tm	Dry Gas Meter Temp. Outlet (F) Tm	Last Impinger Temperature (F)	Probe Temperature (F)	Filter Box Temperature (F)	Filter Box Exit Temperature (F)	Expected DGM (cubic feet)	Isokinetic Variation %
1	0	9:52	2	120	0.32	2.55	2.52	851.850	73	70	59	259	258		856.37	101.3
2	5		2	121	0.32	2.55	2.52	856.43	84	73	50	255	254		861.01	97.4
3	10		2	121	0.27	2.15	2.14	860.89	87	80	48	256	258		865.14	102.4
	15	10:07						865.24								
1	15	10:12	2	122	0.35	2.79	2.77	865.24	81	75	52	261	255		870.02	102.0
2	20		2	123	0.34	2.71	2.70	870.11	90	77	52	256	256		874.87	101.2
3	25		2	122	0.30	2.39	2.38	874.92	90	77	58	244	260		879.39	104.5
	30	10:27						879.59								
1	30	10:31	2	123	0.34	2.71	2.70	879.59	82	78	57	261	258		884.32	102.5
2	35		3	123	0.31	2.47	2.46	884.43	90	79	53	249	260		888.98	105.5
3	40		3	123	0.29	2.31	2.31	889.23	91	79	55	245	260		893.64	108.7
	45	10:46						894.02								
1	45	10:50	2	121	0.32	2.55	2.55	894.02	86	80	57	259	257		898.64	100.8
2	50		2	121	0.29	2.31	2.31	898.67	91	81	55	248	260		903.09	101.1
3	55		2	122	0.29	2.31	2.31	903.14	93	81	55	246	254		907.57	99.7
	60	11:05						907.55								
Average	60			121.8	0.31	2.48	2.47	55.700	86.5	77.5	54.3	253.3	257.5	#DIV/0!		102.3
									82.00							

Rev. 14.0
3-20-15 BC

Company	USS				
Source Designation	Pickle Out				
Test Date	9/27/2018	**Assumed Moisture (Bws)**	13	**Barometric Pressure at Sea Level ("Hg)**	30.14
Test Number	3	**Condensate Volume (Vlc)**	160	**Site elevation (ft)**	580
Operator	DT / BD	**Silica Gel Weight Gain (Vlc)**	14	**Port Elevation Above Ground(ft)**	100
Filter Number		**Nozzle Diameter (in.)**	0.318		
Barometric Pressure (Pb)	29.46	**Leak Rate Initial**	.001 @ 15"		
Stack Static Pressure (Pg)	-0.19	**Leak Rate Final**	.000 @ 6"		
Stack Dimensions 1 (in.)	17	**Traverse points**	3 x 4		
***Stack Dimensions 2 (in.)**	47	**Pitot Corr. Factor (Cp)**	0.84		
Pitot Tube Number	3' C	**Meter Corr. Factor (Y)**	0.997		
Meter Number	7	**Fyrite Results (%)**			
Computer Number	13	**CO2**	0		
Delta ΔH@	1.77	**O2**	20.9		

Traverse Point Number	Sampling Time (Minutes) ø	Clock Time (24 hour)	Sampling Train Vac. ("Hg)	Stack Temp. (F) Ts	Velocity Pres. ("H2O) ΔPs	Desired Orifice Differential ("H2O) ΔH	Actual Orifice Differential ("H2O) ΔH	Sample Volume (cubic feet) Vm	Dry Gas Meter Temp. Inlet (F) Tm	Dry Gas Meter Temp. Outlet (F) Tm	Last Impinger Temperature (F)	Probe Temperature (F)	Filter Box Temperature (F)	Filter Box Exit Temperature (F)	Expected DGM (cubic feet)	Isokinetic Variation %
1	0	11:23	4	120	0.32	2.58	2.55	907.760	82	81	66	262	257		912.37	100.5
2	5		4	117	0.31	2.50	2.49	912.39	88	82	55	259	257		916.97	101.2
3	10		4	118	0.27	2.17	2.18	917.02	91	82	53	261	260		921.30	103.0
	15	11:38						921.43								
1	15	11:41	4	118	0.35	2.82	2.82	921.43	82	87	57	253	254		926.29	100.2
2	20		4	120	0.34	2.74	2.74	926.29	92	83	55	255	258		931.09	101.1
3	25		4	120	0.30	2.42	2.42	931.14	93	83	55	260	257		935.66	102.3
	30	11:56						935.76								
1	30	11:59	4	122	0.35	2.82	2.82	935.76	87	83	59	260	259		940.60	101.9
2	35		4	121	0.33	2.66	2.66	940.69	93	83	57	255	257		945.42	102.1
3	40		4	121	0.30	2.42	2.42	945.52	94	84	57	257	260		950.04	101.3
	45	12:14						950.10								
1	45	12:17	4	121	0.35	2.82	2.82	950.10	88	84	61	259	258		954.96	99.8
2	50		4	122	0.31	2.50	2.50	954.94	93	84	58	250	260		959.53	101.9
3	55		4	122	0.25	2.01	2.00	959.61	94	84	60	248	259		963.73	101.1
	60	12:32						963.78								
Average	60			120.2	0.32	2.54	2.54	56.020	89.8	83.3	57.8	256.6	258.0	#DIV/0!		101.4
									86.54							

Rev. 14.0
3-20-15 BC

BTEC Inc. Field Sampling Data Sheet

Company US Steel
Source Pickle Inlet
Test Date 9-27-18
Test Method 26A
Test Number 1
Operators MS
Filter Number
Barometric Pressure (Pbar) 30.14
Site Elevation (ft) 540
Port Height Above Ground (ft) 10

Static Pressure (Ps)
Stack Diameter (in.) 32
Pitot Tube Number
Meter Number M89
Computer Number 21
Delta ΔH @ 1.86
Assumed Moisture (Bws)
Condensate Volume 198
Silica Gel Weight Gain 18
Nozzle Diameter (in.)

Leak Rate Initial 0.000 @ 15"
Leak Rate Final 0.000 @ 4"
Traverse Points
Pitot Tube Corr. Factor (Cp)
Meter Corr. Factor (Y) 0.994
Fyrite Results (%)
CO2 0
O2 20.9

Source Diagram (Sketch)

Weather conditions:

Traverse Point Number	Sampling Time Minutes	Clock Time (24 hour)	Sample Train Vacuum ("Hg)	Stack Temp (°F) Ts	Velocity Pres. ("H2O) ΔPs	Orifice Differential ("H2O) ΔH	Sample Volume (Vm) (Cubic Feet)	Dry Gas Meter Temp Inlet (°F) Tm	Dry Gas Meter Temp Outlet (°F) Tm	Last Impinger Temp (°F)	Probe Temp. (°F)	Filter Box Temp. (°F)	Filter Box Exit Temp. (°F)	CPM Filter (°F)
1	0	8:28	3			2.0	730.30	74	74	61				
2	5		3			2.0	734.10	77	74	56				
3	10		3			2.0	738.06	80	74	55				
4	15		3			2.0	742.03	82	74	60				
5	20		3			2.0	745.97	72	78	61				
6	25		3			2.0	749.88	83	75	64				
7	30		3			2.0	753.80	83	76	64				
8	35		3			2.0	757.70	84	76	65				
9	40		3			2.0	761.60	84	76	64				
10	45		3			2.0	765.55	84	76	61				
11	50		3			2.0	769.45	84	77	60				
12	55		3			2.0	773.36	84	77	60				
	60	9:29					777.26							

12

BTEC Inc. Field Sampling Data Sheet

Company US Steel
Source Pickle Inlet
Test Date 9-27-18
Test Method 26.4
Test Number 2
Operators MS
Filter Number
Barometric Pressure (Pbar) 30.14
Site Elevation (ft) 540
Port Height Above Ground (ft) 10

Static Pressure (Ps)
Stack Diameter (in.) 32
Pitot Tube Number
Meter Number MB9
Computer Number 21
Delta ΔH @ 1.84
Assumed Moisture (Bws) .208
Condensate Volume 11
Silica Gel Weight Gain
Nozzle Diameter (in.)

Leak Rate Initial 0.000 @ 15"
Leak Rate Final 0.00 @ 4"
Traverse Points
Pitot Tube Corr. Factor (Cp)
Meter Corr. Factor (Y) 0.994
Fyrite Results (%)
CO2 0
O2 20.5

Source Diagram (Sketch)

Weather conditions:

Traverse Point Number	Sampling Time Minutes	Clock Time (24 hour)	Sample Train Vacuum ("Hg)	Stack Temp (°F) Ts	Velocity Pres. ("H2O) ΔPs	Orifice Differential ("H2O) ΔH	Sample Volume (Vm) (Cubic Feet)	Dry Gas Meter Temp Inlet (°F) Tm	Dry Gas Meter Temp Outlet (°F) Tm	Last Impinger Temp (°F)	Probe Temp. (°F)	Filter Box Temp. (°F)	Filter Box Exit Temp. (°F)	CPM Filter (°F)
1	0	9:52	3			2.0	777.51	79	77	67				
2	5		3			2.0	781.40	82	78	63				
3	10		3			2.0	785.30	85	78	60				
4	15		3			2.0	789.30	86	79	60				
5	20		3			2.0	793.3	87	79	61				
6	25		3			2.0	797.3	87	80	62				
7	30		3			2.0	801.27	88	80	63				
8	35		3			2.0	805.20	88	81	64				
9	40		3			2.0	809.15	88	81	64				
10	45		3			2.0	813.17	88	81	65				
11	50		3			2.0	816.96	88	81	64				
12	55		3			2.0	821.02	89	81	62				
	60						825.13							

r3

BTEC Inc. Field Sampling Data Sheet

Company US Steel
Source Pickle Inlet
Test Date 9-27-18
Test Method 26A
Test Number 3
Operators MS
Filter Number
Barometric Pressure (Pbar) 30.14
Site Elevation (ft) 540
Port Height Above Ground (ft) 10

Static Pressure (Ps)
Stack Diameter (in.)
Pitot Tube Number
Meter Number MB9
Computer Number 21
Delta ΔH @ 1.86
Assumed Moisture (Bws)
Condensate Volume 198
Silica Gel Weight Gain 9
Nozzle Diameter (in.)

Leak Rate Initial 0.000 @ 15"
Leak Rate Final 0.000 @ 3"
Traverse Points
Pitot Tube Corr. Factor (Cp)
Meter Corr. Factor (Y) 0.994
Fyrite Results (%)
CO2 0
O2 20.9

Source Diagram (Sketch)

Weather conditions:

Traverse Point Number	Sampling Time Minutes	Clock Time (24 hour)	Sample Train Vacuum ("Hg)	Stack Temp (°F) Ts	Velocity Pres. ("H2O) ΔPs	Orifice Differential ("H2O) ΔH	Sample Volume (Vm) (Cubic Feet)	Dry Gas Meter Temp Inlet (°F) Tm	Dry Gas Meter Temp Outlet (°F) Tm	Last Impinger Temp (°F)	Probe Temp. (°F)	Filter Box Temp. (°F)	Filter Box Exit Temp. (°F)	CPM Filter (°F)
1	0	11:23	2			2.0	825.30	83	82	66				
2	5		2			2.0	829.25	86	82	62				
3	10		2			2.0	833.25	87	83	58				
4	15		2			2.0	837.20	89	83	59				
5	20		2			2.0	841.15	90	84	58				
6	25		2			2.0	845.06	90	84	59				
7	30		2			2.0	849.04	91	84	58				
8	35		2			2.0	853.00	91	84	58				
9	40		2			2.0	857.04	91	84	58				
10	45		2			2.0	861.05	91	84	59				
11	50		2			2.0	865.09	91	85	60				
12	55		2			2.0	869.06	91	85	60				
	60	12:23					873.07							

C1
Inlet

BTEC Inc.
Sample Recovery and Data Integrity Form

Plant USS
Sampling Location Pickle Inlet
Recovered By MY / MS
Sample Date 9-27-18
Run Number 1
Recovery Date 9-27-18

EXHAUST GAS COMPOSITION

Method used: (circle one)
Fyrite Orsat

% CO2	% O2	% CO	% N2

MOISTURE

Impingers	1st	2nd	3rd	4th	5th	6th	Silica Gel
Final Vol/Wt	933	781	664				976
Initial Vol/Wt	769	756	635				958
Net Vol/Wt	164	25	9				18

Total Moisture Gain: Impingers 198 Silica Gel 18 Total 216

Description of Silica Gel
Description of Impinger Solution

RECOVERED SAMPLE

Filter Container # NA
Container Sealed ? NA
Description of Particulate on Filter NA

Backhalf Rinse Container # ✓
Liquid Level Marked ? ✓
Fronthalf Rinse Container #
Liquid Level Marked ?

Samples Stored and Locked ?
Remarks

BLANKS

Blank Filter Container #				
Blank FH Rinse Container #				
Blank BH Rinse Container #				
Blank Reagent Container #'s				

Date of Laboratory Custody
Remarks

Revision 1.0
9-20-2011 - DLC

R2
Inlet

BTEC Inc.
Sample Recovery and Data Integrity Form

Plant USS | Sample Date 9-27-18
Sampling Location Pickle Inlet | Run Number 2
Recovered By MY/MS | Recovery Date 9-27-18

EXHAUST GAS COMPOSITION

Method used: (circle one)
Fyrite Orsat

% CO2	% O2	% CO	% N2

MOISTURE

Impingers	1st	2nd	3rd	4th	5th	6th	Silica Gel
Final Vol/Wt	948	783	662				986
Initial Vol/Wt	769	760	656				975
Net Vol/Wt	179	23	6				11

Total Moisture Gain: Impingers 208 Silica Gel 11 Total 219

Description of Silica Gel ~ 90% spent
Description of Impinger Solution Clear

RECOVERED SAMPLE

Filter Container # NA | Container Sealed ? NA
Description of Particulate on Filter NA

Backhalf Rinse Container # ✓ | Liquid Level Marked ? ✓
Fronthalf Rinse Container # | Liquid Level Marked ?

Samples Stored and Locked ?
Remarks

BLANKS

Blank Filter Container #				
Blank FH Rinse Container #				
Blank BH Rinse Container #				
Blank Reagent Container #'s				

Date of Laboratory Custody
Remarks

Revision 1.0
9-20-2011 - DLC

BTEC Inc.
Sample Recovery and Data Integrity Form

Plant US Steel
Sampling Location Pickle Inlet
Recovered By MS / MY
Sample Date 9-27-18
Run Number 3
Recovery Date 9.27.18

EXHAUST GAS COMPOSITION

Method used: (circle one)
Fyrite Orsat

% CO2	% O2	% CO	% N2

MOISTURE

Impingers	1st	2nd	3rd	4th	5th	6th	Silica Gel
Final Vol/Wt	936	773	663				940
Initial Vol/Wt	762	755	657				931
Net Vol/Wt	174	18	6				9

Total Moisture Gain: Impingers 198 Silica Gel 9 Total 207

Description of Silica Gel ~207. spent
Description of Impinger Solution clear

RECOVERED SAMPLE

Filter Container # NA
Container Sealed ? NA
Description of Particulate on Filter NS

Backhalf Rinse Container # ✓
Liquid Level Marked ? ✓
Fronthalf Rinse Container #
Liquid Level Marked ?

Samples Stored and Locked ?
Remarks

BLANKS

Blank Filter Container #				
Blank FH Rinse Container #				
Blank BH Rinse Container #				
Blank Reagent Container #'s				

Date of Laboratory Custody
Remarks

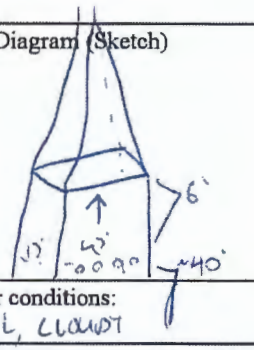
Revision 1.0
9-20-2011 - DLC

BTEC Inc. Field Sampling Data Sheet

R1 OUTLET M26A

Company	USS	Static Pressure (Ps)	-.19	Leak Rate Initial	.000 @ 15"
Source	PICKLE OUT	Stack Diameter (in.)	17x47	Leak Rate Final	.000 @ 6"
Test Date	9-27-18	Pitot Tube Number	3'C	Traverse Points	~~4x3~~ 3,4
Test Method	26A	Meter Number	7	Pitot Tube Corr. Factor (Cp)	.84
Test Number	1	Computer Number	13	Meter Corr. Factor (Y)	.997
Operators	DT / BD	Delta ΔH @	1.77	Fyrite Results (%)	
Filter Number		Assumed Moisture (Bws)	~13	CO2	0
Barometric Pressure (Pbar)	30.14	Condensate Volume	131	O2	20.9
Site Elevation (ft)	~580	Silica Gel Weight Gain	14		
Port Height Above Ground (ft)	~100	Nozzle Diameter (in.)	.318		

Source Diagram (Sketch)



Weather conditions: COOL, CLOUDY

Traverse Point Number	Sampling Time Minutes	Clock Time (24 hour)	Sample Train Vacuum ("Hg)	Stack Temp (°F) Ts	Velocity Pres. ("H2O) ΔPs	Orifice Differential ("H2O) ΔH	Sample Volume (Vm) (Cubic Feet)	Dry Gas Meter Temp Inlet (°F) Tm	Dry Gas Meter Temp Outlet (°F) Tm	Last Impinger Temp (°F)	Probe Temp. (°F)	Filter Box Temp. (°F)	Filter Box Exit Temp. (°F)	CPM Filter (°F)
1	0	8:28	4	120	.33	2.50	798.110	55	53	56	260	257		
2	5		4	121	.32	2.44	802.55	63	54	53	257	258		
3	10		3.5	121	.26	1.99	807.04	70	55	53	253	258		
	15	8:43					811.15							
1	15	8:44	4.5	121	.35	2.68	811.15	73	58	57	260	258		
2	20		4.5	120	.35	2.69	815.93	75	60	55	260	259		
3	25		4	120	.30	2.31	820.72	78	61	60	259	258		
	30	8:59					825.13							
1	30	9:01	4.5	120	.36	2.78	825.13	73	63	60	262	259		
2	35		4	119	.33	2.56	829.88	79	64	58	258	256		
3	40		4	120	.30	2.33	834.51	81	66	58	258	258		
	45	9:16					838.96							
1	45	9:18	4	120	.32	2.48	838.96	76	67	60	260	258		
2	50		4	121	.31	2.41	843.51	80	67	57	261	258		
3	55		4	121	.24	1.87	847.92	82	68	59	261	260		
	60	9:33					851.98							

BTEC Inc. Field Sampling Data Sheet

R2
OUTLET
M26A

Company	USS	Static Pressure (Ps)	-.19	Leak Rate Initial	.000@15"
Source	PICKLE OUT	Stack Diameter (in.)	17x47	Leak Rate Final	.000@6"
Test Date	9-27-18	Pitot Tube Number	3'L	Traverse Points	3x4
Test Method	26A	Meter Number	7	Pitot Tube Corr. Factor (Cp)	.84
Test Number	2	Computer Number	13	Meter Corr. Factor (Y)	.967
Operators	DT / DD	Delta ΔH @	1.77	Fyrite Results (%)	
Filter Number		Assumed Moisture (Bws)	~13	CO2	0
Barometric Pressure (Pbar)	30.14	Condensate Volume	136	O2	20.9
Site Elevation (ft)	~500	Silica Gel Weight Gain	15		
Port Height Above Ground (ft)	~100	Nozzle Diameter (in.)	.318		

Source Diagram (Sketch)

SEE R1

Weather conditions:
COOL, CLOUDY

Traverse Point Number	Sampling Time Minutes	Clock Time (24 hour)	Sample Train Vacuum ("Hg)	Stack Temp (°F) Ts	Velocity Pres. ("H2O) ΔPs	Orifice Differential ("H2O) ΔH	Sample Volume (Vm) (Cubic Feet)	Dry Gas Meter Temp Inlet (°F) Tm	Dry Gas Meter Temp Outlet (°F) Tm	Last Impinger Temp (°F)	Probe Temp. (°F)	Filter Box Temp. (°F)	Filter Box Exit Temp. (°F)	CPM Filter (°F)
1	0	9:52	2	120	0.32	2.52	851.850	73	70	59	259	258		
2	5		2	121	0.32	2.52	856.43	84	73	50	255	254		
3	10		2	121	0.27	2.14	860.89	87	80	48	256	258		
	15	10:07	~~2~~	~~122~~	~~0.35~~	~~2.77~~	865.24	~~81~~	~~75~~	~~52~~	~~261~~	~~255~~		
1	15	10:12	2	122	0.35	2.77	865.24	81	75	52	261	255		
2	20		2	123	0.34	~~2.70~~	870.11	90	77	52	256	256		
3	25		2	122	0.30	2.38	874.92	90	77	58	244	260		
	30	10:27					879.59							
1	30	10:33	2	123	0.34	~~2.70~~ 2.75	879.59	82	78	57	261	258		
2	35		3	123	~~0.34~~ 0.31	~~2.70~~ 2.46	884.43	90	79	53	249	260		
3	40		3	123	0.29	2.31	889.23	91	79	55	245	260		
	45	10:46					894.02							
1	45	~~10:58~~ 10:50	2	121	0.32	2.55	894.02	86	80	57	259	257		
2	50		2	121	0.29	2.31	898.67	91	81	55	248	260		
3	55		2	122	0.29	2.31	903.14	93	81	55	246	254		
	60	~~11:05~~ 11:05					907.55							

BTEC Inc. Field Sampling Data Sheet

R3 Outlet 26A

Company	USS	Static Pressure (Ps)	-.19	Leak Rate Initial	.001 @ 15"
Source	Pickle - out	Stack Diameter (in.)	17x47	Leak Rate Final	.000 @ 6"
Test Date	9/27/18	Pitot Tube Number	3'C	Traverse Points	3X4
Test Method	26A	Meter Number	7	Pitot Tube Corr. Factor (Cp)	.84
Test Number	3	Computer Number	13	Meter Corr. Factor (Y)	.997
Operators	DT/BD	Delta ΔH @	1.77	Fyrite Results (%)	
Filter Number		Assumed Moisture (Bws)	~13	CO2	0
Barometric Pressure (Pbar)	30.14	Condensate Volume	160	O2	20.9
Site Elevation (ft)	~580	Silica Gel Weight Gain	14		
Port Height Above Ground (ft)	~100	Nozzle Diameter (in.)	.318		

Source Diagram (Sketch)

See Run #1

Weather conditions: Cool & Cloudy

Traverse Point Number	Sampling Time Minutes	Clock Time (24 hour)	Sample Train Vacuum ("Hg)	Stack Temp (°F) Ts	Velocity Pres. ("H2O) ΔPs	Orifice Differential ("H2O) ΔH	Sample Volume (Vm) (Cubic Feet)	Dry Gas Meter Temp Inlet (°F) Tm	Dry Gas Meter Temp Outlet (°F) Tm	Last Impinger Temp (°F)	Probe Temp. (°F)	Filter Box Temp. (°F)	Filter Box Exit Temp. (°F)	CPM Filter (°F)
1	0	10:23	4	120	0.32	2.55	907.76	82	81	66	262	257		
2	5		4	118	0.31	2.49	912.39	88	82	55	259	257		
3	10		4	118	0.27	2.18	917.02	91	82	53	261	260		
	15	10:38					921.43							
1	15	11:41	4	118	0.35	2.82	921.43	82	87	57	253	254		
2	20		4	120	0.34	2.74	926.29	92	83	55	255	258		
3	25		4	120	0.30	2.42	931.14	93	83	55	260	257		
	30	11:56					935.76							
1	30	11:59	4	122	0.35	2.82	935.76	87	83	59	260	259		
2	35		4	121	0.33	2.66	940.69	93	83	57	255	257		
3	40	12:14	4	121	0.30	2.42	945.52	94	84	57	257	260		
	45	12:17 ~~12:11~~	4				950.10							
1	45		4	121	0.35	2.82	950.10	88	84	61	259	258		
2	50		4	122	0.31	2.50	954.94	93	84	58	250	260		
3	~~12:55~~		4	122	.25	2.00	~~963.78~~ 961.94	94	84	60	248	259		
	60	12:32					967.78							

R1
OUTLET
M26A

BTEC Inc.
Sample Recovery and Data Integrity Form

Plant USS
Sampling Location DIGLW OUT
Recovered By DT
Sample Date 9-27-18
Run Number 1
Recovery Date 9-27-18

EXHAUST GAS COMPOSITION

Method used: (circle one)
Fyrite Orsat

% CO2	% O2	% CO	% N2

MOISTURE

Impingers	1st	2nd	3rd	4th	5th	6th	Silica Gel
Final Vol/Wt	831	786	685				983
Initial Vol/Wt	742	751	678				969
Net Vol/Wt	89	35	7				14

Total Moisture Gain: Impingers 131 Silica Gel 14 Total 145

Description of Silica Gel 40% SPENT
Description of Impinger Solution CLEAR

RECOVERED SAMPLE

Filter Container # _____ Container Sealed ? _____
Description of Particulate on Filter _____

Backhalf Rinse Container # _____ Liquid Level Marked ? _____
Fronthalf Rinse Container # _____ Liquid Level Marked ? _____

Samples Stored and Locked ? _____
Remarks _____

BLANKS

Blank Filter Container #				
Blank FH Rinse Container #				
Blank BH Rinse Container #				
Blank Reagent Container #'s				

Date of Laboratory Custody _____
Remarks _____

Revision 1.0
9-20-2011 - DLC

R2
OUTLET
M26A

BTEC Inc.
Sample Recovery and Data Integrity Form

Plant USS
Sampling Location PICKLE OUT
Recovered By DT
Sample Date 9-27-18
Run Number 2
Recovery Date 9-27-18

EXHAUST GAS COMPOSITION

Method used: (circle one)
Fyrite Orsat

% CO2	% O2	% CO	% N2

MOISTURE

Impingers	1st	2nd	3rd	4th	5th	6th	Silica Gel
Final Vol/Wt	873	780	642				961
Initial Vol/Wt	778	747	634				946
Net Vol/Wt	95	33	8				15

Total Moisture Gain: Impingers 136 Silica Gel 15 Total 151

Description of Silica Gel 40% SPENT
Description of Impinger Solution CLEAR

RECOVERED SAMPLE

Filter Container # _____ Container Sealed ? _____
Description of Particulate on Filter _____

Backhalf Rinse Container # _____ Liquid Level Marked ? _____
Fronthalf Rinse Container # _____ Liquid Level Marked ? _____

Samples Stored and Locked ? _____
Remarks _____

BLANKS

Blank Filter Container #				
Blank FH Rinse Container #				
Blank BH Rinse Container #				
Blank Reagent Container #'s				

Date of Laboratory Custody _____
Remarks _____

Revision 1.0
9-20-2011 - DLC

R3
outlet
n36A

BTEC Inc.
Sample Recovery and Data Integrity Form

Plant USS
Sampling Location PICKLE OUT
Recovered By DI
Sample Date 9-27-18
Run Number 3
Recovery Date 9-27-18

EXHAUST GAS COMPOSITION

Method used: (circle one)
Fyrite Orsat

% CO2	% O2	% CO	% N2

MOISTURE

Impingers	1st	2nd	3rd	4th	5th	6th	Silica Gel
Final Vol/Wt	825	768	665				966
Initial Vol/Wt	719	728	651				951
Net Vol/Wt	106	40	14				15

Total Moisture Gain: Impingers 160 Silica Gel 15 Total 175

Description of Silica Gel 30% SPENT
Description of Impinger Solution CLEAR

RECOVERED SAMPLE

Filter Container # _____ Container Sealed ? _____
Description of Particulate on Filter _____

Backhalf Rinse Container # _____ Liquid Level Marked ? _____
Fronthalf Rinse Container # _____ Liquid Level Marked ? _____

Samples Stored and Locked ? _____
Remarks _____

BLANKS

Blank Filter Container #				
Blank FH Rinse Container #				
Blank BH Rinse Container #				
Blank Reagent Container #'s				

Date of Laboratory Custody _____
Remarks _____

Revision 1.0
9-20-2011 - DLC

Flows
PICKLE OUT

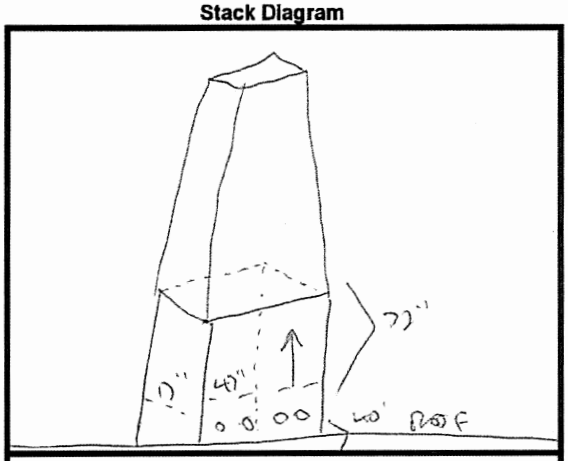
BTEC Inc.

USEPA METHOD 2 GAS VELOCITY TRAVERSE
AND VOLUMETRIC FLOWRATE DATA SHEET

Client USS
Sampling Location PICKLE OUTLET
Run Number: 1
Date 9-26-18 Time 14:30
Port and Stack _____ in.
Port 8 in.
Nipple Protrusion _____ in.
Stack Diameter 17x47 in.
Bar. Pressure 30.11 in Hg
Static Pressure -.19 in H_2O
Moisture % ~13
% CO2 0 % CO 0
% O2 20.9 % N2 79.1

Operators DT / BD
Pitot Tube number 3'C
Pitot Tube factor, Cp .84

Stack Diagram



Weather conditions:
WARM, CLEAR

Site Elevation ~580 ft.
Port Height ~100 ft.
Upstream ~72 in.
Downstream ~40' ~~in.~~

% of Stack Diameter	Point Distance (in.)	Traverse Point Number	Velocity Head (ΔP) in H2O	Stack Temp °F	Null Angle (zero ΔP angle)	Flow Angle Ø (90° from null angle)
	2.8	1	.34	120	0	
	8.5	2	.33	120	0	
	14.2	3	.26	121	0	
		1	.34	120	0	
		2	.34	120	0	
		3	.30	121	0	
		1	.35	121	0	
		2	.34	120	0	
		3	.30	120	0	
		1	.32	121	0	
		2	.31	121	0	
		3	.25	121	0	

Revision 2.0
11-8-2012 - BC

Appendix B
Calibration Data

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
4) Record data and information in the **GREEN** cells, YELLOW cells are calculated.

DATE:	4/20/2018	METER SERIAL #:	1695452	BAROMETRIC PRESSURE (in Hg):	INITIAL 30.48 / FINAL 30.48 / AVG (P_{bar}) 30.48
METER PART #:	MB9	CRITICAL ORIFICE SET SERIAL #:	1447		

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH ($in H_2O$)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
32	1	0.8305	15	633.250	639.790	6.540	61	65	68	61	62	64	6.00	4.1	6.7810	6.6560	0.982		1.94
	2	0.8605	15	639.790	646.325	6.535	61	68	69	62	62	65.25	6.00	4.1	6.7596	6.8965	1.020		1.81
	3	0.8305	15	646.325	652.890	6.565	61	69	70	62	63	66	6.00	4.1	6.7810	6.6560	0.982		1.94
																AVG =	0.994	0.00	
18	1	0.4847	15	653.180	658.865	5.685	62	64	65	63	63	63.75	9.00	1.35	5.8585	5.8214	0.994		1.87
	2	0.4847	15	658.865	664.540	5.675	62	65	66	63	63	64.25	9.00	1.35	5.8427	5.8214	0.996		1.87
	3	0.4847	15	664.540	670.215	5.675	63	66	67	63	64	65	9.00	1.35	5.8343	5.8158	0.997		1.87
																AVG =	0.996	0.12	
12	1	0.3326	15	617.33	622.525	5.195	60	59	62	59	59	59.75	12.00	0.62	5.3853	5.3364	0.991		1.83
	2	0.3326	15	622.525	627.71	5.185	61	62	64	59	60	61.25	12.00	0.62	5.3595	5.3312	0.995		1.83
	3	0.3326	15	627.71	632.91	5.20	61	64	65	60	61	62.5	12.00	0.62	5.3621	5.3312	0.994		1.82
																AVG =	0.993	-0.12	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.994

AVERAGE $\Delta H_@$ = 1.86

(1) $$Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions
K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)
T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $$Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

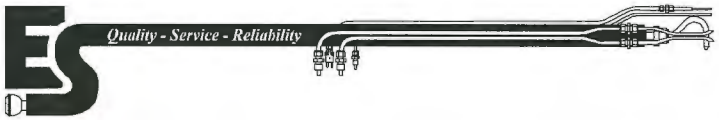
= Volume of gas sample passed through the critical orifice, corrected to standard conditions
T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

$$\Delta H_@ = \left(\frac{0.75\,\theta}{V_{cr}(std)}\right)^2 \Delta H \left(\frac{V_m(std)}{V_m}\right)$$

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES



1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
4) Record data and information in the **GREEN** cells, YELLOW cells are calculated.

DATE:	9/18/2017	METER SERIAL #:	9632668	BAROMETRIC PRESSURE (in Hg):	INITIAL 30.11	FINAL 30.1	AVG (P_{bar}) 30.105
METER PART #:	MB7	CRITICAL ORIFICE SET SERIAL #:	1447				

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
32	1	0.8305	15	142.0	148.620	6.620	75	76	77	76	76	76.25	6.00	3.9	6.6221	6.4875	0.980		1.88
	2	0.8305	15	148.620	155.230	6.610	75	77	79	76	76	77	6.00	3.9	6.6029	6.4875	0.983		1.87
	3	0.8305	15	155.230	161.850	6.620	76	79	81	76	76	78	6.00	3.9	6.6006	6.4815	0.982		1.87
																AVG =	0.981	-1.74	
18	1	0.4847	15	162.20	167.880	5.680	75	81	82	76	76	78.75	9.00	1.2	5.6185	5.6794	1.011		1.68
	2	0.4847	15	167.880	173.590	5.710	76	82	83	76	77	79.5	9.00	1.2	5.6403	5.6741	1.006		1.68
	3	0.4847	15	173.590	179.310	5.720	77	83	84	77	77	80.25	9.00	1.2	5.6423	5.6688	1.005		1.68
																AVG =	1.007	0.84	
12	1	0.3326	15	179.60	184.850	5.250	77	84	83	77	78	80.5	12.00	0.58	5.1685	5.1866	1.003		1.72
	2	0.3326	15	184.850	190.10	5.250	77	83	83	78	78	80.5	12.00	0.58	5.1685	5.1866	1.003		1.72
	3	0.3326	15	190.10	195.280	5.180	78	83	83	78	79	80.75	12.00	0.58	5.0972	5.1817	1.017		1.72
																AVG =	1.008	0.91	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.999

AVERAGE $\Delta H_@$ = 1.76

(1) $$Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions
K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)
T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $$Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions
T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

$$\Delta H_@ = \left(\frac{0.75\,\theta}{V_{cr(std)}}\right)^2 \Delta H \left(\frac{V_{m(std)}}{V_m}\right)$$

THERMOCOUPLE CALIBRATION

Date: 1-3-18
Calibrator: MM/SR

Probe: 3'C	ICE H2O		BOILING H2O		BOILING OIL	
	TC	Thermometer	TC	Thermometer	TC	Thermometer
Cal 1	35	34	198	198	382	382
Cal 2	35	34	200	198	382	382
Cal 3	35	34	199	198	382	382
Average	35	34	199	198	382	382

PITOT TUBE INSPECTION CRITERIA CHECKLIST

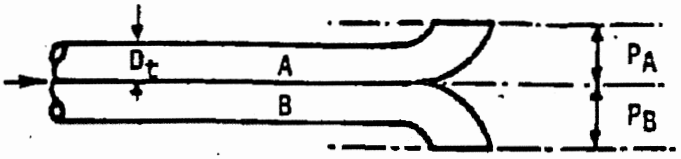
PITOT TUBE NUMBER 3'C

DATE 1-3-18

Pitot Tube not on Probe

Operator MN SR

$3/16 \leq Dt \leq 3/8$
.48cm .95cm
$P_A = P_B$



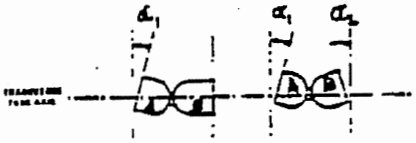
YES NO

YES NO

$1.05\ Dt \leq P_{A,B} \leq 1.5\ Dt$

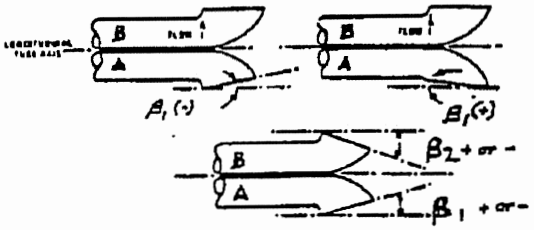
YES NO

α_1 and $\alpha_2 < 10°$



α YES NO

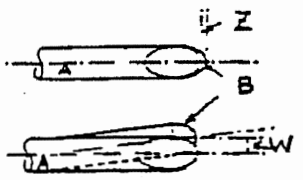
β_1 and $\beta_2 < 5°$



β YES NO

z < 0.32 cm (1/8 in)

w < 0.08 cm (1/32 in)



z YES NO

w YES NO

Pitot Tube Correction Factor .84

Pitot on Probe
Component Spacing OK

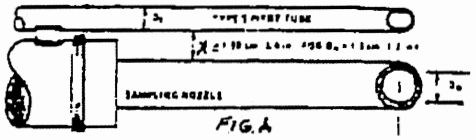


FIG. A

Figure

A. $x \geq 1.9$ cm

B-1. $z \geq 1.9$ cm
$w \geq 7.62$ cm

or

B-2. $z \geq 5.08$ cm

C. $Y \geq 7.62$ cm

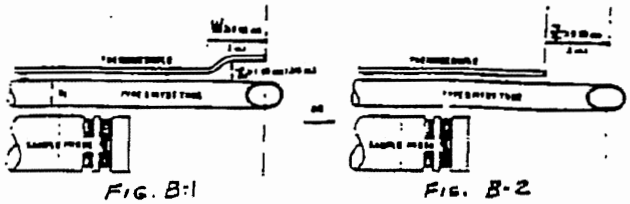


FIG. B-1 FIG. B-2

FIG. C

A. YES NO

B-1 YES NO

B-2 YES NO

C YES NO

Pitot Tube Correction Factor: .84

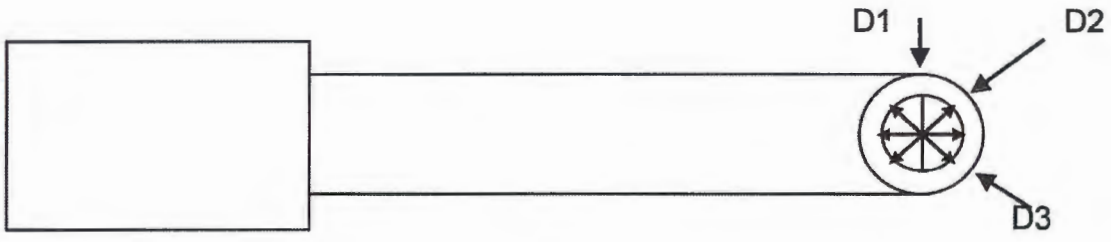
NOZZLE CALIBRATION

BTEC Inc.
Environmental Consulting

Sample Location: Pickle Outlet
Plant: USS
Inspector: DT
Date: 9-27-18

Nozzle Inside Diameter (inches)					
Nozzle ID	D1	D2	D3	ΔD	D (average)
	0.318	0.318	0.318	0.000	0.318

Where:
D1, D2, and D3 = nozzle diameter on a different diameter reported in inches.
Accuracy within 0.001 inches.
Δ = maximum difference in any two measurements
Tolerance = 0.004 inches.
D (average) = average of D1, D2, and D3



Revision 1.0
9-20-2011 - DLC

201800138

Appendix C
Laboratory Analytical Results

Montrose Air Quality Services, LLC - Detroit

4949 Fernlee Avenue
Royal Oak, MI 48073

US Steel – Pickle Line

Client Project # 049AS-470744

Analytical Report
(0918-173)

EPA Method 26A

Hydrogen chloride

Enthalpy Analytical, LLC

Phone: (919) 850 - 4392 / Fax: (919) 850 - 9012 / www.enthalpy.com
800-1 Capitola Drive Durham, NC 27713-4385

I certify that to the best of my knowledge all analytical data presented in this report:

- Have been checked for completeness
- Are accurate, error-free, and legible
- Have been conducted in accordance with approved protocol, and that all deviations and analytical problems are summarized in the appropriate narrative(s)

This analytical report was prepared in Portable Document Format (.PDF) and contains ??? pages.

Report Issued: xx/xx/xxxx

ENTHALPY

Summary of Results

Enthalpy Analytical

Company: Montrose Air Qualtiy Services, LLC - Detroit
Job No.: 0918-173 - EPA Method 26A
Client No.: 049AS-470744

Summary - Hydrogen chloride

Sample ID	Catch Weight (ug)
Pickle Line Inlet - Run 1	3,607,767
Pickle Line Inlet - Run 2	3,535,137
Pickle Line Inlet - Run 3	3,006,794
Pickle Line Outlet - Run 1	8,849
Pickle Line Outlet - Run 2	9,067
Pickle Line Outlet - Run 3	9,938
Pickle Line 0.1N H2SO4 Blank	30.9 ND

Results

Enthalpy Analytical

Company: Montrose Air Qualtiy Services, LLC - Detroit

Job No.: 0918-173 - EPA Method 26A

Client No.: 049AS-470744

Hydrogen Chloride as Chloride

Sample ID	Filename #1	Filename #2	Analysis Method	MDL	Curve Min	Curve Max	Ret Time (min)	Ret Time (min)	%diff RT	Conc # 1 (ug/mL)	Conc # 2 (ug/mL)	%diff conc	Avg Conc (ug/mL)	DF	Liquid Vol (mL)	Conv Factor	Catch Weight (ug)	Flag
Pickle Line Inlet - Run 1	055	056	Raphael262b.m	0.0500	0.500	15.0	1.62	1.62	0.1	11.0	11.1	0.1	11.0	500	635	1.028	3,607,767	
Pickle Line Inlet - Run 2	057	058	Raphael262b.m	0.0500	0.500	15.0	1.62	1.62	0.0	10.6	10.7	0.1	10.7	500	645	1.028	3,535,137	
Pickle Line Inlet - Run 3	059	060	Raphael262b.m	0.0500	0.500	15.0	1.62	1.62	0.0	9.49	9.53	0.2	9.51	500	615	1.028	3,006,794	
Pickle Line Outlet - Run 1	067	068	Raphael262b.m	0.0500	0.500	15.0	1.62	1.62	0.0	3.50	3.52	0.2	3.51	5	490	1.028	8,849	
Pickle Line Outlet - Run 2	069	070	Raphael262b.m	0.0500	0.500	15.0	1.62	1.62	0.0	3.17	3.18	0.1	3.18	5	555	1.028	9,067	
Pickle Line Outlet - Run 3	071	072	Raphael262b.m	0.0500	0.500	15.0	1.62	1.62	0.0	3.79	3.79	0.1	3.79	5	510	1.028	9,938	
Pickle Line 0.1N H2SO4 Blank	073	074	Raphael262b.m	0.0500	0.500	15.0	1.61	1.61	0.1	0.0500	0.0500	0.0	0.0500	1	600	1.028	30.9	ND

Enthalpy Analytical

Company: Montrose Air Qualtiy Services, LLC - Detroit

Job No.: 0918-173 - EPA Method 26A

Client No.: 049AS-470744

Matrix Spike Recovery

Sample ID	Compound	Filename #1	Filename #2	Analysis Method	Ret Time (min)	Ret Time (min)	%diff RT	Conc # 1 (ug/mL)	Conc # 2 (ug/mL)	%diff conc	Avg Conc (ug/mL)	DF	Vol (mL)	Catch Weight (ug)
MS / Pickle Line Inlet - Run 1	Chloride	075	076	Raphael262b.m	1.62	1.62	0.0	18.7	18.7	0.1	18.7	1	5.50	103
													Spike Amount	50.0
													Native Amount	55.2
													Spike Recovery (%)	95.3%
MSD / Pickle Line Inlet - Run 1	Chloride	077	078	Raphael262b.m	1.63	1.62	0.1	18.6	18.6	0.1	18.6	1	5.50	102
													Spike Amount	50.0
													Native Amount	55.2
													Spike Recovery (%)	94.4%

2018000138

Narrative Summary

ENTHALPY

Enthalpy Analytical Narrative Summary

Company	Montrose Air Quality Services, LLC - Detroit
Job #	0918-173 - EPA Method 26A (H2SO4) Analysis
Client #	049AS-470744

Custody

Matthew St. Lawrence received the samples on 9/28/18 at 21.2 °C after being relinquished by Montrose Air Quality Services, LLC of Detroit, MI. The samples were received in good condition.

Prior to, during, and after analysis, the samples were kept under lock with access only to authorized personnel by Enthalpy Analytical, LLC.

Analysis

The samples were analyzed for chloride using the analytical procedures in EPA Method 26A, Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic Method (40 CFR Part 60, Appendix A).

The samples were analyzed following the procedures in Section 11.0, Analytical Procedures.

The Dionex Ion Chromatograph ***"Raphael"*** was equipped with a Conductivity Detector for these analyses.

Calibration

The calibration curve is included in the Raw Data section of this report. A quadratic curve type was used instead of the method specified linear curve. The calibration curve met all method-specified precision criteria for the calibration curve. The data analysis method is referenced in the Analysis Method column on the Detailed Results page.

For each calibration curve used, the second page of the curve contains all method specific parameters (i.e., curve type, origin, weight, etc.) used to quantify the samples. The calibration curve section also includes a table with the Retention Time, Level, Amount (corresponding units), Area, and the analyte Name. The calibration table is used to identify (by retention time) and quantify each target compound.

Chromatographic Conditions

The acquisition method ***AS22 FAST 2 mlsMin.M*** is included in the Raw Data section of this report.

QC Notes

The analyses of the client's blank and the laboratory reagent blanks did not contain chloride at concentrations greater than the detection limit (MDL).

ENTHALPY
ANALYTICAL

Enthalpy Analytical Narrative Summary
(continued)

QC Notes (continued)

Duplicate matrix spikes were prepared using aliquots of sample ***Pickle Line Inlet Run 1*** and exhibited spike recovery values of 95.3% and 94.4%.

The second source standard was analyzed as Laboratory Control Samples (LCS) and had spike recovery values of 101%.

The samples were analyzed within the 4-week holding time specified by the method.

Reporting Notes

The sulfuric acid matrix samples were analyzed for chloride but are reported as hydrogen chloride. The results were converted using a factor of 1.028 to account for the additional hydrogen mass.

These analyses met the requirements of the TNI Standard. Any deviations from the requirements of the reference method or TNI Standard have been stated above.

The results presented in this report are representative of the samples as provided to the laboratory.

ENTHALPY

General Reporting Notes

The following are general reporting notes that are applicable to all Enthalpy Analytical, Inc. data reports, unless specifically noted otherwise.

- Any analysis which refers to the method as ***"Type"*** represents a planned deviation from the reference method. For instance a Hydrogen Sulfide assay from a Tedlar bag would be labeled as "EPA Method 16-Type" because Tedlar bags are not mentioned as one of the collection options in EPA Method 16.
- The acronym ***MDL*** represents the Minimum Detection Limit. Below this value the laboratory cannot determine the presence of the analyte of interest reliably.
- The acronym ***LOQ*** represents the Limit of Quantification. Below this value the laboratory cannot quantitate the analyte of interest within the criteria of the method.
- The acronym ***ND*** following a value indicates a non-detect or analytical result below the MDL.
- The letter ***J*** in the Qualifier or Flag column in the results indicates that the value is between the MDL and the LOQ. The laboratory can positively identify the analyte of interest as present, but the value should be considered an estimate.
- The letter ***E*** in the Qualifier or Flag column indicates an analytical result exceeding 100% of the highest calibration point. The associated value should be considered as an estimate.
- The acronym ***DF*** represents Dilution Factor. This number represents dilution of the sample during the preparation and/or analysis process. The analytical result taken from a laboratory instrument is multiplied by the DF to determine the final undiluted sample results.
- The addition of ***MS*** to the Sample ID represents a Matrix Spike. An aliquot of an actual sample is spiked with a known amount of analyte so that a percent recovery value can be determined. The MS analysis indicates what effect the sample matrix may have on the target analyte, i.e. whether or not anything in the sample matrix interferes with the analysis of the analyte(s).
- The addition of ***MSD*** to the Sample ID represents a Matrix Spike Duplicate. Prepared in the same manner as a MS, the use of duplicate matrix spikes allows further confirmation of laboratory quality by showing the consistency of results gained by performing the same steps multiple times.
- The addition of ***LD*** to the Sample ID represents a Laboratory Duplicate. The analyst prepares an additional aliquot of sample for testing and the results of the duplicate analysis are compared to the initial result. The result should have a difference value of within 10% of the initial result (if the results of the original analysis are greater than the LOQ).

ENTHALPY

General Reporting Notes

(continued)

- The addition of ***AD*** to the Sample ID represents an Alternate Dilution. The analyst prepares an additional aliquot at a different dilution factor (usually double the initial factor). This analysis helps confirm that no additional compound is present and coeluting or sharing absorbance with the analyte of interest, as they would have a different response/absorbance than the analyte of interest.
- The Sample ID ***LCS*** represents a Laboratory Control Sample. Clean matrix, similar to the client sample matrix, prepared and analyzed by the laboratory using the same reagents, spiking standards and procedures used for the client samples. The LCS is used to assess the control of the laboratory's analytical system. Whenever spikes are prepared for our client projects, two spikes are retained as LCSs. The LCSs are labeled with the associated project number and kept in-house at the appropriate temperature conditions. When the project samples are received for analysis, the LCSs are analyzed to confirm that the analyte could be recovered from the media, separate from the samples which were used on the project and which may have been affected by source matrix, sample collection and/or sample transport.
- **Significant Figures**: Where the reported value is much greater than unity (1.00) in the units expressed, the number is rounded to a whole number of units, rather than to 3 significant figures. For example, a value of 10,456.45 ug catch is rounded to 10,456 ug. There are five significant digits displayed, but no confidence should be placed on more than two significant digits.
- **Manual Integration**: The data systems used for processing will flag manually integrated peaks with an "M". There are several reasons a peak may be manually integrated. These reasons will be identified by the following two letter designations on sample chromatograms, if provided in the report. The peak was ***not integrated*** by the software **"NI"**, the peak was ***integrated incorrectly*** by the software **"II"** or the ***wrong peak*** was integrated by the software **"WP"**. These codes will accompany the analyst's manual integration stamp placed next to the compound name on the chromatogram.

ENTHALPY

Sample Custody

BTEC Inc.

CHAIN OF CUSTODY RECORD

4949 Fernlee Ave. : Royal Oak : MI 48073
Tel 248-548-8070 ♦ Fax 248-548-8073

Analytical Laboratory used: Enthalpy

CLIENT NAME: US Steel

BTEC Project Number: 049AS-470744

ADDRESS: 4949 Fernlee Ave.
Royal Oak, MI 48073

PHONE: 248-548-8070
FAX: 248-548-8073

PROJECT MANAGER: Matt Young

e-mail results to: bchase@montrose-env.com

Billing/Invoice Information:
Randal Tysar
BTEC Inc.
4949 Fernlee Ave.
Royal Oak, MI 48073

For Lab Use Only	DATE SAMPLED	SAMPLE IDENTIFICATION/SITE LOCATION	BTEC CONT.#	ANALYSIS REQUESTED: USEPA Method 26A	USEPA Method	USEPA Method	USEPA Method	USEPA Method	USEPA Method	USEPA Method	USEPA Method	USEPA Method	COMMENTS
	09/27/18	Pickle Line Inlet .1 N H2SO4 and DI BH run 1	5272	x									Rushed analysis, charged with 200 ml .1 N H2SO4
	09/27/18	Pickle Line Inlet .1 N H2SO4 and DI BH run 2	5273	x									Rushed analysis, charged with 200 ml .1 N H2SO4
	09/27/18	Pickle Line Inlet .1 N H2SO4 and DI BH run 3	5274	x									Rushed analysis, charged with 200 ml .1 N H2SO4
	09/27/18	Pickle Line Outlet .1 N H2SO4 and DI BH run 1	5275	x									Rushed analysis, charged with 200 ml .1 N H2SO4
	09/27/18	Pickle Line Outlet .1 N H2SO4 and DI BH run 2	5276	x									Rushed analysis, charged with 200 ml .1 N H2SO4
	09/27/18	Pickle Line Outlet .1 N H2SO4 and DI BH run 3	5277	x									Rushed analysis, charged with 200 ml .1 N H2SO4
	09/27/18	Pickle Line .1 N H2SO4 and DI Blank	5278	x									Rushed analysis, charged with 200 ml .1 N H2SO4

RELINQUISHED BY	DATE / TIME 9-27-18	RECEIVED BY Nicole M. Lawrence	9-28-18 8:58am
RELINQUISHED BY	DATE / TIME	RECEIVED BY	
RELINQUISHED BY	DATE / TIME	RECEIVED BY	

Lab Use:

Authorized by: Date:

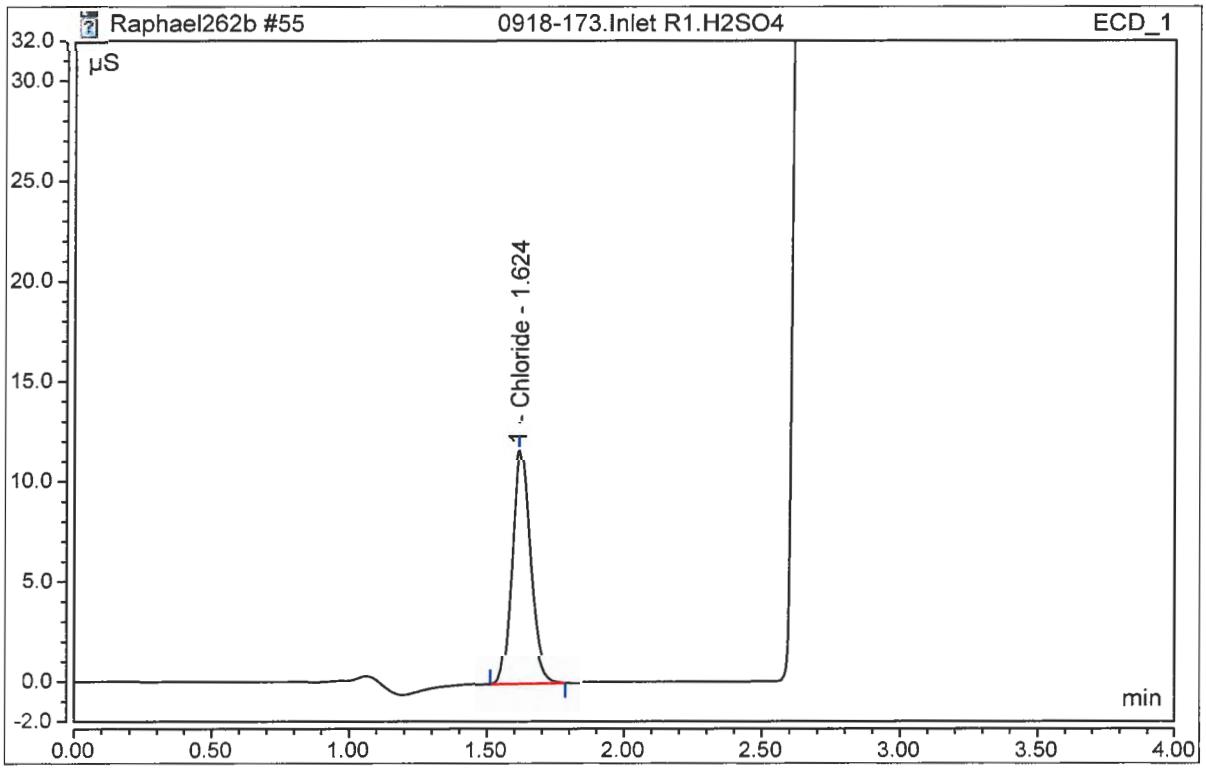
Project Specific Comments: Test for HCl Good condition 21.2°C Rayxes MST 9/28/18

2018000138

Raw Data

Peak Analysis Report

Sample Name:	**0918-173.Inlet R1.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**500.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 04:10**	Run Time:	**4.50**

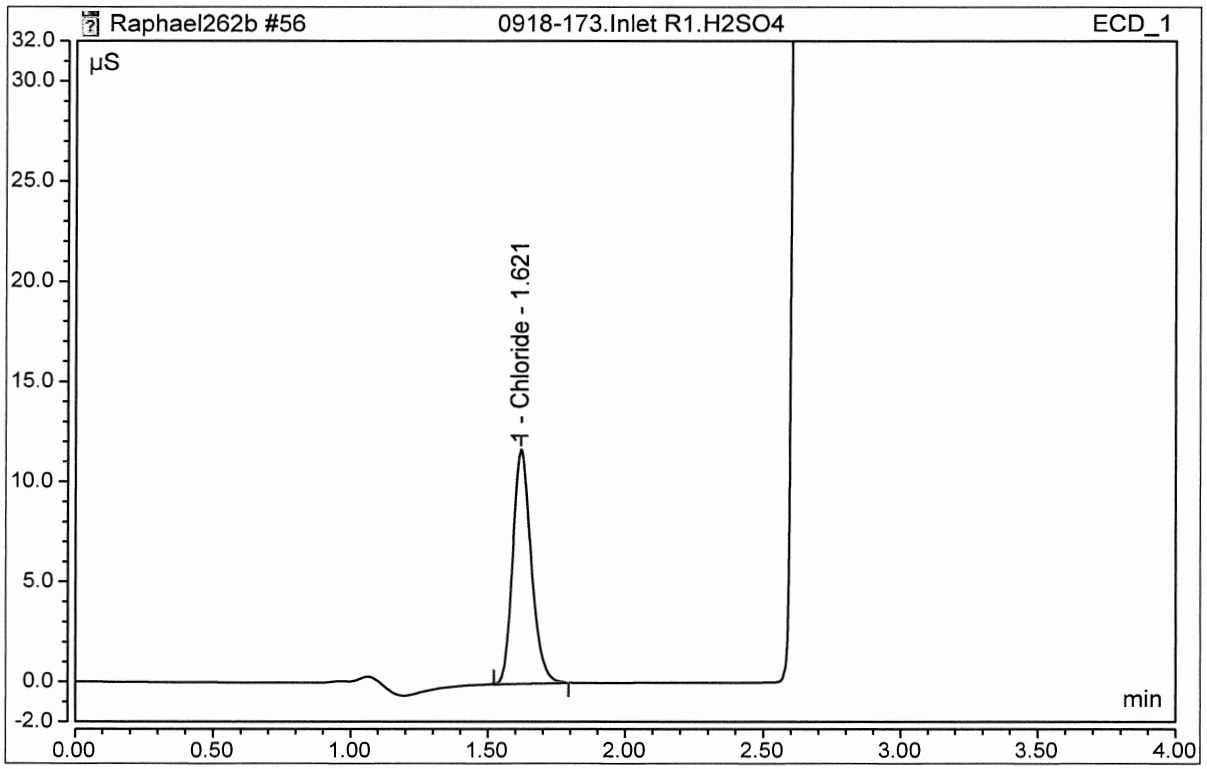


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.904	11.685	11.0361	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Inlet R1.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**500.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 04:17**	Run Time:	**4.50**

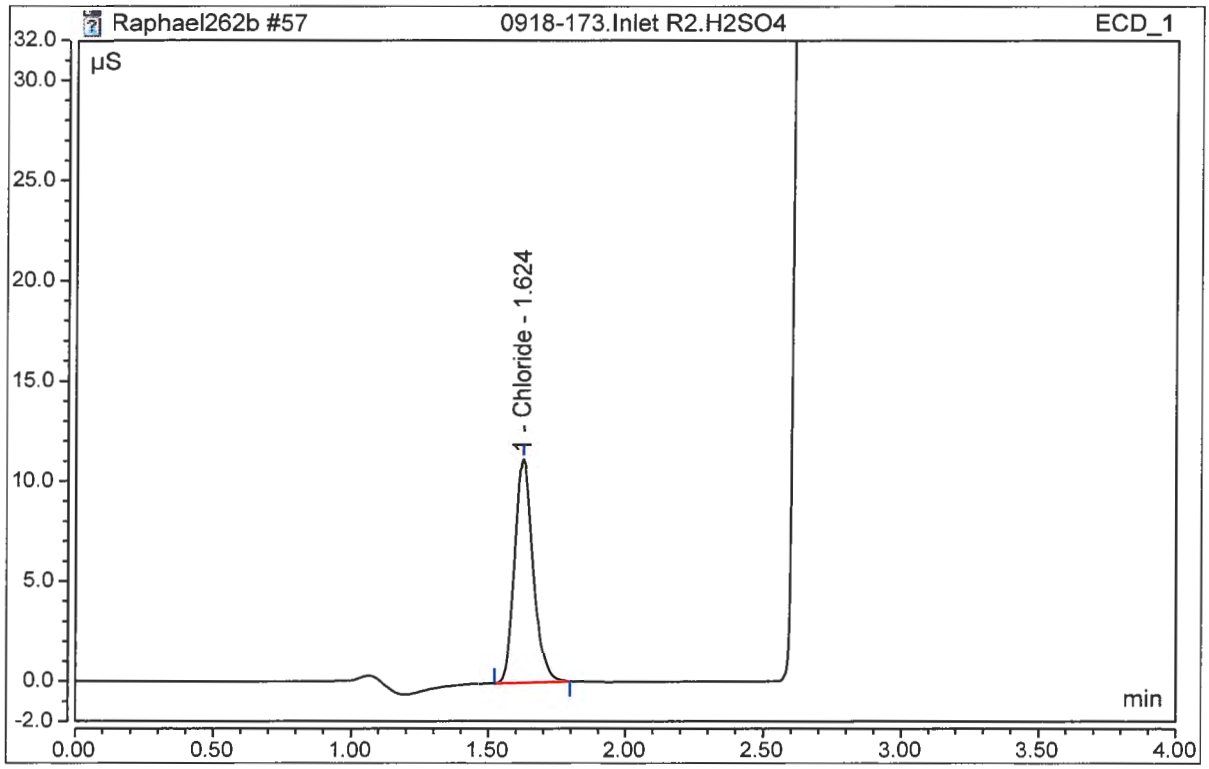


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.906	11.702	11.0617	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Inlet R2.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**500.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 04:22**	Run Time:	**4.50**

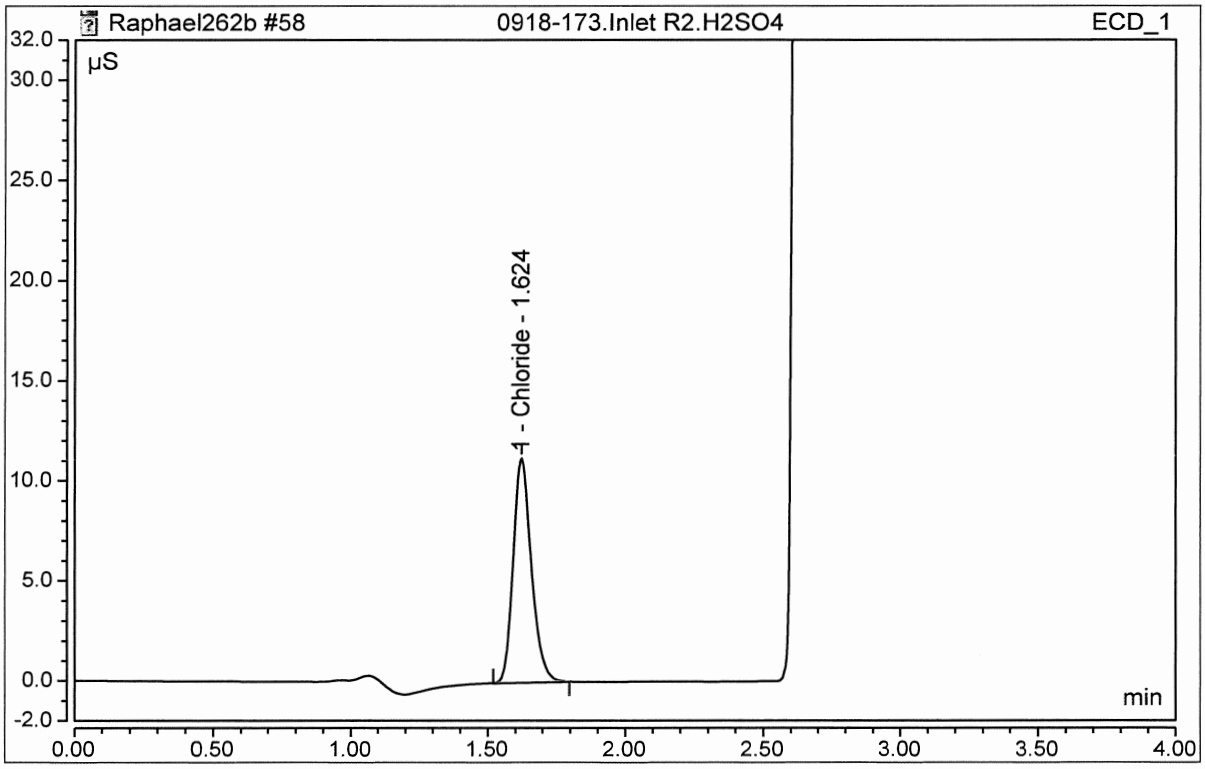


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.868	11.196	10.6495	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Inlet R2.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**500.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 04:28**	Run Time:	**4.50**

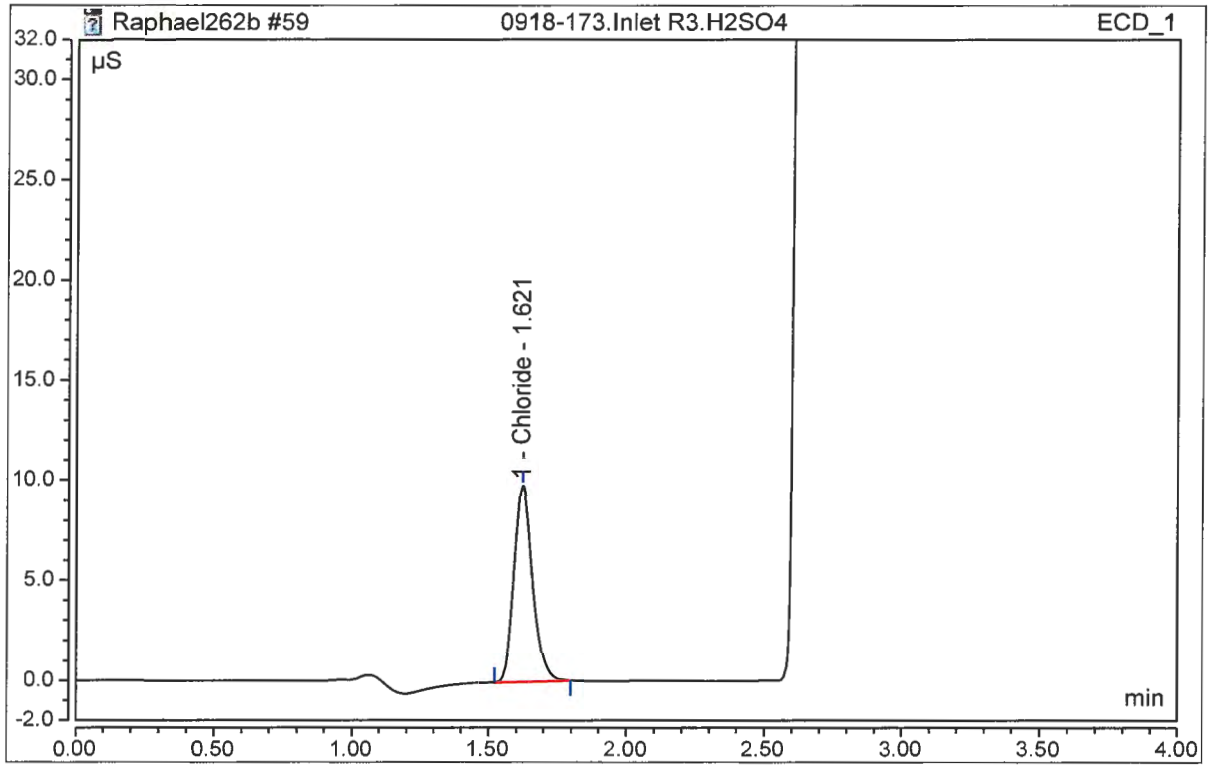


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.869	11.224	10.6678	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Inlet R3.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**500.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 04:33**	Run Time:	**4.50**

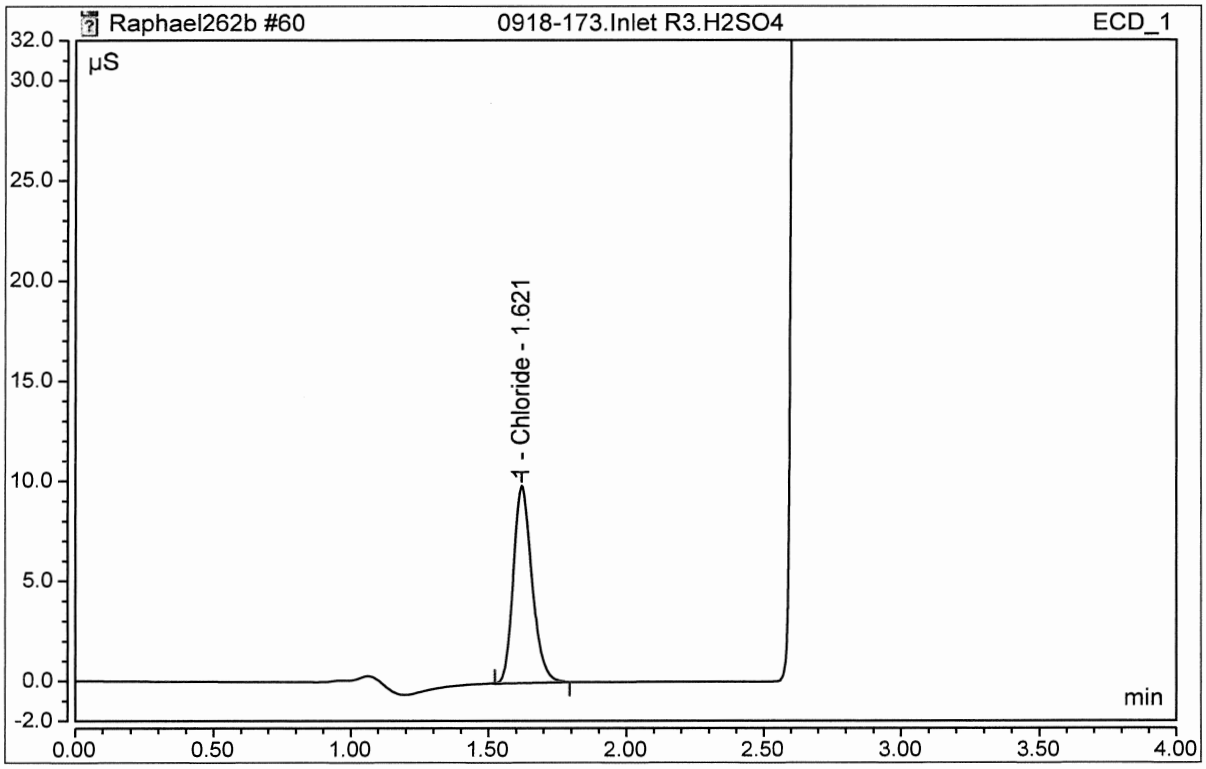


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.762	9.806	9.4861	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Inlet R3.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**500.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 04:40**	Run Time:	**4.50**

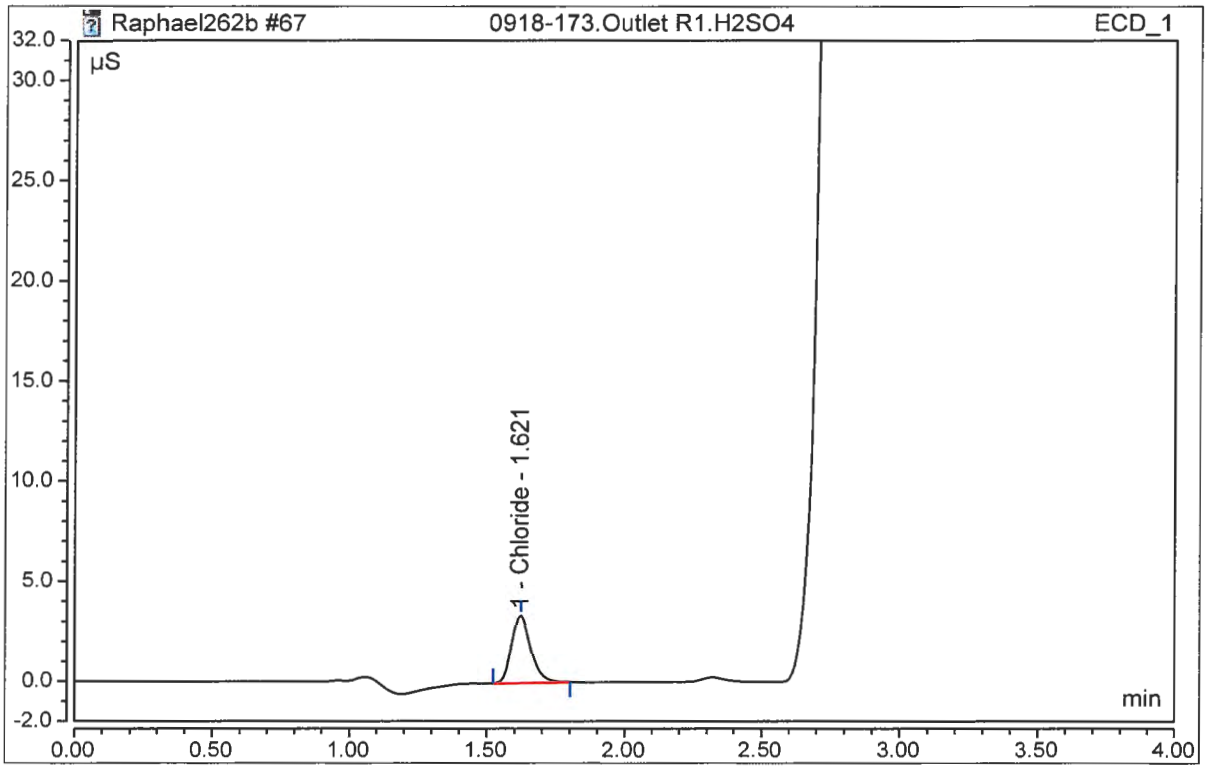


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.766	9.847	9.5297	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Outlet R1.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**5.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 05:19**	Run Time:	**4.50**

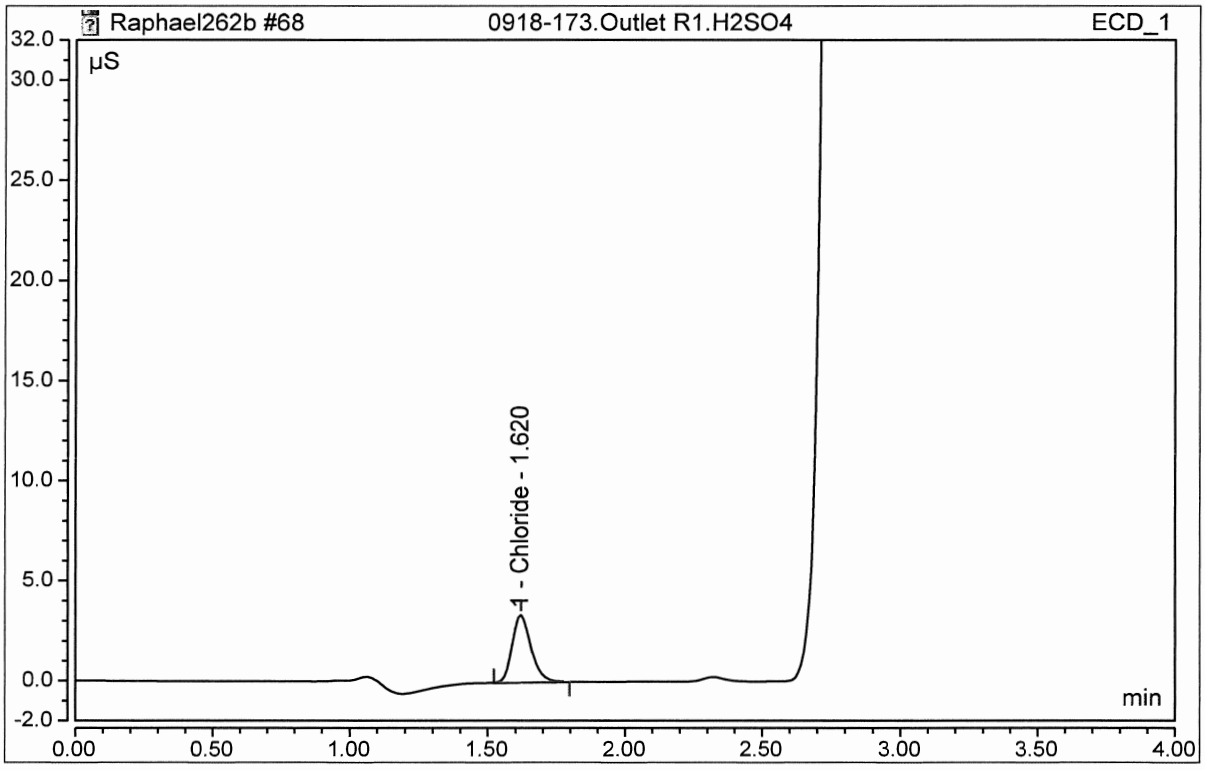


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.266	3.379	3.5042	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Outlet R1.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**5.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 05:26**	Run Time:	**4.50**

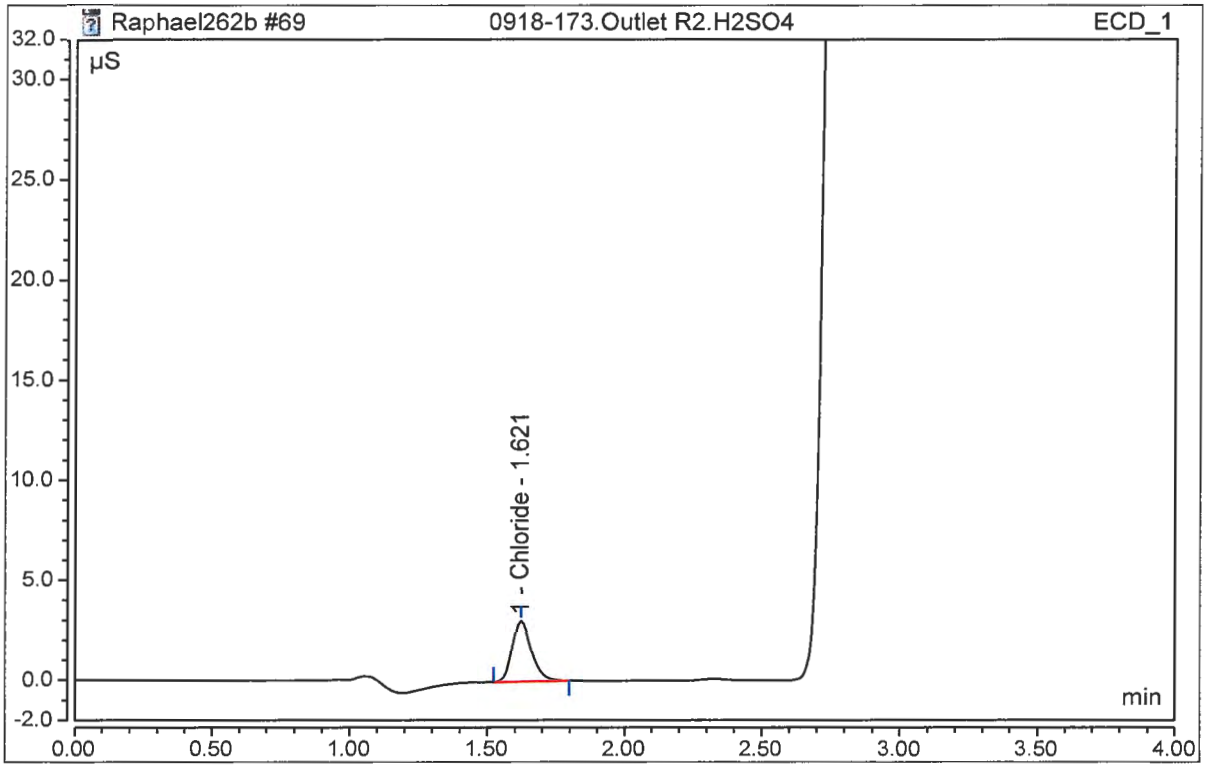


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.268	3.387	3.5200	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Outlet R2.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**5.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 05:31**	Run Time:	**4.50**

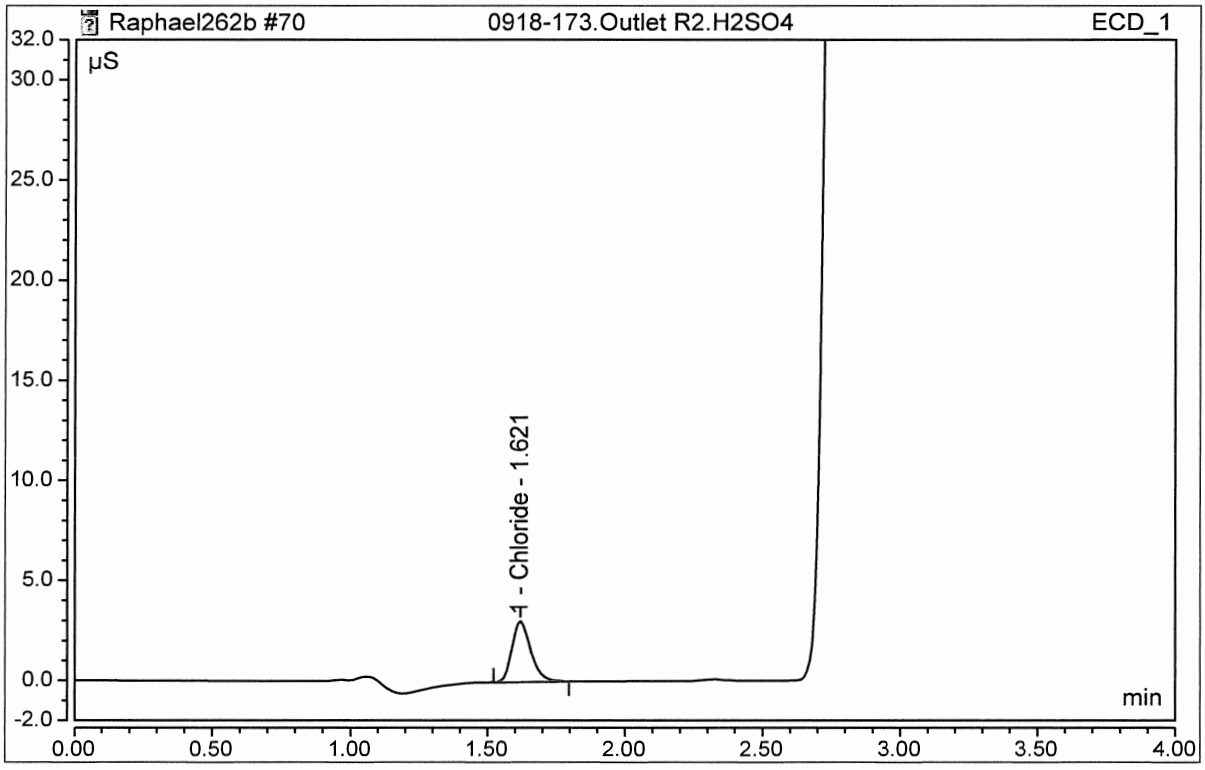


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.241	3.048	3.1737	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Outlet R2.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**5.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 05:37**	Run Time:	**4.50**

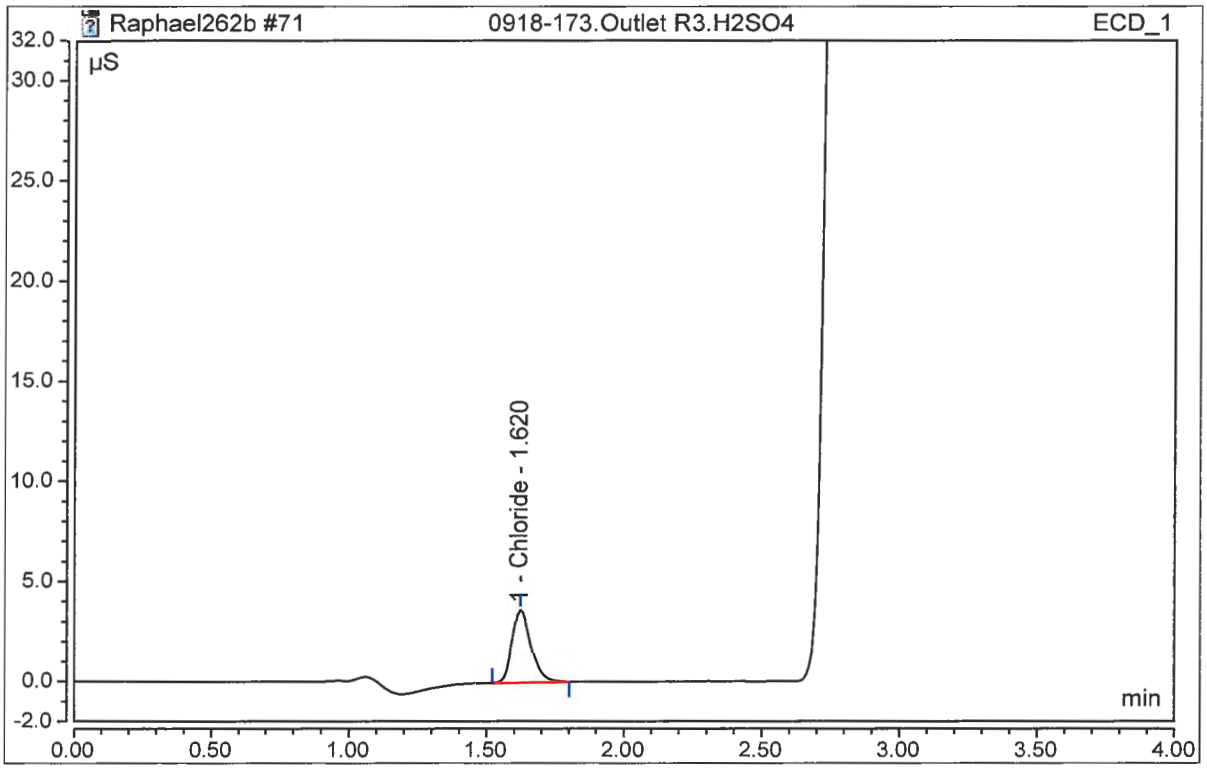


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.241	3.053	3.1804	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Outlet R3.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**5.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 05:43**	Run Time:	**4.50**

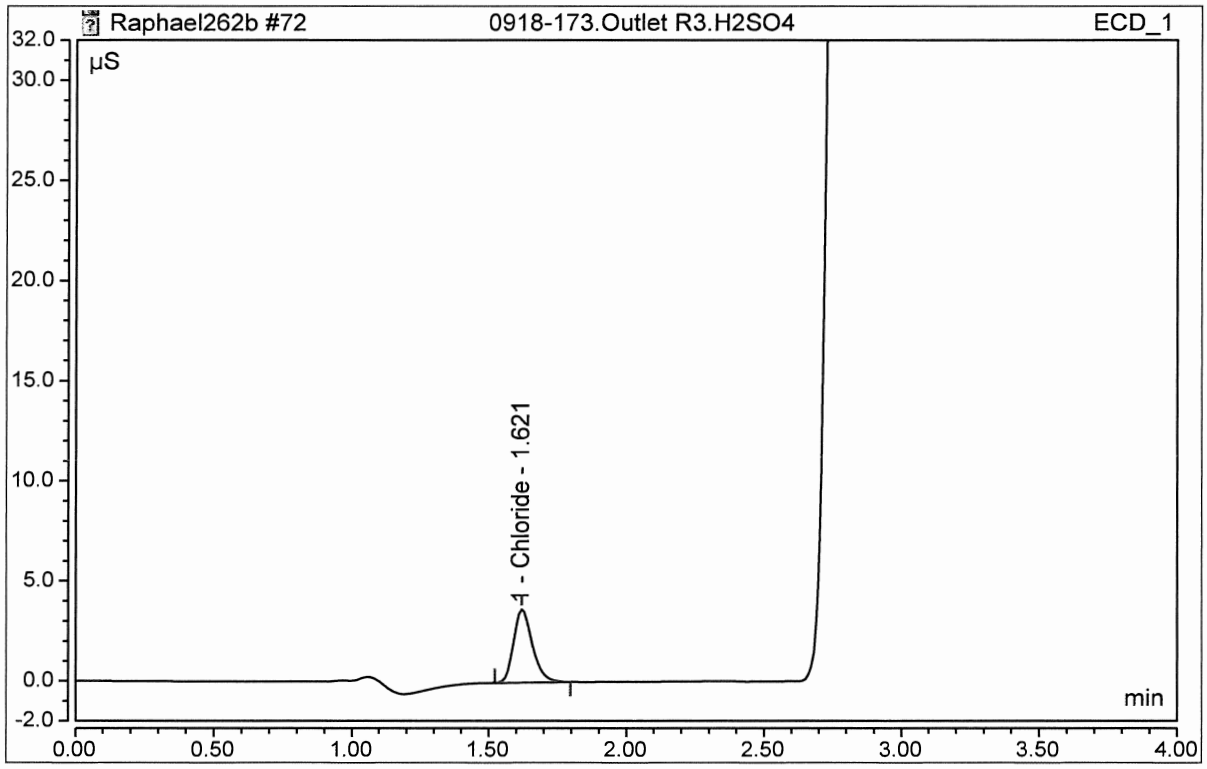


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.288	3.659	3.7863	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.Outlet R3.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**5.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 05:49**	Run Time:	**4.50**

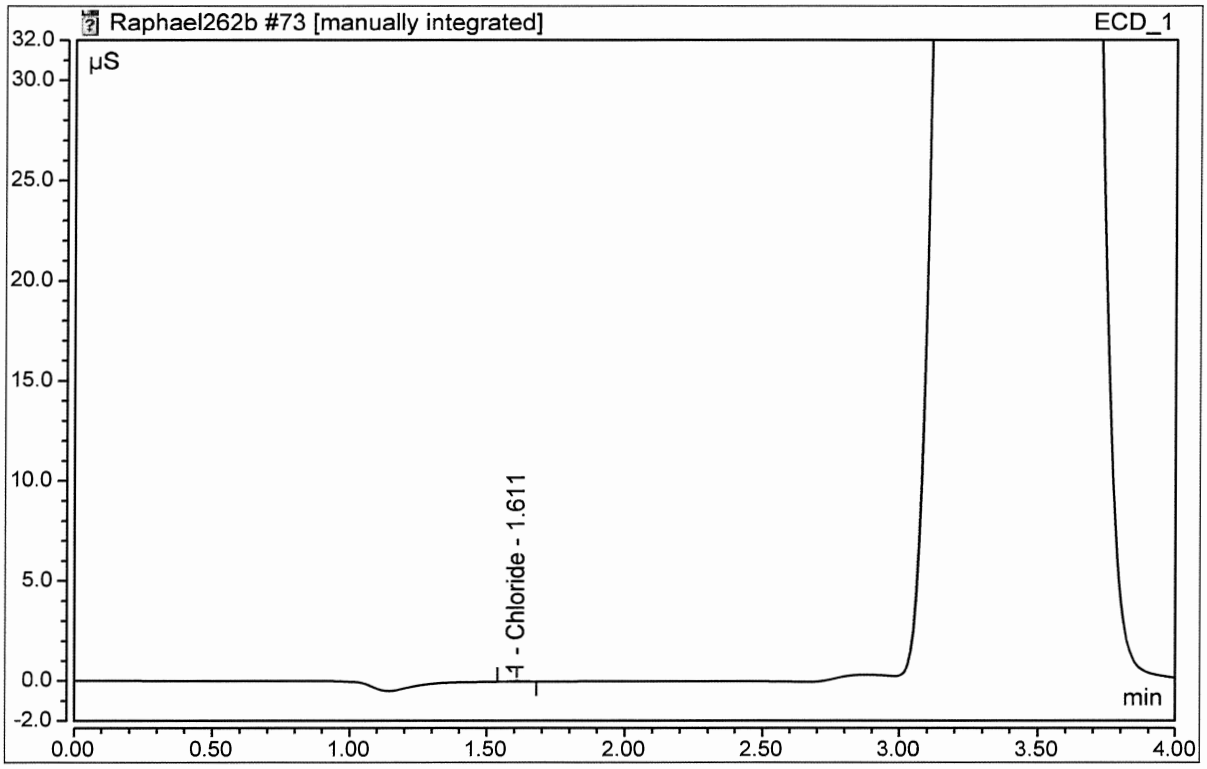


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.289	3.669	3.7927	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.H2SO4 Blk.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 05:54**	Run Time:	**4.50**

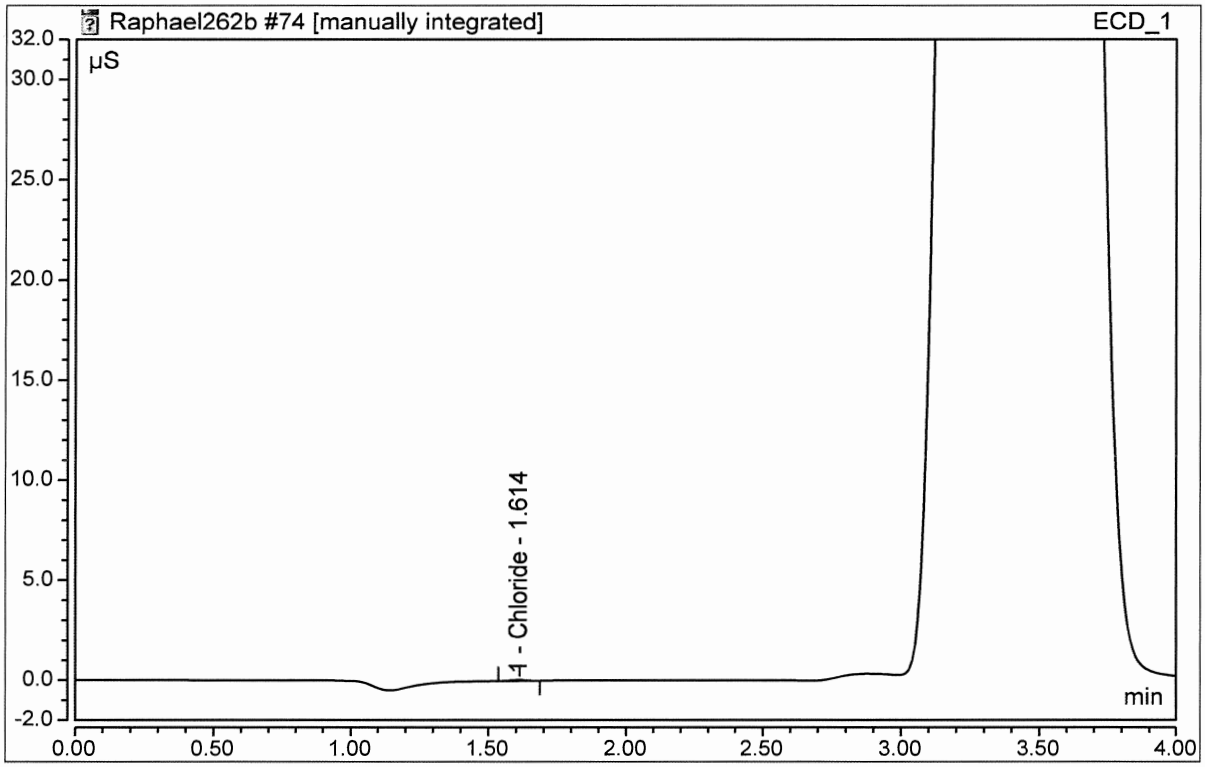


Analyst Comment: NI PRM 10/2/18

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.61	Chloride	0.002	0.026	n.a.	FALSE	TRUE

Peak Analysis Report

Sample Name:	**0918-173.H2SO4 Blk.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:00**	Run Time:	**4.50**

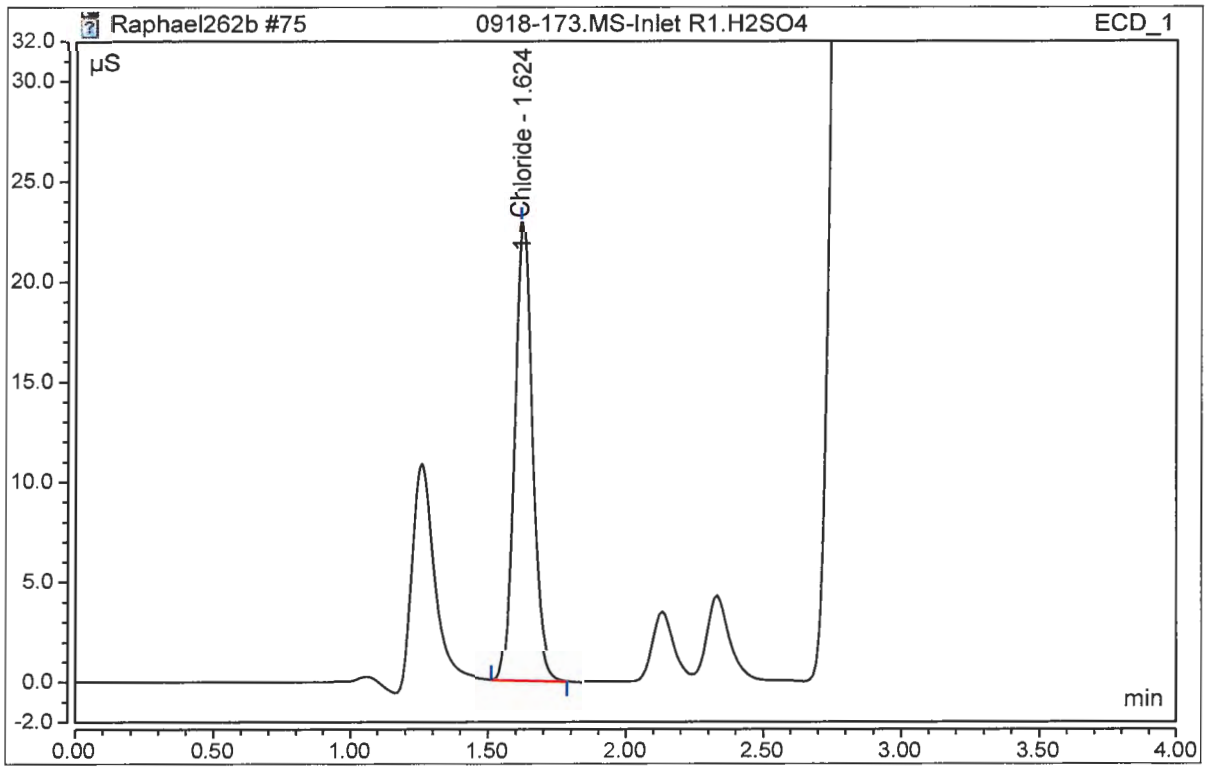


Analyst Comment: NI PRM 10/2/18

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.61	Chloride	0.002	0.027	n.a.	FALSE	TRUE

Peak Analysis Report

Sample Name:	**0918-173.MS-Inlet R1.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:06**	Run Time:	**4.50**

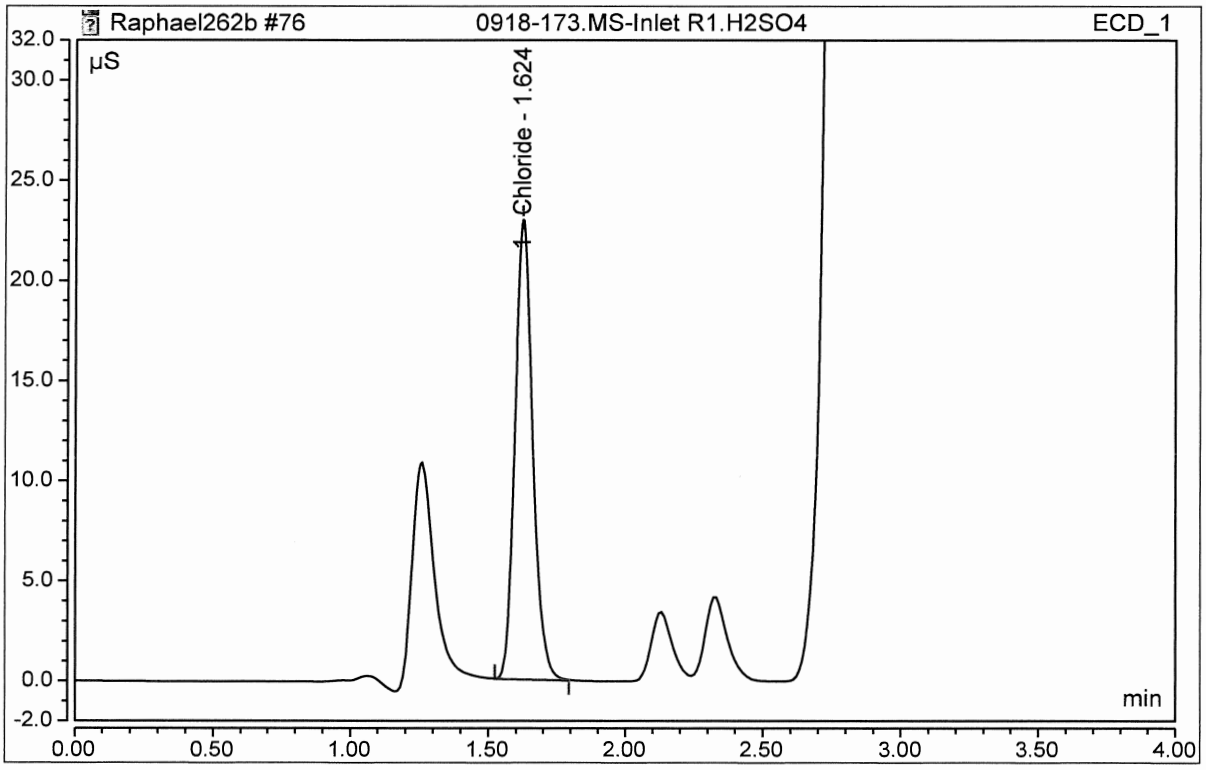


Analyst Comment: @*500

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	1.719	22.899	18.6838	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.MS-Inlet R1.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:12**	Run Time:	**4.50**

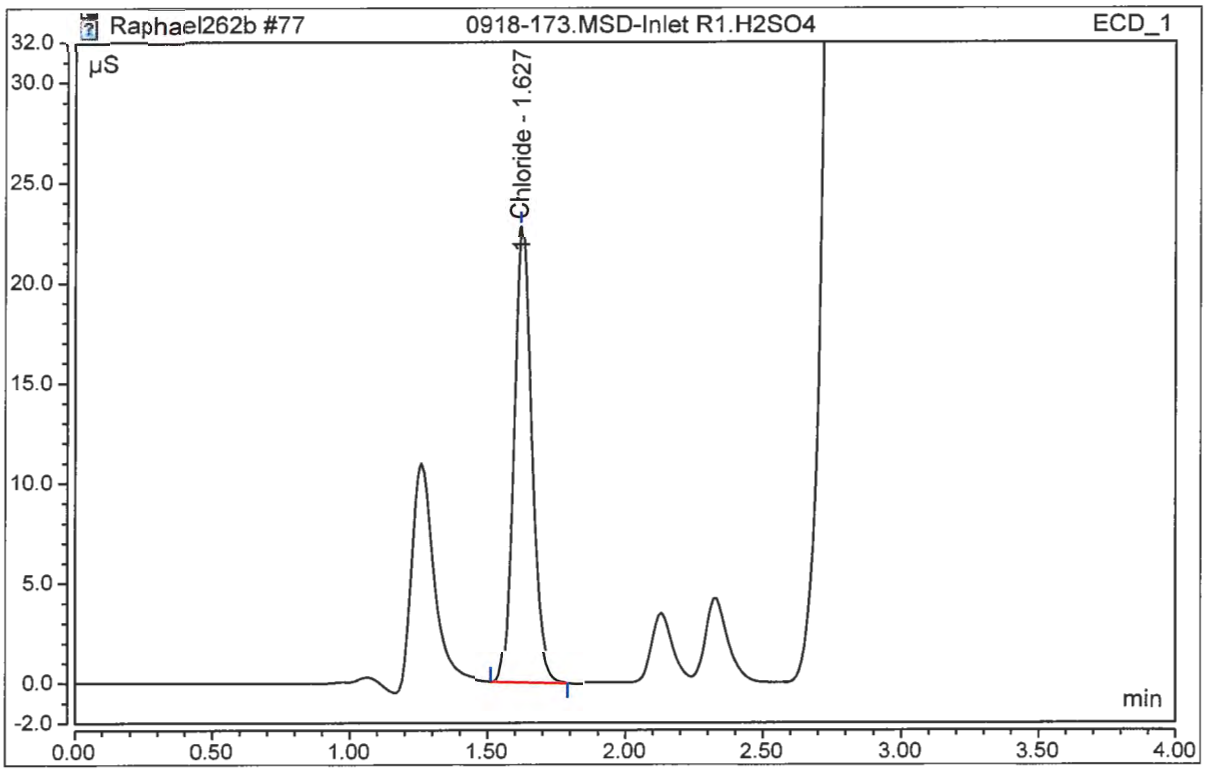


Analyst Comment: @*500

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	1.724	22.961	18.7256	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.MSD-Inlet R1.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:17**	Run Time:	**4.50**

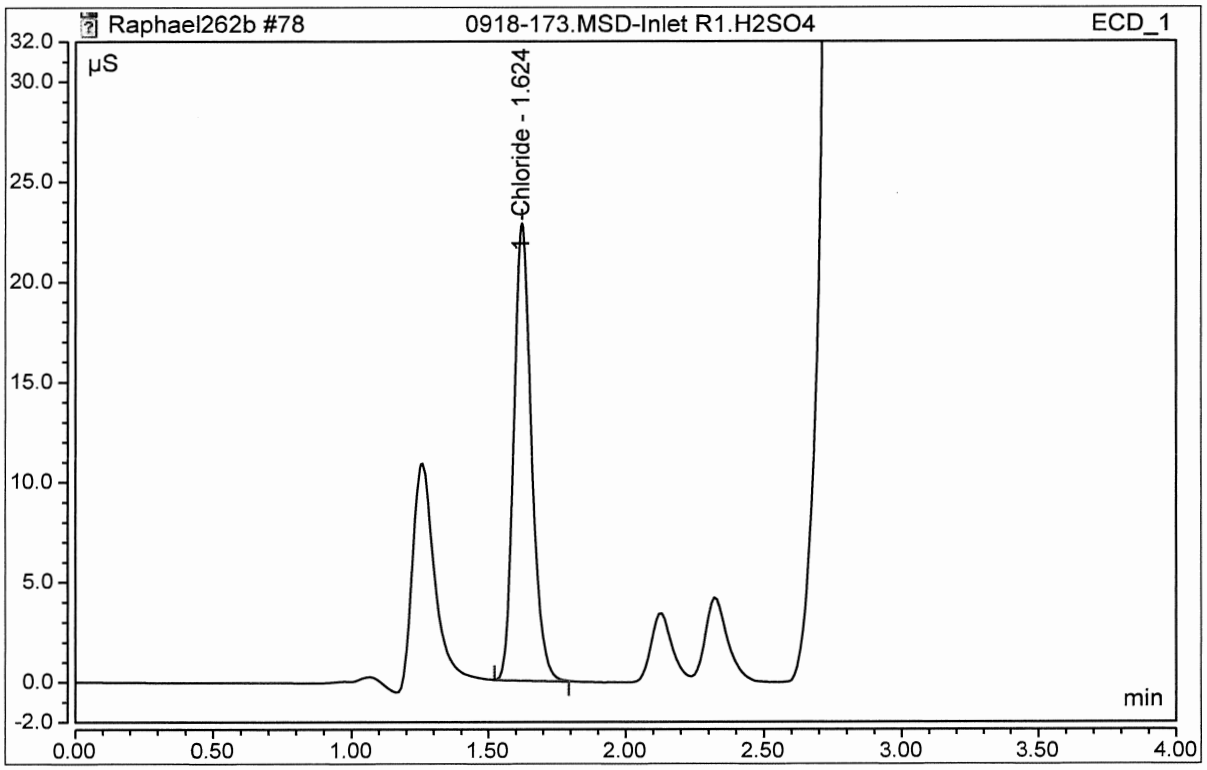


Analyst Comment: @*500

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.63	Chloride	1.710	22.796	18.6087	FALSE	FALSE

Peak Analysis Report

Sample Name:	**0918-173.MSD-Inlet R1.H2SO4**	Injection Volume:	**25.00**
Injection Type:	**Unknown**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:23**	Run Time:	**4.50**



Analyst Comment: @*500

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	1.714	22.832	18.6453	FALSE	FALSE

Enthalpy Analytical

Company: Montrose Air Qualtiy Services, LLC - Detroit

Job No.: 0918-173 - EPA Method 26A

Client No.: 049AS-470744

Chloride -- Calibration Standards, Laboratory Blanks and Controls

SAMPLE ID	Filename #1	Filename #2	Analysis Method	Ret Time (min)	Ret Time (min)	%diff RT	Conc # 1 (ug/mL)	Conc # 2 (ug/mL)	%diff conc	Avg Conc (ug/mL)	Standard Tag	%Tag
HPLCSTDS679 #5	003	004	Raphael262b.m	1.62	1.62	0.1	15.0	15.0	0.0	15.0	15.0	100
HPLCSTDS679 #4	005	006	Raphael262b.m	1.62	1.62	0.0	10.0	10.1	0.1	10.0	10.0	100
HPLCSTDS679 #3	007	008	Raphael262b.m	1.62	1.62	0.0	4.96	4.97	0.1	4.96	5.00	99.3
HPLCSTDS679 #2	009	010	Raphael262b.m	1.62	1.62	0.0	1.01	1.01	0.3	1.01	1.00	101
HPLCSTDS679 #1	011	012	Raphael262b.m	1.62	1.62	0.0	0.501	0.504	0.2	0.502	0.500	100
HPLCSTDS679 #SS	013	014	Raphael262b.m	1.61	1.62	0.1	4.02	4.03	0.2	4.02	4.00	101
HPLCSTDS679 #NIST	015	016	Raphael262b.m	1.62	1.62	0.1	10.2	10.3	0.2	10.3	9.99	103
HPLCSTDS679 #RB	017	018	Raphael262b.m	NA	NA	NA	0.0500	0.0500	0.0	0.0500	ND	
HPLCSTDS679 #3	039	040	Raphael262b.m	1.62	1.62	0.0	4.96	4.96	0.0	4.96	5.00	99.2
HPLCSTDS679 #4	061	062	Raphael262b.m	1.62	1.62	0.1	10.0	10.1	0.1	10.0	10.0	100
HPLCSTDS679 #SS	063	064	Raphael262b.m	1.62	1.62	0.0	4.04	4.05	0.1	4.04	4.00	101
HPLCSTDS679 #RB	065	066	Raphael262b.m	NA	NA	NA	0.0500	0.0500	0.0	0.0500	ND	
HPLCSTDS679 #5	079	080	Raphael262b.m	1.62	1.62	0.0	15.0	15.0	0.0	15.0	15.0	99.7
HPLCSTDS679 #4	081	082	Raphael262b.m	1.62	1.62	0.0	10.0	10.1	0.1	10.1	10.0	101
HPLCSTDS679 #3	083	084	Raphael262b.m	1.62	1.62	0.1	4.96	4.97	0.1	4.97	5.00	99.3
HPLCSTDS679 #2	085	086	Raphael262b.m	1.62	1.62	0.1	1.00	1.01	0.6	1.01	1.00	101
HPLCSTDS679 #1	087	088	Raphael262b.m	1.62	1.62	0.0	0.489	0.496	0.7	0.493	0.500	98.5

Calibration Table

No.	Injection Name	Inject Time	Pos.	Level	Amount	Calibration Point Status	Dil.Factor	Volume
					µg/mL ECD_1 Chloride	ECD_1 Chloride		
3	HPLCSTDS679 #5	01/Oct/2018 23:11	1	05	15.0000	Ok	1.0000	25.00
4	HPLCSTDS679 #5	01/Oct/2018 23:17	1	05	15.0000	Ok	1.0000	25.00
5	HPLCSTDS679 #4	01/Oct/2018 23:22	2	04	10.0000	Ok	1.0000	25.00
6	HPLCSTDS679 #4	01/Oct/2018 23:29	2	04	10.0000	Ok	1.0000	25.00
7	HPLCSTDS679 #3	01/Oct/2018 23:34	3	03	5.0000	Ok	1.0000	25.00
8	HPLCSTDS679 #3	01/Oct/2018 23:40	3	03	5.0000	Ok	1.0000	25.00
9	HPLCSTDS679 #2	01/Oct/2018 23:45	4	02	1.0000	Ok	1.0000	25.00
10	HPLCSTDS679 #2	01/Oct/2018 23:52	4	02	1.0000	Ok	1.0000	25.00
11	HPLCSTDS679 #1	01/Oct/2018 23:57	5	01	0.5000	Ok	1.0000	25.00
12	HPLCSTDS679 #1	02/Oct/2018 00:03	5	01	0.5000	Ok	1.0000	25.00
79	HPLCSTDS679 #5	02/Oct/2018 06:29	45	05	15.0000	Ok	1.0000	25.00
80	HPLCSTDS679 #5	02/Oct/2018 06:35	45	05	15.0000	Ok	1.0000	25.00
81	HPLCSTDS679 #4	02/Oct/2018 06:40	46	04	10.0000	Ok	1.0000	25.00
82	HPLCSTDS679 #4	02/Oct/2018 06:47	46	04	10.0000	Ok	1.0000	25.00
83	HPLCSTDS679 #3	02/Oct/2018 06:52	47	03	5.0000	Ok	1.0000	25.00
84	HPLCSTDS679 #3	02/Oct/2018 06:58	47	03	5.0000	Ok	1.0000	25.00
85	HPLCSTDS679 #2	02/Oct/2018 07:03	48	02	1.0000	Ok	1.0000	25.00
86	HPLCSTDS679 #2	02/Oct/2018 07:10	48	02	1.0000	Ok	1.0000	25.00
87	HPLCSTDS679 #1	02/Oct/2018 07:15	49	01	0.5000	Ok	1.0000	25.00
88	HPLCSTDS679 #1	02/Oct/2018 07:21	49	01	0.5000	Ok	1.0000	25.00

Detection Parameters

Ret. Tir min	Param. Name	Param. Value	Inj. Type	Channel
Always	Baseline Noise Auto Range	On	Any	All Channels
Always	Cobra Smoothing Width	Auto	Any	All Channels
Always	Consider Void Peak	Off	Any	All Channels
0.000	Tailing Sensitivity Factor	0.200 [%]	Any	All Channels
0.000	Inhibit Integration	On	Any	All Channels
0.000	Minimum Area	Auto	Any	All Channels
1.520	Inhibit Integration	Off	Any	All Channels
1.800	Inhibit Integration	On	Any	All Channels
5.500	Baseline Point	Fixed	Any	All Channels
6.000	Inhibit Integration	Off	Any	All Channels

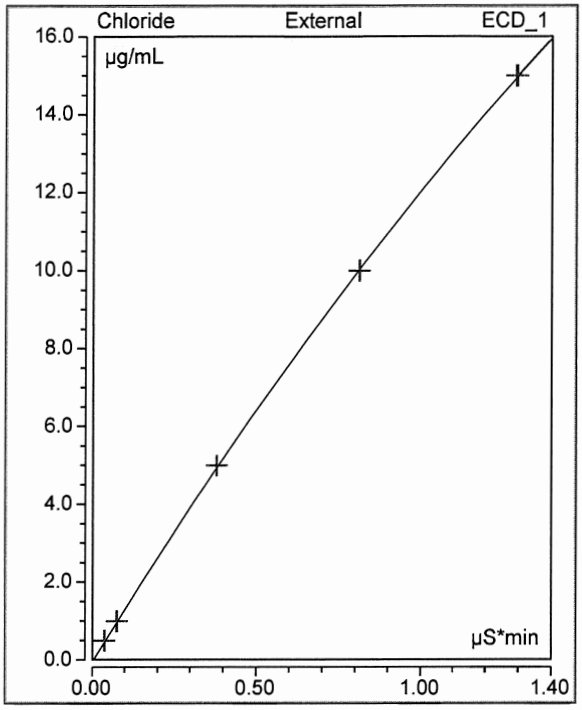
Calibration Batch Report

Sequence:	**Raphael262b**	*Injection Volume:*	**25.00**
Instrument Method:	**AS22 FAST 2 mlsMin**	*Operator:*	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:23**	*Run Time:*	**4.5003333**

Calibration Summary

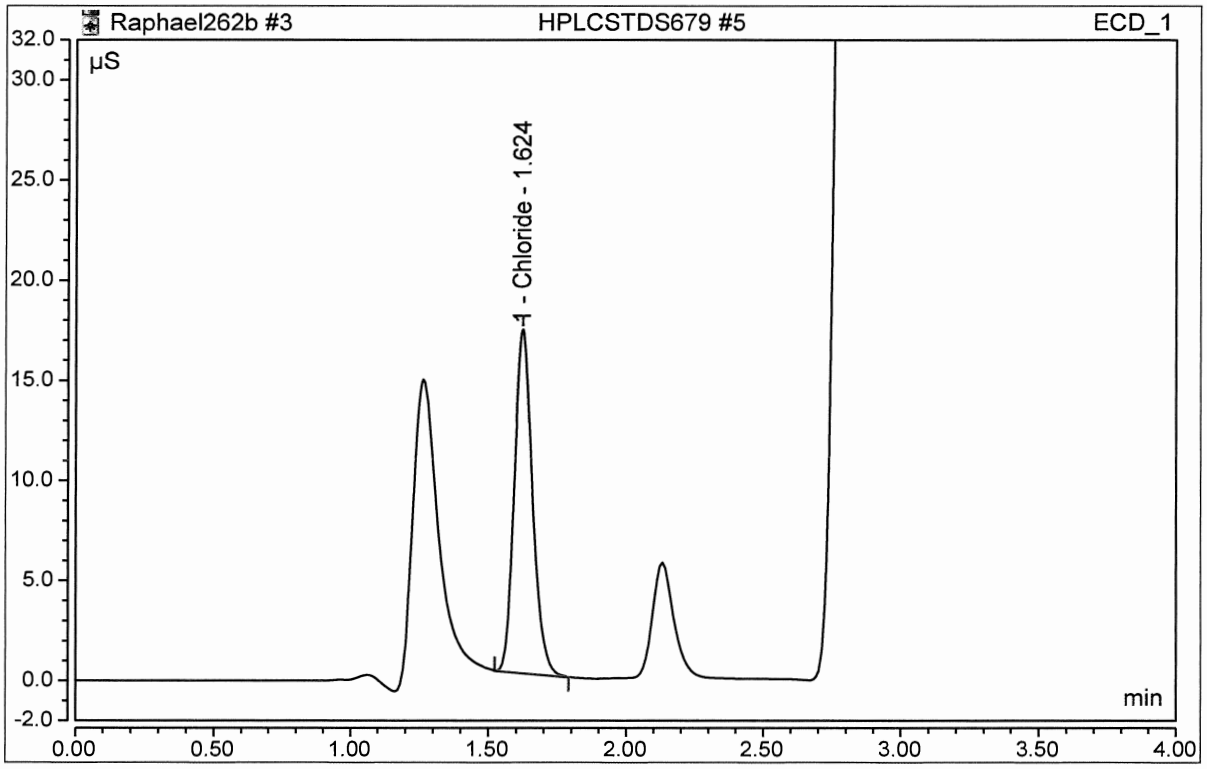
Peak Name	Eval.Type	Cal.Type	Points	Offset (C0)	Slope (C1)	Curve (C2)	Coeff.Det. %
Chloride	Area	Quad, WithOffset, 1/A	20.000	-0.049	13.788	-1.682	99.997
		AVERAGE:		-0.0486	13.7875	-1.6817	99.9970

Injection Name	Ret.Time min ECD_1	Area µS*min ECD_1	Height µS ECD_1	Amount µg/mL ECD_1
	Chloride	Chloride	Chloride	Chloride
HPLCSTDS679 #5	1.624	1.297	17.157	15.003
HPLCSTDS679 #5	1.621	1.296	17.118	14.993
HPLCSTDS679 #4	1.621	0.812	10.575	10.039
HPLCSTDS679 #4	1.621	0.813	10.597	10.054
HPLCSTDS679 #3	1.617	0.381	4.859	4.960
HPLCSTDS679 #3	1.617	0.381	4.867	4.965
HPLCSTDS679 #2	1.617	0.077	0.943	1.008
HPLCSTDS679 #2	1.617	0.078	0.945	1.015
HPLCSTDS679 #1	1.617	0.040	0.471	0.501
HPLCSTDS679 #1	1.617	0.040	0.472	0.504
HPLCSTDS679 #5	1.624	1.292	17.039	14.958
HPLCSTDS679 #5	1.624	1.293	17.062	14.966
HPLCSTDS679 #4	1.624	0.813	10.573	10.044
HPLCSTDS679 #4	1.624	0.814	10.580	10.059
HPLCSTDS679 #3	1.624	0.381	4.844	4.961
HPLCSTDS679 #3	1.620	0.382	4.859	4.972
HPLCSTDS679 #2	1.624	0.077	0.937	1.000
HPLCSTDS679 #2	1.621	0.078	0.941	1.011
HPLCSTDS679 #1	1.621	0.039	0.463	0.489
HPLCSTDS679 #1	1.621	0.040	0.466	0.496



Peak Analysis Report

Sample Name:	**HPLCSTDS679 #5**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**01-Oct-2018 / 23:11**	Run Time:	**4.50**

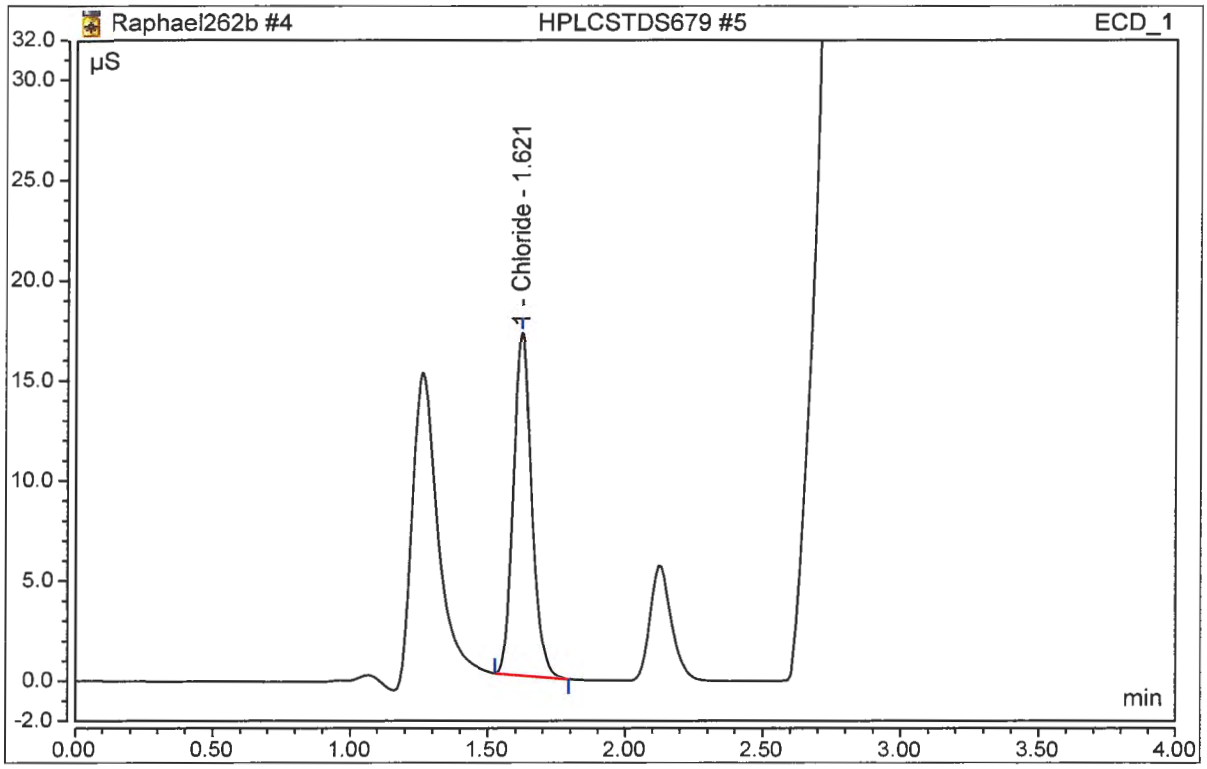


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	1.297	17.157	15.0026	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #5**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**01-Oct-2018 / 23:17**	Run Time:	**4.50**

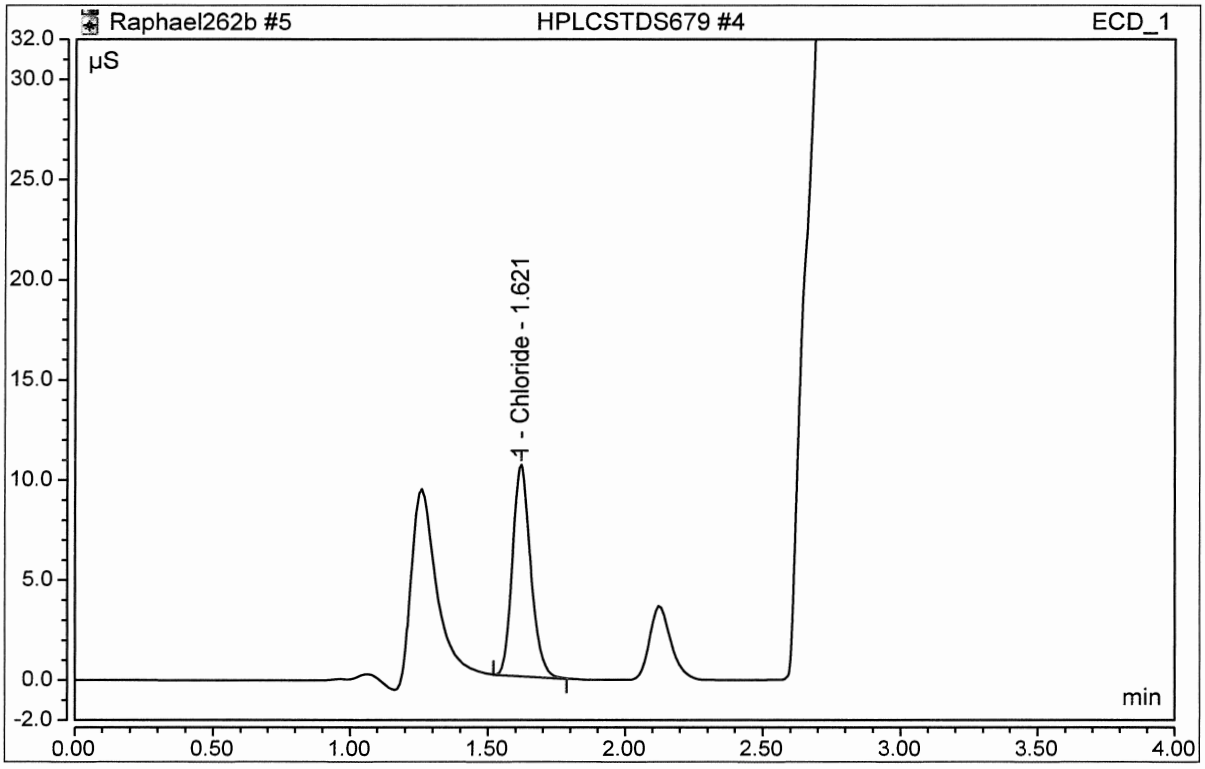


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	1.296	17.118	14.9928	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #4**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**01-Oct-2018 / 23:22**	Run Time:	**4.50**

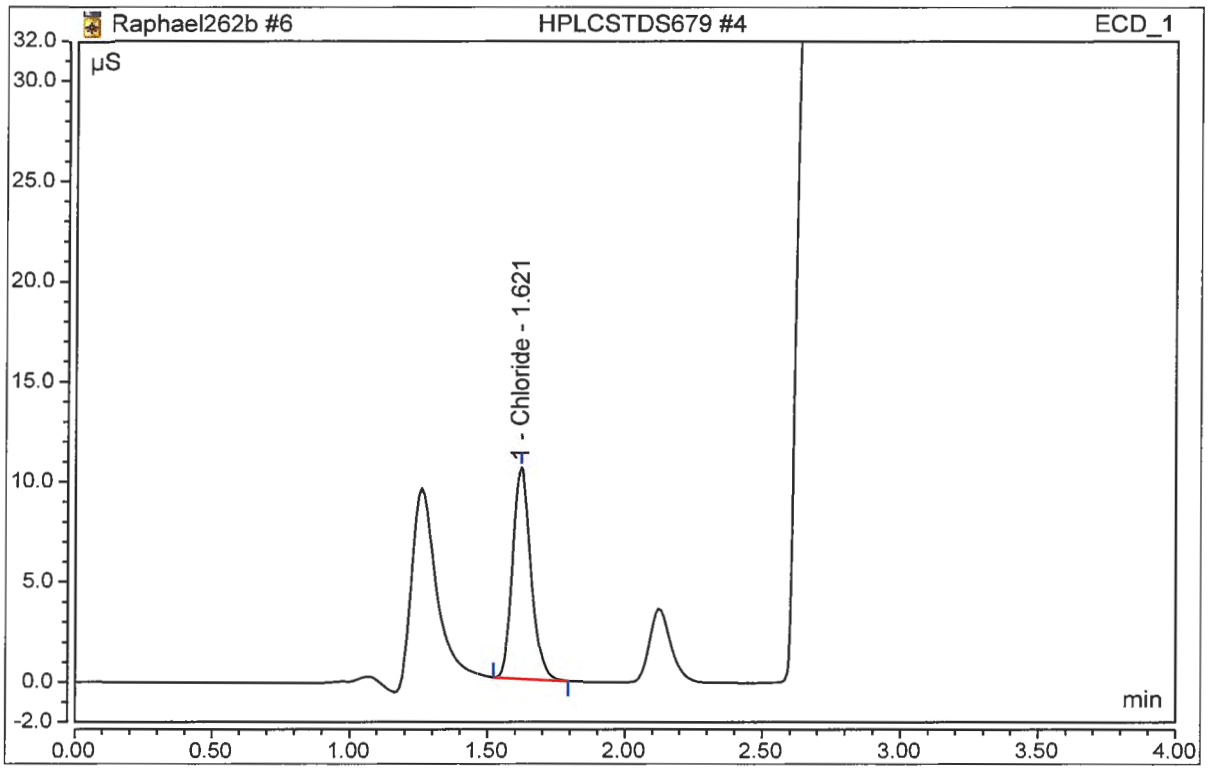


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.812	10.575	10.0387	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #4**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**01-Oct-2018 / 23:29**	Run Time:	**4.50**

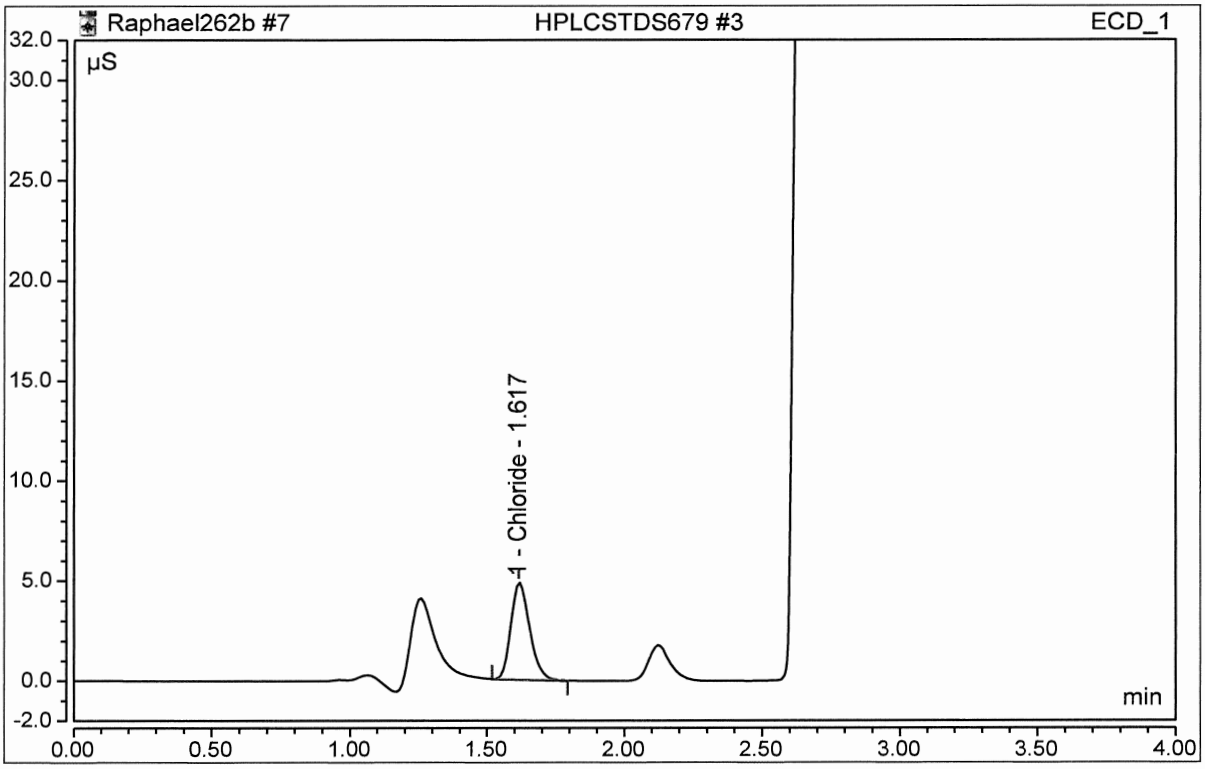


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.813	10.597	10.0539	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #3**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**01-Oct-2018 / 23:34**	Run Time:	**4.50**

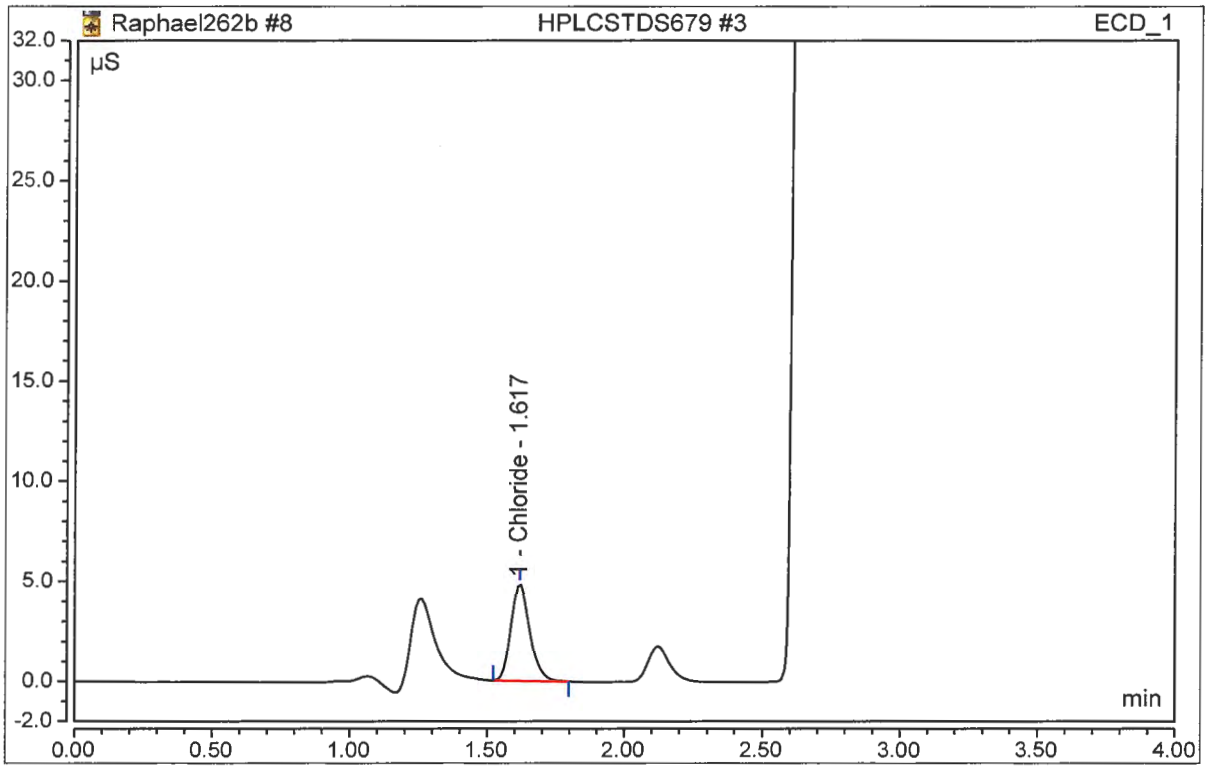


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.381	4.859	4.9604	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #3**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mIsMin**	Operator:	**PMann**
Inj. Date / Time:	**01-Oct-2018 / 23:40**	Run Time:	**4.50**

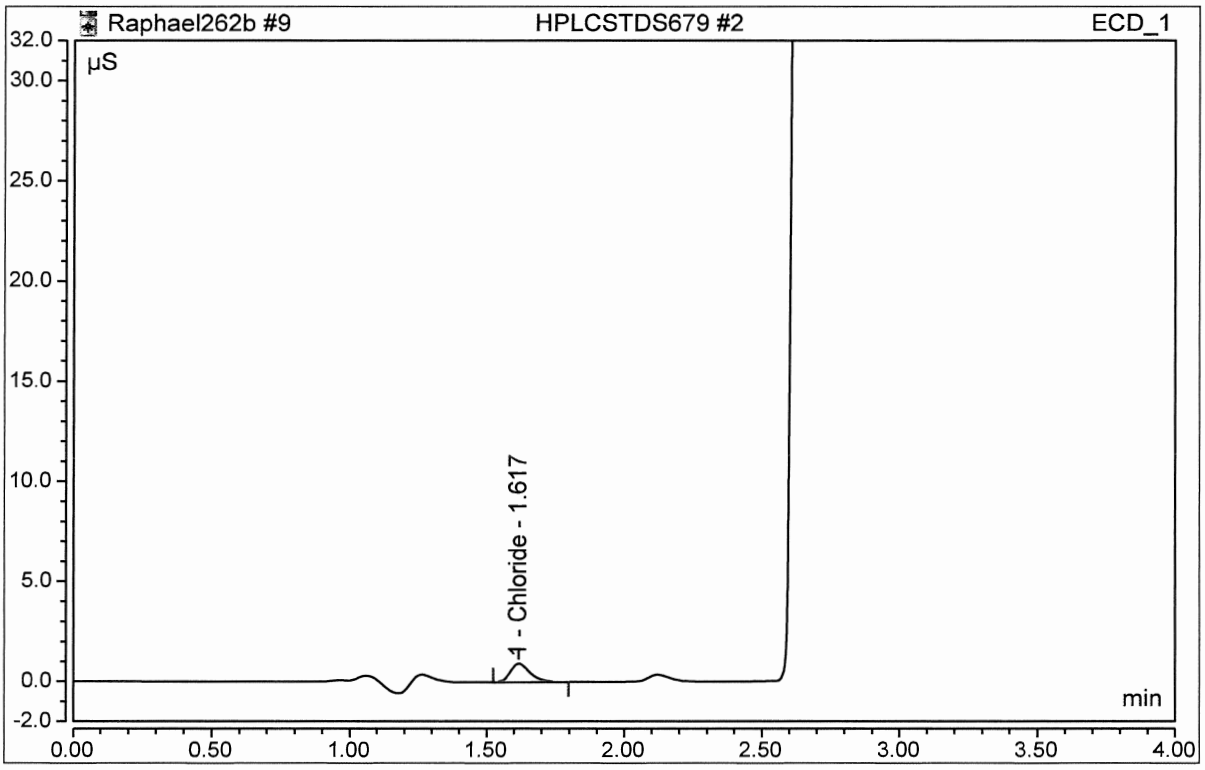


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.381	4.867	4.9655	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #2**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**01-Oct-2018 / 23:45**	Run Time:	**4.50**

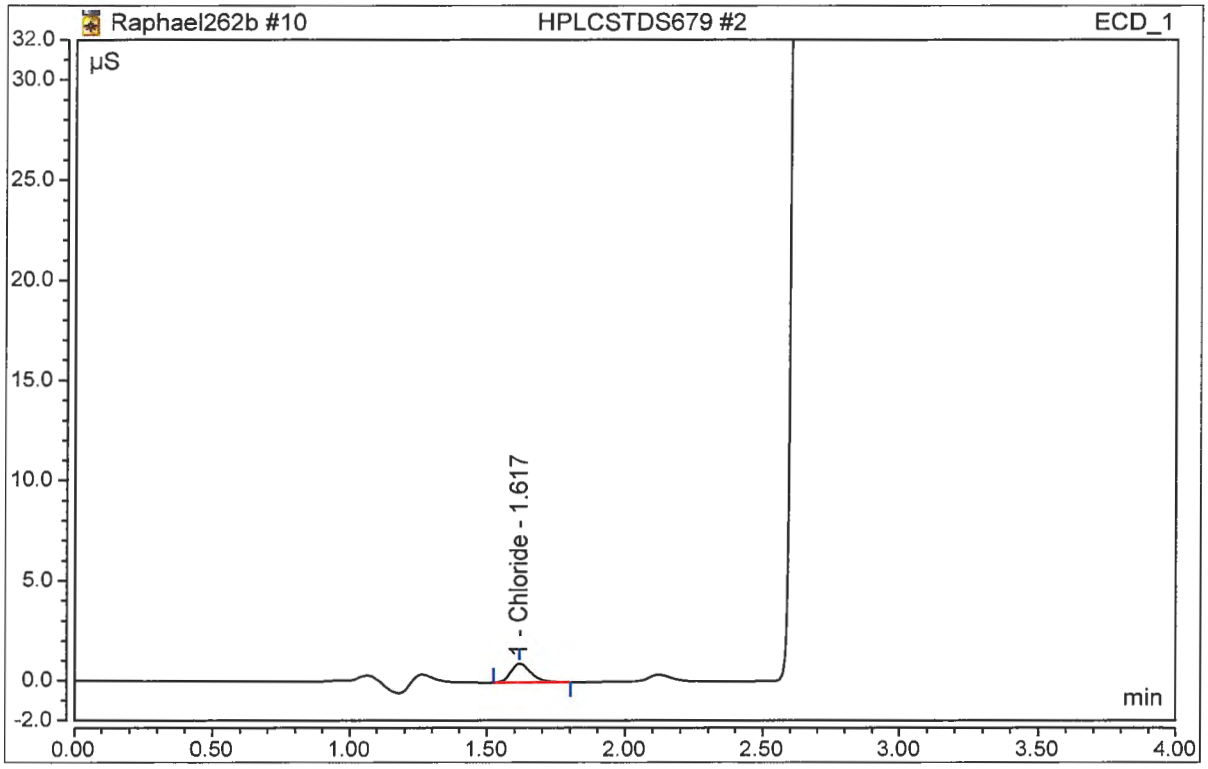


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.077	0.943	1.0083	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #2**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**01-Oct-2018 / 23:52**	Run Time:	**4.50**

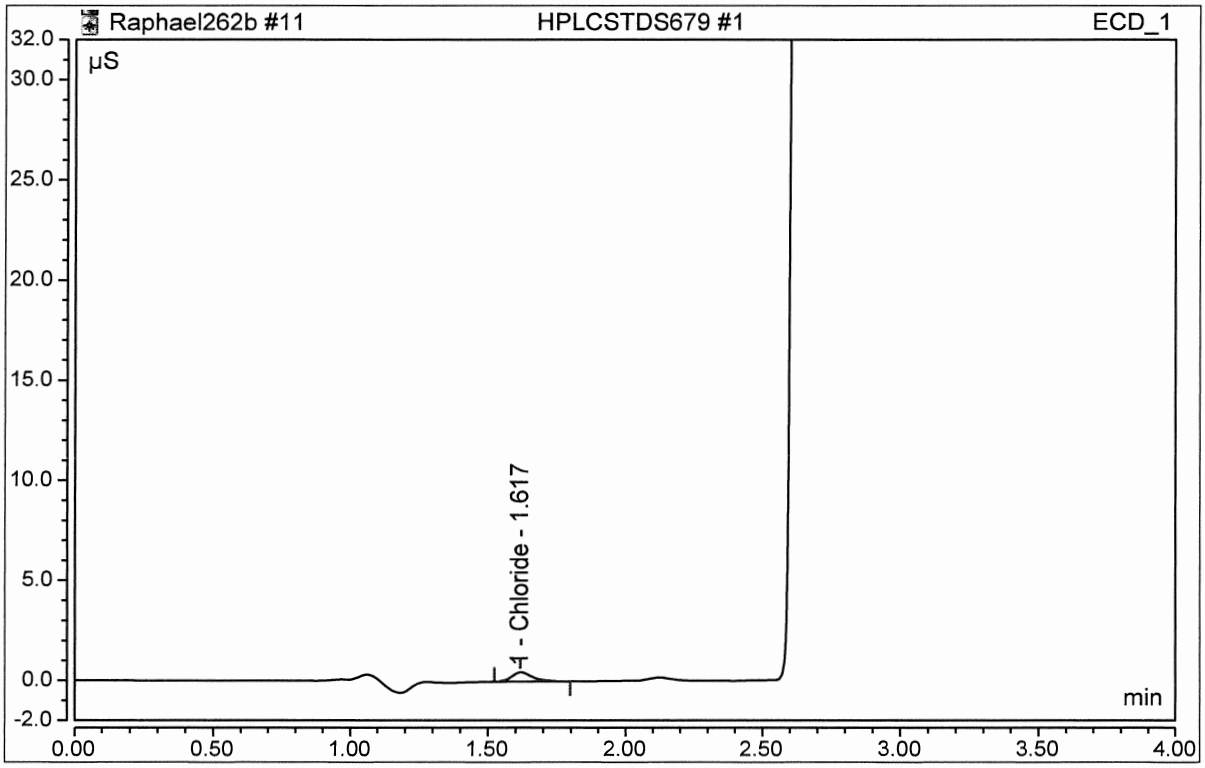


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.078	0.945	1.0147	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #1**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**01-Oct-2018 / 23:57**	Run Time:	**4.50**

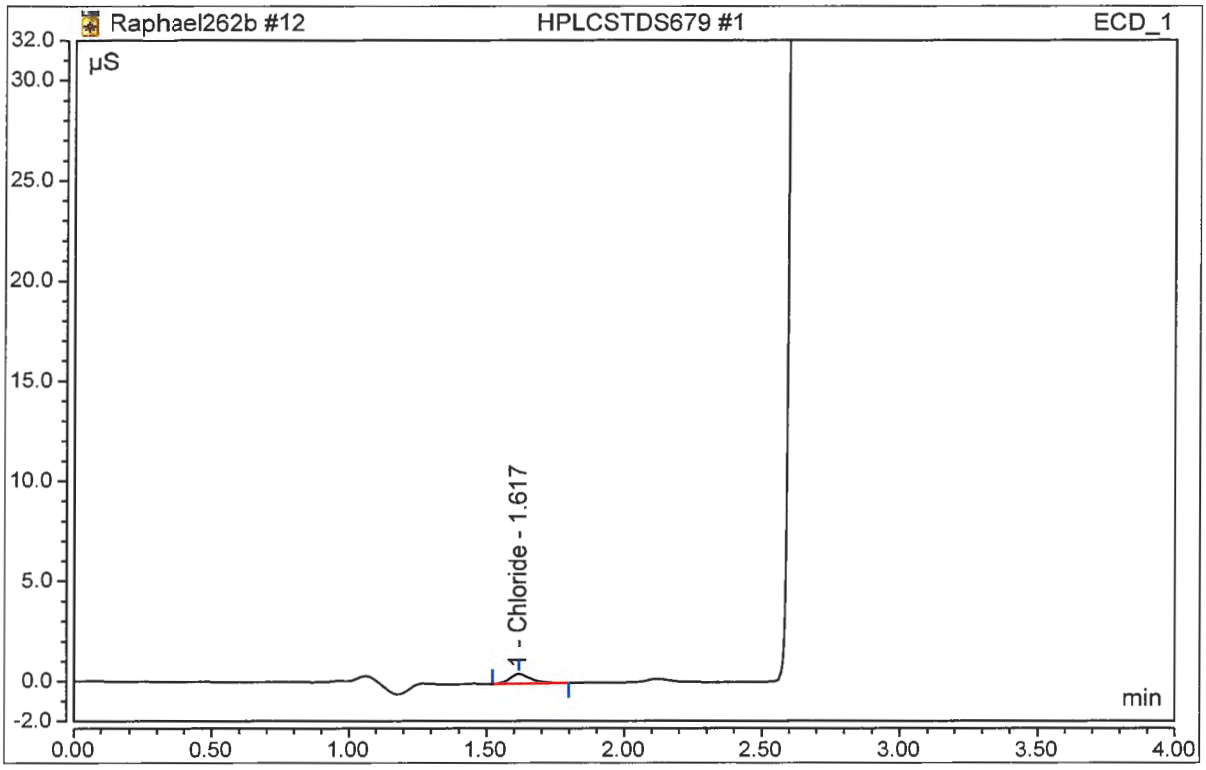


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.040	0.471	0.5014	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #1**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 00:03**	Run Time:	**4.50**

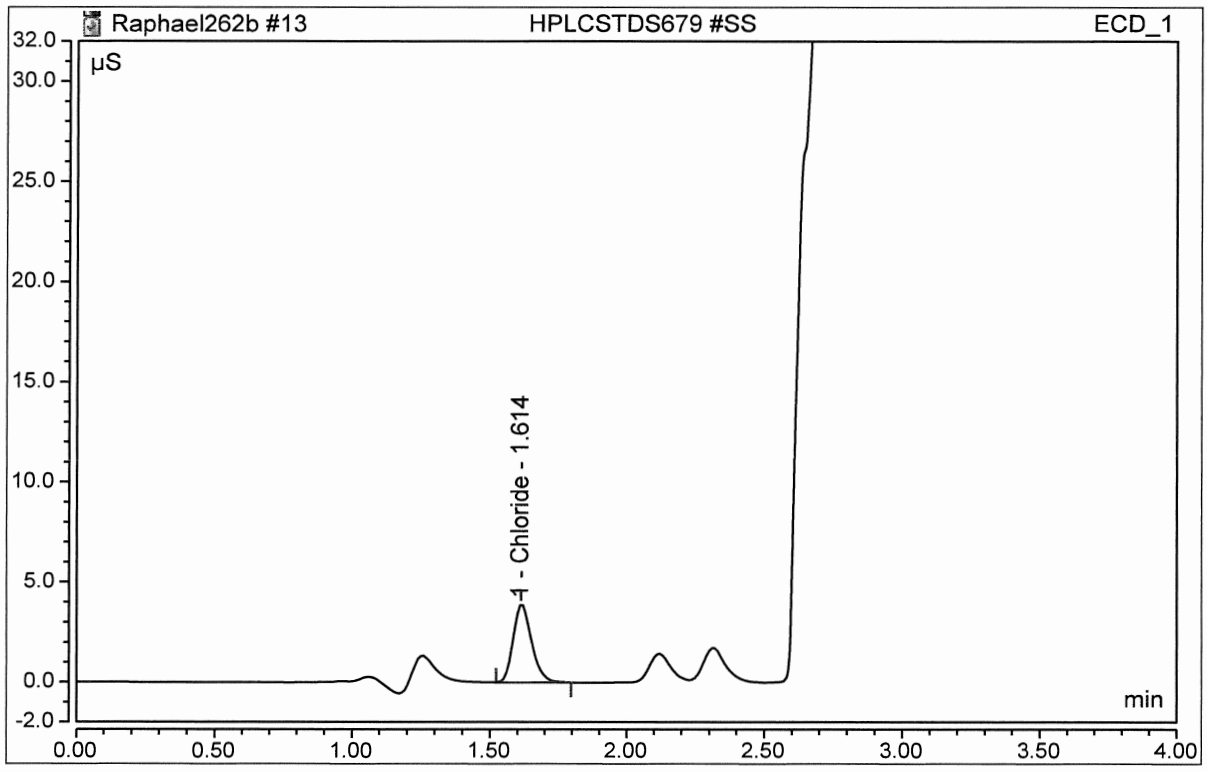


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.040	0.472	0.5036	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #SS**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 00:08**	Run Time:	**4.50**

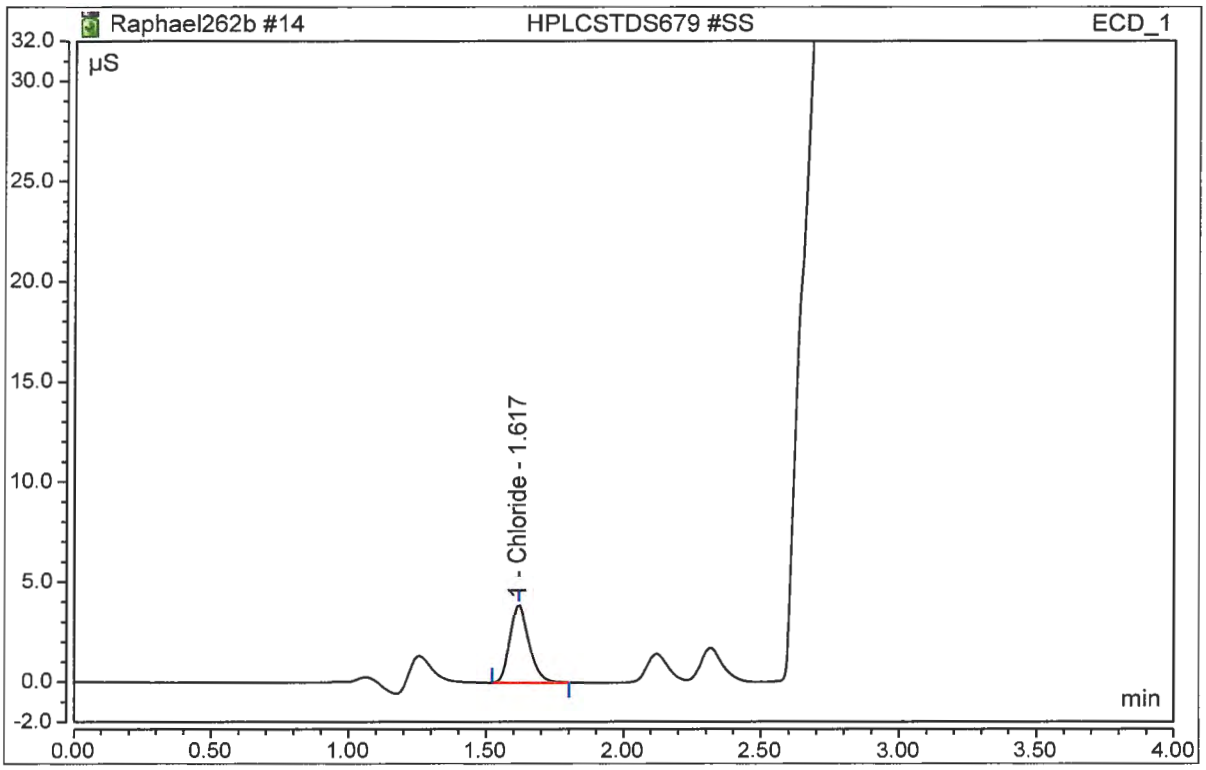


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.61	Chloride	0.306	3.898	4.0164	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #SS**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 00:15**	Run Time:	**4.50**

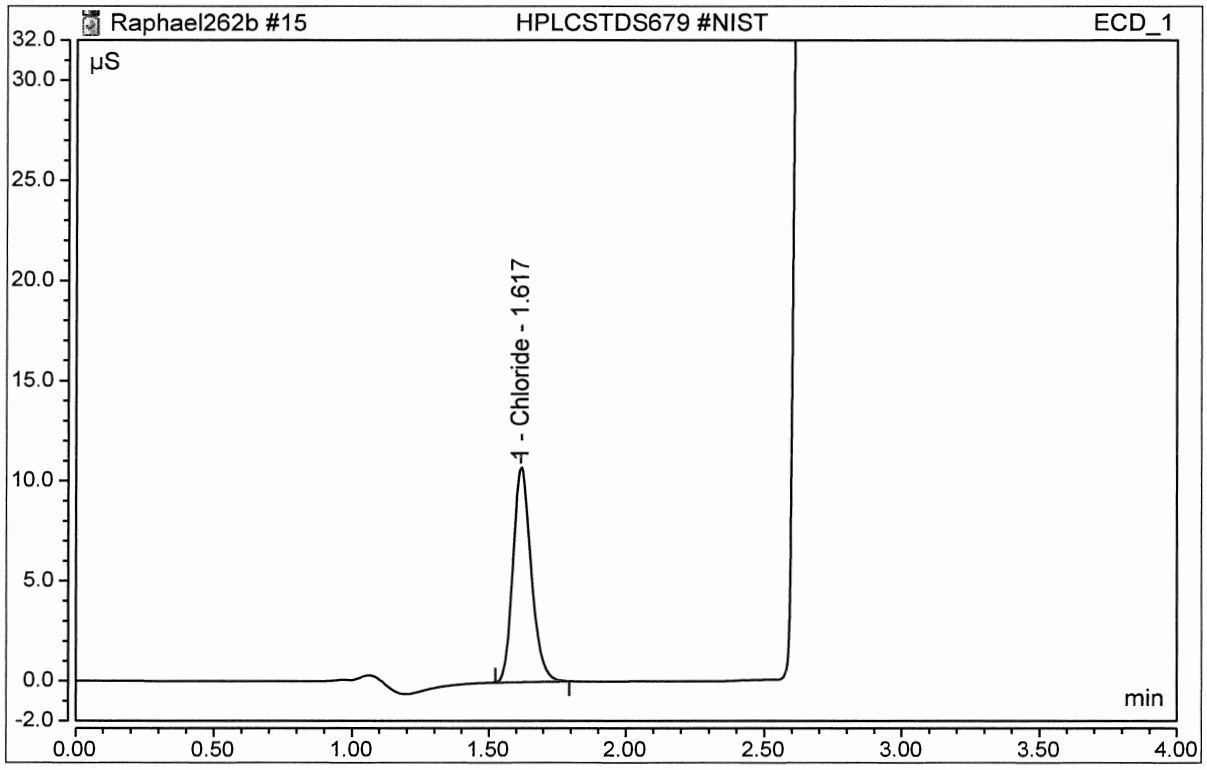


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.307	3.912	4.0288	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #NIST**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 00:20**	Run Time:	**4.50**

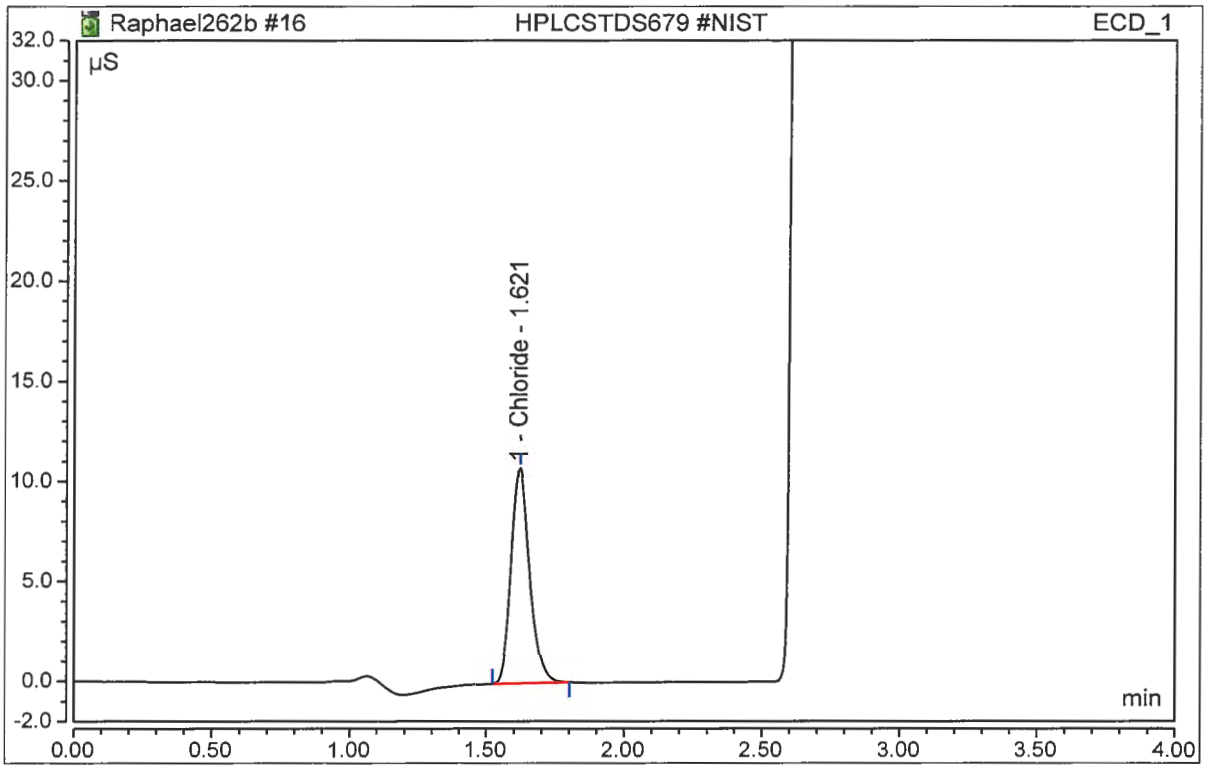


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.830	10.735	10.2405	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #NIST**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 00:26**	Run Time:	**4.50**

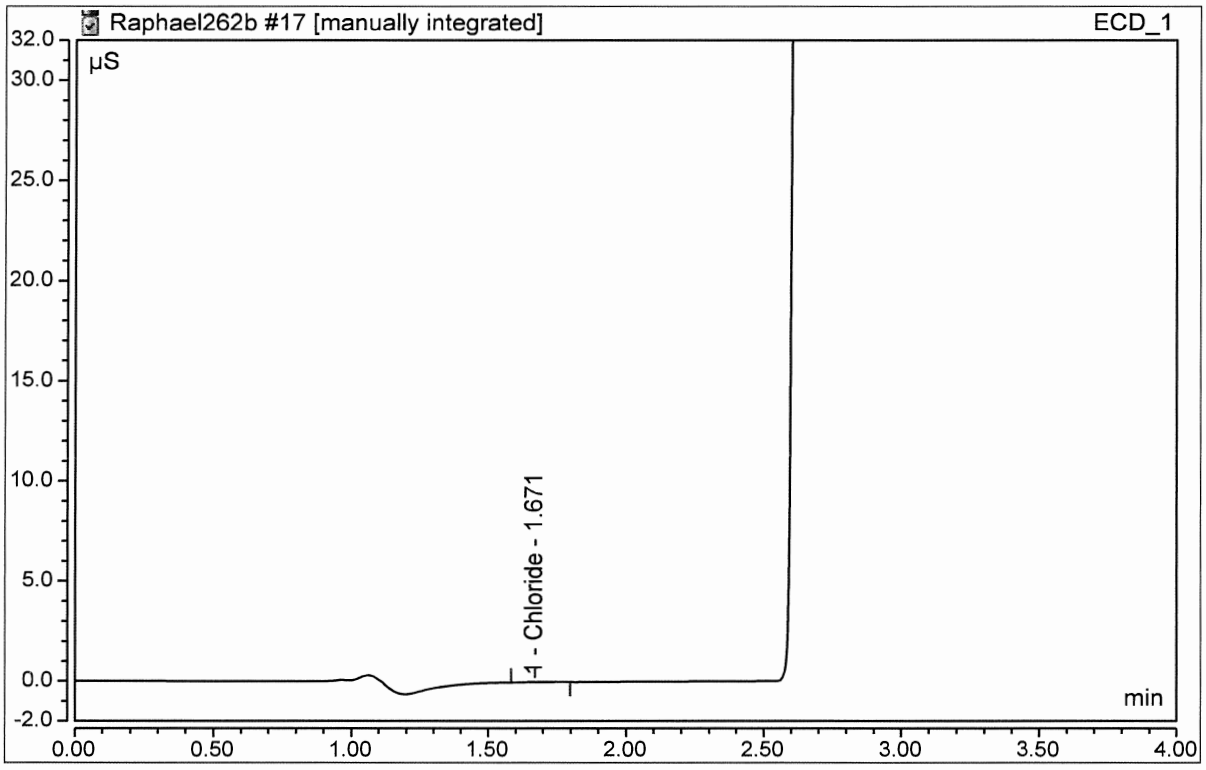


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.834	10.755	10.2773	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #RB**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 00:31**	Run Time:	**4.50**

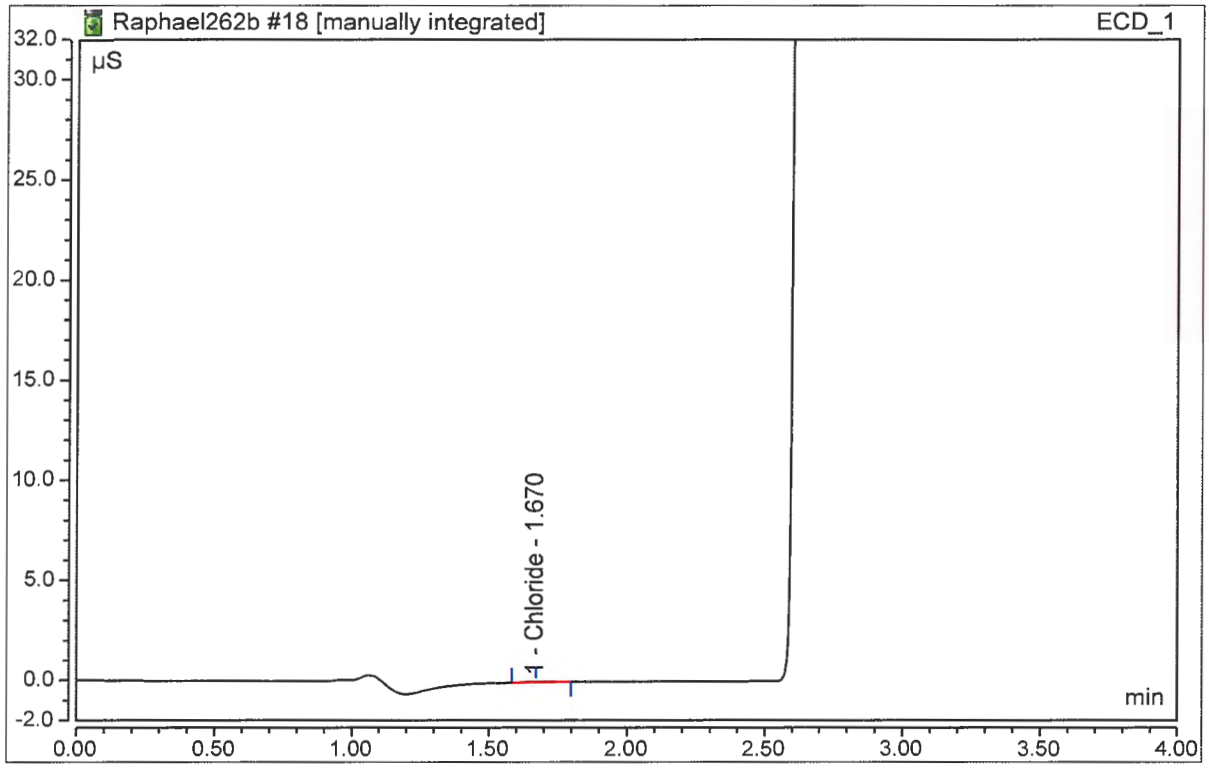


Analyst Comment: II PRM 10/2/18

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.67	Chloride	0.003	0.032	n.a.	FALSE	TRUE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #RB**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 00:38**	Run Time:	**4.50**

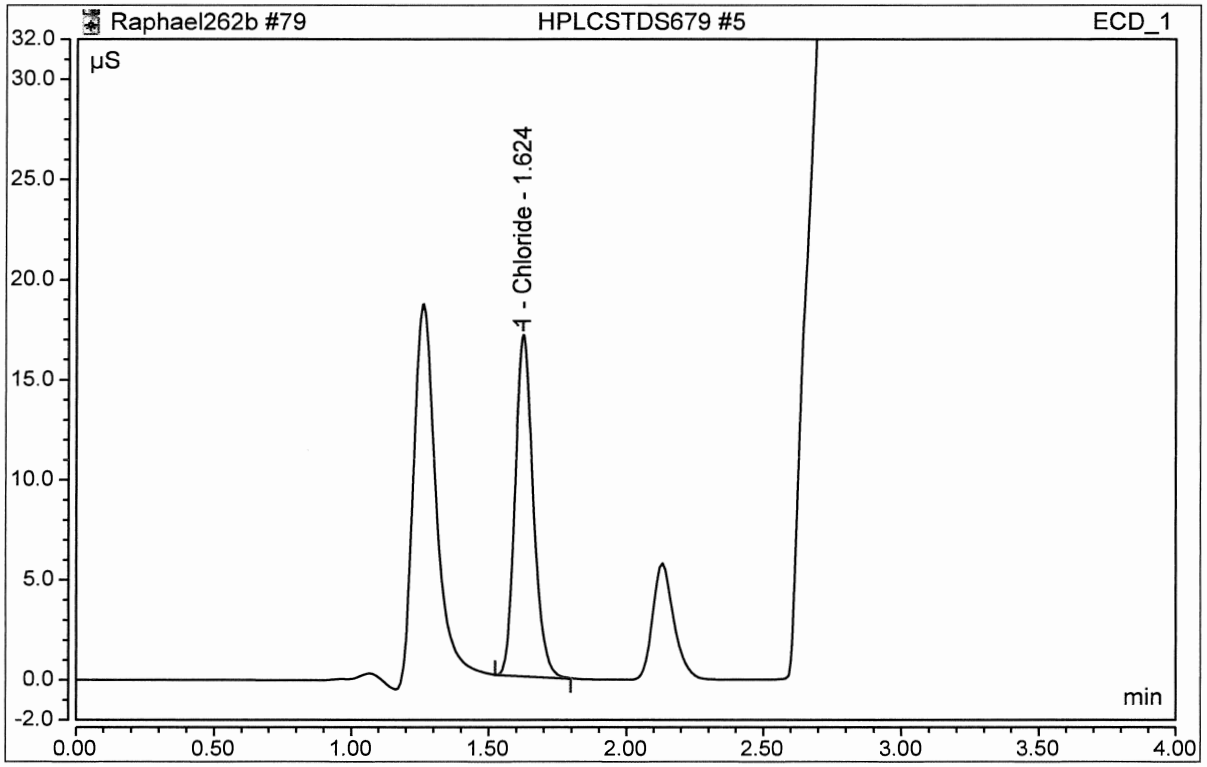


Analyst Comment: II PRM 10/2/18

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.67	Chloride	0.003	0.032	n.a.	FALSE	TRUE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #5**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:29**	Run Time:	**4.50**

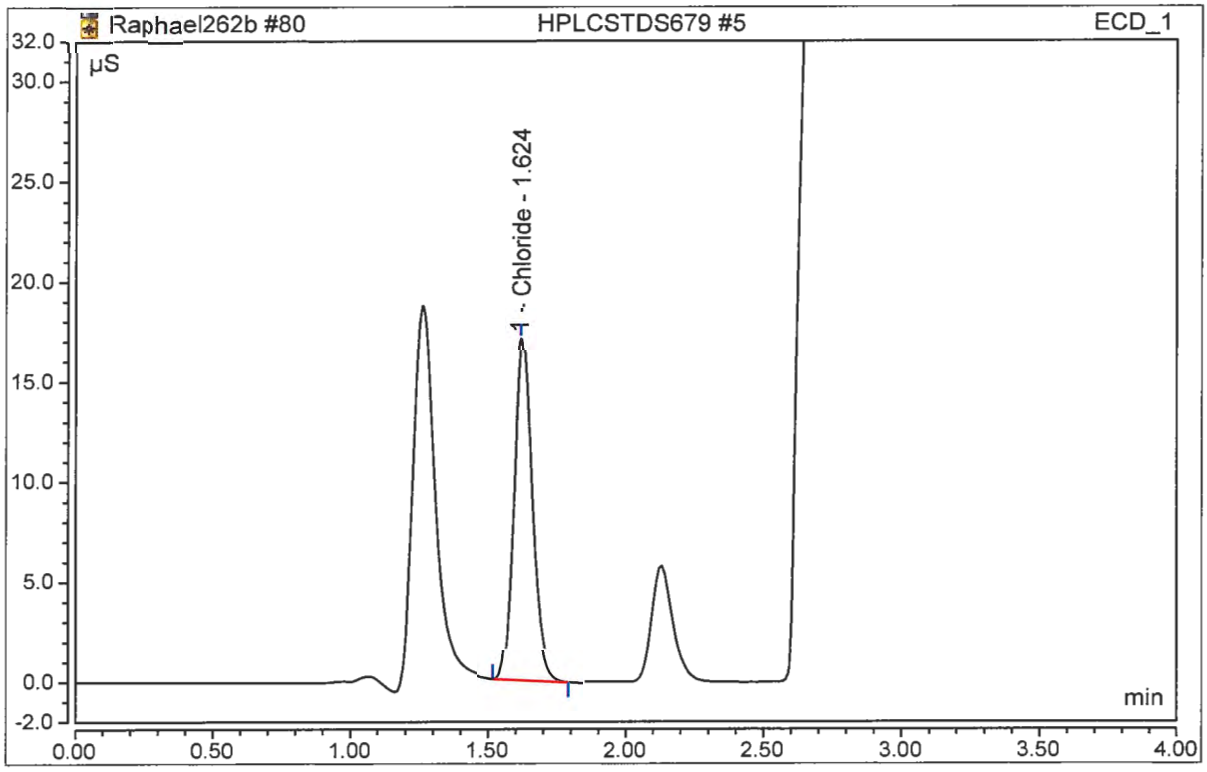


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	1.292	17.039	14.9581	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #5**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:35**	Run Time:	**4.50**

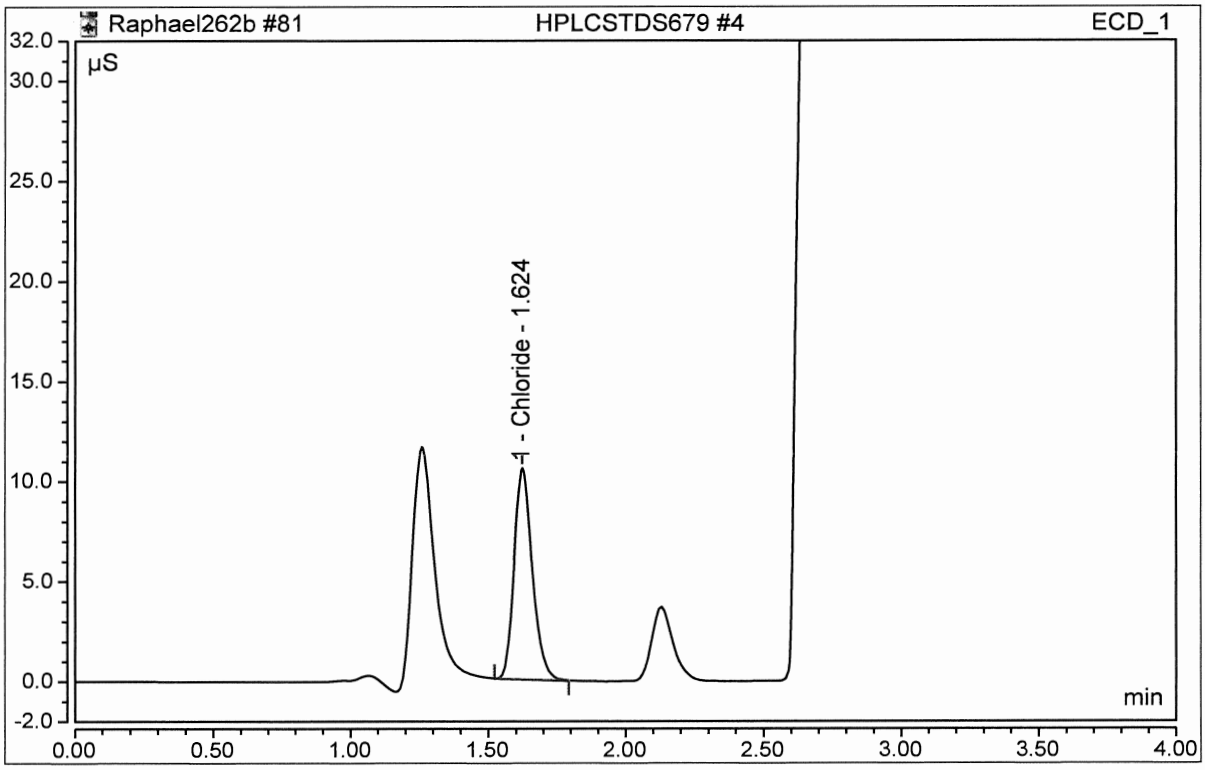


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	1.293	17.062	14.9660	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #4**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:40**	Run Time:	**4.50**

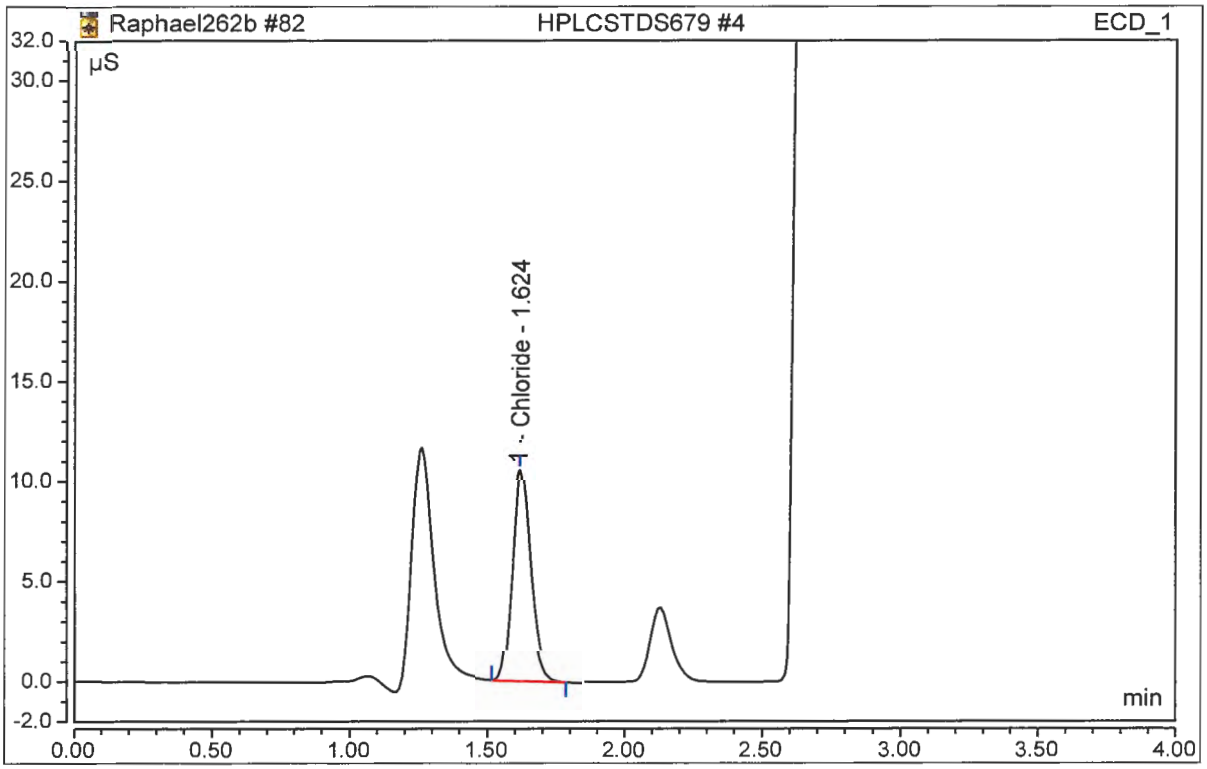


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.813	10.573	10.0437	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #4**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:47**	Run Time:	**4.50**

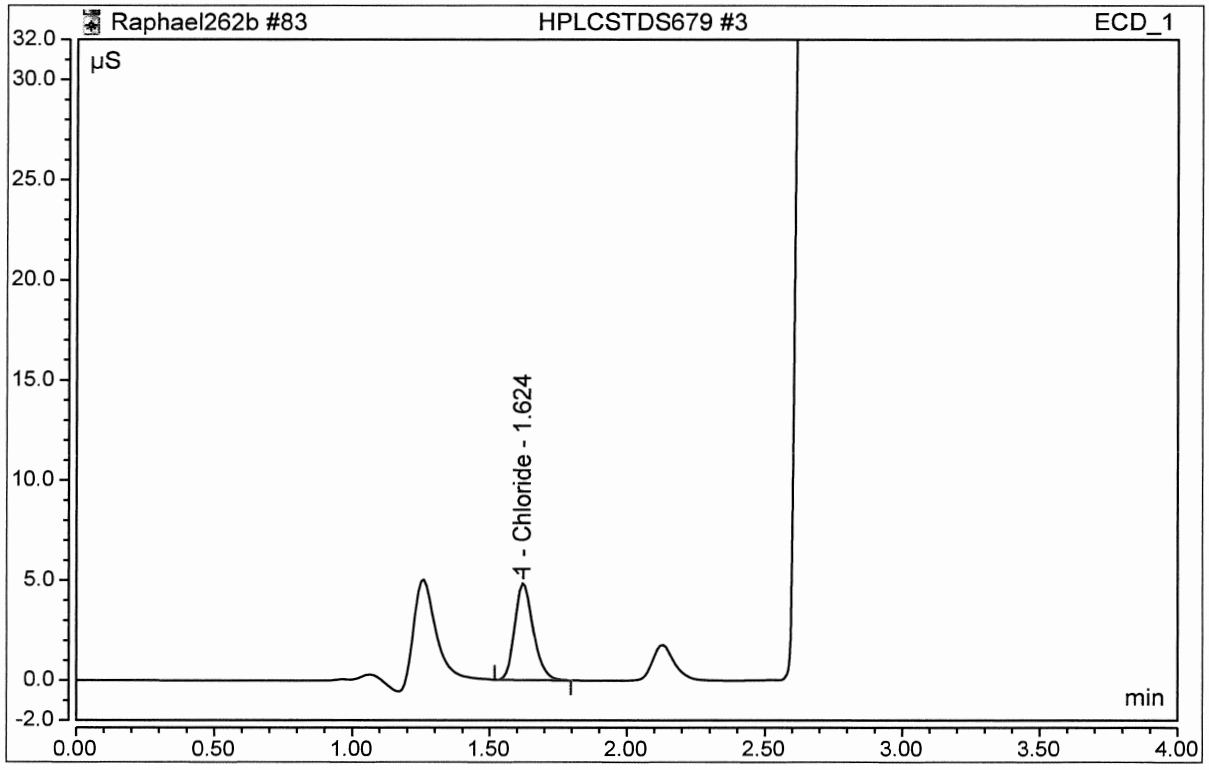


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.814	10.580	10.0588	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #3**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:52**	Run Time:	**4.50**

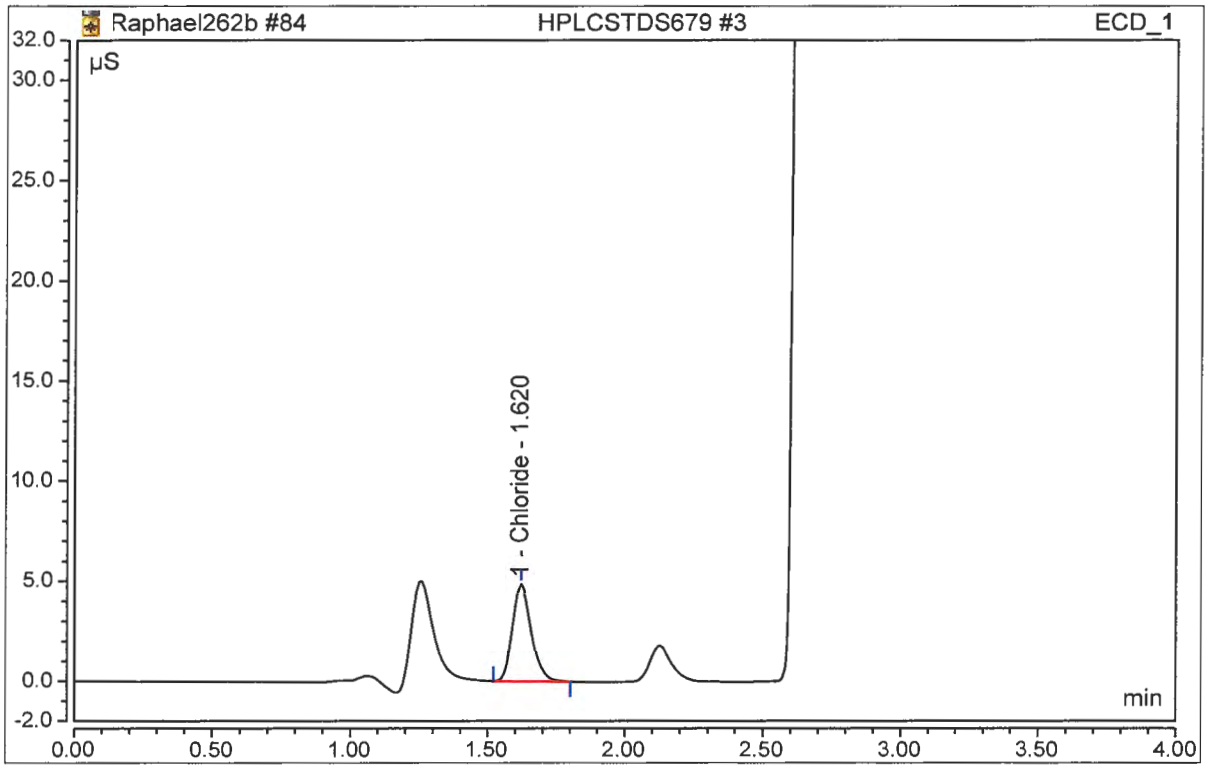


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.381	4.844	4.9609	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #3**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 06:58**	Run Time:	**4.50**

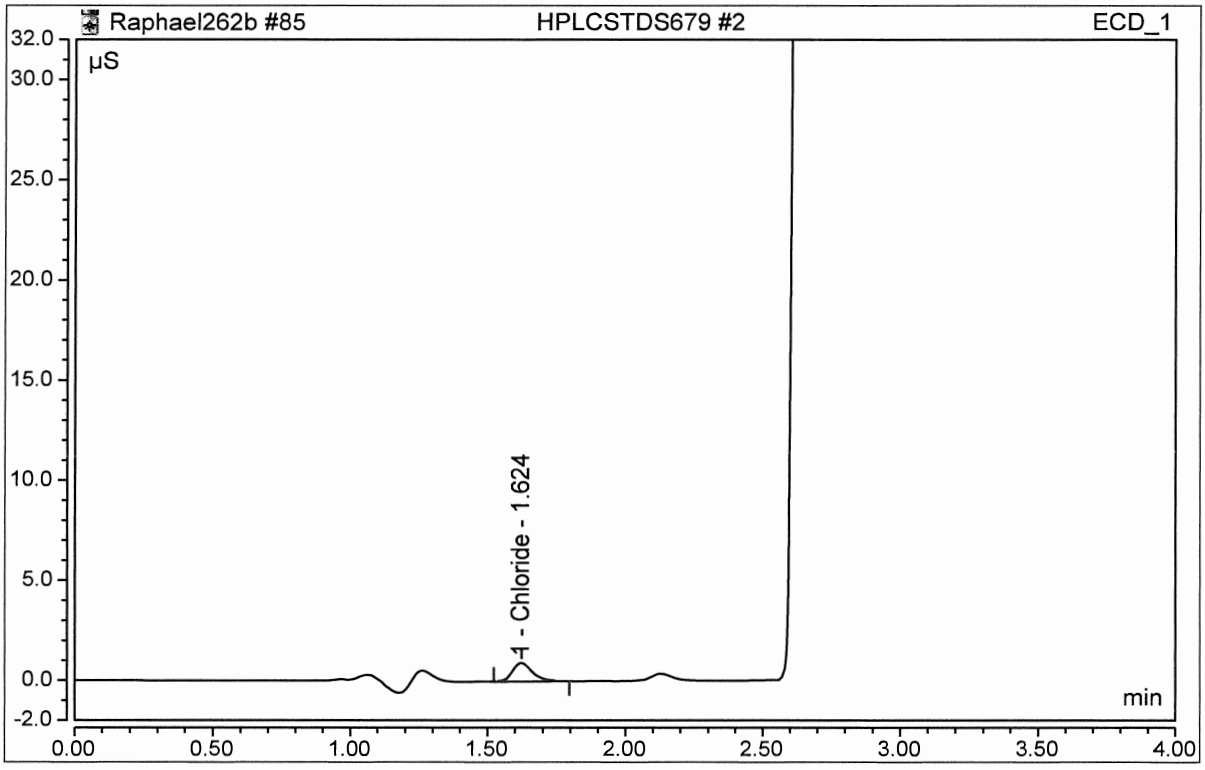


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.382	4.859	4.9720	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #2**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 07:03**	Run Time:	**4.50**

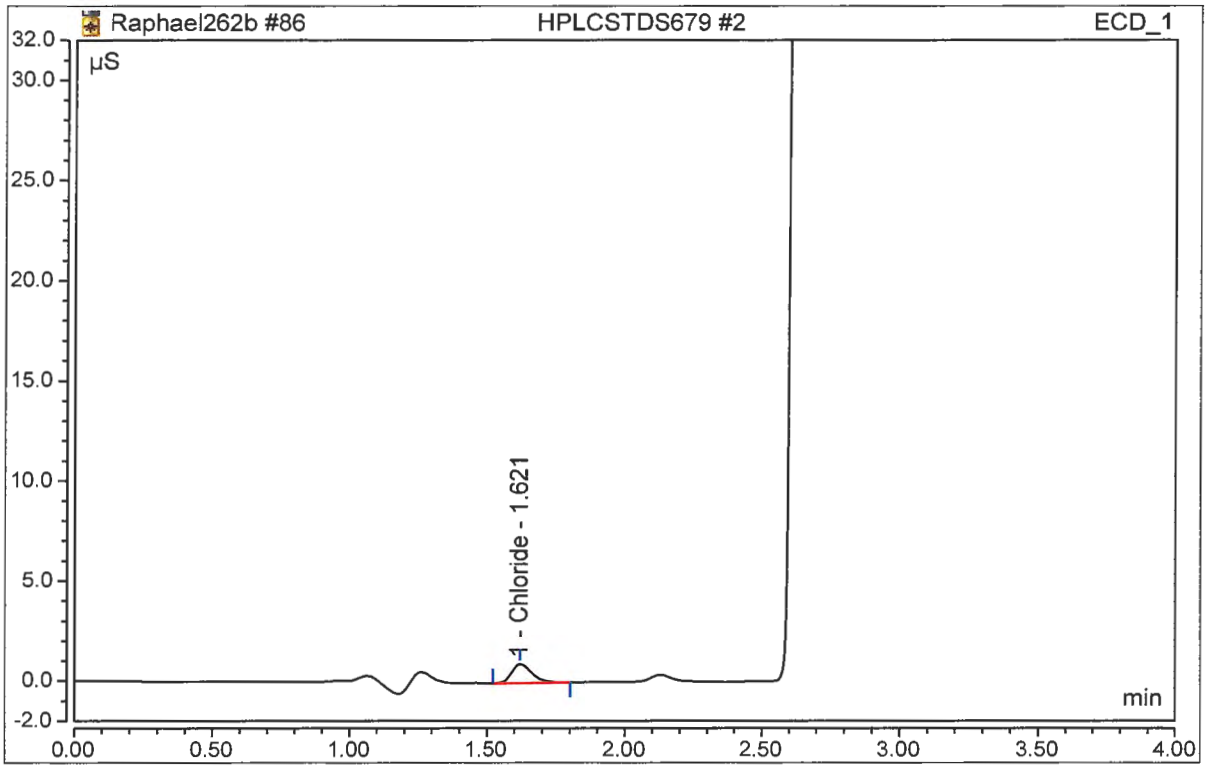


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.077	0.937	0.9995	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #2**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 07:10**	Run Time:	**4.50**

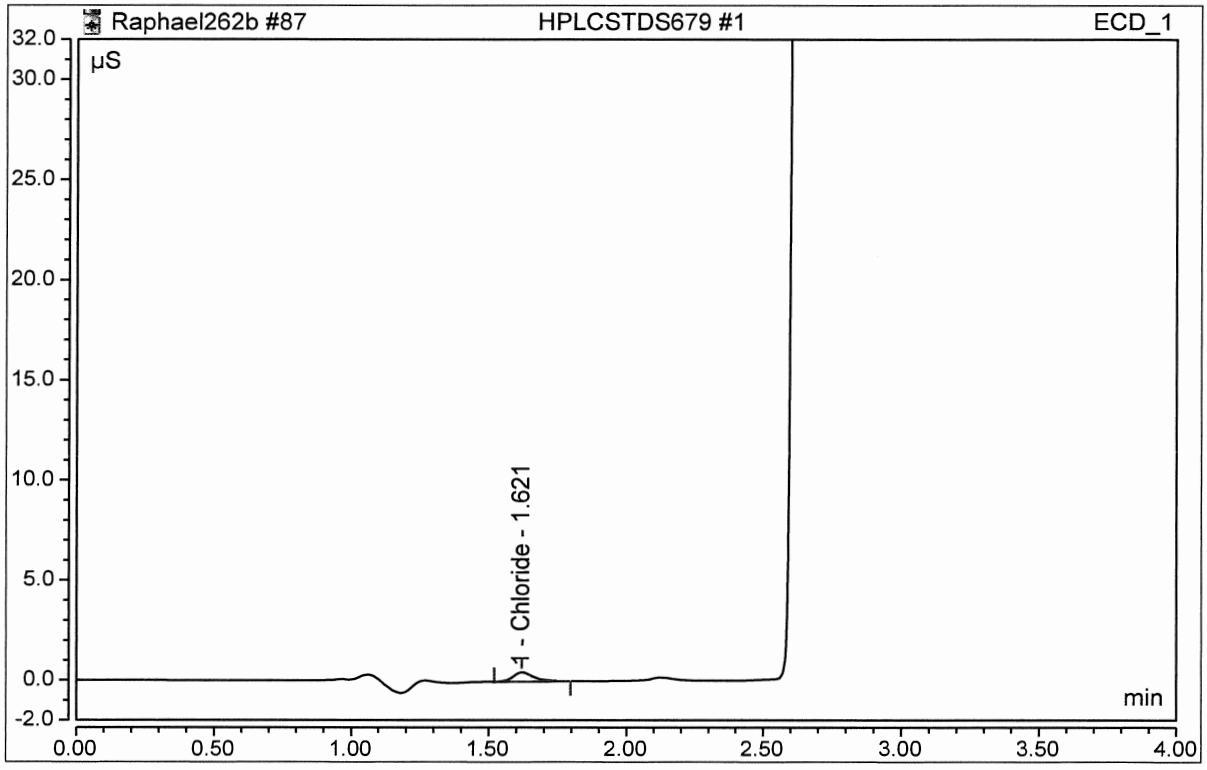


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.078	0.941	1.0107	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #1**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 07:15**	Run Time:	**4.50**

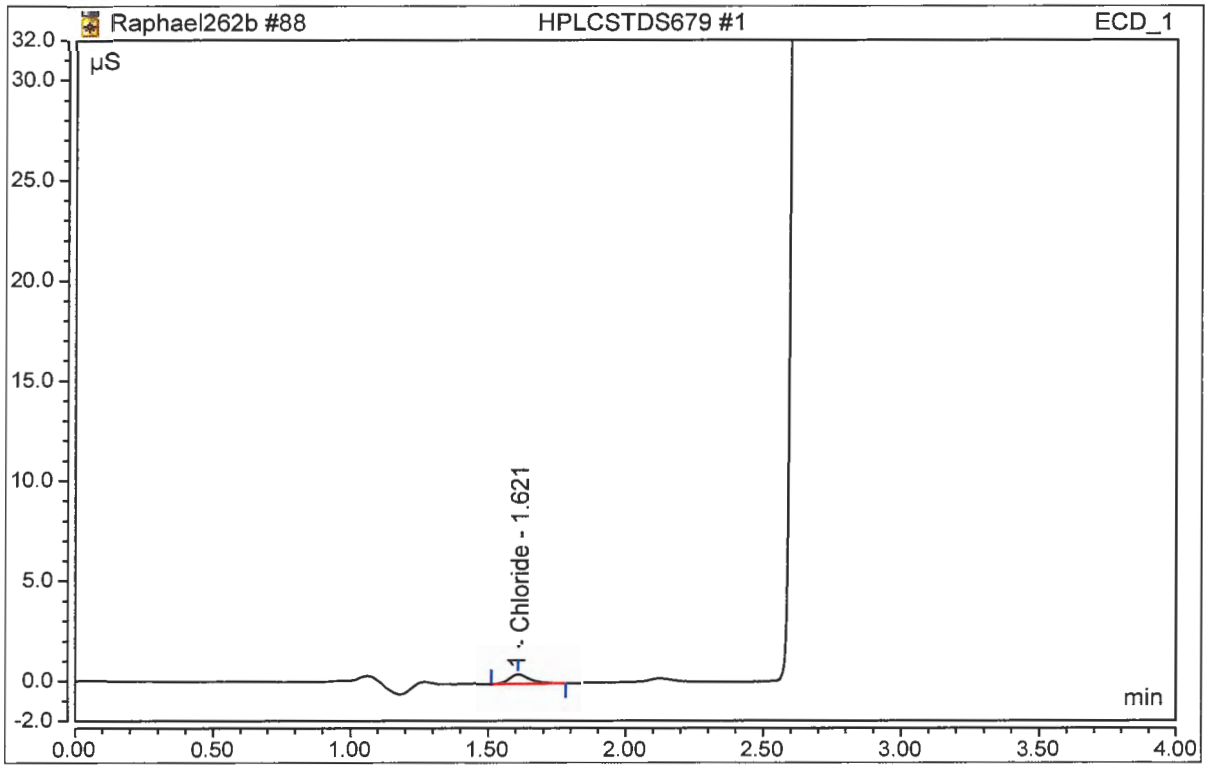


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.039	0.463	0.4893	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #1**	Injection Volume:	**25.00**
Injection Type:	**Calibration Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 07:21**	Run Time:	**4.50**

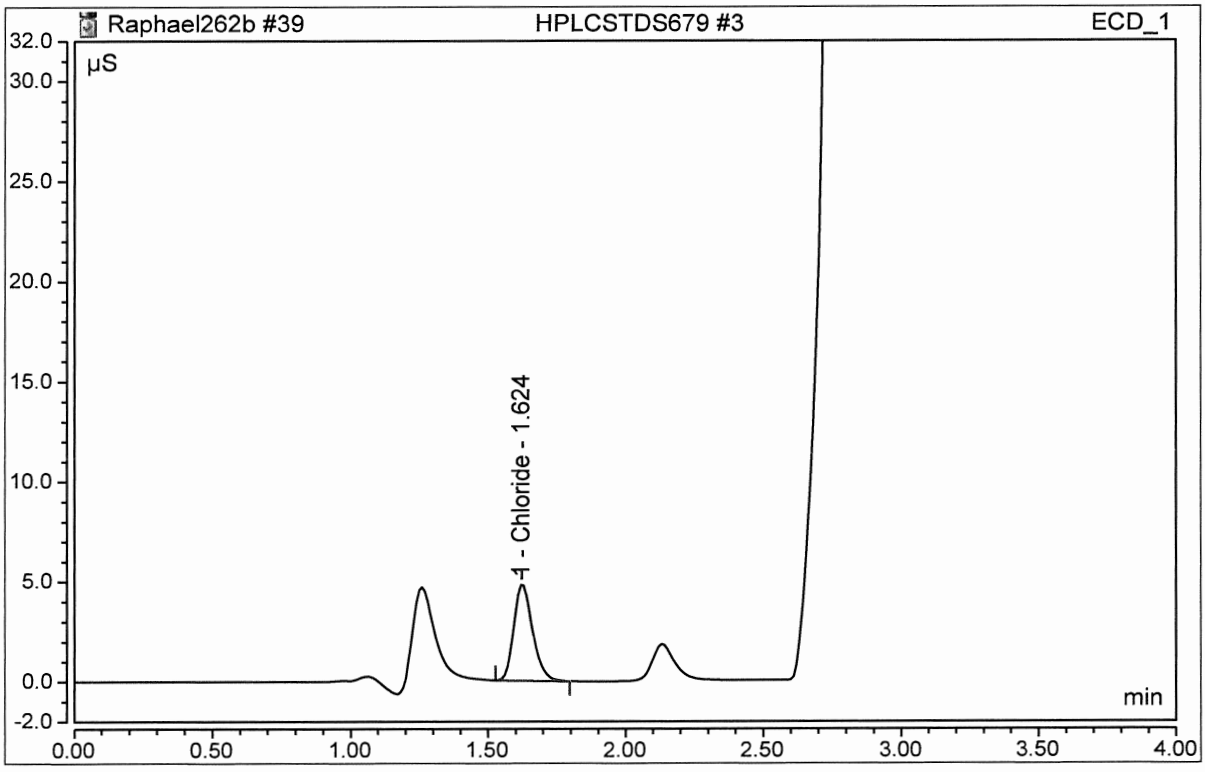


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.040	0.466	0.4962	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #3**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 02:38**	Run Time:	**4.50**

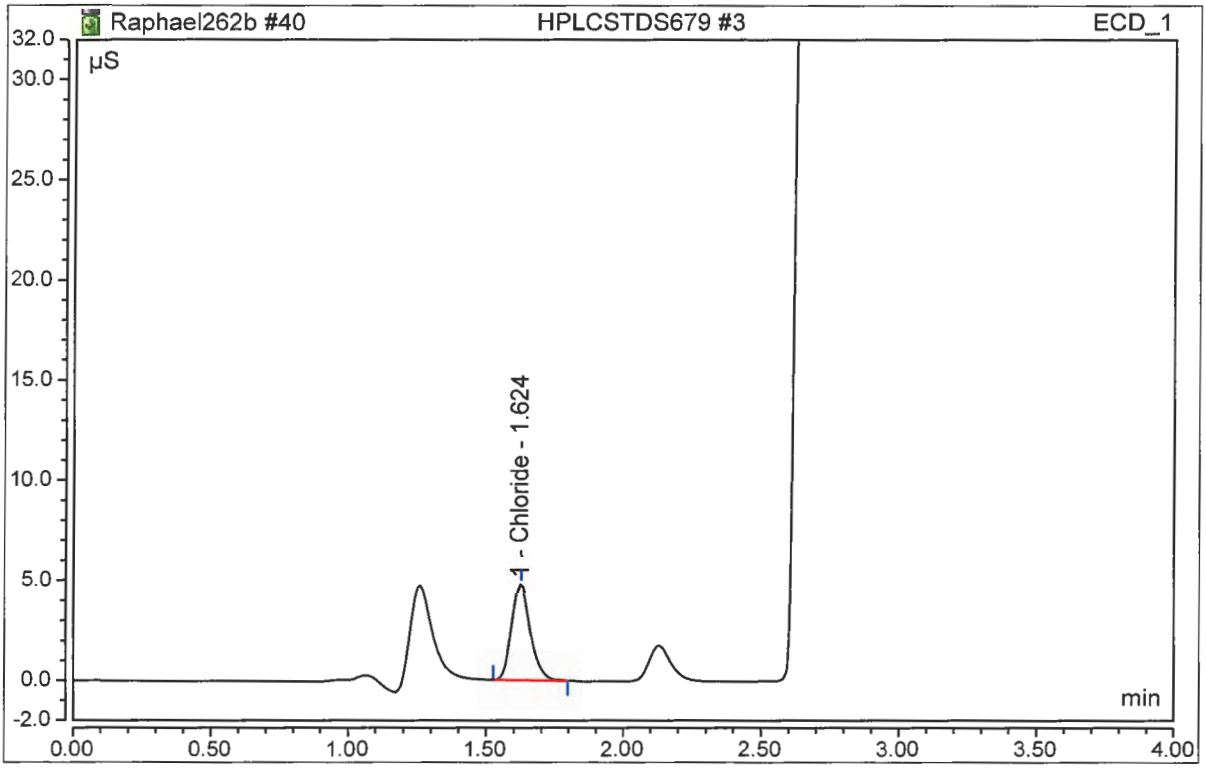


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.381	4.853	4.9589	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #3**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 02:44**	Run Time:	**4.50**

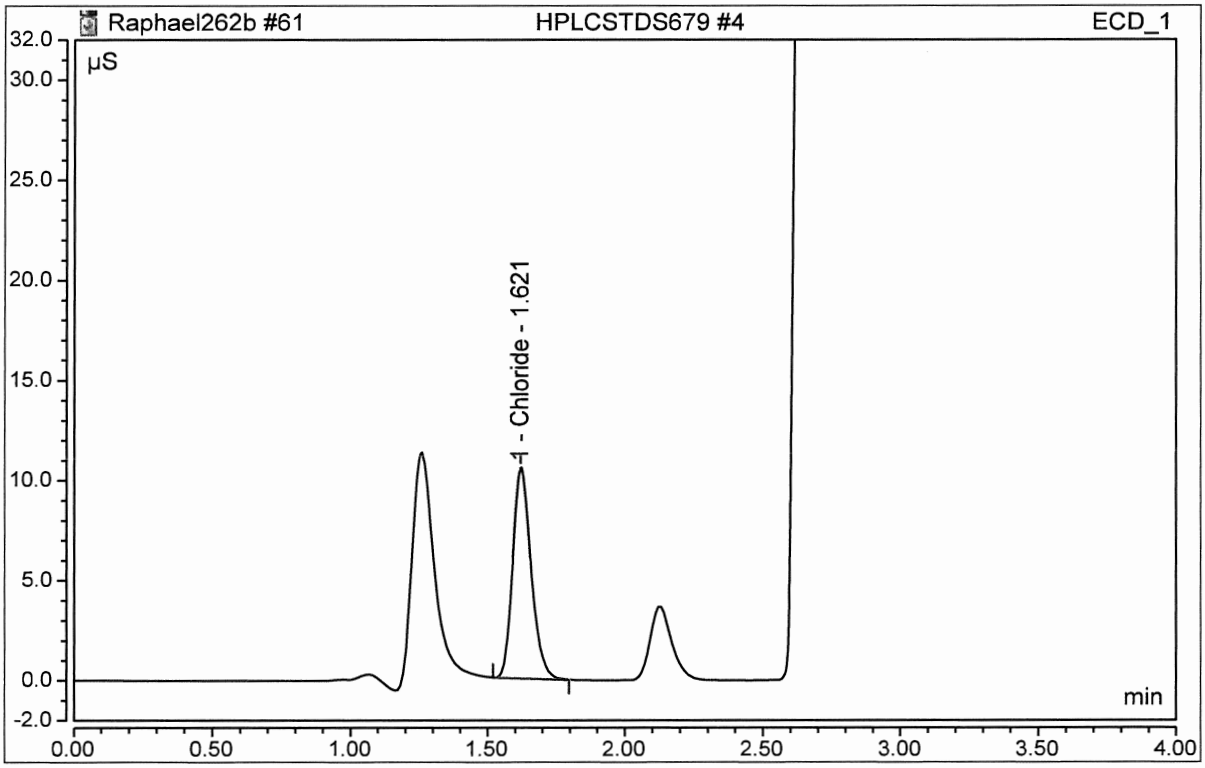


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.381	4.840	4.9599	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #4**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 04:45**	Run Time:	**4.50**

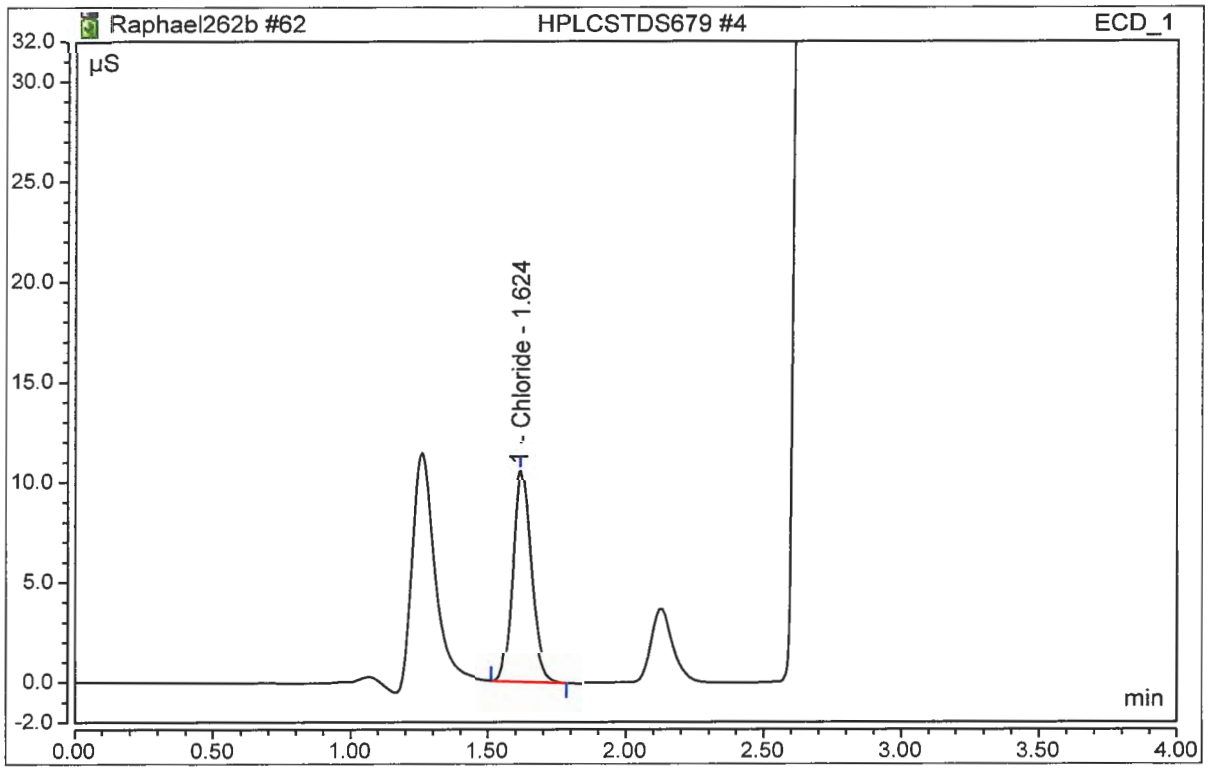


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.812	10.542	10.0385	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #4**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mIsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 04:51**	Run Time:	**4.50**

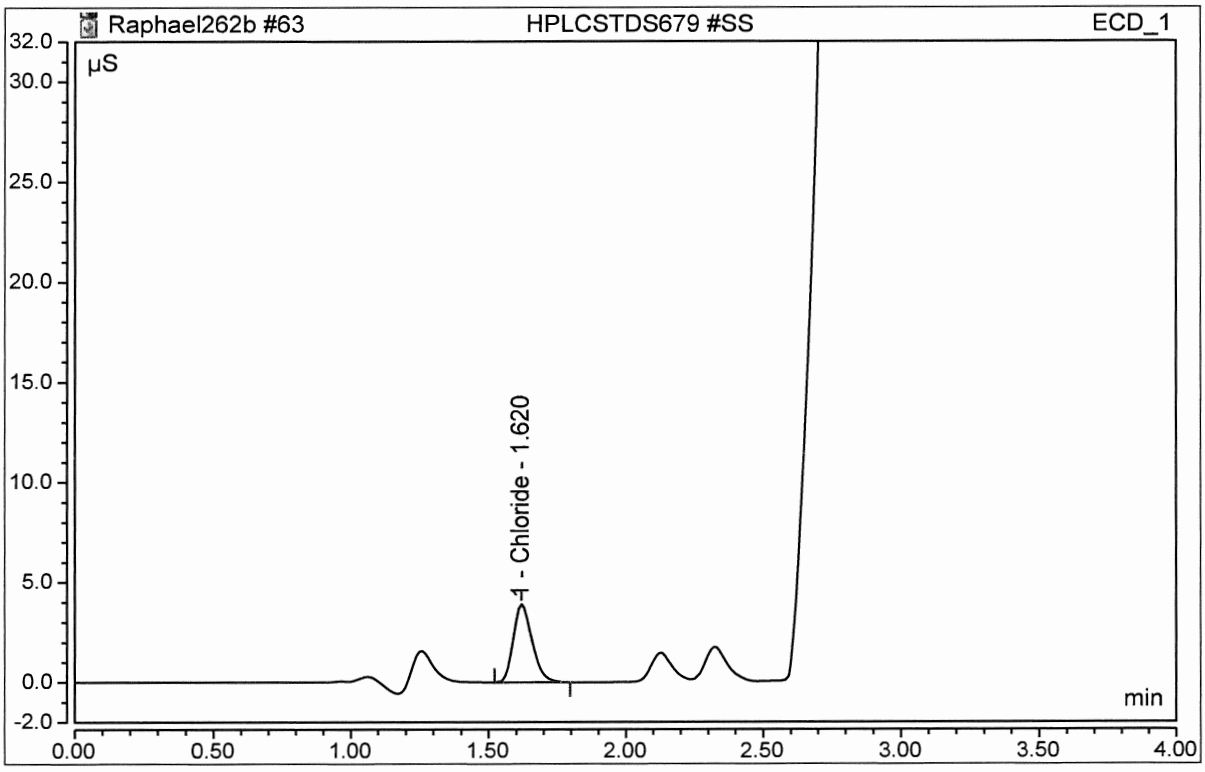


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.814	10.566	10.0571	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #SS**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 04:56**	Run Time:	**4.50**

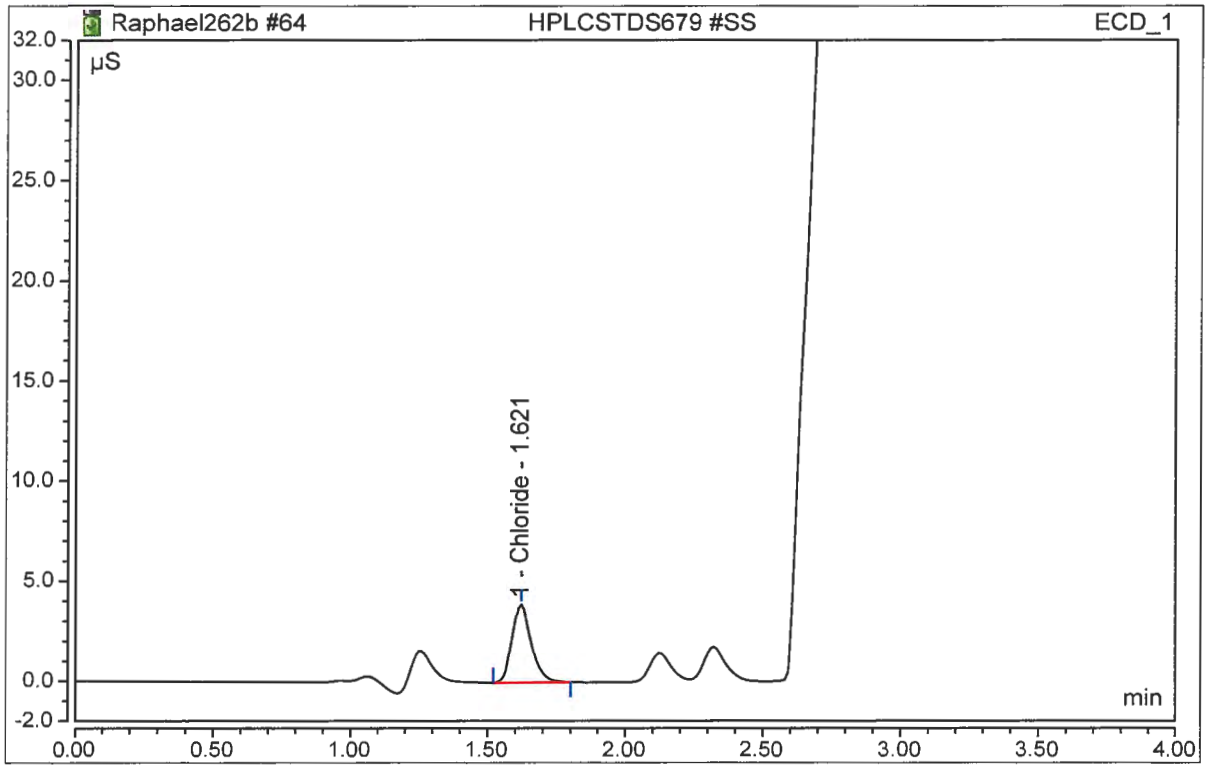


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.308	3.910	4.0396	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #SS**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mIsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 05:03**	Run Time:	**4.50**

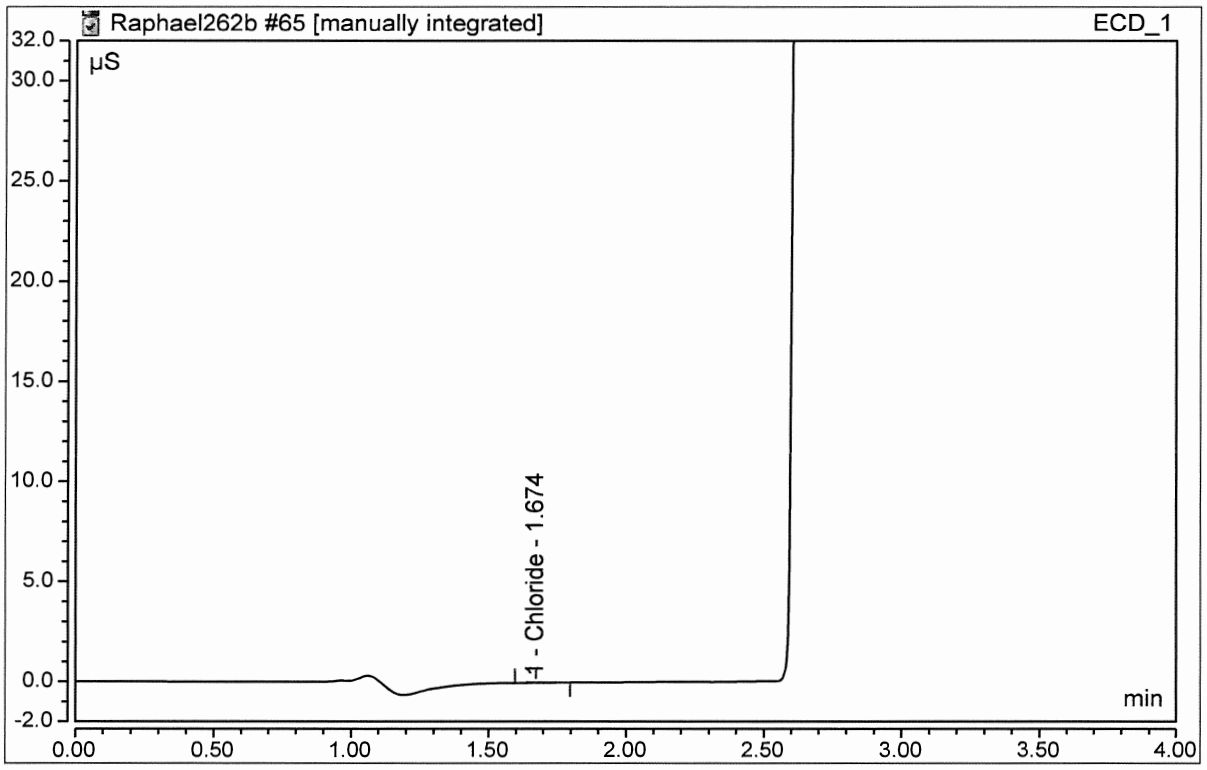


Analyst Comment:

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.62	Chloride	0.309	3.912	4.0483	FALSE	FALSE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #RB**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 05:08**	Run Time:	**4.50**

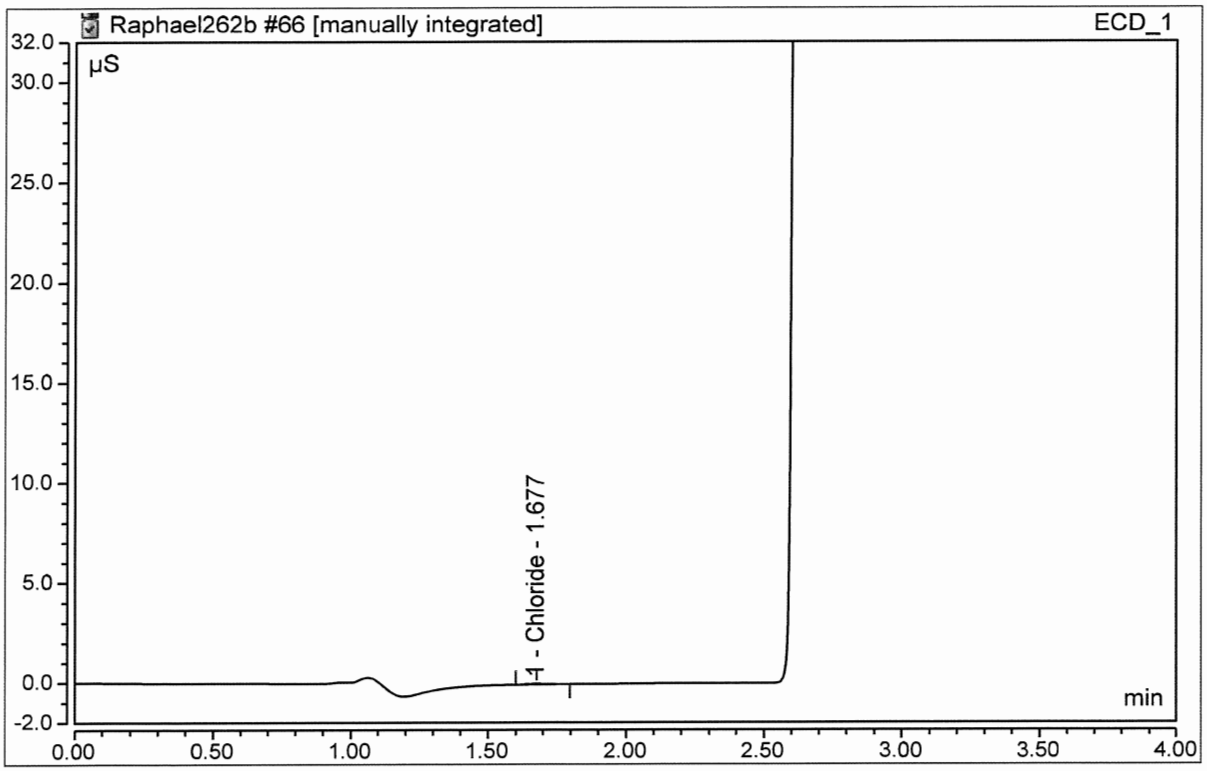


Analyst Comment: II PRM 10/2/18

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.67	Chloride	0.002	0.027	n.a.	FALSE	TRUE

Peak Analysis Report

Sample Name:	**HPLCSTDS679 #RB**	Injection Volume:	**25.00**
Injection Type:	**Check Standard**	Dilution Factor:	**1.0**
Instrument Method:	**AS22 FAST 2 mlsMin**	Operator:	**PMann**
Inj. Date / Time:	**02-Oct-2018 / 05:14**	Run Time:	**4.50**



Analyst Comment: II PRM 10/2/18

No.	Time min	Peak Name	Area µS*min	Height µS	Conc µg/mL	Manually Assigned?	Manipulated?
1	1.68	Chloride	0.003	0.028	n.a.	FALSE	TRUE

Name	**AS22 FAST 2 mlsMin**
Data Vault	**CM7SQLDV**
Path	**chrom://cm-server/CM7SQLDV/Instrument Data/Raphael/2018 Q1/Raphael14a/Raphael14a.seq/AS22 FAST 2 mlsMin.instmeth**
Comment	**AS22**
Description	
Run time	**4.500 [min]**
Instrument	**Raphael on hp6300-8**
Created	**11/30/2017 11:33:24 AM -05:00 APennington**
Last Update	**1/3/2018 5:25:48 PM -05:00 CSvendsen**

Stage	Time min	Command	Value	Comment
Instrument Setup				
	initial			
		Sampler.FlushFactor	10	
		Sampler.DelayVolume	125 [µl]	
		Sampler.DeliverSpeed	4.0 [ml/min]	
		Pump_ECD.Pressure.UpperLimit	5000 [psi]	
		Pump_ECD.%A.Equate	"%A"	
		Pump_ECD.Pressure.LowerLimit	0 [psi]	
		Pump_ECD.ColumnTemperature.Nominal	30.0 [°C]	
		Pump_ECD.CellTemperature.Nominal	35.0 [°C]	
		Pump_ECD.Data_Collection_Rate	5.0 [Hz]	
		Pump_ECD.Suppressor_Type	AERS_Carbonate_4mm	
		Pump_ECD.Suppressor_RecommendedCurrent	67 [mA]	
		Pump_ECD.Suppressor_Carbonate	4.5 [mM]	
		Pump_ECD.Suppressor_Bicarbonate	1.4 [mM]	
		Pump_ECD.Suppressor_Hydroxide	0.0 [mM]	
		Pump_ECD.Suppressor_Current	67 [mA]	
		Pump_ECD.Flow	2 [ml/min]	
		Sampler.LoadPosition		
		Sampler.DeliverSample	Volume=1500	
		Sampler.EndSamplePrep		
Inject				
	0.000			
		Wait	Sampler.CycleTimeState, Run=Hold, Timeout=Infinite	
		Sampler.Inject		
Start Run				
	0.000			
		Pump_ECD.Channel_Pressure.AcqOn		
		Pump_ECD.ECD_1.AcqOn		
		Pump_ECD.ECD_Total.AcqOn		
		Pump_ECD.Autozero		
Run			Duration = 4.500 [min]	
	0.000			
	0.500			
		Sampler.BeginOverlap		
Stop Run				
	4.500			
		Pump_ECD.Channel_Pressure.AcqOff		
		Pump_ECD.ECD_1.AcqOff		
		Pump_ECD.ECD_Total.AcqOff		
End				

This Is The Last Page Of This Report.

20180013B

Appendix D
Example Calculations

EXAMPLE CALCULATIONS

Note: answers obtained by sample calculations may deviate from that presented within the report due to rounding discrepancies.

USEPA METHODS 1-4, 26A

Moisture Content

$$V_{wc} = K_1 \cdot V_1$$

Where: V_{wc} = mass of water vapor condensed in impingers at standard conditions (g)
$K_1 = 0.04715\ ft^3/g$ water
V_1 = volume of water collected in impingers (mL)

For example, for Run 1 of the HCl testing at the Scrubber outlet, 131 g of water was condensed in the impingers, and 14 g of water were collected by the silica gel. The volume of water collected in each section of the sampling train, in ft^3, was calculated as follows:

$$V_{wc} = \left(0.04715 \frac{g}{mL}\right)(131 + 14\ mL) = 6.83675\ ft^3$$

The total volume of water collected was 6.83675 ft^3.

Gas Volume Standardization

$$V_{std} = V_m Y_m \left(\frac{T_{std}}{P_{std}} \right) \left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m} \right)$$

Where: V_{std} = volume of gas sampled at standard conditions
V_m = volume of gas measured by dry gas meter (ft^3)
Y_m = dry gas meter correction factor (dimensionless)
T_{std} = standard temperature ($^oR = 460 + {}^oF$)
P_{std} = standard pressure ("Hg)
P_b = barometric pressure ("Hg)
ΔH = average orifice differential pressure ("H_2O)
T_m = average meter temperature (^oR)

For example, the volume of gas measured at the dry gas meter for Run 1 of the HCl testing at the Scrubber outlet was 53.87 ft^3. The dry gas meter correction factor was 0.997. Standard temperature and pressure are 528°R and 29.92"Hg, respectively. The barometric pressure at the time of testing was 29.45"Hg. The average orifice differential, and meter temperature were 2.42 and 527.54°R, respectively. The volume of gas sampled was corrected to standard conditions as follows:

$$V_{std} = (53.87\ ft^3)(0.997)\left(\frac{528^o R}{29.92\ "Hg} \right) \left(\frac{29.46"Hg + \frac{2.42"H_2O}{13.6\frac{"H_2O}{"Hg}}}{527.54^\circ R} \right) = 53.25\ ft^3, \text{ standard}$$

Moisture Fraction

$$B_{ws} = \frac{V_{wc}}{V_{wc} + V_{std}}$$

Where: B_{ws} = exhaust gas moisture content

For example, from previously calculated values, the exhaust gas moisture fraction for Run 1 of the HCl testing at the Scrubber outlet was calculated as follows:

$$B_{ws} = \frac{6.83675\ ft^3}{6.83675\ ft^3 + 53.25\ ft^3} = 0.1139$$

Absolute Stack Gas Temperature, T_s (^oR)

$$T_s = 460 + t_s$$

Where: t_s = Measured stack gas temperature (^oF)

For example, for Run 1 of the HCl testing at the Scrubber outlet, the average stack temperature was 120.3°F. The average temperature in degrees Rankine is therefore 120.3+ 460 = 580.3°R.

Absolute Stack Gas Pressure, P_s (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_{stat}}{13.6}\right)$$

Where: P_{bar} = Barometric pressure at test site (in. Hg)
P_{stat} = Stack static pressure (in. Hg)

For example, for Run 1 of the HCl testing at the Scrubber outlet, the barometric and stack static pressures were 29.46"Hg, and -0.19"H_2O, respectively. The absolute stack pressure is then:

$$P_s = 29.46 + \left(\frac{-0.19}{13.6}\right) = 29.45"Hg$$

Stack Gas Molecular Weight, Dry Basis (lb/lb mole)

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$

For example, for Run 1 of the HCl testing at the Scrubber outlet, the average O_2 content of the exhaust gas stream was 20.9% (from Fyrite). The CO_2 content of the gas stream was 0% (from Fyrite). The CO content was assumed to be negligible, and the N_2 content is assumed to make up the balance of the gas content (i.e. 100-20.9 = 79.1%). The dry stack gas molecular weight is therefore:

$$M_d = 0.44(0\%) + 0.32(20.9\%) + 0.28(79.1\%) = 28.836 \frac{\text{lb}}{\text{lb mol}}$$

Stack Gas Molecular Weight, Wet Basis (lb/lb mole)

$$M_s = M_d\left(1-\frac{B_{ws}}{100}\right)+18\left(\frac{B_{ws}}{100}\right)$$

The stack gas moisture content for Run 1 of the HCl testing at the Scrubber outlet was 11.39%. The wet stack gas molecular weight is then:

$$M_s = 28.836\frac{\text{lb}}{\text{lb mol}}\left(1-\frac{11.39}{100}\right)+18\left(\frac{11.39}{100}\right)=27.60\frac{\text{lb}}{\text{lb mol}}$$

Stack Gas Velocity, V_s (fpm)

$$V_s = \left(60\frac{\text{sec}}{\text{min}}\right)K_pC_p\Delta P\sqrt{\frac{T_s}{P_sM_s}}$$

Where: K_p = Pitot tube constant equal to $85.49\ \frac{ft}{\text{sec}}\sqrt{\frac{(lb/lb\cdot mole)(in.Hg)}{(^oR)(in.H_2O)}}$

C_p = Pitot tube coefficient, dimensionless

ΔP = The average square root of the velocity head of stack gas (in. H_2O)

M_s = Molecular weight of the stack gas, wet basis (lb/lb mole)

For example, for Run 1 of the HCl testing at the Scrubber outlet, the average square root of the velocity head of the stack gas was 0.5596"H_2O. Using values already calculated, the average stack gas velocity was calculated as follows:

$$V_s = \left(60\frac{\text{sec}}{\text{min}}\right)\left(85.49\frac{ft}{\text{sec}}\sqrt{\frac{(\text{lb/lb mol})(in.Hg)}{(^oR)(in.H_2O)}}\right)(0.84)$$

$$0.5596*\sqrt{\frac{(580.3^oR)}{(29.45 n.Hg)\left(27.60\frac{\text{lb}}{\text{lb mol}}\right)}}=2{,}037\frac{ft}{\text{min}}$$

Average Stack Gas Volumetric Flowrate, Q_s (cfm)

$$Q_s = V_s \cdot A$$

Where: V_s = Stack gas velocity (fpm)
A = Cross-sectional area of stack (ft^2)

For example, the Scrubber outlet stack has dimensions of 17" by 47". The area of the stack is calculated as follows:

(17 x 47) / 144 = 5.549

For Run 1 of the HCl testing at the Scrubber outlet, the stack gas volumetric flowrate was then calculated as follows:

$$Q_s = \left(2{,}037 \frac{ft}{\min}\right) \cdot \left(5.549\, ft^2\right) = 11{,}303 \frac{ft^3}{\min}$$

Standard Stack Gas Volumetric Flowrate, Q_{std} (scfm)

$$Q_{std} = Q_s \left(\frac{528^o R}{T_s}\right)\left(\frac{P_s}{29.92 in.Hg}\right)$$

Where: T_s = Absolute stack gas temperature (^oR)
P_s = Absolute stack gas pressure (in. Hg)

For example, for Run 1 of the HCl testing at the Scrubber outlet, the standard stack gas volumetric flowrate was calculated as follows:

$$Q_{std} = 11{,}303 \frac{ft^3}{\min}\left(\frac{528^o R}{580.3^o R}\right)\left(\frac{29.45 in.Hg}{29.92 in.Hg}\right) = 10{,}123 \frac{ft^3}{\min}, \text{standard}$$

Dry Standard Stack Gas Volumetric Flowrate, $Q_{std,dry}$ (dscfm)

$$Q_{std,dry} = Q_{std}(1 - B_{ws})$$

For example, for Run 1 of the HCl testing at the Scrubber outlet, the dry standard stack gas volumetric flowrate was calculated as follows:

$$Q_{std,dry} = 10{,}123\frac{ft^3}{\min}, \text{standard}(1 - 0.1139) = 8{,}970\frac{ft^3}{\min}, \text{standard dry}$$

HCl Concentration, C_1 (ppmv, dry basis)

$$C_1 = \frac{m}{V_t}\left(\frac{1lb}{453.6g}\right)\left(\frac{1}{MW}\right)385.4\frac{ft^3}{lbmol}$$

Where: m = mass of HCl (µg).
V_t = total (dry) volume of gas sampled (ft^3).
MW = Molecular weight of HCl, 36.5 lb/lbmol
Bws = Moisture fraction

For example, for Run 1 of the HCl testing at the Pickle outlet, the total mass of HCl measured was 8,849 µg. The total standardized (dry) volume of gas sampled was 53.25 ft^3. The dry HCl concentration of the gas stream is then:

$$C_1 = \frac{8{,}849\,\mu g}{(53.25scf)}\left(\frac{1\,lb}{453.6\,g}\right)\left(\frac{1}{36.5}\right)385.4\frac{ft^3}{lbmol} = 3.87\ ppmv$$

HCl Concentration, C_2 (lbs/scf, wet basis)

$$C_2 = \frac{m}{\left(V_t \Big/ \left(1 - \frac{B_{ws}}{100}\right)\right)}\left(\frac{1\,g}{10^6\,\mu g}\right)\left(\frac{1\,lb}{453.6\,g}\right)$$

$$C_2 = \frac{8{,}849\,\mu g}{\left(53.25scf \Big/ \left(1 - \frac{11.39}{100}\right)\right)}\left(\frac{1\,g}{10^6\,\mu g}\right)\left(\frac{1\,lb}{453.6\,g}\right) = 3.25\times10^{-7}\frac{lb}{scf}$$

Mass Emission Rate (lb/hr)

$$\text{Emission Rate} = C_2 Q_{std,wet}\left(60\frac{\text{min}}{hr}\right)$$

Where: $Q_{std,wet}$ = wet standard stack gas volumetric flowrate (ft^3/min).

For example, from the previous calculation, $C_2 = 3.25*10^{-7}$ lb/ft^3. The wet standard flowrate for Run 1 of the HCl testing at the Scrubber outlet was 10,123 ft^3/min. The mass emission rate in pounds per hour is then:

$$\text{Emission Rate} = 3.25*10^{-7}\frac{lb}{ft^3}\left(10{,}123\frac{ft^3}{\text{min}}\right)\left(60\frac{\text{min}}{hr}\right) = 0.20\frac{lb}{hr}$$

20180013S

Appendix E
Process Data

USS Great Lakes Works (GLW) - No. 5 Pickle Line Scrubber

Test Date: Sept. 27, 2018

Time	Makeup (gpm)	Recirc (gpm)	dP (in H2O)	Tons Charged
Run #1				
8:28 AM	49.6	570.2	1.67	118 tons start
8:43 AM	49.7	570.8	1.70	465 end
8:58 AM	49.8	571.7	1.76	
9:13 AM	49.8	571.5	1.76	
9:28 AM	49.9	571.5	1.76	347 tons
9:33 AM	49.7	570.5	1.75	
Run #2				
9:52 AM	49.8	570.4	1.83	502 tons at start
10:07 AM	49.5	572.1	1.82	
10:22 AM	49.5	572.2	1.81	439 tons
10:37 AM	49.1	571.2	1.83	
10:52 AM	49.4	571.6	1.89	
11:05 AM	49.6	571.3	1.92	961 end
Run #3				
11:23 AM	49.5	570.9	1.94	985 tons at start
11:38 AM	49.7	570.3	1.93	
11:53 AM	49.9	570.8	1.92	
12:08 PM	49.5	570.6	1.91	336 tons
12:23 PM	49.3	571.8	1.95	
12:32 PM	49.4	571.2	1.95	
				1321

Time	Tank 1 Concentration	Tank 1 Temp	Tank 2 Concentration	Tank 2 Temp	Tank 3 Concentration	Tank 3 Temp
Run #1						
8:28 AM	3.56%	192°F	4.96%	193°F	9.89%	180°F
8:43 AM	3.54%	192°F	4.91%	193°F	9.76%	180°F
8:58 AM	3.55%	192°F	4.97%	193°F	9.78%	180°F
9:13 AM	3.56%	192°F	4.97%	194°F	9.77%	181°F
9:28 AM	3.56%	192°F	4.99%	193°F	9.82%	179°F
9:33 AM	3.55%	192°F	5.02%	194°F	9.85%	179°F
Run #2						
9:52 AM	3.56%	193°F	5.12%	194°F	9.76%	178°F
10:07 AM	3.63%	192°F	5.01%	193°F	9.72%	178°F
10:22 AM	3.72%	194°F	5.18%	193°F	9.53%	175°F
10:37 AM	3.86%	193°F	5.23%	194°F	9.96%	178°F
10:52 AM	3.91%	192°F	5.41%	194°F	10.19%	181°F
11:05 AM	3.86%	191°F	5.23%	194°F	9.73%	178°F
Run #3						
11:23 AM	3.88%	195°F	5.46%	194°F	9.89%	185°F
11:38 AM	3.90%	191°F	5.26%	195°F	9.77%	181°F
11:53 AM	3.91%	192°F	5.32%	194°F	9.96%	181°F
12:08 PM	3.91%	190°F	5.13%	194°F	9.97%	179°F
12:23 PM	3.93%	192°F	5.20%	194°F	10.08%	180°F
12:32 PM	4.03%	193°F	5.64%	195°F	10.24%	185°F

This is the last page of this document.