AP-42 Section 11.14
Reference 8
Report Sect.
Reference 8

WESTON (AO) Work Order No. 3977-01-02-0017

NO. 1 SOUTH STACK
PARTICULATE TEST REPORT
CHI-VIT CORPORATION
LEESBURG, ALABAMA
APRIL 1989

T13-1c
303-0001

Prepared For:

CHI-VIT CORPORATION
P.O. Box 188
Leesburg, AL 35983

APPROVED FOR TRANSMITTAL
MAY 1989

Prepared By:

Roy F. Weston, Inc.
1635 Pumphrey Avenue
Auburn, AL 36830

CHI-VIT
CORPORATION
720 S. EDGEWOOD AVENUE • URBANA, OHIO 43078
513-652-1341 • FAX #513-653-7977

May 23, 1989

Ms. Caroline Melton
ADEM Air Division
1751 Dickinson Drive
Montgomery, Alabama 36130

Dear Ms. Melton:

Enclosed you will find the results of the particulate emission test performed on Chi-Vit #1 frit unit/#1 scrubber on April 12, 1989 by Roy F. Weston, Inc of Auburn, Alabama.

If you need additional information please call me at 526-8522.

Sincerely,

Bobby Grimes
Plant MAnager

BG/nn

Encl:

COMPLIANCE DETERMINATION SUBMITTAL FORM

COMPANY Chi - Vit DATE OF TEST 04/12/89

FACILITY NUMBER 303-0001-0002 SOURCE FRIT UNIT w/ Venturi Scrubber

( ) Notification of observation of:
(✓) Test report on sampling of:

Particulate - Method 5	(✓)	VE (initial) - Method 9	( )
Sulfur dioxide - Method 6	( )	GAP Test (initial)	( )
Oxides of Nitrogen - Method 7	( )	SOCMI - Method 21	( )
Other ( )	( )		

This is ( ) ~~initial~~ compliance of ( ) an NSPS source.
(✓) retest (✓) a SIP source.
( ) a NESHAP source.
( ) a RCRA source.
( ) an air toxics source

Note any special considerations (Expiration of Permit, litigation, etc):

Allowable Emissions (with units)

Run 1	Run 2	Run 3
4.4 lb/hr	same	same

Submitted by: Carolyn Melton Date 5/30/89

Emissions

Run 1	Run 2	Run 3	AVG.
1.7	1.79	2.02	1.90 #/hr

Comments:

Evaluated by: MTM Date 6-20-89

ADEM Form 175 3/87

RETEST STACK TEST EVALUATION OF

CHI-VIT 303-0001-0002 04-12-89
CONDUCTED BY WESTON #1 SOUTH STACK

INPUT PARAMETERS	1	2	3
DELTA H	1.048	1.103	1.317
AVE SQRT DELTA P	.637	.630	.648
METER TEMP	75.000	89.000	89.000
STACK TEMP	129.000	129.000	129.000
BAROMETRIC PRESS	29.890	29.890	29.890
STACK PRESS	29.860	29.860	29.860
VOLUME METERED	36.941	38.947	39.337
METER CORR. FACTOR	.927	.927	.927
%CO2	5.500	5.000	5.500
%O2	14.500	13.500	14.000
%N2	80.000	81.500	80.500
%CO	0.000	0.000	0.000
TOTAL VOLUME H2O	199.300	226.900	204.300
PART WT	43.900	53.500	53.700
PITOT COEF	.840	.840	.840
STACK AREA	5.580	5.580	5.580
NOZZLE DIAMETER	.2480	.2480	.2480
TIME	60.000	60.000	60.000

CALCULATED PARAMETERS	1	REPORT	2	REPORT	3	REPORT
NOZZLE AREA x 1000	.3354		.3354		.3354	
VOLUME MTR STD (sdcf)	33.835		34.768		35.134	
VOLUME H2O VAPOR	5.872		6.033		6.097	
% MOISTURE	21.7	(21.7)	23.5	(23.5)	21.5	(21.5)
THEORETICAL MOISTURE	14.7	(_____)	14.7	(_____)	14.7	(_____)
MOL WT DRY	29.46		29.34		29.44	
MOL WT WET	27.77		27.66		27.75	
AVG STACK VEL (fps)	38.5	(39.1)	38.2	(38.9)	39.2	(39.8)
FLOW RATE ACTUAL (acfm)	12900		12800		13100	
FLOW RATE STD (sdcfm)	9900	(9200)	9800	(9100)	10000	(9400)
CONCENTRATION (Gr/sdcf)	.0199	(.02)	.0236	(.02)	.0235	(.02)
PART MASS RATE (#/Hr)	1.70	(1.9)	1.99	(1.8)	2.02	(1.9)
% ISOKINETIC	102	(102)	106	(106)	104	(104)
POUNDS PER HOUR	1.700	(_____)	1.990	(_____)	2.020	(_____)

AVERAGE EMISSION RATE = 1.90 POUNDS PER HOUR
ALLOWABLE EMISSION RATE = 4.4 POUNDS PER HOUR

EVALUATED BY AWS (06/08/89)

MOISTURE DEPENDENT CALCULATIONS WERE BASED ON THEORETICAL MOISTURE

COMPANY NAME: CHI-VIT FACILITY NO.: 303-0001-0002
TESTED BY: WESTON TEST DATE: 04/12/89 EVAL BY AWS
TEST ON: #1 SOUTH STACK

Run #	1	2	3	
Unit of Allowable	lb/hr			
Allowable Rate	4.4	4.4	4.4	
Production Rate				
^H (in. H2O)	1.048	1.103	1.317	
√^p (in. H2O)	.637	.630	.648	
tm	750	890	890	
ts	129	129	129	
Pb (in. Hg)	29.89	29.89	29.89	
Ps (in. Hg)	29.86	29.86	29.86	
Vm (acf)	36.941	38.947	39.337	
MCF	.927	.927	.927	
% CO2	5.5	5.0	5.5	
% O2	14.5	13.5	14.0	
% CO				
Vlc (ml)	199.3	226.9	204.3	
Mn (mg)	43.9	53.5	53.7	
Cp	.84	.84	.84	
As(ft²)	5.58	5.58	5.58	
Dn (in)	.248	.248	.248	
θ	60	60	60	

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

SECTION 1

INTRODUCTION

SECTION 1.

INTRODUCTION

Roy F. Weston, Inc. (WESTON) was retained by the Chi-Vit Corporation (Chi-Vit) to conduct particulate emission testing on the No. 1 South Stack at the Leesburg, Alabama facility. The purpose of the testing was to demonstrate compliance with the applicable Alabama Department of Environmental Management (ADEM) regulations.

The emission testing was performed 12 April 1989 by a WESTON test team comprised of Mr. Landie Fowler and Mr. Chris Norris. Mr. Michael Steele was the Project Manager, and Dr. Bruce Ferguson was the Project Director. Appendix A includes a copy of the project summary and resumes of project personnel. Mr. Bobby Grimes of Chi-Vit coordinated the testing with plant operations and served as the WESTON technical contact. Mr. John Hughes of ADEM was present during testing.

Section 2 of this report details the emission test results. Section 3 outlines the sampling and analytical procedures used to conduct the testing. Supporting field and laboratory data are provided in the appendices.

SECTION 2

RESULTS AND DISCUSSION

SECTION 2.

RESULTS AND DISCUSSION

Table 2.1 summarizes the results of the particulate emission testing performed on the No. 1 South Stack on 12 April 1989. The mean particulate emission rate was 1.8 lb/hr, 41 percent of the permit limit of 4.4 lb/hr. Field and laboratory data are provided in Appendix B. Example calculations and process data are presented in Appendices D and E, respectively.

TABLE 2.1

NO. 1 SOUTH STACK EMISSION DATA

	RUN 1	RUN 2	RUN 3	MEAN
Date	4/12/89	4/12/89	4/12/89	---
Time Began	0921	1418	1650	---
Time Ended	1111	1527	1757	---
Stack Gas				
Temperature, ^{o}F	129	129	129	129
Velocity, ft/sec	39.1	38.9	39.8	39.3
Moisture, %	21.7	23.5	21.5	22.2
Oxygen, %	14.5	13.5	14.0	14.0
Carbon Dioxide, %	5.5	5.0	5.5	5.3
Volumetric Flow Rate				
At Stack Conditions x 10^4 ft^3/min	1.31	1.30	1.33	1.31
At Standard Conditions x 10^3 ft^3/min	9.17	8.90	9.36	9.14
Particulate				
Isokinetic Sampling Rate, %	102	108	104	105
Concentration at Standard Measured[a], gr/ft^3	0.02	0.02	0.02	0.02
Emission Rate, lb/hr	1.8	1.8	1.9	1.8
Permit Limit, lb/hr	---	---	---	4.4

[a] At Standard Conditions

SECTION 3

ANALYTICAL METHODOLOGY

SECTION 3.

ANALYTICAL METHODOLOGY

3.1 PROCEDURES

Testing was performed using the EPA reference methods identified below:

Parameter	EPA Reference Method
Volumetric Flow	1, 2
Gas Composition (CO_2 and O_2)	3
Moisture	4
Particulate	5

The most current revision of each method (as described in the Federal Register) was used. The following paragraphs summarize the protocol:

Stack Gas Volumetric Flow

The sampling points were selected in accordance with EPA Reference Method 1 so that a representative sample of stack gas was taken. The traverse points were located in the centers of equal area zones, the number of which was determined by the stack dimensions and the number of duct diameters upstream and downstream from the sampling points to the nearest disturbance.

The velocity of the gas stream was determined according to EPA Reference Method 2 by reading the instantaneous velocity head with an inclined manometer at each sampling point by means of a calibrated S-type pitot tube. The stack pressure was measured with the static side of an S-type pitot tube. A calibrated pyrometer was used to measure stack temperature at each sampling point.

Stack Gas Molecular Weight

Carbon dioxide and oxygen concentrations were determined using EPA Reference Method 3. A single point sample was taken for each run and analyzed with a Fyrite brand analyzer for carbon dioxide and oxygen content.

Moisture Content

The preliminary moisture content was determined by estimation. The final moisture content used for calculating the gas stream flow rate was determined by measuring the amount of condensed moisture in the impingers of the particulate sampling train, as described in EPA Reference Method 4.

Particulate Concentration

The particulate emission testing was conducted using EPA Reference Method 5. The sampling points were selected in accordance with EPA Reference Method 1 described above. An S-type pitot tube was connected adjacent to the sample nozzle so that an instantaneous head was measured at each sampling point during each test run. The stack temperature was also measured at each point.

Three runs (each of one-hour duration) were performed. The gas stream was sampled isokinetically at each sampling point by adjusting the sample flow rate to correspond to the measured velocity at each point.

The probe and nozzle were washed with acetone after each run to remove adhering particulate matter. The filter was removed from the holder and stored in a petri dish until analyzed. The filter holder was then rinsed with acetone. This rinse was added to the probe rinse. The container was sealed and labeled and liquid levels marked for transport to the laboratory.

The mass of particulate matter collected in the probe wash was analyzed in the laboratory by evaporating the acetone in a tared beaker and weighing the residue. The filter was then weighed separately in a tared beaker. The filter tare weight and solvent blank corrections were subtracted from the sum of the particulate matter from the filter and probe wash weights to give the weight of particulate matter collected. The total weight was used to calculate the particulate concentration. All weight measurements were made on the same Mettler balance (accurate to 0.1 mg).

The mean temperatures of the stack gas and the dry gas meter were used in calculating the final data. The mean isokinetic sampling rate and the stack gas velocity (volumetric flow) were calculated from the mean of the square roots of the velocity pressure measured at each traverse point during the particulate sampling.

3.2 QUALITY CONTROL

Throughout the entire project, a high level of quality control was maintained to ensure the accuracy of the data. The test personnel are experienced in the use of the instrumentation, the procedures, and the quality control requirements. Resumes of the personnel involved in the project are included in Appendix A. The following paragraphs briefly summarize the quality control associated with the project:

General

All data were recorded at the time of collection on preprinted data sheets. All samples were prepared for shipment, and chain-of-custody was maintained from the sampling technician to the analyst. Calculations were performed (where possible) with preprogrammed calculators. Data transfers were minimized, and all calculations were verified by a second person. The report was reviewed and approved by the Project Director, prior to transmittal. In general, all accepted quality control standards and practices recommended by the reference methods were followed.

Stack Gas Volumetric Flow

The stack was measured with a certified tape to an accuracy of 0.1 inch. The velocity and sampling traverse points were marked on the probe with heat resistant glass fiber tape.

The S-type pitot tubes used to measure the velocity pressures were geometrically calibrated prior to the test and verified at its completion. The pyrometer used to measure the stack gas temperature and all thermocouples for intermediate measurements were calibrated with respect to standard thermometers, prior to the test. At the completion of the test, all equipment was visually inspected, and damage was not indicated.

Stack Gas Molecular Weight

Quality control on oxygen analyses by EPA Reference Method 3 involved the analysis of ambient air before and after every sixth sample. If the measured concentration was less than 20.0 percent, the Fyrite chemicals were changed before proceeding. If the measured concentration was greater than 20.0 percent but less than 20.6 percent, the sample data were corrected for the low measurement. If the measured concentration was 20.6 percent or greater, no correction was made.

WESTON also participated satisfactorily in the most recent EPA Audit Sample for Reference Method 3. Those data are on file at WESTON.

Moisture Content

Quality control of the moisture analysis involved the accurate measurement of the gas flow and the accurate determination of the moisture condensed in the sampling train. A graduated cylinder was used to measure the volume of water in each impinger before and after sampling. The silica gel was weighed, before and after its use, with a triple beam balance to the nearest 0.1 gram. The difference in measurement was considered to be the moisture collected.

Particulate Concentration

The dry gas meter used to measure the sample volume collected was calibrated before and after sampling. The calibration obtained was within the required specifications each time. The lower meter calibration factor was used to calculate the data. Meter calibration work sheets are copied in Appendix C. All thermocouples and other items used to calculate the mass emission rate were calibrated on a routine schedule.

WESTON participated satisfactorily in the most recent dry gas meter audit supplied by EPA. Those data are on file at WESTON.

WESTON uses a Class S 1-gram weight to verify the accuracy of the balance for each use. The weight is weighed when the filters are tared and also at the final weighings. Any significant difference in weight indicates a problem with the balance, and the balance is repaired before proceeding.

Acetone and filter blanks were analyzed at the same time as the particulate samples. The mass of particulate matter collected was corrected by the blank measurements.

The rate of sample collection was determined to be within 10 percent of the isokinetic rate. Those data indicate the validity of sample collection.

APPENDIX A

PROJECT SUMMARY AND PERSONNEL RESUMES

PROJECT SUMMARY

CLIENT: Chi-ViT Corporation PROJECT NO. 3977-02-01-0017

LOCATION: Leesburg, Alabama.

PROJECT PERSONNEL: Landie Fowler, Chris Norris

Client Contact(s) Bobby Grimes Tel No. (205) 526-8522

Tel No.

Regulatory Personnel John Hughes (ADEM)

Process Description

Process Vendor(s)

Item	Manufacturer	Rated Capacity

Process Sketch/Flow Diagram

Miscellaneous Information

Page ____ of ____ Test Team Leader ____ Date ____

TAR-10-1/85

WESTON

PROJECT SUMMARY

CLIENT Chi-Vit WESTON PROJECT NO. 3977-02-01

DATE/TIME	ACTION TAKEN
4-11-89	
1.10	Arrive Chi-Vit meet Bobby Grimes
	Set up equipmt do preliminary measurmts
5:45	Leave plant
~~7:45~~	
4-12-89	
7:15	Arrive at Plant - finish setting up
	equipmt
9:21	Start 1st Run John Hughes arrives 9:50
11 11	End 1st Run. Break glass piece clean
	up from run. Bobby Grimes finds us a piece
	of hose to finish testing
1418	Start 2nd Run
1527	End 2nd Run
	Clean up -
1650	Start 3rd Run John Leaves
1751	End 3rd Run
	clean up.
	Load equipmt
1900	Leave plant
2300	Arrive Auburn.

Page _____ of _____

TAR-10A-1/85

WESTON

Bruce B. Ferguson

Fields of Competence

Overall direction and management of projects; extensive experience in air quality testing and studies; industrial hygiene investigations and air quality studies; professional services associated with management of hazardous waste and asbestos; expert witness for environmental matters; project manager for large government projects; and research projects associated with chromatographic analysis and reduced sulfur analysis.

Experience Summary

Broadly based experience as a consultant and researcher; extensive training in environmental regulations in all media; compliance management project experience in pulp and paper, chemicals, and petrochemicals, oil and gas production, food, and electronics manufacturing. Has performed projects in more than 20 states and two foreign countries.

Credentials

B.S., Chemistry/Mathematics — Athens College (1968)

M.A., Physical Chemistry — Vanderbilt University (1973)

Ph.D., Physical Chemistry — Vanderbilt University (1974)

Certification

Certified Industrial Hygienist, American Board of Industrial Hygiene

Employment History

1983-Present	WESTON
1977-1983	Harmon Engineering and Testing
1974-1977	PBR Electronics
1972-1973	College Grove Smelter

Key Projects

Project Manager for site assessments and surveys for the Navy Assessment and Control of Installation Pollutants (NACIP) program. Projects were conducted in South Carolina, Tennessee, and Texas. The multi-faceted programs encompassed a variety of waste disposal practices and waste site locations at various Naval Installations.

Served as Project Manager and Project Director for more than 800 source emission tests for hydrocarbons and sulfur species from petroleum refineries, craft pulp mills, and steel mills. Directed over 250 routine emission tests at refineries, foundries, pharmaceutical plants, magnetic tape coating plants, and high density urban areas. Directed over 400 tests utilizing EPA Reference Methods for Particulate, NO_x, SO_2, and other routine compounds.

Served as Project Director for developing VOC emission inventories and for defining Reasonably Available Control Technology (RACT) for VOC emissions; developed permits documentation for VOC incinerators and conducted equipment evaluation and cost studies for projects. These projects have been performed for such clients as Upjohn Chemical, Republic Steel, Richmond Gravure, Southern Wood Piedmont, and International Paper Company.

Directed efforts of a commercial laboratory to obtain accreditation for all parameters by the American Industrial Hygiene Association. Directed the firm's participation in the NIOSH proficiency analytical testing programs and the EPA Round Robin test programs. Considerable experience has been gained as a laboratory manager performing routine chemical analyses using instrumental techniques.

Served as a Project Manager for a $517,000 contamination monitoring contract involving particle sampling and counting at the Marshall Wright Space Center. The work involved evaluation of clean rooms, and sampling of breathing air and other contamination media at the Center.

Principal Investigator for a multi-year EPA contract for development of source tests methodology for reduced sulfur compounds at kraft pulp mills and petroleum refineries. Tasks assigned involved evaluating methodology, developing new methodology and field validating the new procedures. As a result of the contract, new methodology was presented in the Federal Register.

Served as Project Director for a project requiring claims documentation testing on an indoor air quality cleaning device. Testing was performed on the device in a closed chamber to demonstrate the reduction and removal deficiency for such compounds as light weight hydrocarbons, formaldehyde, sulfur dioxide, hydrogen sulfide, and other common pollutants. The project resulted in information submitted to the Federal Trade Commission to document the manufacturer's claim.

Served as Principal Investigator for a U.S. Army Project to develop a transportable gas chromatograph-mass spectrometer. The instrument was used to monitor emissions from solid rocket firings.

Prepared RCRA-required ground water sampling, monitoring, and compliance plans for companies such as Prestolite, Wolverine, Courtaulds, Fruehauf, and TR Miller Company in Alabama; Merck Pharmaceuticals, International Paper Company, and Mount Pine Wood Treating in Texas, Missouri, Virginia, Georgia, Mississippi, Louisiana, and Arkansas.

Michael E. Steele

Fields of Competence

Management, supervision, performance of air quality testing, preparation of emission inventories, financial analysis and engineering evaluation of emission control equipment.

Experience Summary

Manager of Weston's Air Quality Department in Auburn, Alabama. Experience in standard reference method testing, emission inventories, odor abatement studies, permit assistance, proposal preparation, and engineering evaluations for a variety of industrial and government clients. Strong background in preparing work plans, developing schedules, conducting field studies, performing engineering and economic analyses, and preparing project reports. These activities have been aided by the use and development of computer programs and models.

Credentials

B.S., Chemical Engineering — Pennsylvania State University (1981)

M.B.A. — University of Pittsburgh (1982)

WESTON Health and Safety Training

Source Evaluation Society Member

Employment History

1986-Present	WESTON
1983-1986	Martin Marietta Energy Systems, Inc.
1982-1983	Union Carbide Corporation

Key Projects

Project Manager on an incinerator evaluation study for a circuit board manufacturer. Specific responsibilities included evaluation of the incinerator, recommendations for remedial action, supervision of the field testing effort, and report preparation. Served as client's representative at meetings with the state regulatory agency.

Project Manager for a reasonably available control technology (RACT) evaluation for volatile organic compound (VOC) emissions form an offset printing facility. Specific responsibilities included determining the current status of production and emissions, determining VOC collection strategies, and control options. Various methods of reducing the VOC usage as well as methods of collecting and removing VOC from the air were considered in light of maintaining product quality and the economics of the control.

Project Manager for a mill-wide inventory at a large southern pulp and paper mill. Specific responsibilities included the coordination and supervision of the testing effort which encompassed 19 sources and 9 parameters. In addition, performance specification testing on four total reduced sulfur (TRS) and two sulfur dioxide (SO_2) continuous emission monitoring systems (CEMS) were also required. Preparation, field testing, and report submittal were completed to the client's approval within the required 30 days.

Publications

Steele, M.E. and O. Fick, "Reasonably Available Control Technology for VOC Control from a Lithographic Printing Facility" presented at the TAPPI Environmental Conference, Charleston, South Carolina, April 18-20, 1988.

APPENDIX B

FIELD AND LABORATORY DATA - NO. 1 SOUTH STACK

PARTICULATE CALCULATIONS

Client: Chi-Vit Corporation
WESTON Project No.: 3977-01-02-0017
Source: #1 Scrubber,south stack

Date: 4-12-89

INPUT DATA		Run 1	Run 2	Run 3	Mean
Sampling Time, min	(Theta)	60	60	60	60
Stack Area, ft2	(As)	5.58	5.58	5.58	5.58
Barometric Pressure, in Hg	(Pb)	29.89	29.89	29.89	29.89
Stack Pressure, in Hg	(Ps)	29.86	29.86	29.86	29.86
Pitot Tube Coefficient	(Cp)	.84	.84	.84	.84
Meter Correction Factor	(Y)	.927	.927	.927	.927
Nozzle Diameter, in	(Dn)	.248	.248	.248	.248
Meter Volume, ft^3	(Vm)	36.941	38.947	39.337	38.408
Meter Temperature, F	(Tm)	75	89	89	84
Meter Orifice Pressure, in H2O	(Delta H)	1.048	1.103	1.317	1.156
Volume H2O Collected, mL	(Vlc)	199.3	226.9	204.3	210.2
CO2 Concentration, %	(CO2)	5.5	5.0	5.5	5.3
O2 Concentration, %	(O2)	14.5	13.5	14.0	14.0
Average Sq Rt Velo Head, in H2O^1/2	(Delta P^1/2)ave	.637	.630	.648	.638
Stack Temperature, F	(Ts)	129	129	129	129
Particulate Collected, g	(Mn)	.0499	.0535	.0537	.0524
CALCULATED DATA					
Standard Meter Volume, ft3	(Vmstd)	33.839	34.778	35.138	34.585
Standard Water Volume, ft3	(Vwstd)	9.381	10.680	9.616	9.893
Moisture Fraction	(BWS)	.217	.235	.215	.222
Mol Wt of Stack Gas	(Ms)	27.0	26.7	27.0	26.9
Average Stack Gas Velocity, ft/sec	(Vs)	39.1	38.9	39.8	39.3
Stack Gas Flow @ Stack Cond, ft^3/min	(Qa)	1.31E+4	1.30E+4	1.33E+4	1.31E+4
Stack Gas Flow @ Std Cond, ft^3/min	(Qs)	9.17E+3	8.90E+3	9.36E+3	9.14E+3
Isokinetic Sampling Rate, %	(%I)	102.4	108.4	104.2	105.0
Particulate Conc @ Std Cond, gr/ft^3	(Cs)	.023	.024	.024	.023
Particulate Emission Rate, lb/hr	(PMR)	1.785	1.807	1.887	1.826

PARTICULATE FIELD DATA

Client:Chi-Vit Corporation
WESTON Project No.:3977-01-02-0017
Source:#1 Scrubber,south stack
Date:4-12-89
Run#:1

PORT POINT NO.	DGM READING Vm(ft^1/3)	DELTA P in. H20	DELTA P SQUARE ROOT	DELTA H IN. H20	AVERAGE DGM TEMP (F)	STACK TEMP (F)	IMP OUT (F)	HOT BOX TEMP (F)	SAMPLE TRAIN VAC (in Hg)
1/1	487.214	.190	.436	.450	63	123	23	264	3
2	488.570	.270	.520	.640	65	123	23	267	3
3	489.950	.290	.539	.690	68	128	23	265	4
4	491.440	.330	.574	.780	70	129	23	267	5
5	493.110	.400	.632	1.030	71	130	27	270	6
6	494.860	.510	.714	1.320	71	130	40	269	10
7	497.100	.550	.742	1.420	72	130	50	271	13
8	498.900	.570	.755	1.470	73	130	50	270	13
9	501.090	.550	.742	1.420	75	131		269	13
10	503.400	.490	.700	1.260	77	130		270	10
2/1	505.384	.330	.574	.850	78	122	36	262	4
2	507.370	.330	.574	.850	79	121	29	256	4
3	509.110	.360	.600	.930	79	131	29	252	5
4	510.810	.400	.632	1.030	79	132	29	252	5
5	512.800	.450	.671	1.160	80	132	31	255	7
6	514.500	.460	.678	1.180	80	131	31	261	7
7	516.470	.440	.663	1.130	80	130	31	261	7
8	518.620	.460	.678	1.130	80	129	33	263	7
9	520.379	.430	.656	1.110	78	130	33	274	6
10	522.370	.430	.656	1.110	81	130	33	264	6
	524:155								

DGM READING Vm: 36.941
AVG DELTA P: .412
AVG DELTA H: 1.048
AVG SQT DELTA P: .637
AVG DGM TEMP: 74.950
AVG STACK TEMP: 128.600

PARTICULATE DATA

CLIENT Chi-Vit ATC PROJECT NO. 3972-01-02 -0017

SOURCE South Stack DATE 4-12-89

RUN # 1 START TIME 921 END TIME 1111

SAMPLING SITE South Stack CONTROL DEVICE Wet Scrubber

SAMPLING TYPE M-5 SAMPLE CONSOLE # ATC-1 SAMPLE CASE # _____

AMBIENT TEMP 47° WEATHER Cloudy WIND SPEED/DIRECTION _____

ATC TEST PERSONNEL L.F. E.N. OBSERVERS John Hughes

SKETCH OF STACK

Stack Dimensions 32" Orifice ΔH 1.705

Sample Time (min/pt) 3 Meter Corr. Factor 0.927

Net Sample Time (min) 60 Pitot Tube # _____

Baro Press. (in Hg) 29.88 Pitot Factor 0.84

Stack Press. (in Hg) -.3 29.86 Nozzle ID # _____

Stack Temp DB/WB (°F) 143 Noz Dia Pretest (in) 0.248

Assumed Mois (%) 21 Noz Dia Posttest (in) 0.248

Pretest Leak Check 0.002 @ 10" Avg Noz Dia (in) 0.248

Posttest Leak Check 0.002 @ 14" 0.014 @ 14" Filter Type/Number 900 131

Final Gas Meter Reading 524.155 Silica gel # 1

Initial Gas Meter Reading 487.214 Δ Condensate (mL) _____

Δ Meter Reading 36.941

Orsat: Method of Collection Fyrite

	RUN 1	RUN 2	RUN 3	AVG
% CO_2	5.5	5.5		5.5
% O_2	14.5	14.5		14.5
% CO				

FIELD DATA

CLIENT Chi-ViT ATC PROJECT NO. 3977-01-02

SOURCE South Stack DATE 4-12-89 RUN # 1

PORT POINT NO.	DIST FROM WALL (IN)	CLOCK TIME	DGM READING V_m (ft^3)	ΔP (in. H_2O)	ΔH (in. H_2O)	Average DGM TEMP IN (°F)	Average DGM TEMP OUT (°F)	STACK TEMP (°F)	IMP OUT (°F)	HOT BOX TEMP (°F)	SAMPLE TRAIN VAC (inHg)
1-1		921 0	487.214	0.19	0.45	63		123	23	264	3
2		924 3	438.57	0.27	0.64	65		123	23	267	3
3		928 6	489.95	0.29	0.69	68		128	23	265	4
4		931 9	491.44	0.33	0.78	70		129	23	267	5
5		934 12	493.11	0.40	1.03	71		130	27	270	6
6		937 15	494.86	0.51	1.32	71		130	40	269	10
7		940 18	497.10	0.55	1.42	72		130	50	271	13
8		943 21	498.90	0.57	1.47	73		130	50	270	13
9		946 24	501.09	0.55	1.42	75		131	✓	269	13
10		949 27	503.40	0.49	1.26	77		130	✓	270	10
2-2		1018	505.384	0.33	~~1.02~~ 0.85	78		122	36	262	4
2		1021	507.37	0.33	0.85	79		121	29	256	4
3		1024	509.11	0.36	0.93	79		131	29	252	5
4		1027	510.81	0.40	1.03	79		132	29	252	5
5		1030	512.80	0.45	1.16	80		132	31	255	7
6		1033	514.50	0.46	1.18	80		131	31	261	7
7		1036	516.47	0.44	1.13	80		130	31	261	7
8		1039	518.42	0.46	1.13	80		129	33	263	7
9	1105	~~1042~~	520.379	0.43	1.11	78		130	33	274	6
10	1108	~~1045~~	522.37	0.43	1.11	81		130	33	264	
Final	1111	~~1048~~	524.155								
			36.941	0.6368	1.05	75		129			

NOTES/REMARKS:

$$\Delta H = \Delta P[(893.94)(C_p)^2(FDA)^2(\Delta H_@)(Dn)^4(\frac{T_m}{T_s})]$$

$K_2 = 2.5803$ 1284

Page ____ of ____

TAR-26-1/85

WESTON

PARTICULATE FIELD DATA

Client:Chi-Vit Corporation
WESTON Project No.:3977-01-02-0017
Source:#1 Scrubber,south stack
Date:4-12-89
Run#:2

PORT POINT NO.	DGM READING Vm(ft^3)	DELTA P in. H2O	DELTA P SQUARE ROOT	DELTA H IN. H2O	AVERAGE DGM TEMP (F)	STACK TEMP (F)	IMP OUT (F)	HOT BOX TEMP (F)	SAMPLE TRAIN VAC (in Hg)
1/1	526.601	.300	.548	.820	84	120	ICED	261	4
2	528.510	.300	.548	.820	87	125		262	4
3	530.420	.370	.608	1.010	87	132		258	4
4	531.980	.410	.640	1.120	88	133		256	5
5	534.150	.450	.671	1.230	88	133		254	6
6	535.970	.480	.693	1.310	89	133		258	6
7	538.010	.450	.671	1.230	89	134		260	6
8	540.440	.450	.671	1.230	90	133		259	6
9	542.320	.450	.671	1.230	90	132		261	6
10	544.300	.440	.663	1.200	90	133		258	6
2/1	546.588	.190	.436	.520	85	120		254	2
2	547.990	.250	.500	.680	89	120		255	3
3	549.580	.260	.510	.710	89	129		252	3
4	551.140	.300	.548	.820	89	130		254	4
5	552.820	.370	.608	1.010	89	130		262	5
6	554.660	.510	.714	1.390	89	131		263	8
7	556.900	.580	.762	1.580	90	130		273	10
8	559.040	.560	.748	1.530	91	130		266	10
9	561.360	.550	.742	1.500	91	130		266	9
10	563.660	.410	.640	1.120	93	131		268	5
	565.679								

DGM READING Vm:	38.947
AVG DELTA P:	.404
AVG DELTA H:	1.103
AVG SQT DELTA P:	.630
AVG DGM TEMP:	88.850
AVG STACK TEMP:	129.450

PARTICULATE DATA

CLIENT Christ ATC PROJECT NO. 3977-01-02-017

SOURCE South Stack DATE 4-12-89

RUN # 2 START TIME 1418 END TIME 1527

SAMPLING SITE South Stack CONTROL DEVICE wet scrubber

SAMPLING TYPE M-5 SAMPLE CONSOLE # ATC-1 SAMPLE CASE # _____

AMBIENT TEMP 62 WEATHER Clear WIND SPEED/DIRECTION _____

ATC TEST PERSONNEL L.F. CN OBSERVERS John Hughs

SKETCH OF STACK

Stack Dimensions 32" Orifice ΔH 1.705

Sample Time (min/pt) 3 Meter Corr. Factor 0.927

Net Sample Time (min) 60 Pitot Tube # _____

Baro Press. (in Hg) 29.88 Pitot Factor 0.84

Stack Press. (in Hg) 29.86 Nozzle ID # _____

Stack Temp DB/WB (°F) 130 Noz Dia Pretest (in) 0.248

Assumed Mois (%) 15 Noz Dia Posttest (in) 0.248

Pretest Leak Check 0.004 @ 7" Avg Noz Dia (in) 0.248
0.009 @ 10" 1st port

Posttest Leak Check 0.018 @ 10" Filter Type/Number 900141

Final Gas Meter Reading 565.679 Silica gel # 2

Initial Gas Meter Reading 526.601 Δ Condensate (mL) _____

Δ Meter Reading 39.078 38.947 (leak check after 1st port)

Orsat: Method of Collection Fyrite

	RUN 1	RUN 2	RUN 3	AVG
% CO_2	5.0			5.0
% O_2	13.5			13.5
% CO				

Page _____ of _____

TAR-24-1/85

WESTON

FIELD DATA

CLIENT Chi-Ver T ATC PROJECT NO. 3977-01-02-0017

SOURCE South Stack DATE 4-12-89 RUN # 2

PORT POINT NO.	DIST FROM WALL (IN)	CLOCK TIME	DGM READING V_m (ft^3)	ΔP (in. H_2O)	ΔH (in. H_2O)	Average DGM TEMP IN (°F)	Average DGM TEMP OUT (°F)	STACK TEMP (°F)	IMP OUT (°F)	HOT BOX TEMP (°F)	SAMPLE TRAIN VAC (inHg)
2-2		1418 0	526.601	0.30	0.82	84		120	Read	261	4
2		1421 3	528.51	0.30	0.82	87		125		262	4
3		1424 6	530.42	0.37	1.01	87		132		258	4
4		1427 9	531.98	0.41	1.12	88		133		256	5
5		1430 12	534.15	0.45	1.23	88		133		254	6
6		1433 15	535.97	0.48	1.31	89		133		258	6
7		1436 18	538.01	0.45	1.23	89		134		260	6
8		1439 21	540.44	0.45	1.23	90		133		259	6
9		1442 24	542.32	0.45	1.23	90		132		261	6
10		1445 27	544.30	0.44	1.20	90		133		258	6
11		1457	546.457 546.588	0.19	0.52	85		120		254	2
2		1500	547.99	0.25	0.68	89		120		255	3
3		1503	549.58	0.26	0.71	89		129		252	3
4		1506	551.14	0.30	0.82	89		130		254	4
5		1509	552.82	0.37	1.01	89		130		262	5
6		1512	554.66	0.51	1.39	89		131		263	8
7		1515	556.90	0.58	1.58	90		130		275	10
8		1518	559.04	0.56	1.53	91		130		266	10
9		1521	561.36	0.55	1.50	91		130		266	9
10		1524	563.66	0.41	1.12	93		131		268	
Final		1527	565.679	0.4098	1.103	89		129			

NOTES/REMARKS:

$$\Delta H = \Delta P\left[(893.94)(C_p)^2(FDA)^2(\Delta H_@)(Dn)^4\left(\frac{T_m}{T_s}\right)\right]$$

K2 2.7335

Page ____ of ____

TAR-26-1/85

207

WESTON

PARTICULATE FIELD DATA

Client:Chi-Vit Corporation
WESTON Project No.:3977-01-02-0017
Source:#1 Scrubber,south stack
Date:4-12-89
Run#:3

PORT POINT NO.	DGM READING Vm(ft^1/3)	DELTA P in. H20	DELTA P SQUARE ROOT	DELTA H IN. H20	AVERAGE DGM TEMP (F)	STACK TEMP (F)	IMP OUT (F)	HOT BOX TEMP (F)	SAMPLE TRAIN VAC (in Hg)
1/1	566.127	.200	.447	.550	85	122	ICED	253	2
2	567.730	.260	.510	.710	87	123		273	2
3	569.270	.300	.548	.820	88	129		270	4
4	570.920	.343	.586	.930	89	130		267	4
5	572.680	.383	.619	1.040	88	130		265	5
6	574.580	.520	.721	1.420	87	130		262	7
7	576.720	.520	.721	1.420	89	130		263	7
8	578.850	.500	.707	4.370	90	131		266	7
9	581.010	.600	.775	1.640	92	132		266	9
10	583.390	.620	.787	1.690	93	132		264	9
2/1	585.851	.320	.566	.870	86	130		266	4
2	587.610	.320	.566	.870	88	128		260	4
3	589.330	.400	.632	1.090	89	129		260	5
4	591.250	.450	.671	1.230	89	130		262	5
5	593.320	.470	.686	1.280	89	130		260	7
6	595.170	.490	.700	1.340	90	130		261	8
7	597.310	.470	.686	1.280	90	130		261	7
8	599.440	.470	.686	1.280	90	131		262	7
9	601.560	.470	.686	1.280	90	131		261	7
10	603.640	.450	.671	1.230	90	131		264	7
	605.603								

DGM READING Vm:	39.337
AVG DELTA P:	.428
AVG DELTA H:	1.317
AVG SQT DELTA P:	.648
AVG DGM TEMP:	88.950
AVG STACK TEMP:	129.450

PARTICULATE DATA

CLIENT Chi-Vit ATC PROJECT NO. 3977-01-02-0017

SOURCE South Stack DATE 4-12-89

RUN # 3 START TIME 1650 END TIME 1757

SAMPLING SITE South Stack CONTROL DEVICE wet scrubber

SAMPLING TYPE M-5 SAMPLE CONSOLE # ATC-1 SAMPLE CASE # _____

AMBIENT TEMP 54 WEATHER cloudy WIND SPEED/DIRECTION _____

ATC TEST PERSONNEL L.F. CN OBSERVERS none

SKETCH OF STACK

Stack Dimensions 32" Orifice ΔH 1.705

Sample Time (min/pt) 3 Meter Corr. Factor 0.927

Net Sample Time (min) 60 Pitot Tube # _____

Baro Press. (in Hg) 29.88 Pitot Factor 0.84

Stack Press. (in Hg) 29.86 Nozzle ID # _____

Stack Temp DB/WB (°F) 129 Noz Dia Pretest (in) 0.248

Assumed Mois (%) 15 Noz Dia Posttest (in) 0.248

Pretest Leak Check 0.004 @ 10" Avg Noz Dia (in) 0.248
0.008 @ 13 Actual

Posttest Leak Check 0.005 @ 10" Filter Type/Number 900142

Final Gas Meter Reading 605.605 Silica gel # 3

Initial Gas Meter Reading 566.127 Δ Condensate (mL) _____

Δ Meter Reading 39.337 (leak check after 1st part)

Orsat: Method of Collection Fyrite

	RUN 1	RUN 2	RUN 3	AVG
% CO_2	5.5			5.5
% O_2	14.0			14.0
% CO				

FIELD DATA

CLIENT: Chi - Vit WEC PROJECT NO.: 3977-01-02-0017

SOURCE: South Stack DATE: 4-11-89 RUN #: 3

PORT POINT NO.	DIST FROM WALL (IN)	CLOCK TIME	DGM READING V_m (ft^3)	ΔP (in. H_2O)	ΔH (in. H_2O)	Average DGM TEMP IN (°F)	Average DGM TEMP OUT (°F)	STACK TEMP (°F)	IMP OUT (°F)	HOT BOX TEMP (°F)	SAMPLE TRAIN VAC (inHg)
1-1		1650	566.127	0.20	0.55	85		122	Foal	253	2
2		1653	567.73	0.26	0.71	87		123		273	2
3		1656	569.27	0.30	0.82	88		129		270	4
4		1659	570.92	0.34	0.93	89		130		261	4
5		1702	572.68	0.38	1.04	88		130		265	5
6		1705	574.58	0.52	1.42	87		130		262	7
7		1708	576.72	0.52	1.42	89		130		263	7
8		1711	578.85	0.50	1.37	90		131		266	7
9		1714	581.01	0.60	1.64	92		132		266	9
10		1717	583.39	0.62	1.69	93		132		264	9
2-2		1728	585.712 / 585.851	0.32	0.87	86		130		266	4
2		1731	587.61	0.32	0.87	88		128		260	4
3		1734	589.33	0.40	1.09	89		129		260	5
4		1736	591.25	0.45	1.23	89		130		262	5
5		1739	593.22	0.47	1.28	89		130		260	7
6		1742	595.17	0.49	1.34	90		130		261	8
7		1745	597.31	0.47	1.28	90		130		261	7
8		1748	599.44	0.47	1.28	90		131		262	7
9		1751	601.56	0.47	1.28	90		131		261	7
10		1754	603.64	0.45	1.23	90		131		264	7
Final		1757	605.603								

NOTES/REMARKS:

$$\Delta H = \Delta P\left[(893.94)(C_p)^2 (FDA)^2 (\Delta H_@)(Dn)^4 \left(\frac{T_m}{T_s}\right)\right]_{130}^{80}$$

K = 2.7335

Page _____ of _____

TAR-26-1/85

2 10

$\bar{D}_m$ = 0.7368

WESTON

PRELIMINARY VELOCITY DATA

CLIENT Chi-Vit PROJECT NO. 3977-01-02-0117

SOURCE South Stack DATE 4-11-89

DUCT DATA

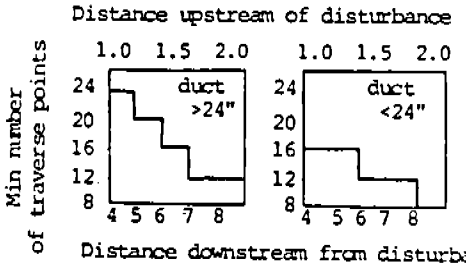
Dist from far wall to outside of port	33.5	in.	
Nipple length	1.5	in.	
Depth of duct	32	in.	
Width of duct (rec)		in.	
Area of duct		ft^2	

Equivalent diameter = $\frac{2 \times \text{depth} \times \text{width}}{\text{depth} + \text{width}}$

$\frac{2(\quad)(\quad)}{(\quad)+(\quad)}$

Dist from ports to nearest disturbance	upstream	downstream
ft	22	18 17.96
dia	8.25	6.75 6.73

LOCATION OF TRAVERSE POINTS



CIRCULAR DUCTS

Traverse point number on a diameter	(Percent of stack diameter from inside wall to traverse point) 2	4	6	8	10	12
1	14.6	6.7	4.4	3.2	2.6	2.1
2	85.4	25.0	14.6	10.5	8.2	6.7
3		75.0	29.6	19.4	14.6	11.8
4		93.3	70.4	32.3	22.6	17.7
5			85.4	67.7	34.2	25.0
6			95.6	80.6	65.8	35.6
7				89.5	77.4	64.4
8				96.8	85.4	75.0
9					91.8	82.3
10					97.4	88.2
11						93.3
12						97.9

RECTANGULAR DUCTS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

MEASUREMENTS

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	2.6	0.83	2.33
2	8.2	2.62	4.12
3	14.6	4.67	6.17
4	22.6	7.23	8.73
5	34.2	10.94	12.44
6	65.8	21.06	22.56
7	77.4	24.77	26.27
8	85.4	27.33	28.83
9	91.8	29.38	30.88
10	97.4	31.17	32.67
11			
12			

SKETCH OF DUCT

WESTON MANAGERS DESIGNERS CONSULTANTS

PRELIMINARY VELOCITY DATA

CLIENT Chi-Vi T SOURCE South Stack PROJECT NO. _____

DATE 4-12-89 PERSONNEL L.F. C.N.

DUCT DIMENSION 32" CROSS SECTIONAL AREA 5.58 BAR. PRESSURE _____

PITOT TUBE ID # _____ AVG COEFFICIENT 0.84 DATE CALIBRATED _____

T_s (dry bulb) _____

T_s (wet bulb) _____

Moisture _____

P_s _____

O_2 _____

CO_2 _____

M_s _____

$\sqrt{\Delta P}$ _____

C_p _____

Base time _____

$V_s = 85.49\ C_p \sqrt{\Delta P} \sqrt{\frac{T_s}{M_s P_s}}$

M_s =

Q_a =

Q_s =

TRAVERSE PT	ΔP	Temp ●	COS$\sqrt{\Delta P}$	Test Time
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
mean				

WESTON MANAGERS DESIGNERS CONSULTANTS

SAMPLE RECOVERY AND INTEGRITY

CLIENT Chi-Vit PROJECT NO. 3977-01-02-0017

SOURCE South Stack

SAMPLE DATE 4-12-89 SAMPLE PERSONNEL L.F, C.N

RECOVERY DATE 4-12-89 RECOVERY PERSONNEL L.F, C.N

MOISTURE DATA

	RUN # 1	RUN # 2	RUN # 3
Final Volume in Impingers (mL)	383	418	395
Initial Volume in Impingers (mL)	200	200	200
Net Volume Increase (mL)	183	218	195
Silica Gel Number	1	2	3
Final Silica Gel Wt (g)	233.0	232.2	214.7
Initial Silica Gel Wt (g)	216.7	223.3	205.4
Δ Wt (g)	16.3	8.9	9.3
Total Moisture (mL)	199.3	226.9	204.3

		IMPINGER NUMBER 1	2	3	4	5
Run # 1	Final Wt	215	150	18	233.0	
	Initial Wt	100	100	0	216.7	
	Δ Wt	115	50	18	16.3	
Run # 2	Final Wt	300	115	3	232.2 1/07	
	Initial Wt	100	100	0	223.3	
	Δ Wt	200	15	3	23.7 X03	
Run # 3	Final Wt	280	115	0	214.7 225 1/07	
	Initial Wt	100	100	0	205.4	
	Δ Wt	180	15	0	19.6 20 3	

SAMPLE RECOVERY

	RUN # 1	RUN # 2	RUN # 3
Filter Number	900131	900141	900142
Filter Cont. No/Wash Cont. No.	CV1F/CV1W	CV2F/CV2W	CV3F/CV3W
Filter Container Sealed (Y/N)	Y	Y	Y
Probe Wash Level Mark? (Y/N)	Y	Y	Y
Solvent Blank Cont. No.	CVFB	CV1N13	

NOTES:

Page ____ of ____

Lucille O. Fowler
TEST TEAM LEADER

TAR-25-1/85

WESTON

LABORATORY DATA

CLIENT Chi-Vit PROJECT NO. 3977-01-02-017

Condition of Sample on Arrival?	✓	✓	✓	✓	
Liquid Levels Marked? (Y/N)	Y	Y	Y	Y	
Filter Container Sealed (Y/N)	-	-	-	-	
Laboratory Number					

Laboratory Personnel Taking Custody Landie O. Fowler Jr.

Date Received in Laboratory April 17, 1989

Sample Identification Beaker #/Liquid Volume Run # ~~Filter #~~	Initial Wt. #1 Initial Wt. #2 Initial Wt. #3 Avg. Initial Wt.	Final Wt. #1 Final Wt. #2 Final Wt. #3 Avg. Final Wt.	Δ Weight + Filter Weight -- Blank Net Particulate Wt.
CV1W	114.7094	114.7272	0.0178
CV1/205	114.7095	114.7272	+0.0345
1			-0.0024
	114.7094	114.7272	0.0499
CV2W	110.9097	110.9320	0.0225
CV2/149	110.9097	110.9324	+0.0327
			-0.0017
2	110.9097	110.9322	0.0535
CV3W	113.0038	113.0274	0.0238
CV3/136	113.0036	113.0276	+0.0315
			-0.0016
3	113.0037	113.0275	0.0537
CVUB	107.3346	107.3377	+0.0029
~~CB~~ 2.5 ml	107.3349	107.3377	
Blank			
	107.3348	107.3377	

Analyst Landie O. Fowler Jr. Laboratory Supervisor Belinda Castle

WESTON MANAGERS DESIGNERS/CONSULTANTS

LABORATORY DATA

CLIENT Chi-Vit PROJECT NO. 3977-01-02-017

Condition of Sample on Arrival?	✓	✓	✓		
Liquid Levels Marked? (Y/N)	Y	Y	Y		
Filter Container Sealed (Y/N)	Y	Y	Y	✓	
Laboratory Number					

Laboratory Personnel Taking Custody Landie O. Fowler Jr.

Date Received in Laboratory April 17, 1989

Sample Identification ~~Beaker #/Liquid Volume~~ Run # Filter #	Initial Wt. #1 Initial Wt. #2 Initial Wt. #3 Avg. Initial Wt.	Final Wt. #1 Final Wt. #2 Final Wt. #3 Avg. Final Wt.	Δ Weight -- Filter Weight -- Blank NET Filter WT.
CV1F	0.4700	0.5047	0.0352
Run 1	0.4696	0.5052	
			-0.0007
900131	0.4698	0.5050	0.0345
CV2F	0.4579	0.4913	0.0334
Run2	0.4577	0.4910	—
			-0.0007
900141	0.4578	0.4912	0.0327
CV3F	0.4567	0.4890	0.0322
Run 3	0.4564	0.4887	—
			-0.0007
900142	0.4566	0.4888	0.0315
CVFB	0.4562	0.4567	+0.0007
Blank	0.4560	0.4570	
900144	0.4561	0.4568	

Analyst Landie O. Fowler Jr. Laboratory Supervisor Belinda Castle

WESTON MANAGERS DESIGNERS/CONSULTANTS

APPENDIX C

CALIBRATIONS

DRY GAS METER CALIBRATION

Date 4-13-89 Console No. ATC-1 P_{bar} 29.78 P_b in. Hg

Calibrated by (full name) Landis O. Fowler Jr

ΔH "WG	Std Meter Volume final	int.	ΔVol V_w	Volume Meter V_d final	int.	ΔVol	T_w (°F)	T meter (°F) in	out	avg T_d	θ (min)	$\bar{Y}_1$	$\Delta H_@$
1.0	320.489	315.360	5.671	673.738	667.431	6.307	67	85	88	87	10		
	326.652	320.989	5.663	680.057	673.738	6.319	67	87	89	88	10		
	332.328	326.652	5.676	686.390	680.057	6.333	67	87	90	88	10		

Avg

ΔH	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460) Y_{std}}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$	$\Delta H_{@i} = \frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\theta}{V_w (Y_{std})}\right]^2$
1.0 ~~0.5~~	0.074 ~~0.037~~	$Y_i = \frac{(5.671)(29.78)(547)(0.985)}{(6.307)(29.85)(527)} = 0.917$	$\Delta H_{@i} = \frac{(0.0317)(1.0)}{(29.78)(547)}\left[\frac{(527)(10)}{(5.671)(.985)}\right]^2 = 1.73$
1.0	0.074	$Y_i = \frac{(5.663)(29.78)(548)(0.985)}{(6.319)(29.85)(527)} = 0.916$	$\Delta H_{@i} = \frac{(0.0317)(1.0)}{(29.78)(548)}\left[\frac{(527)(10)}{(5.663)(.985)}\right]^2 = 1.73$
1.0	0.074 ~~0.110~~	$Y_i = \frac{(5.676)(29.78)(548)(0.985)}{(6.333)(29.85)(527)} = 0.916$	$\Delta H_{@i} = \frac{(0.0317)(1.0)}{(29.78)(548)}\left[\frac{(527)(10)}{(5.676)(.985)}\right]^2 = 1.72$
2.0	0.147		
3.0	0.221		

0.916 1.73

Page _____ of _____

TAR-19-1/85

3 01

1.719

APPLIED TECHNOLOGY CONSULTANTS

DRY GAS METER CALIBRATION

Date 10/28/88 Console No. ATC-1 P_{bar} 30.19 in. Hg

Calibrated by (full name) JEFF BURDETTE

ΔH "WG	Std Meter Volume final	int.	ΔVol	Volume Meter final	int.	ΔVol	T_w (°F)	T meter (°F) in	~~out~~ FINAL	avg	Θ (min)	$\bar{Y}_1$	$\Delta H_@$
0.5	996.047	989.775	6.272	145.607	138.862	6.745	75 76	75	83	79	15.0		
1.0	1003.998	996.542	6.956	154.129	146.581	7.548	76 76	85	90	87.5	12.0		
1.5	1013.424	1004.246	9.178	164.502	154.499	10.003	76 76	92	95	93.5	13.0		
2.0	1023.253	1013.626	9.627	175.247	164.722	10.525	77 77	95	98	96.5	12.0		
~~3.0~~	~~1032.594~~	~~1023.659~~	~~8.935~~	~~185.456~~	~~175.617~~	~~9.838~~	77 77	98	103	100.5	10.0		
3.0	43.728	32.927	10.801	197.544	185.810	11.734	77 77	90	97	93.5	11.0		

ΔH	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460) Y_{std}}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$	$\Delta H_{@i} = \frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\Theta}{V_w Y_{std}} \right]^2$
0.5	0.037	0.921	JB ~~1.598~~ 1.647
1.0	0.074	0.925	JB ~~1.640~~ 1.690
1.5	0.110	0.930	JB ~~1.640~~ 1.690
2.0	0.147	0.929	JB ~~1.690~~ 1.742
3.0	0.221	JB ~~0.933~~ 0.928	JB ~~1.702~~ 1.754
		0.927	1.705

Page ____ of ____

TAR-19-1/85

APPENDIX D

EXAMPLE CALCULATIONS

PARTICULATE EMISSION EQUATIONS

Standard Meter Volume, $V_{mstd} = \dfrac{17.64\ Y\ V_m\ P_m}{T_m}$

Standard Wet Volume, $V_{wstd} = 0.04707\ V_{\ell c}$

Moisture Content, $BWS = \dfrac{V_{wstd}}{(V_{wstd} + V_{mstd})}$

Molecular Weight, $M_s = [0.44\ CO_2 + 0.32\ O_2 + 0.28(100-CO_2-O_2)](1-BWS) + 18\ BWS$

Average Velocity, $V_s = 85.49\ C_p\ (\sqrt{\Delta P})_{ave} \sqrt{\dfrac{T_s}{P_s\ M_s}}$

Average Stack Gas Flow
@ Stack Cond, $Q_a = 60\ V_s A_s$

Average Stack Gas Flow
@ Std Cond, $Q_s = 17.64\ Q_a (1-BWS) \dfrac{P_s}{T_s}$

% Isokinetic Sampling, $\%I = \dfrac{0.0945\ T_s\ V_{mstd}}{P_s\ V_s\ A_n\ \theta(1-BWS)}$

Particulate Concentration
@ Std Conditions, $C_s = 15.4 \dfrac{M_n}{V_{mstd}}$

Particulate Emission Rate, $PMR = 0.00857\ C_s\ Q_s$

Chi-ViT Corporation
WESTON Work Order no. 3977-01-02 -0001
Emission limit Calculations

From NSEM rules and Regulations Section 4.4.1 for processes producing less than 30 T/hr/day.

Emission Limit 16/hr = 3.59 X Production rate$^{.62}$

Chi-ViT production rate — 1.4 T/hr.

Emission Limit 16/hr = $(3.59)(1.4)^{0.62}$

= 4.42

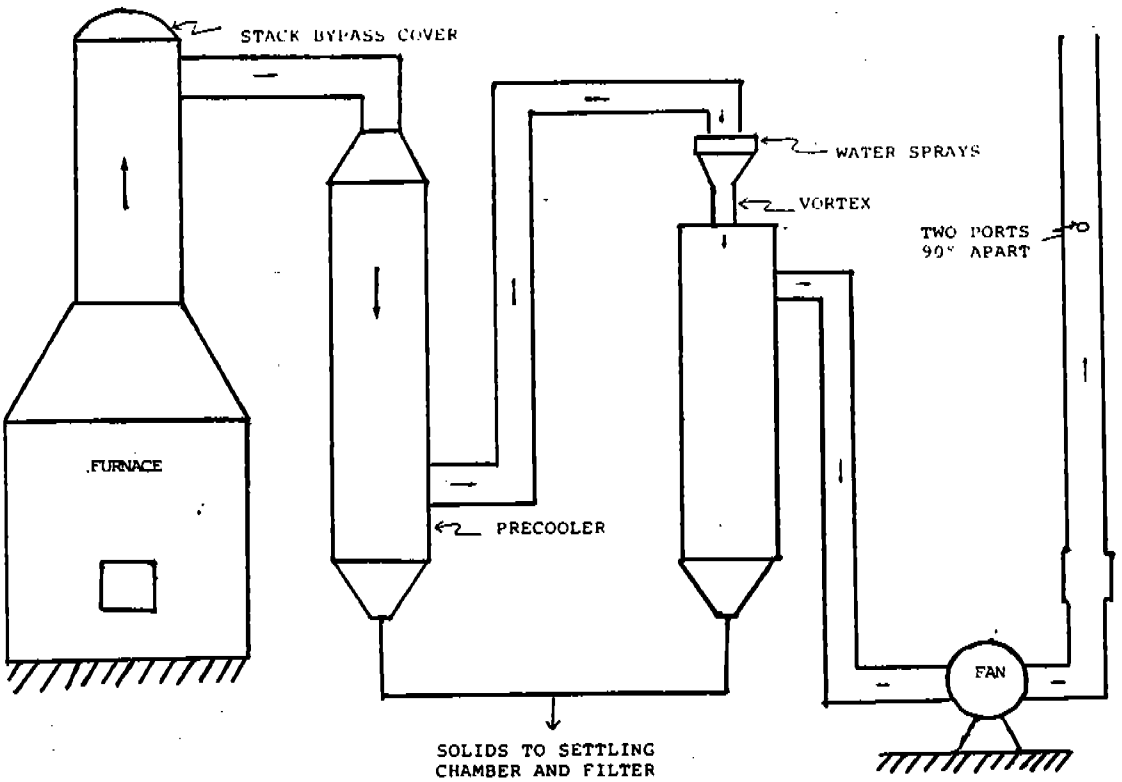
APPENDIX E

PROCESS DATA

WESTON
MANAGERS DESIGNERS·CONSULTANTS

PROCESS DESCRIPTION

The Chi-Vit plant at Leesburg, Alabama produces coated glass frit for industry. The emissions from No. 1 South Stack are controlled by a Venturi wet Scrubber using water with lime added as the scrubbing media. The wet scrubber has 16 spray nozzles. The scrubber is designed to control particulate emissions using only eight of the nozzles at any one time. During the testing ten of the nozzles were operating. A schematic of the process is given in the figure below.



NOT TO SCALE

SCHEMATIC DRAWING OF FRIT UNIT

Chi-Vit Corporation

720 South Edgewood Avenue • Urbana, Ohio 43078 • Phone No. (513) 652-1341 • FAX No. (513) 653-7977

CHI-VIT CORPORATION LEESBURG, ALABAMA OPERATOR: BOBBY GRIMES

SOUTH STACK #1

UNIT: #1 FRIT UNIT ALABAMA PERMIT: 303-0001-Z002

PRODUCT: A1397 GROUND COAT FRIT

DATE	TIME	FEED RATE	CFH GAS USAGE	VENTURI PRESS. DROP	TOTAL GAS AND AIR CFH
4-12-89	8 AM	1.4 T/H	11,200	41	134,400
	9 AM	1.4 T/H	11,200	41	134,400
	10 AM	1.4 T/H	11,200	41	134,400
	11 AM	1.4 T/H	11,200	41	134,400
	12 AM	1.4 T/H	11,200	41	134,400
	1 PM	1.4 T/H	11,200	41	134,400
	2 PM	1.4 T/H	11.200	41	134,400
	3 PM	1.4 T/H	11,200	41	134,400
	4 PM	1.4 T/H	11,200	41	134,400
	5 PM	1.4 T/H	11,200	41	134,400
	6 PM	1.4 T/H	11,200	41	134,400