Background Report Reference

AP-42 Section Number: 9.9.1

Background Report Section: 2

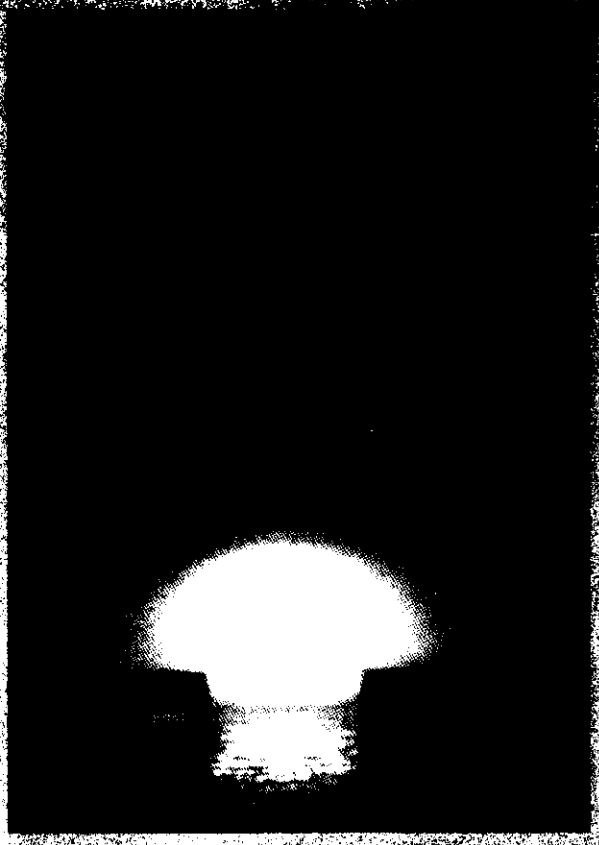
Reference Number: 37

Title: Compliance Test Report for the No. 15 Kiln Malt Dryer Exaust

Ladish Malting Company

December 1995

AP-42 Section 9.2.1
Reference
Report Sect. 2
Reference 37



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SCIENCES &

ENGINEERING

COMPLIANCE TEST REPORT FOR THE NO. 15 KILN MALT DRYER EXHAUST

LADISH MALTING COMPANY

December 18, 1995
Project No. 95.502AQ

Fluid Management, Inc.

COMPLIANCE TEST REPORT FOR THE DETERMINATION OF NONMETHANE ORGANIC COMPOUND EMISSIONS FROM THE NO. 15 KILN MALT DRYER EXHAUST

Prepared for:

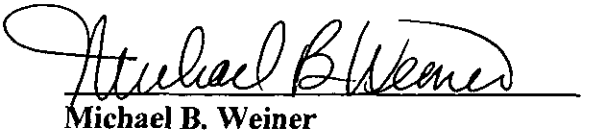
LADISH MALTING COMPANY
N5355 East Junction Road
Jefferson Junction, WI 53549

Prepared by:

Fluid Management, Inc.
Air Sciences & Engineering
Milwaukee, WI

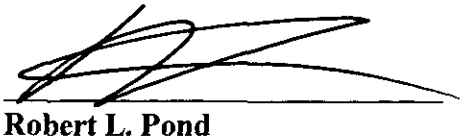
December 1995
Project No. 95.502AQ

Prepared by:



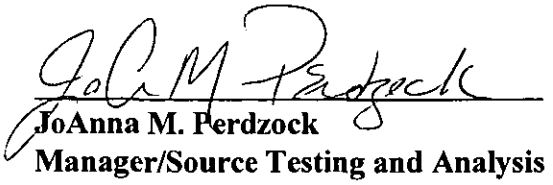
Michael B. Weiner
Senior Scientist

Approved by:



Robert L. Pond
Director/Principal Engineer

Reviewed by:



JoAnna M. Perdzock
Manager/Source Testing and Analysis

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1.0 INTRODUCTION

Fluid Management, Inc. ("FMI") was retained by Ladish Malting Company ("Ladish") to conduct compliance emissions testing at its facility located in Jefferson Junction, Wisconsin.

Methane and nonmethane organic compound ("NMOC") emission testing was performed on the No. 15 kiln while processing barley. The No. 15 kiln is one of Ladish's largest kilns. No. 15 kiln has two (2) floors and represents a "worst case" scenario for potential nonmethane hydrocarbon emissions. The kiln is heated by indirect natural gas-fired kiln propylene glycol heaters. During the test, approximately 7,000 bushels of barley were dried on each of two (2) floors. The upper floor malt goes from 45-48 percent moisture to 15-20 percent moisture, while the lower floor goes from 15-20 percent moisture to 3.5-4.3 percent moisture during the 24 hour cycle. The total amount of barley dried during the testing event was recorded by Ladish and used by FMI to determine the emission factor for NMOCs being emitted.

All testing was performed in accordance with the United States Environmental Protection Agency ("U.S. EPA") and Wisconsin Department of Natural Resources ("WDNR") source testing methodologies. Testing was conducted in accordance with a compliance test plan submitted to Mr. James Crawford of the WDNR on September 26, 1995. The only notable deviation from the methodologies described in the original compliance test plan was a change in sampling and analytical methodologies from U.S. EPA Reference Method 25A using a total hydrocarbon analyzer to U.S. EPA Reference Method 18 using an on-site gas chromatograph ("GC"). This change was determined to be necessary due to anticipated extremely low concentrations of NMOCs in the exhaust stack gas and was done with the approval of the WDNR. The instrumentation utilized for U.S. EPA Reference Method 18 testing has a reported lower level of detection of less than 0.10 parts per million by volume ("ppmv") total hydrocarbon. Testing was completed by Messrs. Michael Weiner and Jeffrey Anderson of FMI's Air Science and Engineering Group on November 14 and 15, 1995. Production coordination was conducted by Mr. Roger Ziegler and process data collection was conducted by Ms. Gail Smith of Ladish. All compliance testing was witnessed by Mr. James Crawford of the WDNR.

Fluid Management, Inc.

April 1, 1996

VIA CERTIFIED MAIL RETURN RECEIPT

Mr. James G. Crawford, P.E.
Wisconsin Department of Natural Resources
1125 N. Military Avenue
P.O. Box 10448
Green Bay, WI 54307-0448

RE: LADISH MALTING COMPANY
COMPLIANCE TEST REPORT FOR THE DETERMINATION OF NON-METHANE ORGANIC COMPOUND EMISSIONS FROM THE NO. 15 KILN MALT DRYER EXHAUST
Project No. 95.502AQ

Dear Mr. Crawford:

Please find enclosed a copy of two (2) gas chromatograms. The first chromatogram demonstrates the position of a standard propylene glycol peak. The second is a blank water sample used as a method blank. Both samples were run on an SPB-5 column identical to that used during the November testing.

Also included is an example of one (1) of the testing event chromatograms with the relative position of a propylene glycol peak superimposed. Having reviewed the chromatograms included in the test report, and comparing them to the propylene glycol standard, it is evident that no measurable amounts of propylene glycol were contained within any of the sample bags. The sample corresponding to Run No. 2, Fan No. 2, indicates a peak in the general location of propylene glycol, but is most likely water, which also shows a peak in close proximity to propylene glycol. This peak shows concentrations just slightly over the detection limit, and does not show the characteristic sharpness of a standard propylene glycol peak.

2831 N. Grandview Blvd.
Post Office Box 90
Pewaukee, Wisconsin 53072-0090
Tel: (414) 549-6898
Fax: (414) 549-6938

Fluid Management, Inc.

We hope this additional information clears up any previous questions or concerns. If you have any further questions or require additional information, please contact us at (414) 549-6898.

Sincerely,

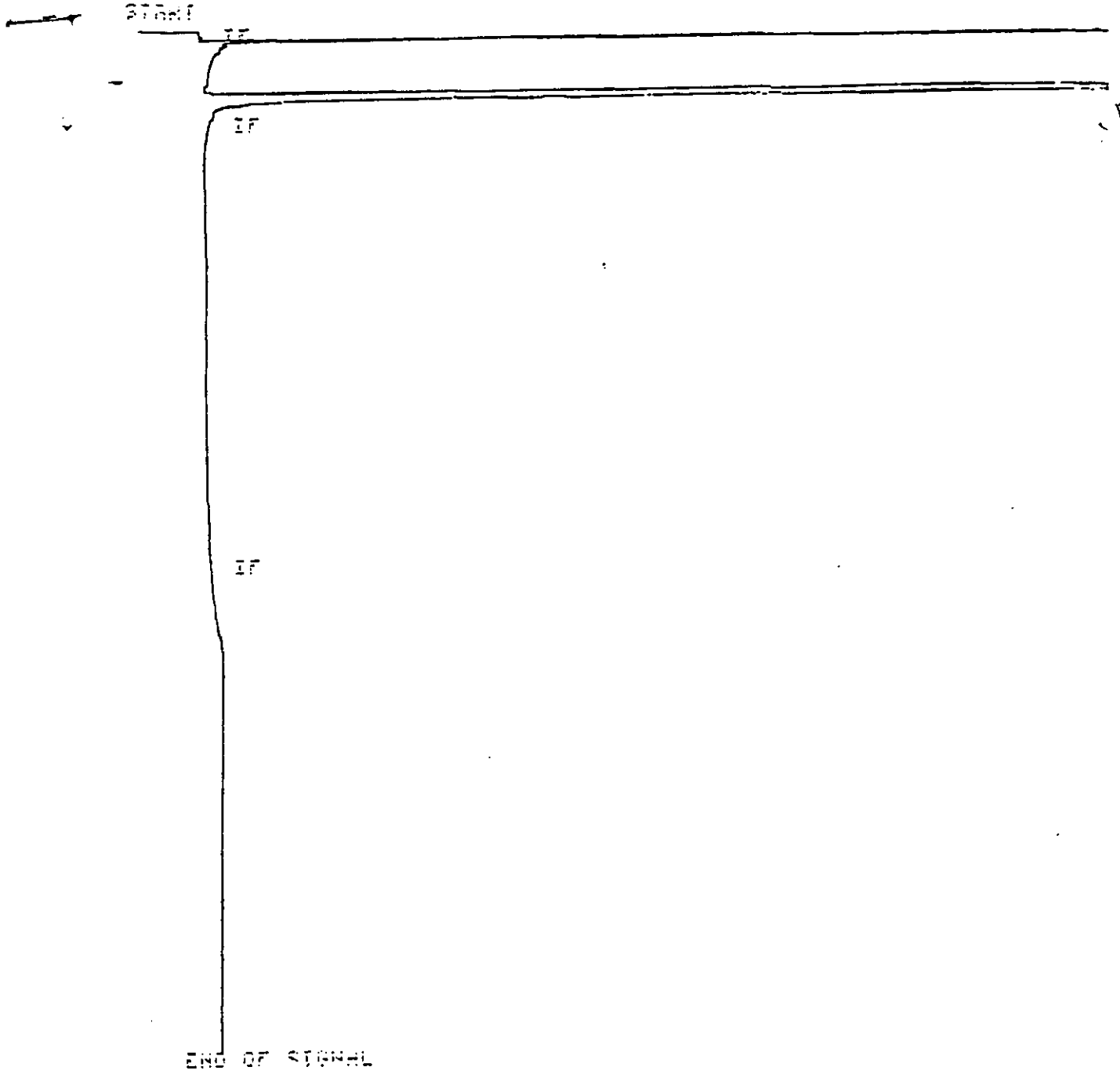
FLUID MANAGEMENT, INC.

Jeffrey K. Anderson
Project Chemical Engineer

Robert L. Pond
Principal Engineer

Enclosures

cc: Mr. George Groskopf, Ladish Malting Company
Mr. John Renz, Ladish Malting Company
Mr. Roger Ziegler, Ladish Malting Company



Propylene Glycol.

BUFFERED RUN# 573 MAR 26, 1996 14:27:43

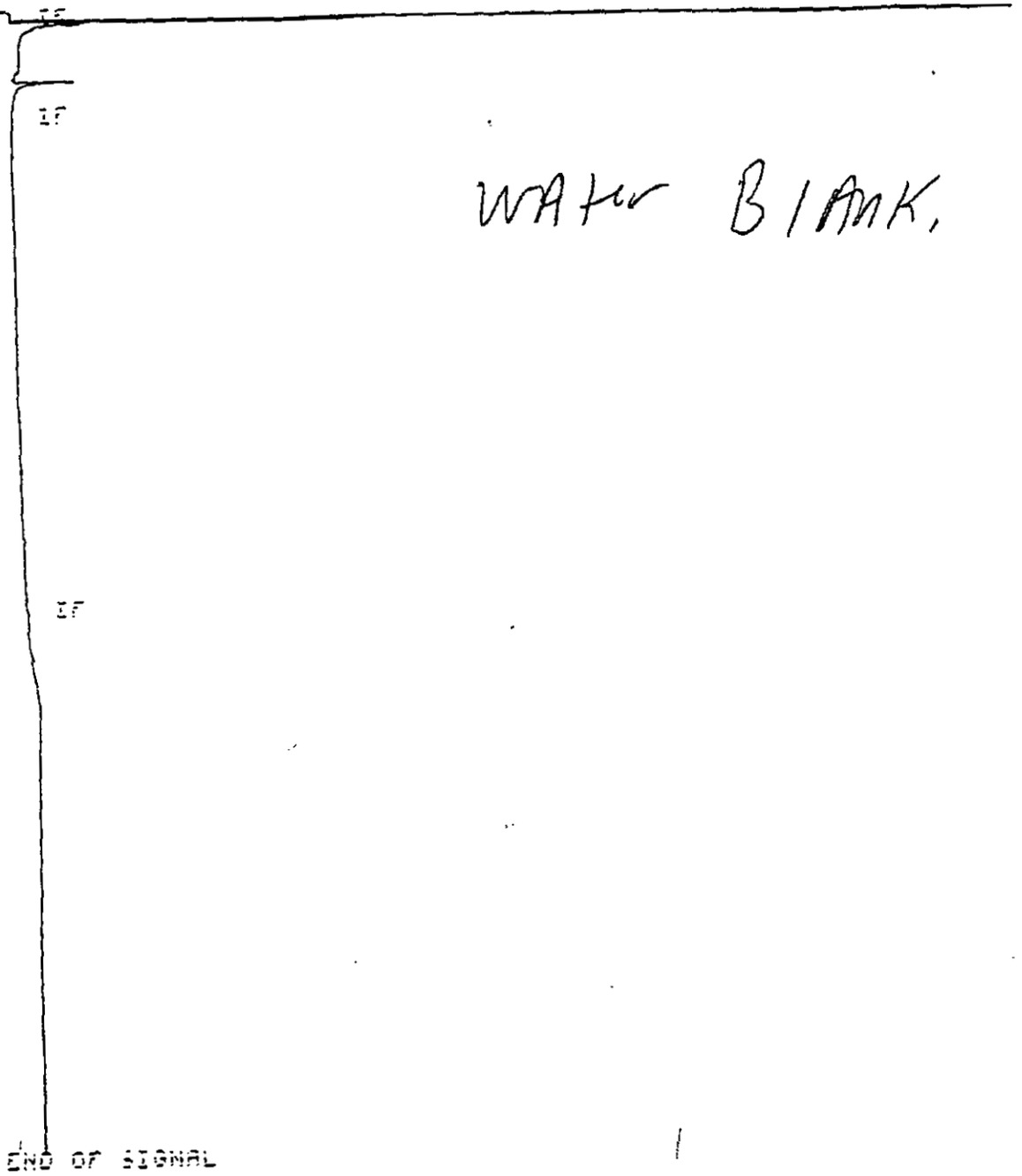
SAMPLE NAME: 857 SAMPLE# 57
METHOD NAME: M:EXTB.MET
PROPYLENE GL/COL

EXTRACTABLE HYDRO FROM URANGE

NO RUN PEAKS STORED

BUFFER pH-mV=0.01 Sig 2 RUN # 572 MAR 26, 1996 15:42:37

START



WATER BLANK.

BUFFERED RUN# 572 MAR 26, 1996 15:42:37

SAMPLE# 00

METHOD NAME: H-DATE.MET
H2O

EXTRACTABLE HYDRO FRONT ORANGE

NO RUN PEAKS STORED

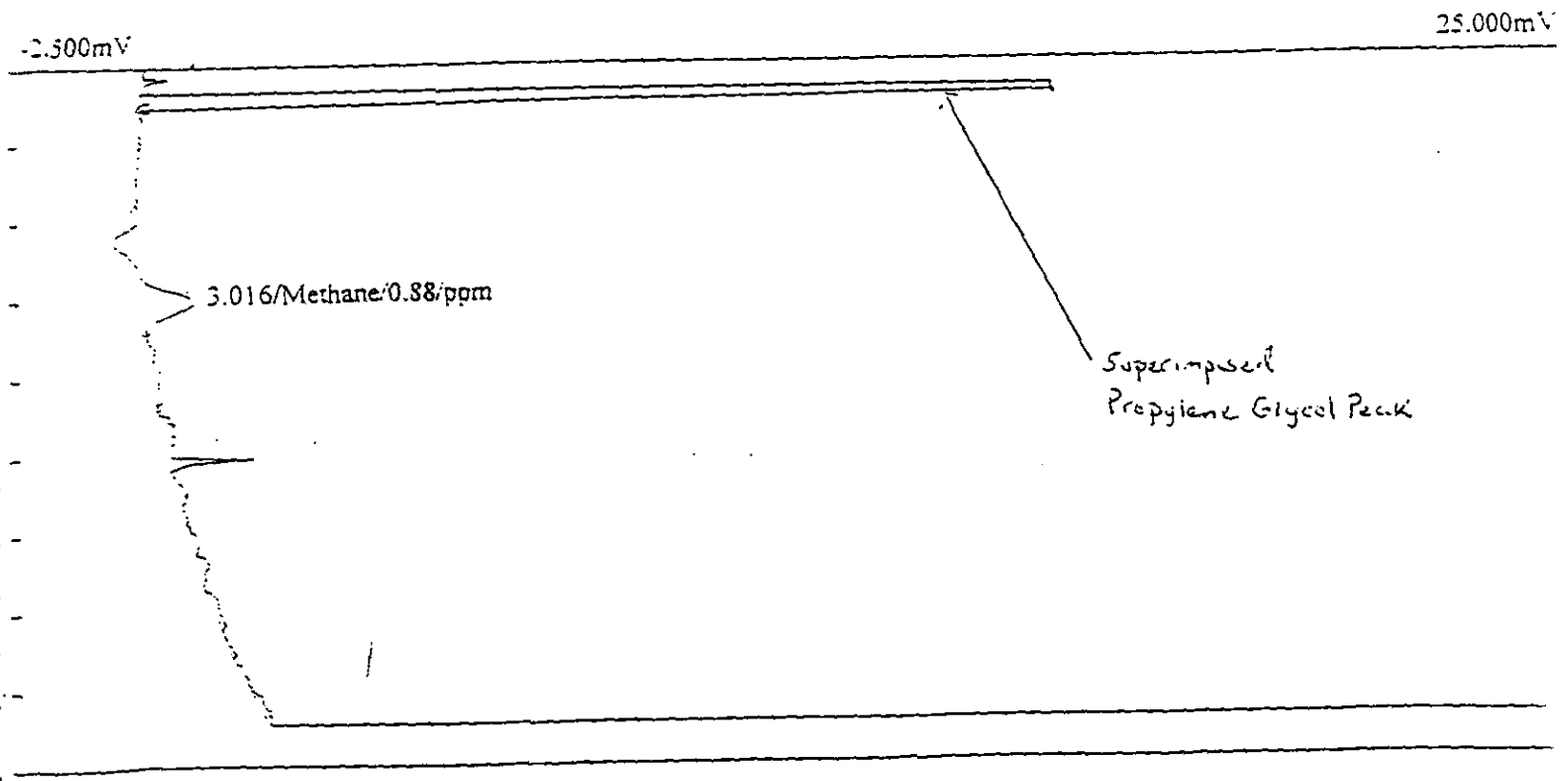
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: 95-502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 14:33:04
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F1R62.CHR (c:\peakwin)
Sample: Fan #1 Run #6
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
	1.000	10.000	130

Components:

PeakName	Start	End	Calibration	Int.Std	Units
Methane	2.850	3.150	CH4.CAL	0.000	ppm
Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.016	28.154	0.88	ppm
		28	1	

Fluid Management, Inc.

December 19, 1995

VIA CERTIFIED MAIL RETURN RECEIPT

Mr. Jim Crawford
Wisconsin Department of Natural Resources
1125 North Military Avenue, Box 10448
Green Bay, WI 54307

RE: LADISH MALTING COMPANY
COMPLIANCE TEST REPORT
Project No. 95.502AQ

Dear Mr. Crawford:

Enclosed please find three (3) copies of the compliance test report for the determination of non-methane organic compound emissions from the No. 15 kiln malt dryer exhaust at Ladish Malting Company.

If you have any questions, please contact us at (414) 291-8282.

Sincerely,

FLUID MANAGEMENT, INC.
Air Sciences & Engineering

Robert A. Schilling
Project Engineer

JoAnna Perdzock
Manager/Source Testing & Analysis

cc: Mr. John Renz, Ladish Malting Company
Mr. George Groskopf, Ladish Malting Company

250 East Wisconsin Avenue
Suite 1000
Milwaukee, Wisconsin 53202
Tel: (414) 291-8282
Fax: (414) 291-8299

2.0 PROCESS DESCRIPTION

Ladish receives barley by rail. The malt is loaded out in an enclosed area. From the receiving area, barley is conveyed via a bucket elevator to the top of the elevator. The barley is then screened and separated to proper sizes. The barley that does not meet the size specification is conveyed to the palletizing area. The rest of the barley is conveyed to the steeping tanks. The barley is rinsed several times in the steeping tanks. Next, the barley is dumped into compartments, and is then moved by screw conveyor to one (1) of nine (9) kilns. The heat is provided to the kilns by six (6) indirect natural gas-fired kiln heaters, each with a maximum heat input rating of sixty (60) mmBtu/hr. The kilns are typically comprised of three (3) levels, and the barley spends a predetermined amount of time at each level of the kiln. The barley enters the kilns at approximately forty-five (45) percent moisture content, and leaves at approximately four (4) percent moisture content. While in the kiln, the barley is converted from barley to malted barley. The malted barley is then transported by a screw conveyor to a storage elevator until it is needed for shipping. Additional process steam requirements are met by a seventy-five (75) horsepower Cleaver-Brooks package boiler.

Testing was conducted on the No. 15 kiln. The No. 15 kiln was processing malt during the testing event. Typically, the malt will spend twenty-four (24) hours on each level of the kiln. The No. 15 kiln is heated by a Somerset Technologies, Inc., sixty (60) mmBtu/hr indirect natural gas-fired propylene glycol heater. Sulfur is burned below the kiln, in a stove exhausting directly into the kiln. The fan speed will be set on high for the start of the testing. Fan speed is changed (lowered) as the malt becomes dryer by continuously monitoring the relative humidity and relaying the signal to the PCL which controls the fan speed during the cycle. The following schedule was followed during the testing program:

- 7:00 am - 7:30 pm holding heats
- 7:30 pm- 8:30 pm first high heat
- 8:30 pm- 12:30 am second high heats
- 12:30 am- 1:00 am cool down
- 1:00 am kiln dumped
- 1:30 am- 3:00 am upper floor is empty
- 3:30 am- 5:00 am upper floor is being loaded

Ladish personnel were responsible for operating the process and monitoring the operation during the testing event. Appendix A presents calculations for volumetric flowrates from field data included in Appendix B of this report. Appendix C contains sample chromatograms from the six (6) runs performed on the five (5) fan malt dryer exhausts. Appendix D contains calibration and certification data for the testing program. Process data collected during the testing program is included in Appendix E of this report. Appendix F contains a listing of key personnel involved in the project.

3.0 SUMMARY OF RESULTS

Summaries of the nonmethane organic compound emission test results for each fan malt dryer exhaust are presented in Table Nos. 1 through 5. Included in these tables are the results for stack gas temperature (°F), stack gas velocity in feet per second ("ft/sec"), volumetric flowrate in actual cubic feet per minute ("acfm"), methane concentration in parts per million by volume ("ppmv"), and nonmethane organic compound concentration in parts per million by volume (as propane) ("ppmvp").

Table No. 6 presents the overall summary of stack gas parameters for the five (5) fan malt dryer exhaust ducts of Kiln No. 15. The average stack gas temperature for the ducts over the entire drying cycle was determined to be 73.5 °F. Average stack gas velocity of the outlet ducts over the entire cycle was determined to be 157.28 ft/sec. The average volumetric flowrate of the outlet ducts over the entire drying cycle was determined to be 197,573 acfm. For the purposes of determining emission rates, the true volumetric flowrates were used for all exhaust stacks tested.

Table No. 7 presents the summary of methane concentrations (in terms of ppmv), nonmethane organic compound concentrations (in terms of ppmvp), and emission rates (in terms of pounds per hour as carbon) for the five fan malt dryer exhaust ducts of Kiln No. 15. The NMOC concentrations and emission rates were found to be:

- **Run No. 1 - < 0.35 ppmv (as propane), < 0.45 lb/hr (as carbon)**
- **Run No. 2 - < 0.35 ppmv (as propane), < 0.61 lb/hr (as carbon)**
- **Run No. 3 - < 0.35 ppmv (as propane), < 0.50 lb/hr (as carbon)**
- **Run No. 4 - < 0.35 ppmv (as propane), < 0.20 lb/hr (as carbon)**
- **Run No. 5 - < 0.35 ppmv (as propane), < 0.23 lb/hr (as carbon)**
- **Run No. 6 - < 0.35 ppmv (as propane), < 0.34 lb/hr (as carbon)**

The average NMOC concentration and emission rate of organic compounds from the five fan malt drying exhausts was determined to be < 0.35 ppmv (as propane) and < 0.39 lb/hr (as carbon).

4.0 SAMPLING AND ANALYTICAL PROCEDURES

The following sampling and analytical procedures were used during this testing program.

4.1 Exhaust Gas Parameters

Determination for velocity pressures, temperature, gas density, and moisture in the exhaust gas stream was performed in accordance with U.S. EPA Reference Methods 1 through 3.

4.1.1 Traverse and Sampling Points

The number of traverse points for the exhaust stacks was determined using U.S. EPA Reference Method 1, *"Sampling and Velocity Traverses for Stationary Sources."* The No. 15 Kiln fan room has five (5) fans each with six (6) sampling locations located three (3) diameters upstream and two (2) diameters downstream from the flow disturbance. They are located on the floor above the two (2) separate barley drying floors. Figure No. 1 visually depicts a typical fan with these ducts along with the sample port locations. Based on the configuration of the stacks, thirty-six (36) sample points [six (6) per traverse] were used for each fan. These five (5) fan exhaust stacks were used for velocity determinations.

4.1.2 Velocity Traverse

A velocity traverse was performed for each fan during each of the tests in accordance with U.S. EPA Reference Method 2, *"Determination of Stack Gas Temperature and Velocity (Type S Pitot Tube)."* An "S" type pitot tube with an attached "K" type thermocouple was used in conjunction with an oil-filled manometer to conduct the velocity traverses.

4.1.3 Molecular Weight of Stack Gas

The determination of molecular weight of the stack gas was made in accordance with U.S. EPA Reference Method 3, *"Gas Analysis for the Determination of Dry Molecular Weight."* An integrated gas sample will be collected during each test and analyzed for oxygen and carbon dioxide with a Fyrite analyzer. Nitrogen was determined by difference.

4.2 Nonmethane Organic Compound ("NMOC")

Nonmethane organic compound ("NMOC") emissions were determined in accordance with applicable sections of U.S. EPA Reference Method 18, Section 7.1, *"Determination of Gaseous Organic Compound Emissions Using a Gas Chromatograph (Flexible Bag Sampling Method)"*. Six (6) discrete, one (1) hour continuously collected samples were taken from each of five (5) fans during the testing event. All samples were one (1) hour in duration. NMOC measurements were made in the malt dryer exhaust fan stacks on the top floor of the kiln, after the gas has been passed through the propylene glycol heat exchangers, and just before it is exhausted into the atmosphere.

The concentration of NMOCs in each gas stream were extracted and measured according to the requirements and procedures of U.S. EPA Reference Method 18. The method principle is that a gas sample is extracted from the emission source; transported to a mobile laboratory; and then an aliquot of the sample gas is then analyzed for NMOCs by gas chromatography ("GC") utilizing a GC column for compound separation and flame ionization detection ("FID").

The sample was injected onto the analytical column by compression of the Tedlar bag inserted into the sample inlet of a heated, electrically actuated, 10-port Valco valve. Separation of methane and nonmethane organic compound was accomplished by utilizing a SPB-5 3 feet x 0.53 millimeter silica gel column capable of back flush. Temperature ramping was utilized to aid in the elution of the compounds and decrease the sample run time on the GC. Separation of the compounds was accomplished in approximately ten (10) minutes. The GC used was a SRI Instruments, Inc. Model 8610A equipped with a FID, with output directed through a serial port to a notebook computer. Integration, interpretation, manipulation, and storage was performed by gas chromatograph software - PeakSimple for Windows ®, version 1.20. All chromatograms are maintained as a permanent record of each project.

The GC system was field calibrated for each compound using a mixed compound calibration gas generated in accordance with U.S. EPA Reference Method 18 protocol for the preparation of gaseous standards by dynamic dilution of cylinder gas with oxygen-free nitrogen. Before testing began, the GC was checked thoroughly for proper operation. A standard gas was injected several times to verify compound retention times and to check

peak area with previously obtained calibration curves. Calibration curves were prepared before each test began and verified periodically. Calibration points were constructed daily. Each gas concentration was injected at least three times to ensure instrument stability. The resulting calibration curves were produced from the mean response of three (3) injections of at least three (3) concentrations. Each calibration point is considered valid when the mean peak area of three successive injections does not differ by more than five (5) percent from the peak areas contributing to the mean.

Data reduction was accomplished by referral to calibration curves generated from the analysis of known concentrations. Calibration curves fit the general equation of $Y = mX + b$. Coefficients of this equation were determined using the PeakSimple for Windows software which was programmed with a linear regression least-squares program to give the best fit of the points. Correlation coefficients (R^2 values) are typically 0.98 or better.

The NMOC measurement system consisted of the following:

- a flexible Tedlar bag sampling system to collect exhaust gas from the centrally located ten (10) percent area of the stack cross-section;
- a heated, electrically-actuated 10-port sampling valve;
- a gas chromatograph equipped with a flame ionization detector;
- a silica gel column equipped with back-flush capabilities for component separation;
- a personal notebook computer equipped with a serial port for recording measurement data;
- high purity nitrogen with less than 0.25 percent of NMOCs;
- a series of calibration gases with a concentration equivalent to the applicable exhaust value; and
- gas chromatography software capable of generating calibration curves and storage of analytical data.

The GC was calibrated in accordance with the prescribed methodology. Calibrations were performed at the beginning and end of the testing. U.S. EPA Protocol 1 gases were used for all calibrations and preparation of dynamically diluted standards.

5.0 QUALITY ASSURANCE PROGRAM

5.1 QA/QC Procedures and Results

The objectives of a quality assurance/quality control ("QA/QC") program is to assure that the precision and accuracy of all environmental data generated by FMI are commensurate with data quality objectives ("DQOs"). DQOs are based on a common understanding of the intended end use(s) of the data, the measurement process, and the availability of resources. Once DQOs are established, formally or informally, QA/QC protocol can be defined for the measurements.

The DQOs in this project are to provide defensible data that can be used for determination of NMOC emission rates. The final data user will be Ladish and the WDNR.

The goal of a QA/QC program is that data generated and used for decision-making are scientifically sound, of known quality, and documented to be "in control." To accomplish this goal, standardized methods or procedures are used whenever possible. They must be validated for their intended use, rigorously followed, and data reported with quality indicators (precision, accuracy, completeness, etc.).

Two (2) basic concepts used in a QA/QC program are to:

1. Control errors; and
2. Verify that the entire Sampling and Analytical ("S&A") method is operating within acceptable performance limits.

Use of qualified personnel, reliable and well-maintained equipment, appropriate calibrations and standards, and close supervision of all operations are important components of the QA/QC system. QA/QC in this test program included the use and documentation of calibrated sampling and analytical instruments, use of U.S. EPA validated methods (U.S. EPA 40 CFR Part 60), adherence to established protocol, method blanks as a check against possible contamination, sample chain-of-custody documentation, and redundant data calculation with checking.

5.1.1 Equipment Quality Control

All of the equipment used was calibrated according to procedures outlined in the Quality Assurance Handbook for Air Pollution Measurement System, Volume III, EPA-600/4-77-027b. Actual calibration data sheets are provided in Appendix D.

5.1.2 Volumetric Flow

5.1.2.1 Barometer

Barometric pressure values for the testing period were recorded from a calibrated barometer on-site and verified by telephone from a local airport and were corrected for elevation to stack sample port level (0.01 inches Hg per 10 ft. elevation).

5.1.2.2 Pitot Tubes

Each pitot tube used in sampling meets the design specifications for type-S pitot tubes in U.S. EPA Method 2. Therefore, a maximum value baseline coefficient ("C_p") of 0.84 is assigned to each pitot tube. Calibration at the manufacturer for pitot face-opening alignment included measuring the external tubing diameter (dimension "D_t"), the base-to-opening plane distance (dimensions "P_a" and "P_b"), and the face opening misalignment angles, with all terms as described in Figures 2-2 and 2-3 of U.S. EPA Method 2. Pitot tubes were visually inspected at the completion of the test to insure structural integrity.

5.1.2.3 Calibration Meter and Metering System

The secondary reference meter equipment arrangement for calibration is shown in Figure 5.7 of U.S. EPA Method 5. The prescribed procedures were followed. A wet test meter with a 1 cubic feet per revolution ("ft^3/rev") capacity and $\pm$ 1 percent accuracy is used as the primary calibrant. The dry gas meter's pump is operated for a minimum of five (5) minutes at a flow rate of 0.35 cubic feet per minute ("cfm") to condition the interior surface of the wet test meter. Leak checks are performed and if satisfactory, triplicate runs at each of no less than five (5) different flow rates are performed. A calibration curve is prepared and the meter is recalibrated after two hundred (200) hours of operation or annually, whichever comes first.

The calibration set-up for the dry gas metering system using the secondary reference meter in lieu of the wet test meter is given in Figure 5.5 of U.S. EPA Method 5. A leak check of the metering system before calibration was performed as shown in Figure 5.4 of U.S. EPA Method 5. The metering system's pump is operated for five (5) minutes at an orifice manometer setting of 0.5 inches H_20 to heat up the pump and system to stabilize the meter inlet and outlet temperatures. Values for the orifice setting ("ΔH"), wet test meter volume ("V_w"), corresponding dry test meter volume ("V_d"), dry test meter inlet and outlet gas temperatures ("t_{di}" and "t_{dn}"), and time are recorded for the initial calibration. The ratio of the wet test meter to the dry test meter ("gamma") and the orifice pressure differential that equates to 0.75 cubic feet per minute ("cfm") at standard conditions ("ΔH@") are then calculated.

5.1.2.4 Thermocouples and Digital Indicators

Thermocouples are calibrated by comparison to an American Standards for Testing and Materials ("ASTM") Method-3F mercury-in-glass thermometer at approximately 32° F (ice water), ambient temperature and approximately 100° F (hot oil). Each thermocouple is calibrated against temperature ranges to which it is typically exposed during test conditions, and they must agree within 1.5 percent (expressed in degrees Rankine ["°R"]) of the reference thermometer throughout the entire calibration range.

Digital indicators are checked by introducing a series of millivolt signal strengths to the input and comparing the indicator reading with the actual signal strength. Acceptable calibration error must not exceed 0.5 percent when temperatures are expressed in °R.

5.1.2.5 Analytical Balance

The analytical balance was calibrated by comparing its readings against National Institute of Standards and Technology ("NIST"), formerly known as the National Bureau of Standards ("NBS"), traceable Class-S1 standard weights, with acceptable agreement within 0.5 milligram ("mg").

5.1.2.6 Replicates and Precision

Replicate samples of NMOCs are not possible due to the nature of continuous emission sampling. In addition, no analytical precision estimate can be determined.

Precision and accuracy are quantitative measures that characterize the amount of variability and bias inherent in a given data set. Precision refers to the level of agreement among repeated measurements of the same parameter. Accuracy refers to the difference between an estimate based on the data and the true value of the parameter being estimated. The error due to measurement variability for sulfur dioxide concentration can be as much as ±10.4 percent of concentration (intralab precision determined by U.S. EPA during collaborative method validation tests). Accuracy for NMOC concentration cannot be determined because no "true" concentration can be created to estimate accuracy. Instead, documentation of equipment calibration is used to establish traceability as a surrogate for accuracy of NMOC measurements.

5.1.3 Nonmethane Organic Compound

The GC used in this series of tests was calibrated according to the methodologies described in 40 CFR, Part 60, Appendix A, Method 18. Measurement system performance specifications followed during the testing program in accordance with U.S. EPA Method 18, included the following:

- analyzer calibration error of less than ±2 percent of the span value for zero, mid, and high-range calibration gases;
- sampling system bias of less than ±5 percent of the span value for zero, and mid- or high-range calibration gases;
- zero drift of less than ±3 percent of the span value over the period of the run; and
- calibration drift of less than ±3 percent of span value over the period of the run.

All calibration gases utilized during the testing program will be U.S. EPA Protocol 1 gases, certified in accordance with Method G1, "*Traceability Protocol for Establishing True Concentrations of Gases Used for Calibration and Audits of Continuous Source Emission Monitors (Protocol No. 1)*." Additionally, the certification of the cylinders provides a recommended shelf life for each calibration gas cylinder over which the concentration does not change more than ±2 percent from the certified value. Cylinder gas certifications were available during the testing event.

6.0 REGULATORY REVIEW

Ladish was issued a Synthetic Minor Non-Part 70 operating permit (Permit No. 128002930.F01) on June 14, 1995. The operating permit does not specify specific emissions limitations for volatile organic compound emissions from the malt kilns (Process P28). However, the malt kilns are subject to the general permit conditions found in Part II of the operating permit. The general emissions limits for organic compounds as listed in Part II, section C, are as follows:

> 4. *No person may cause, allow or permit organic compound emissions into the ambient air which substantially contribute to the exceeding of an air standard or cause air pollution (s. NR 419.03, Wis. Adm. Code).*

Additionally, Chapter NR 424 of the Wisconsin Administrative Code regulates emissions of organic compounds from process lines. Pursuant to § NR 424.03(1)(a)4, Wis. Adm. Code, all process lines emitting less than 15 pounds of organic compounds in any day and 3.1 pounds of organic compounds in any hour are exempt from the requirements of Chapter NR 424.

The measured emission rates of organic compounds from the malt kilns are below the limitations specified in the operating permit and are exempt from the requirements of Chapter NR 424, Wisconsin Administrative Code.

TABLE NO. 1
Summary of Exhaust Gas Parameters for the Fan No. 1 Malt Dryer Exhaust of Kiln No. 15 at Ladish Malting Company

Source I.D.	Stack Gas Temperature (°F)	Stack Gas Velocity (ft/sec)	Stack Gas Flowrate (acfm)	Methane Concentration (ppmv)	NMOC Concentration (ppmvp)
Fan 1 Run 1	71.1	33.54	42,131	0.72	<0.07
Fan 1 Run 2	72.8	49.75	62,498	0.84	<0.07
Fan 1 Run 3	69.5	38.71	48,633	0.72	<0.07
Fan 1 Run 4	73.3	15.41	19,357	0.58	<0.07
Fan 1 Run 5	73.7	18.34	23,042	1.37	<0.07
Fan 1 Run 6	73.7	18.34	23,042	0.88	<0.07
Average	72.4	29.02	36,451	0.85	<0.07

NMOC: Nonmethane organic compound.
°F: Degrees Fahrenheit.
ft/sec: Feet per second.
acfm: Actual cubic feet per minute.
ppmv: Parts per million by volume, wet basis.
ppmvp: Parts per million by volume, wet basis, as propane.
<: Indicates a nondetectable concentration.

TABLE NO. 2
Summary of Exhaust Gas Parameters for the Fan No. 2 Malt Dryer Exhaust of Kiln No. 15 at Ladish Malting Company

Source I.D.	Stack Gas Temperature (°F)	Stack Gas Velocity (ft/sec)	Stack Gas Flowrate (acfm)	Methane Concentration (ppmv)	NMOC Concentration (ppmvp)
Fan 2 Run 1	72.7	37.18	46,710	0.73	<0.07
Fan 2 Run 2	71.9	48.64	61,100	0.73	<0.07
Fan 2 Run 3	71.2	38.90	48,865	0.64	<0.07
Fan 2 Run 4	72.4	15.07	18,926	1.15	<0.07
Fan 2 Run 5	74.0	17.14	21,529	0.54	<0.07
Fan 2 Run 6	77.7	25.25	31,720	1.54	<0.07
Average	73.3	30.36	38,141	0.89	<0.07

NMOC: Nonmethane organic compound.
°F: Degrees Fahrenheit.
ft/sec: Feet per second.
acfm: Actual cubic feet per minute.
ppmv: Parts per million by volume, wet basis.
ppmvp: Parts per million by volume, wet basis, as propane.
<: Indicates a nondetectable concentration.

TABLE NO. 3
Summary of Exhaust Gas Parameters for the Fan No. 3 Malt Dryer Exhaust of Kiln No. 15 at Ladish Malting Company

Source I.D.	Stack Gas Temperature (°F)	Stack Gas Velocity (ft/sec)	Stack Gas Flowrate (acfm)	Methane Concentration (ppmv)	NMOC Concentration (ppmvp)
Fan 3 Run 1	73.7	37.76	47,430	0.80	<0.07
Fan 3 Run 2	74.8	53.55	67,212	1.22	<0.07
Fan 3 Run 3	72.2	43.02	54,044	0.65	<0.07
Fan 3 Run 4	72.5	17.70	22,230	0.75	<0.07
Fan 3 Run 5	73.4	20.24	25,423	0.94	<0.07
Fan 3 Run 6	71.5	40.93	51,414	0.89	<0.07
Average	73.0	35.53	44,636	0.88	<0.07

NMOC: Nonmethane organic compound.
°F: Degrees Fahrenheit.
ft/sec: Feet per second.
acfm: Actual cubic feet per minute.
ppmv: Parts per million by volume, wet basis.
ppmvp: Parts per million by volume, wet basis, as propane.
<: Indicates a nondetectable concentration.

TABLE NO. 4
Summary of Exhaust Gas Parameters for the Fan No. 4 Malt Dryer Exhaust of Kiln No. 15 at Ladish Malting Company

Source I.D.	Stack Gas Temperature (°F)	Stack Gas Velocity (ft/sec)	Stack Gas Flowrate (acfm)	Methane Concentration (ppmv)	NMOC Concentration (ppmvp)
Fan 4 Run 1	75.8	39.17	49,206	0.90	<0.07
Fan 4 Run 2	74.3	52.11	65,461	0.72	<0.07
Fan 4 Run 3	72.1	43.42	54,542	1.08	<0.07
Fan 4 Run 4	74.3	17.13	21,525	0.80	<0.07
Fan 4 Run 5	75.1	20.35	25,560	1.14	<0.07
Fan 4 Run 6	77.5	29.62	37,206	0.93	<0.07
Average	74.9	33.63	42,250	0.93	<0.07

NMOC: Nonmethane organic compound.
°F: Degrees Fahrenheit.
ft/sec: Feet per second.
acfm: Actual cubic feet per minute.
ppmv: Parts per million by volume, wet basis.
ppmvp: Parts per million by volume, wet basis, as propane.
<: Indicates a nondetectable concentration.

TABLE NO. 5
Summary of Exhaust Gas Parameters for the Fan No. 5 Malt Dryer Exhaust of Kiln No. 15 at Ladish Malting Company

Source I.D.	Stack Gas Temperature (°F)	Stack Gas Velocity (ft/sec)	Stack Gas Flowrate (acfm)	Methane Concentration (ppmv)	NMOC Concentration (ppmvp)
Fan 5 Run 1	73.8	32.90	41,334	0.79	<0.07
Fan 5 Run 2	73.7	44.60	56,031	0.68	<0.07
Fan 5 Run 3	71.3	36.90	46,351	0.74	<0.07
Fan 5 Run 4	74.5	15.01	18,850	0.83	<0.07
Fan 5 Run 5	76.2	17.42	21,885	0.92	<0.07
Fan 5 Run 6	73.2	25.57	32,120	0.94	<0.07
Average	73.8	28.73	36,095	0.82	<0.07

NMOC: Nonmethane organic compound.
°F: Degrees Fahrenheit.
ft/sec: Feet per second.
acfm: Actual cubic feet per minute.
ppmv: Parts per million by volume, wet basis.
ppmvp: Parts per million by volume, wet basis, as propane.
<: Indicates a nondetectable concentration.

TABLE NO. 6
Overall Summary of the Five Fan Malt Dryer Exhausts of Kiln No. 15 at Ladish Malting Company

Source I.D.	Average Stack Gas Temperature (°F)	Total Stack Gas Velocity (ft/sec)	Total Stack Gas Flowrate (acfm)	Total Methane Concentration (ppmv)	Total NMOC Concentration (ppmvp)
Run 1	73.4	180.55	226,811	3.94	<0.35
Run 2	73.5	248.65	312,362	4.19	<0.35
Run 3	71.3	200.95	252,435	3.83	<0.35
Run 4	73.4	80.32	100,888	4.11	<0.35
Run 5	74.5	93.49	117,439	4.91	<0.35
Run 6	74.7	139.71	175,502	5.18	<0.35
Average	73.5	157.28	197,573	4.36	<0.35

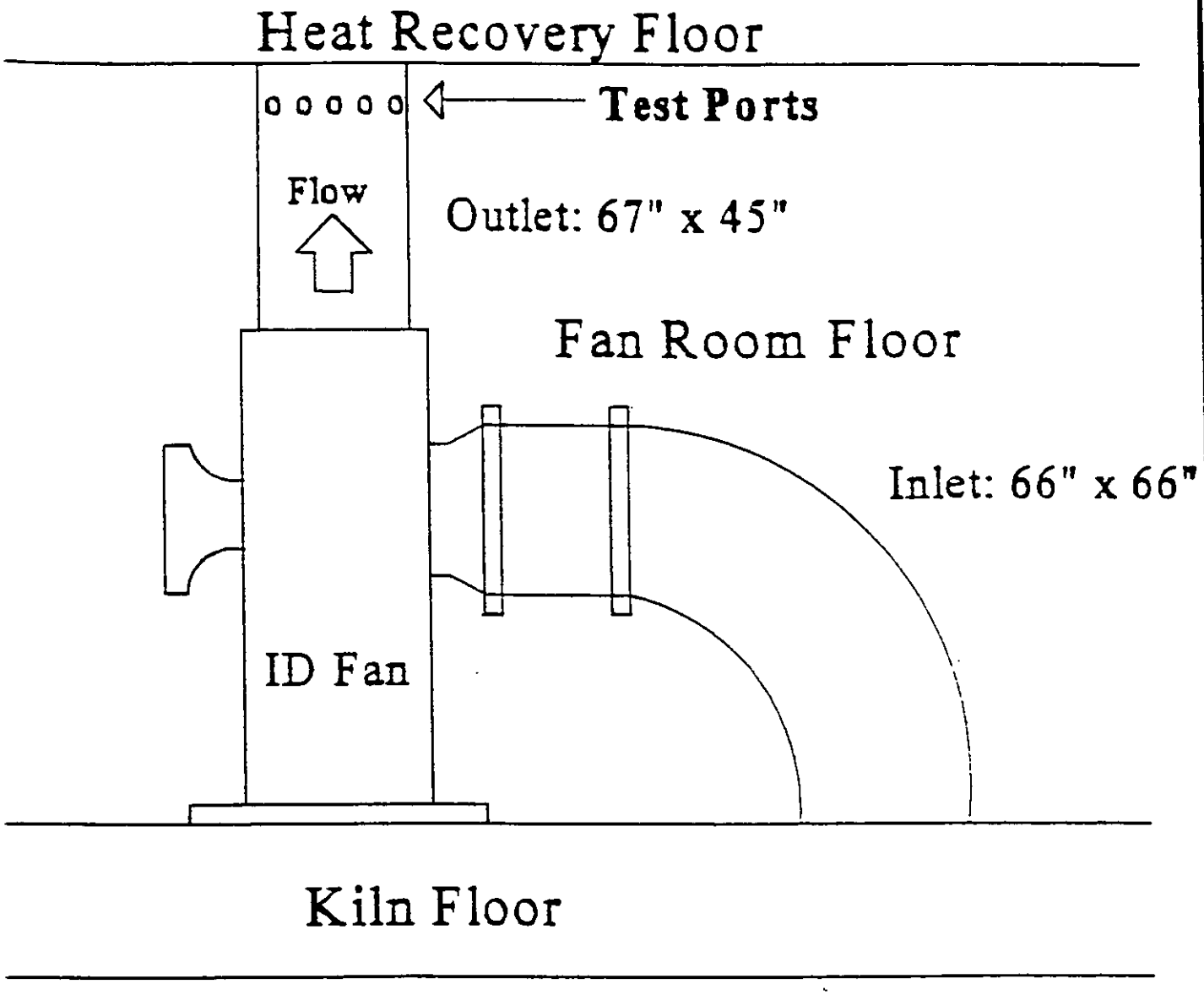
NMOC:	Nonmethane organic compound.
°F:	Degrees Fahrenheit.
ft/sec:	Feet per second.
acfm:	Actual cubic feet per minute.
ppmv:	Parts per million by volume, wet basis.
ppmvp:	Parts per million by volume, wet basis, as propane.
<:	Indicates a nondetectable concentration.

TABLE NO. 7
Summary of NMOC Emission Rates for the Five Fan Malt Dryer Exhausts of Kiln No. 15 at Ladish Malting Company

Source I.D.	Total Methane Concentration (ppmv)	Total NMOC Concentration (ppmvp)	NMOC Emission Rate (lb/hr)
Run 1	3.94	<0.35	<0.45
Run 2	4.19	<0.35	<0.61
Run 3	3.83	<0.35	<0.50
Run 4	4.11	<0.35	<0.20
Run 5	4.91	<0.35	<0.23
Run 6	5.18	<0.35	<0.34
Average	4.36	<0.35	<0.39

NMOC: Nonmethane organic compound.
ppmv: Parts per million by volume, wet basis.
ppmvp: Parts per million by volume, wet basis, as propane.
lb/hr: Pounds per hour, as carbon.
<: Indicates a nondetectable concentration, lower level of detection used for emission rate calculation.

FIGURES



Fluid Management, Inc.

Air Sciences & Engineering Group

Figure No. 1
Malt Dryer Exhaust Sampling Location
Ladish Malting Company

APPENDIX A

Results, Calculations, and Equations

NOMENCLATURE

A_s	Area of stack, square feet
ACFM	Actual cubic feet per minute
B_{ws}	Moisture content of the sample gas
cm^3	Cubic centimeters
CO_2	Carbon dioxide
C_p	Pitot coefficient
DSCFM	Dry standard cubic feet per minute
ft^2	Square feet
ft^3	Cubic feet
hr	Hour
K_p	Pitot tube constant, 85.49 for English units (See Method 2, Equation 2-9)
lb	Pounds
lb-mole	Pound-mole
M_s	Molecular weight of stack gas, wet basis
M_{vw}	Ratio of vapor pressure of water at stack conditions to stack pressure
MBtu	Million British thermal units
min	Minute
ml	Milliliters
O_2	Oxygen
Δp	Gas velocity pressure (in water)
P_s	Stack static pressure (inches mercury)
P_b	Barometric pressure (inches water)
P_s	Absolute stack pressure (barometric ± static pressure in inches of H_2O)
$P_{v,sat}$	Vapor pressure of water at stack conditions
P_{std}	Standard pressure, 29.92-inches mercury
ppm_v	Parts per million by volume
SCFM	Standard cubic feet per minute
T_s	Temperature of the stack
T_{std}	Standard temperature, 68° Fahrenheit (F)
V_m	Volume of sample gas measured by the dry gas meter
V_w	Volume of water collected in the impingers and silica gel
Y_d	Dry gas meter correction factor

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	1
Location	Jefferson Junction, WI	Start	10:00 AM
Stack ID	Fan #1 Outlet	Stop	10:15 AM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.05	in H2O			
Vlc	12.5	g	Ps	30.30	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0254	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.56	lb/lb-mole
Cp	0.84		Vs	33.54	ft/s
Tm		° F	Qs	42,131	acfm
(DP)½	0.5962		Qs	2,544,143	scfh
Ts	71.1	° F	Qs(d)	41,327	dscfm
Vm		ft^3			
Dn		in	C3H8	0.029	lb/hr
As	20.94	ft^2	Carbon	0.024	lb/hr
Yd			Carbon	0.10	tpy

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Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	1
Location	Jefferson Junction, WI	Start	10:00 AM
Stack ID	Fan #1 Outlet	Stop	10:15 AM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.680	0.825	69.0
2	0.665	0.815	70.0
3	0.585	0.765	70.0
4	0.485	0.696	70.0
5	0.420	0.648	70.0
6	0.455	0.675	70.0
B-1	0.595	0.771	71.0
2	0.545	0.738	71.0
3	0.365	0.604	71.0
4	0.280	0.529	71.0
5	0.285	0.534	71.0
6	0.335	0.579	71.0
C-1	0.515	0.718	70.0
2	0.530	0.728	71.0
3	0.525	0.725	71.0
4	0.325	0.570	71.0
5	0.460	0.678	71.0
6	0.395	0.628	71.0
D-1	0.420	0.648	71.0
2	0.415	0.644	71.0
3	0.425	0.652	71.0
4	0.285	0.534	72.0
5	0.280	0.529	72.0
6	0.450	0.671	72.0
E-1	0.310	0.557	71.0
2	0.305	0.552	71.0
3	0.320	0.566	72.0
4	0.260	0.510	72.0
5	0.225	0.474	72.0
6	0.335	0.579	72.0
F-1	0.225	0.474	72.0
2	0.220	0.469	72.0
3	0.215	0.464	72.0
4	0.140	0.374	72.0
5	0.075	0.274	72.0
6	0.070	0.265	72.0
36	0.3728	0.5962	71.14

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	1
Location	Jefferson Junction, WI	Start	11:45 AM
Stack ID	Fan #2 Outlet	Stop	12:00 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.06	in H2O			
Vlc	12.5	g	Ps	30.30	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0267	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.55	lb/lb-mole
Cp	0.84		Vs	37.18	ft/s
Tm		° F	Qs	46,710	acfm
(DP)½	0.6598		Qs	2,812,443	scfh
Ts	72.7	° F	Qs(d)	45,620	dscfm
Vm		ft^3			
Dn		in	C3H8	0.032	lb/hr
As	20.94	ft^2	Carbon	0.026	lb/hr
Yd			Carbon	0.11	tpy

27-Nov-95

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Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	1
Location	Jefferson Junction, WI	Start	11:45 AM
Stack ID	Fan #2 Outlet	Stop	12:00 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	1.050	1.025	73.0
2	1.100	1.049	73.0
3	1.150	1.072	73.0
4	1.100	1.049	73.0
5	0.730	0.854	73.0
6	0.815	0.903	73.0
B-1	0.930	0.964	73.0
2	0.985	0.992	73.0
3	0.975	0.987	73.0
4	1.050	1.025	73.0
5	1.150	1.072	73.0
6	0.640	0.800	73.0
C-1	0.470	0.686	73.0
2	0.645	0.803	73.0
3	0.890	0.943	73.0
4	1.050	1.025	73.0
5	0.865	0.930	73.0
6	0.620	0.787	73.0
D-1	0.260	0.510	71.0
2	0.380	0.616	71.0
3	0.430	0.656	73.0
4	0.495	0.704	73.0
5	0.465	0.682	73.0
6	0.370	0.608	73.0
E-1	0.100	0.316	71.0
2	0.130	0.361	72.0
3	0.165	0.406	73.0
4	0.175	0.418	73.0
5	0.145	0.381	72.0
6	0.085	0.292	73.0
F-1	0.020	0.141	71.0
2	0.030	0.173	73.0
3	0.025	0.158	72.0
4	0.020	0.141	73.0
5	0.015	0.122	73.0
6	0.010	0.100	73.0
36	0.5426	0.6598	72.69

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	1
Location	Jefferson Junction, WI	Start	10:30 AM
Stack ID	Fan #3 Outlet	Stop	10:50 AM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.04	in H2O			
Vlc	12.5	g	Ps	30.30	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0277	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.54	lb/lb-mole
Cp	0.84		Vs	37.76	ft/s
Tm		° F	Qs	47,430	acfm
(DP)½	0.6692		Qs	2,850,185	scfh
Ts	73.7	° F	Qs(d)	46,188	dscfm
Vm		ft^3			
Dn		in	C3H8	0.033	lb/hr
As	20.94	ft^2	Carbon	0.027	lb/hr
Yd			Carbon	0.12	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	1
Location	Jefferson Junction, WI	Start	10:30 AM
Stack ID	Fan #3 Outlet	Stop	10:50 AM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.900	0.949	73.0
2	0.890	0.943	73.0
3	0.820	0.906	73.0
4	0.560	0.748	73.0
5	0.400	0.632	73.0
6	0.500	0.707	73.0
B-1	0.850	0.922	73.0
2	0.860	0.927	73.0
3	0.840	0.917	74.0
4	0.420	0.648	74.0
5	0.425	0.652	73.0
6	0.575	0.758	74.0
C-1	0.785	0.886	74.0
2	0.775	0.880	74.0
3	0.760	0.872	74.0
4	0.380	0.616	74.0
5	0.240	0.490	74.0
6	0.610	0.781	74.0
D-1	0.675	0.822	74.0
2	0.670	0.819	74.0
3	0.595	0.771	74.0
4	0.445	0.667	74.0
5	0.155	0.394	74.0
6	0.320	0.566	74.0
E-1	0.380	0.616	74.0
2	0.405	0.636	74.0
3	0.375	0.612	74.0
4	0.385	0.620	74.0
5	0.135	0.367	74.0
6	0.205	0.453	74.0
F-1	0.225	0.474	74.0
2	0.220	0.469	74.0
3	0.215	0.464	74.0
4	0.135	0.367	73.0
5	0.095	0.308	74.0
6	0.185	0.430	74.0
36	0.4836	0.6692	73.72

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	1
Location	Jefferson Junction, WI	Start	11:20 AM
Stack ID	Fan #4 Outlet	Stop	11:40 AM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.02	in H2O			
Vlc	12.5	g	Ps	30.30	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0297	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.51	lb/lb-mole
Cp	0.84		Vs	39.17	ft/s
Tm		° F	Qs	49,206	acfm
(DP)½	0.6927		Qs	2,945,399	scfh
Ts	75.8	° F	Qs(d)	47,633	dscfm
Vm		ft^3			
Dn		in	C3H8	0.034	lb/hr
As	20.94	ft^2	Carbon	0.028	lb/hr
Yd			Carbon	0.12	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	1
Location	Jefferson Junction, WI	Start	11:20 AM
Stack ID	Fan #4 Outlet	Stop	11:40 AM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.840	0.917	76.0
2	0.845	0.919	76.0
3	0.830	0.911	76.0
4	0.795	0.892	76.0
5	0.640	0.800	76.0
6	0.550	0.742	76.0
B-1	0.735	0.857	75.0
2	0.725	0.851	75.0
3	0.710	0.843	75.0
4	0.745	0.863	75.0
5	0.695	0.834	76.0
6	0.405	0.636	76.0
C-1	0.780	0.883	75.0
2	0.780	0.883	75.0
3	0.840	0.917	76.0
4	0.910	0.954	76.0
5	0.685	0.828	76.0
6	0.335	0.579	76.0
D-1	0.610	0.781	75.0
2	0.680	0.825	76.0
3	0.720	0.849	76.0
4	0.680	0.825	76.0
5	0.355	0.596	76.0
6	0.325	0.570	76.0
E-1	0.455	0.675	75.0
2	0.495	0.704	76.0
3	0.560	0.748	76.0
4	0.585	0.765	76.0
5	0.525	0.725	76.0
6	0.305	0.552	76.0
F-1	0.050	0.224	76.0
2	0.030	0.173	76.0
3	0.030	0.173	76.0
4	0.060	0.245	76.0
5	0.040	0.200	76.0
6	0.040	0.200	76.0
36	0.5386	0.6927	75.78

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	1
Location	Jefferson Junction, WI	Start	11:00 AM
Stack ID	Fan #5 Outlet	Stop	11:15 AM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.06	in H2O			
Vlc	12.5	g	Ps	30.30	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0277	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.54	lb/lb-mole
Cp	0.84		Vs	32.90	ft/s
Tm		° F	Qs	41,334	acfm
(DP)½	0.5832		Qs	2,483,826	scfh
Ts	73.8	° F	Qs(d)	40,250	dscfm
Vm		ft^3			
Dn		in	C3H8	0.028	lb/hr
As	20.94	ft^2	Carbon	0.023	lb/hr
Yd			Carbon	0.10	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	1
Location	Jefferson Junction, WI	Start	11:00 AM
Stack ID	Fan #5 Outlet	Stop	11:15 AM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.690	0.831	74.0
2	0.670	0.819	74.0
3	0.645	0.803	74.0
4	0.400	0.632	74.0
5	0.350	0.592	74.0
6	0.440	0.663	74.0
B-1	0.555	0.745	74.0
2	0.560	0.748	73.0
3	0.515	0.718	74.0
4	0.345	0.587	74.0
5	0.380	0.616	74.0
6	0.475	0.689	74.0
C-1	0.455	0.675	73.0
2	0.430	0.656	73.0
3	0.435	0.660	74.0
4	0.355	0.596	74.0
5	0.525	0.725	74.0
6	0.505	0.711	74.0
D-1	0.430	0.656	74.0
2	0.420	0.648	74.0
3	0.375	0.612	74.0
4	0.300	0.548	74.0
5	0.290	0.539	74.0
6	0.570	0.755	74.0
E-1	0.225	0.474	72.0
2	0.210	0.458	73.0
3	0.265	0.515	74.0
4	0.205	0.453	74.0
5	0.135	0.367	74.0
6	0.425	0.652	74.0
F-1	0.100	0.316	73.0
2	0.105	0.324	73.0
3	0.110	0.332	73.0
4	0.085	0.292	74.0
5	0.075	0.274	74.0
6	0.100	0.316	74.0
36	0.3654	0.5832	73.75

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	2
Location	Jefferson Junction, WI	Start	02:50 PM
Stack ID	Fan #1 Outlet	Stop	03:05 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.09	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0268	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.55	lb/lb-mole
Cp	0.84		Vs	49.75	ft/s
Tm		° F	Qs	62,498	acfm
(DP)½	0.8828		Qs	3,762,545	scfh
Ts	72.8	° F	Qs(d)	61,026	dscfm
Vm		ft^3			
Dn		in	C3H8	0.043	lb/hr
As	20.94	ft^2	Carbon	0.035	lb/hr
Yd			Carbon	0.15	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	2
Location	Jefferson Junction, WI	Start	02:50 PM
Stack ID	Fan #1 Outlet	Stop	03:05 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	1.550	1.245	72.0
2	1.450	1.204	72.0
3	1.400	1.183	72.0
4	0.990	0.995	73.0
5	0.780	0.883	73.0
6	0.860	0.927	73.0
B-1	1.350	1.162	72.0
2	1.200	1.095	72.0
3	0.980	0.990	73.0
4	0.600	0.775	73.0
5	0.765	0.875	73.0
6	0.830	0.911	73.0
C-1	1.250	1.118	72.0
2	1.200	1.095	72.0
3	1.050	1.025	73.0
4	0.525	0.725	73.0
5	0.835	0.914	73.0
6	0.910	0.954	73.0
D-1	0.980	0.990	73.0
2	1.000	1.000	73.0
3	1.000	1.000	73.0
4	0.775	0.880	73.0
5	0.370	0.608	73.0
6	0.960	0.980	73.0
E-1	0.770	0.877	73.0
2	0.790	0.889	73.0
3	0.740	0.860	73.0
4	0.635	0.797	73.0
5	0.305	0.552	73.0
6	0.435	0.660	73.0
F-1	0.325	0.570	73.0
2	0.420	0.648	73.0
3	0.465	0.682	73.0
4	0.405	0.636	73.0
5	0.245	0.495	73.0
6	0.335	0.579	73.0
36	0.8189	0.8828	72.81

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	2
Location	Jefferson Junction, WI	Start	01:50 PM
Stack ID	Fan #2 Outlet	Stop	02:05 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.71	in H2O			
Vlc	12.5	g	Ps	30.35	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0260	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.55	lb/lb-mole
Cp	0.84		Vs	48.64	ft/s
Tm		° F	Qs	61,100	acfm
(DP)½	0.8645		Qs	3,689,879	scfh
Ts	71.9	° F	Qs(d)	59,897	dscfm
Vm		ft^3			
Dn		in	C3H8	0.042	lb/hr
As	20.94	ft^2	Carbon	0.034	lb/hr
Yd			Carbon	0.15	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	2
Location	Jefferson Junction, WI	Start	01:50 PM
Stack ID	Fan #2 Outlet	Stop	02:05 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.011	0.105	71.0
2	0.020	0.141	71.0
3	0.010	0.100	71.0
4	0.005	0.071	71.0
5	0.010	0.100	71.0
6	0.015	0.122	71.0
B-1	0.070	0.265	70.0
2	0.060	0.245	71.0
3	0.065	0.255	71.0
4	0.230	0.480	71.0
5	0.560	0.748	71.0
6	0.465	0.682	71.0
C-1	0.665	0.815	71.0
2	0.865	0.930	71.0
3	1.100	1.049	72.0
4	1.300	1.140	72.0
5	1.150	1.072	72.0
6	0.825	0.908	72.0
D-1	1.700	1.304	72.0
2	1.850	1.360	72.0
3	1.000	1.000	72.0
4	1.150	1.072	73.0
5	1.850	1.360	73.0
6	1.700	1.304	73.0
E-1	1.150	1.072	72.0
2	1.200	1.095	73.0
3	1.750	1.323	73.0
4	1.850	1.360	73.0
5	1.050	1.025	73.0
6	1.850	1.360	73.0
F-1	1.500	1.225	72.0
2	1.600	1.265	73.0
3	1.650	1.285	73.0
4	1.450	1.204	73.0
5	1.200	1.095	73.0
6	1.400	1.183	73.0
36	0.9535	0.8645	71.94

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	2
Location	Jefferson Junction, WI	Start	02:35 PM
Stack ID	Fan #3 Outlet	Stop	02:50 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.43	in H2O			
Vlc	12.5	g	Ps	30.33	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0287	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.53	lb/lb-mole
Cp	0.84		Vs	53.55	ft/s
Tm		° F	Qs	67,272	acfm
(DP)½	0.9485		Qs	4,038,136	scfh
Ts	74.8	° F	Qs(d)	65,371	dscfm
Vm		ft^3			
Dn		in	C3H8	0.046	lb/hr
As	20.94	ft^2	Carbon	0.038	lb/hr
Yd			Carbon	0.17	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	2
Location	Jefferson Junction, WI	Start	02:35 PM
Stack ID	Fan #3 Outlet	Stop	02:50 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.950	0.975	74.0
2	0.850	0.922	74.0
3	0.750	0.866	75.0
4	1.100	1.049	75.0
5	0.910	0.954	75.0
6	1.150	1.072	75.0
B-1	1.850	1.360	74.0
2	1.900	1.378	74.0
3	1.400	1.183	75.0
4	0.755	0.869	75.0
5	0.810	0.900	75.0
6	1.350	1.162	75.0
C-1	0.850	0.922	75.0
2	0.800	0.894	75.0
3	1.550	1.245	75.0
4	0.905	0.951	75.0
5	0.515	0.718	75.0
6	1.300	1.140	75.0
D-1	1.550	1.245	74.0
2	1.500	1.225	74.0
3	1.300	1.140	74.0
4	1.250	1.118	75.0
5	0.955	0.977	75.0
6	0.830	0.911	75.0
E-1	0.965	0.982	75.0
2	1.050	1.025	75.0
3	0.990	0.995	75.0
4	0.600	0.775	75.0
5	0.310	0.557	75.0
6	0.580	0.762	75.0
F-1	0.490	0.700	75.0
2	0.525	0.725	75.0
3	0.415	0.644	75.0
4	0.310	0.557	75.0
5	0.300	0.548	75.0
6	0.490	0.700	75.0
36	0.9474	0.9485	74.81

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	2
Location	Jefferson Junction, WI	Start	02:05 PM
Stack ID	Fan #4 Outlet	Stop	02:20 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.09	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0283	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.53	lb/lb-mole
Cp	0.84		Vs	52.11	ft/s
Tm		° F	Qs	65,461	acfm
(DP)½	0.9230		Qs	3,929,671	scfh
Ts	74.3	° F	Qs(d)	63,643	dscfm
Vm		ft^3			
Dn		in	C3H8	0.045	lb/hr
As	20.94	ft^2	Carbon	0.037	lb/hr
Yd			Carbon	0.16	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	2
Location	Jefferson Junction, WI	Start	02:05 PM
Stack ID	Fan #4 Outlet	Stop	02:20 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	1.300	1.140	74.0
2	1.350	1.162	74.0
3	1.150	1.072	74.0
4	1.100	1.049	74.0
5	1.000	1.000	74.0
6	1.000	1.000	74.0
B-1	1.150	1.072	74.0
2	1.100	1.049	74.0
3	1.150	1.072	74.0
4	1.100	1.049	74.0
5	0.950	0.975	74.0
6	0.750	0.866	74.0
C-1	1.600	1.265	74.0
2	1.700	1.304	74.0
3	1.600	1.265	74.0
4	1.500	1.225	74.0
5	1.400	1.183	74.0
6	1.300	1.140	74.0
D-1	1.300	1.140	74.0
2	1.400	1.183	75.0
3	1.450	1.204	75.0
4	1.400	1.183	75.0
5	0.960	0.980	75.0
6	0.510	0.714	75.0
E-1	0.810	0.900	75.0
2	0.910	0.954	75.0
3	0.940	0.970	75.0
4	0.905	0.951	75.0
5	0.775	0.880	75.0
6	0.460	0.678	75.0
F-1	0.010	0.100	74.0
2	0.010	0.100	74.0
3	0.015	0.122	74.0
4	0.080	0.283	74.0
5	0.280	0.529	74.0
6	0.220	0.469	75.0
36	0.9621	0.9230	74.33

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	2
Location	Jefferson Junction, WI	Start	02:25 PM
Stack ID	Fan #5 Outlet	Stop	02:35 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.32	in H2O			
Vlc	12.5	g	Ps	30.32	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0276	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.54	lb/lb-mole
Cp	0.84		Vs	44.60	ft/s
Tm		° F	Qs	56,031	acfm
(DP)½	0.7909		Qs	3,369,515	scfh
Ts	73.7	° F	Qs(d)	54,606	dscfm
Vm		ft^3			
Dn		in	C3H8	0.038	lb/hr
As	20.94	ft^2	Carbon	0.031	lb/hr
Yd			Carbon	0.14	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	2
Location	Jefferson Junction, WI	Start	02:25 PM
Stack ID	Fan #5 Outlet	Stop	02:35 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	1.300	1.140	73.0
2	1.150	1.072	73.0
3	1.050	1.025	73.0
4	0.675	0.822	73.0
5	0.690	0.831	73.0
6	0.880	0.938	73.0
B-1	1.100	1.049	73.0
2	1.050	1.025	73.0
3	0.915	0.957	73.0
4	0.560	0.748	73.0
5	0.855	0.925	73.0
6	0.940	0.970	73.0
C-1	0.890	0.943	73.0
2	0.900	0.949	73.0
3	0.810	0.900	74.0
4	0.620	0.787	74.0
5	0.670	0.819	74.0
6	1.050	1.025	74.0
D-1	0.790	0.889	74.0
2	0.810	0.900	74.0
3	0.820	0.906	74.0
4	0.630	0.794	74.0
5	0.335	0.579	74.0
6	0.825	0.908	74.0
E-1	0.485	0.696	74.0
2	0.440	0.663	75.0
3	0.475	0.689	75.0
4	0.480	0.693	75.0
5	0.230	0.480	75.0
6	0.520	0.721	75.0
F-1	0.220	0.469	73.0
2	0.185	0.430	73.0
3	0.190	0.436	74.0
4	0.155	0.394	74.0
5	0.150	0.387	74.0
6	0.265	0.515	74.0
36	0.6697	0.7909	73.69

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	3
Location	Jefferson Junction, WI	Start	06:10 PM
Stack ID	Fan #1 Outlet	Stop	06:20 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.32	in H2O			
Vlc	12.5	g	Ps	30.32	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0239	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.58	lb/lb-mole
Cp	0.84		Vs	38.71	ft/s
Tm		° F	Qs	48,633	acfm
(DP)½	0.6897		Qs	2,947,911	scfh
Ts	69.5	° F	Qs(d)	47,956	dscfm
Vm		ft^3			
Dn		in	C3H8	0.033	lb/hr
As	20.94	ft^2	Carbon	0.027	lb/hr
Yd			Carbon	0.12	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	3
Location	Jefferson Junction, WI	Start	06:10 PM
Stack ID	Fan #1 Outlet	Stop	06:20 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
F-1	0.320	0.566	69.0
2	0.365	0.604	69.0
3	0.370	0.608	69.0
4	0.290	0.539	69.0
5	0.130	0.361	69.0
6	0.160	0.400	69.0
E-1	0.455	0.675	69.0
2	0.440	0.663	69.0
3	0.430	0.656	69.0
4	0.425	0.652	69.0
5	0.205	0.453	69.0
6	0.255	0.505	69.0
D-1	0.555	0.745	69.0
2	0.565	0.752	69.0
3	0.520	0.721	69.0
4	0.240	0.490	69.0
5	0.585	0.765	69.0
6	0.550	0.742	69.0
C-1	0.680	0.825	69.0
2	0.715	0.846	70.0
3	0.650	0.806	70.0
4	0.325	0.570	70.0
5	0.515	0.718	70.0
6	0.605	0.778	70.0
B-1	0.695	0.834	70.0
2	0.665	0.815	70.0
3	0.510	0.714	70.0
4	0.360	0.600	70.0
5	0.420	0.648	70.0
6	0.495	0.704	70.0
A-1	0.870	0.933	70.0
2	0.830	0.911	70.0
3	0.755	0.869	70.0
4	0.680	0.825	70.0
5	0.625	0.791	70.0
6	0.560	0.748	70.0
36	0.4949	0.6897	69.47

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	3
Location	Jefferson Junction, WI	Start	07:05 PM
Stack ID	Fan #2 Outlet	Stop	07:15 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.34	in H2O			
Vlc	12.5	g	Ps	30.33	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0254	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.56	lb/lb-mole
Cp	0.84		Vs	38.90	ft/s
Tm		° F	Qs	48,865	acfm
(DP)½	0.6916		Qs	2,952,362	scfh
Ts	71.2	° F	Qs(d)	47,955	dscfm
Vm		ft^3			
Dn		in	C3H8	0.034	lb/hr
As	20.94	ft^2	Carbon	0.027	lb/hr
Yd			Carbon	0.12	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	3
Location	Jefferson Junction, WI	Start	07:05 PM
Stack ID	Fan #2 Outlet	Stop	07:15 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	1.050	1.025	71.0
2	1.150	1.072	71.0
3	1.150	1.072	71.0
4	1.200	1.095	71.0
5	1.150	1.072	71.0
6	0.920	0.959	71.0
B-1	0.905	0.951	71.0
2	0.930	0.964	71.0
3	1.050	1.025	71.0
4	1.250	1.118	71.0
5	0.790	0.889	71.0
6	0.550	0.742	71.0
C-1	0.545	0.738	71.0
2	0.775	0.880	71.0
3	0.965	0.982	71.0
4	1.200	1.095	71.0
5	0.945	0.972	71.0
6	0.685	0.828	71.0
D-1	0.515	0.718	71.0
2	0.595	0.771	71.0
3	0.780	0.883	71.0
4	0.895	0.946	71.0
5	0.865	0.930	72.0
6	0.605	0.778	72.0
E-1	0.070	0.265	72.0
2	0.090	0.300	72.0
3	0.100	0.316	72.0
4	0.120	0.346	72.0
5	0.090	0.300	72.0
6	0.090	0.300	72.0
F-1	0.010	0.100	71.0
2	0.005	0.071	71.0
3	0.010	0.100	71.0
4	0.015	0.122	71.0
5	0.010	0.100	71.0
6	0.005	0.071	71.0
36	0.6133	0.6916	71.22

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	3
Location	Jefferson Junction, WI	Start	06:20 PM
Stack ID	Fan #3 Outlet	Stop	06:30 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.10	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0263	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.55	lb/lb-mole
Cp	0.84		Vs	43.02	ft/s
Tm		° F	Qs	54,044	acfm
(DP)½	0.7639		Qs	3,257,369	scfh
Ts	72.2	° F	Qs(d)	52,862	dscfm
Vm		ft^3			
Dn		in	C3H8	0.037	lb/hr
As	20.94	ft^2	Carbon	0.030	lb/hr
Yd			Carbon	0.13	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	3
Location	Jefferson Junction, WI	Start	06:20 PM
Stack ID	Fan #3 Outlet	Stop	06:30 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	1.100	1.049	72.0
2	1.050	1.025	72.0
3	0.970	0.985	72.0
4	0.790	0.889	72.0
5	0.740	0.860	72.0
6	0.705	0.840	72.0
B-1	1.150	1.072	72.0
2	1.100	1.049	72.0
3	1.050	1.025	72.0
4	0.530	0.728	72.0
5	0.470	0.686	72.0
6	0.690	0.831	72.0
C-1	1.100	1.049	72.0
2	1.050	1.025	72.0
3	1.050	1.025	72.0
4	0.510	0.714	72.0
5	0.320	0.566	72.0
6	0.755	0.869	72.0
D-1	0.900	0.949	72.0
2	0.830	0.911	73.0
3	0.740	0.860	73.0
4	0.515	0.718	73.0
5	0.220	0.469	73.0
6	0.415	0.644	73.0
E-1	0.535	0.731	72.0
2	0.550	0.742	72.0
3	0.520	0.721	72.0
4	0.345	0.587	72.0
5	0.175	0.418	72.0
6	0.345	0.587	72.0
F-1	0.230	0.480	72.0
2	0.255	0.505	72.0
3	0.245	0.495	73.0
4	0.190	0.436	72.0
5	0.200	0.447	72.0
6	0.265	0.515	73.0
36	0.6279	0.7639	72.19

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	3
Location	Jefferson Junction, WI	Start	06:50 PM
Stack ID	Fan #4 Outlet	Stop	07:00 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.05	in H2O			
Vlc	12.5	g	Ps	30.30	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0262	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.55	lb/lb-mole
Cp	0.84		Vs	43.42	ft/s
Tm		° F	Qs	54,542	acfm
(DP)½	0.7710		Qs	3,287,716	scfh
Ts	72.1	° F	Qs(d)	53,360	dscfm
Vm		ft^3			
Dn		in	C3H8	0.037	lb/hr
As	20.94	ft^2	Carbon	0.031	lb/hr
Yd			Carbon	0.13	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	3
Location	Jefferson Junction, WI	Start	06:50 PM
Stack ID	Fan #4 Outlet	Stop	07:00 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	1.050	1.025	72.0
2	1.100	1.049	72.0
3	1.050	1.025	72.0
4	1.000	1.000	72.0
5	0.890	0.943	72.0
6	0.685	0.828	72.0
B-1	0.990	0.995	72.0
2	1.050	1.025	72.0
3	1.150	1.072	72.0
4	1.050	1.025	72.0
5	0.795	0.892	72.0
6	0.530	0.728	72.0
C-1	1.150	1.072	72.0
2	1.100	1.049	72.0
3	1.100	1.049	72.0
4	1.100	1.049	72.0
5	0.825	0.908	72.0
6	0.545	0.738	72.0
D-1	0.815	0.903	72.0
2	0.855	0.925	72.0
3	0.930	0.964	72.0
4	0.920	0.959	72.0
5	0.710	0.843	73.0
6	0.395	0.628	73.0
E-1	0.520	0.721	72.0
2	0.565	0.752	72.0
3	0.570	0.755	72.0
4	0.585	0.765	72.0
5	0.540	0.735	72.0
6	0.360	0.600	73.0
F-1	0.010	0.100	72.0
2	0.005	0.071	72.0
3	0.010	0.100	72.0
4	0.015	0.122	72.0
5	0.020	0.141	72.0
6	0.040	0.200	72.0
36	0.6951	0.7710	72.08

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	3
Location	Jefferson Junction, WI	Start	06:35 PM
Stack ID	Fan #5 Outlet	Stop	06:45 PM

Meter Box	N/A			
Pb	30.30	in Hg		
Static	0.36	in H2O		
Vlc	12.5	g	Ps	30.33 in Hg
VOC	0.1	ppmv	Vmstd	ft³
Theta	60	min	Vwstd	0.59 ft³
O2	20.9	%	Bwo	0.0254
CO2	0.0	%	Below Sat.	NO
N2	79.1	%	Md	28.84 lb/lb-mole
DH		in H2O	Ms	28.56 lb/lb-mole
Cp	0.84		Vs	36.90 ft/s
Tm		° F	Qs	46,351 acfm
(DP)½	0.6560		Qs	2,800,451 scfh
Ts	71.3	° F	Qs(d)	45,487 dscfm
Vm		ft³		
Dn		in	C3H8	0.032 lb/hr
As	20.94	ft²	Carbon	0.026 lb/hr
Yd			Carbon	0.11 tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	3
Location	Jefferson Junction, WI	Start	06:35 PM
Stack ID	Fan #5 Outlet	Stop	06:45 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.865	0.930	70.0
2	0.795	0.892	71.0
3	0.700	0.837	71.0
4	0.560	0.748	71.0
5	0.510	0.714	71.0
6	0.560	0.748	71.0
B-1	0.710	0.843	71.0
2	0.685	0.828	71.0
3	0.550	0.742	71.0
4	0.410	0.640	71.0
5	0.590	0.768	71.0
6	0.705	0.840	71.0
C-1	0.615	0.784	71.0
2	0.625	0.791	71.0
3	0.605	0.778	71.0
4	0.445	0.667	71.0
5	0.395	0.628	71.0
6	0.755	0.869	71.0
D-1	0.565	0.752	71.0
2	0.545	0.738	71.0
3	0.520	0.721	71.0
4	0.405	0.636	71.0
5	0.205	0.453	72.0
6	0.495	0.704	72.0
E-1	0.345	0.587	71.0
2	0.350	0.592	71.0
3	0.365	0.604	71.0
4	0.325	0.570	71.0
5	0.140	0.374	72.0
6	0.370	0.608	72.0
F-1	0.145	0.381	72.0
2	0.155	0.394	72.0
3	0.125	0.354	72.0
4	0.105	0.324	72.0
5	0.100	0.316	72.0
6	0.215	0.464	72.0
36	0.4599	0.6560	71.25

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	4
Location	Jefferson Junction, WI	Start	10:05 PM
Stack ID	Fan #1 Outlet	Stop	10:15 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.16	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0273	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.54	lb/lb-mole
Cp	0.84		Vs	15.41	ft/s
Tm		° F	Qs	19,357	acfm
(DP)½	0.2733		Qs	1,164,417	scfh
Ts	73.3	° F	Qs(d)	18,877	dscfm
Vm		ft^3			
Dn		in	C3H8	0.013	lb/hr
As	20.94	ft^2	Carbon	0.011	lb/hr
Yd			Carbon	0.05	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	4
Location	Jefferson Junction, WI	Start	10:05 PM
Stack ID	Fan #1 Outlet	Stop	10:15 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.135	0.367	74.0
2	0.135	0.367	74.0
3	0.140	0.374	74.0
4	0.120	0.346	74.0
5	0.105	0.324	74.0
6	0.090	0.300	74.0
B-1	0.105	0.324	73.0
2	0.110	0.332	73.0
3	0.095	0.308	73.0
4	0.085	0.292	73.0
5	0.075	0.274	73.0
6	0.070	0.265	73.0
C-1	0.100	0.316	73.0
2	0.110	0.332	73.0
3	0.110	0.332	74.0
4	0.085	0.292	74.0
5	0.085	0.292	74.0
6	0.080	0.283	74.0
D-1	0.075	0.274	73.0
2	0.080	0.283	73.0
3	0.080	0.283	73.0
4	0.060	0.245	74.0
5	0.075	0.274	74.0
6	0.070	0.265	72.0
E-1	0.055	0.235	72.0
2	0.055	0.235	73.0
3	0.065	0.255	73.0
4	0.050	0.224	73.0
5	0.060	0.245	73.0
6	0.055	0.235	73.0
F-1	0.035	0.187	73.0
2	0.040	0.200	73.0
3	0.045	0.212	73.0
4	0.035	0.187	73.0
5	0.020	0.141	73.0
6	0.020	0.141	74.0
36	0.0781	0.2733	73.31

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	4
Location	Jefferson Junction, WI	Start	09:05 PM
Stack ID	Fan #2 Outlet	Stop	09:15 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.20	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft³
Theta	60	min	Vwstd	0.59	ft³
O2	20.9	%	Bwo	0.0264	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.55	lb/lb-mole
Cp	0.84		Vs	15.07	ft/s
Tm		° F	Qs	18,926	acfm
(DP)½	0.2675		Qs	1,140,677	scfh
Ts	72.4	° F	Qs(d)	18,509	dscfm
Vm		ft³			
Dn		in	C3H8	0.013	lb/hr
As	20.94	ft²	Carbon	0.011	lb/hr
Yd			Carbon	0.05	tpy

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Client	Ladish Malting Company	Date	[illegible]
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	4
Location	Jefferson Junction, WI	Start	09:05 PM
Stack ID	Fan #2 Outlet	Stop	09:15 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.005	0.071	72.0
2	0.010	0.100	72.0
3	0.010	0.100	72.0
4	0.005	0.071	72.0
5	0.010	0.100	72.0
6	0.015	0.122	72.0
B-1	0.005	0.071	71.0
2	0.005	0.071	71.0
3	0.010	0.100	72.0
4	0.015	0.122	72.0
5	0.020	0.141	72.0
6	0.005	0.071	72.0
C-1	0.020	0.141	70.0
2	0.025	0.158	71.0
3	0.025	0.158	71.0
4	0.050	0.224	72.0
5	0.060	0.245	72.0
6	0.050	0.224	73.0
D-1	0.150	0.387	73.0
2	0.160	0.400	73.0
3	0.165	0.406	73.0
4	0.180	0.424	73.0
5	0.155	0.394	73.0
6	0.125	0.354	73.0
E-1	0.165	0.406	73.0
2	0.180	0.424	73.0
3	0.200	0.447	73.0
4	0.195	0.442	73.0
5	0.130	0.361	73.0
6	0.115	0.339	73.0
F-1	0.165	0.406	73.0
2	0.185	0.430	73.0
3	0.200	0.447	73.0
4	0.185	0.430	73.0
5	0.180	0.424	73.0
6	0.175	0.418	73.0
36	0.0932	0.2675	72.36

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	4
Location	Jefferson Junction, WI	Start	09:50 PM
Stack ID	Fan #3 Outlet	Stop	10:00 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.13	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0265	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.55	lb/lb-mole
Cp	0.84		Vs	17.70	ft/s
Tm		° F	Qs	22,230	acfm
(DP)½	0.3141		Qs	1,339,255	scfh
Ts	72.5	° F	Qs(d)	21,729	dscfm
Vm		ft^3			
Dn		in	C3H8	0.015	lb/hr
As	20.94	ft^2	Carbon	0.012	lb/hr
Yd			Carbon	0.05	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	4
Location	Jefferson Junction, WI	Start	09:50 PM
Stack ID	Fan #3 Outlet	Stop	10:00 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.165	0.406	72.0
2	0.175	0.418	72.0
3	0.165	0.406	73.0
4	0.145	0.381	73.0
5	0.120	0.346	73.0
6	0.115	0.339	73.0
B-1	0.160	0.400	71.0
2	0.165	0.406	72.0
3	0.170	0.412	73.0
4	0.105	0.324	73.0
5	0.095	0.308	73.0
6	0.110	0.332	73.0
C-1	0.145	0.381	72.0
2	0.155	0.394	72.0
3	0.150	0.387	73.0
4	0.115	0.339	73.0
5	0.080	0.283	73.0
6	0.105	0.324	73.0
D-1	0.110	0.332	72.0
2	0.115	0.339	72.0
3	0.115	0.339	73.0
4	0.100	0.316	73.0
5	0.050	0.224	73.0
6	0.090	0.300	73.0
E-1	0.065	0.255	69.0
2	0.070	0.265	70.0
3	0.085	0.292	71.0
4	0.090	0.300	72.0
5	0.045	0.212	73.0
6	0.055	0.235	73.0
F-1	0.065	0.255	73.0
2	0.060	0.245	73.0
3	0.060	0.245	73.0
4	0.050	0.224	73.0
5	0.035	0.187	73.0
6	0.025	0.158	73.0
36	0.1035	0.3141	72.47

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	4
Location	Jefferson Junction, WI	Start	09:20 PM
Stack ID	Fan #4 Outlet	Stop	09:30 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.14	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft³
Theta	60	min	Vwstd	0.59	ft³
O2	20.9	%	Bwo	0.0282	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.53	lb/lb-mole
Cp	0.84		Vs	17.13	ft/s
Tm		° F	Qs	21,525	acfm
(DP)½	0.3036		Qs	1,292,503	scfh
Ts	74.3	° F	Qs(d)	20,935	dscfm
Vm		ft³			
Dn		in	C3H8	0.015	lb/hr
As	20.94	ft²	Carbon	0.012	lb/hr
Yd			Carbon	0.05	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	4
Location	Jefferson Junction, WI	Start	09:20 PM
Stack ID	Fan #4 Outlet	Stop	09:30 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
F-1	0.005	0.071	66.0
2	0.005	0.071	67.0
3	0.005	0.071	69.0
4	0.005	0.071	70.0
5	0.005	0.071	71.0
6	0.005	0.071	73.0
E-1	0.055	0.235	74.0
2	0.070	0.265	75.0
3	0.085	0.292	75.0
4	0.090	0.300	76.0
5	0.090	0.300	76.0
6	0.060	0.245	76.0
D-1	0.105	0.324	74.0
2	0.120	0.346	75.0
3	0.130	0.361	75.0
4	0.145	0.381	76.0
5	0.125	0.354	76.0
6	0.065	0.255	76.0
C-1	0.145	0.381	74.0
2	0.155	0.394	75.0
3	0.165	0.406	75.0
4	0.185	0.430	75.0
5	0.150	0.387	76.0
6	0.070	0.265	76.0
B-1	0.130	0.361	74.0
2	0.140	0.374	75.0
3	0.155	0.394	75.0
4	0.155	0.394	76.0
5	0.135	0.367	76.0
6	0.095	0.308	76.0
A-1	0.170	0.412	75.0
2	0.185	0.430	75.0
3	0.180	0.424	75.0
4	0.160	0.400	75.0
5	0.135	0.367	75.0
6	0.125	0.354	75.0
36	0.1057	0.3036	74.25

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	4
Location	Jefferson Junction, WI	Start	09:35 PM
Stack ID	Fan #5 Outlet	Stop	09:45 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.16	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0284	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.53	lb/lb-mole
Cp	0.84		Vs	15.01	ft/s
Tm		° F	Qs	18,850	acfm
(DP)½	0.2658		Qs	1,131,509	scfh
Ts	74.5	° F	Qs(d)	18,323	dscfm
Vm		ft^3			
Dn		in	C3H8	0.013	lb/hr
As	20.94	ft^2	Carbon	0.011	lb/hr
Yd			Carbon	0.05	tpy

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Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	4
Location	Jefferson Junction, WI	Start	09:35 PM
Stack ID	Fan #5 Outlet	Stop	09:45 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
F-1	0.030	0.173	73.0
2	0.040	0.200	73.0
3	0.035	0.187	74.0
4	0.035	0.187	75.0
5	0.040	0.200	75.0
6	0.035	0.187	75.0
E-1	0.050	0.224	75.0
2	0.055	0.235	75.0
3	0.050	0.224	75.0
4	0.045	0.212	75.0
5	0.050	0.224	75.0
6	0.070	0.265	75.0
D-1	0.060	0.245	74.0
2	0.060	0.245	74.0
3	0.065	0.255	75.0
4	0.060	0.245	75.0
5	0.070	0.265	75.0
6	0.085	0.292	75.0
C-1	0.080	0.283	73.0
2	0.080	0.283	73.0
3	0.085	0.292	75.0
4	0.080	0.283	75.0
5	0.080	0.283	75.0
6	0.085	0.292	75.0
B-1	0.095	0.308	72.0
2	0.100	0.316	73.0
3	0.100	0.316	74.0
4	0.085	0.292	74.0
5	0.080	0.283	75.0
6	0.075	0.274	75.0
A-1	0.120	0.346	74.0
2	0.130	0.361	75.0
3	0.130	0.361	75.0
4	0.120	0.346	75.0
5	0.105	0.324	75.0
6	0.070	0.265	75.0
36	0.0732	0.2658	74.47

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	5
Location	Jefferson Junction, WI	Start	11:05 PM
Stack ID	Fan #1 Outlet	Stop	11:15 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.18	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft³
Theta	60	min	Vwstd	0.59	ft³
O2	20.9	%	Bwo	0.0276	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.54	lb/lb-mole
Cp	0.84		Vs	18.34	ft/s
Tm		° F	Qs	23,042	acfm
(DP)½	0.3252		Qs	1,385,253	scfh
Ts	73.7	° F	Qs(d)	22,450	dscfm
Vm		ft³			
Dn		in	C3H8	0.016	lb/hr
As	20.94	ft²	Carbon	0.013	lb/hr
Yd			Carbon	0.06	tpy

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27-Nov-95
07:38 AM

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	5
Location	Jefferson Junction, WI	Start	11:05 PM
Stack ID	Fan #1 Outlet	Stop	11:15 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
F-1	0.060	0.245	74.0
2	0.065	0.255	74.0
3	0.070	0.265	74.0
4	0.055	0.235	74.0
5	0.050	0.224	74.0
6	0.035	0.187	74.0
E-1	0.075	0.274	73.0
2	0.080	0.283	73.0
3	0.085	0.292	73.0
4	0.095	0.308	73.0
5	0.075	0.274	74.0
6	0.055	0.235	74.0
D-1	0.110	0.332	73.0
2	0.115	0.339	73.0
3	0.120	0.346	73.0
4	0.080	0.283	73.0
5	0.105	0.324	74.0
6	0.125	0.354	74.0
C-1	0.135	0.367	73.0
2	0.145	0.381	73.0
3	0.140	0.374	74.0
4	0.115	0.339	74.0
5	0.120	0.346	74.0
6	0.115	0.339	74.0
B-1	0.155	0.394	73.0
2	0.160	0.400	74.0
3	0.140	0.374	74.0
4	0.115	0.339	74.0
5	0.105	0.324	74.0
6	0.095	0.308	74.0
A-1	0.195	0.442	73.0
2	0.190	0.436	74.0
3	0.175	0.418	74.0
4	0.150	0.387	74.0
5	0.125	0.354	74.0
6	0.110	0.332	74.0
36	0.1094	0.3252	73.67

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	5
Location	Jefferson Junction, WI	Start	11:55 PM
Stack ID	Fan #2 Outlet	Stop	12:05 AM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.19	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0280	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.53	lb/lb-mole
Cp	0.84		Vs	17.14	ft/s
Tm		° F	Qs	21,529	acfm
(DP)½	0.3037		Qs	1,293,445	scfh
Ts	74.0	° F	Qs(d)	20,954	dscfm
Vm		ft^3			
Dn		in	C3H8	0.015	lb/hr
As	20.94	ft^2	Carbon	0.012	lb/hr
Yd			Carbon	0.05	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	5
Location	Jefferson Junction, WI	Start	11:55 PM
Stack ID	Fan #2 Outlet	Stop	12:05 AM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
F-1	0.250	0.500	74.0
2	0.275	0.524	75.0
3	0.285	0.534	75.0
4	0.280	0.529	75.0
5	0.265	0.515	75.0
6	0.250	0.500	75.0
E-1	0.245	0.495	74.0
2	0.270	0.520	75.0
3	0.295	0.543	75.0
4	0.285	0.534	75.0
5	0.185	0.430	75.0
6	0.160	0.400	75.0
D-1	0.105	0.324	74.0
2	0.225	0.474	73.0
3	0.245	0.495	74.0
4	0.250	0.500	75.0
5	0.225	0.474	75.0
6	0.180	0.424	75.0
C-1	0.015	0.122	73.0
2	0.020	0.141	73.0
3	0.025	0.158	74.0
4	0.050	0.224	74.0
5	0.060	0.245	74.0
6	0.025	0.158	74.0
B-1	0.010	0.100	73.0
2	0.005	0.071	73.0
3	0.010	0.100	73.0
4	0.020	0.141	74.0
5	0.015	0.122	74.0
6	0.010	0.100	74.0
A-1	0.005	0.071	72.0
2	0.005	0.071	72.0
3	0.010	0.100	73.0
4	0.010	0.100	73.0
5	0.005	0.071	74.0
6	0.015	0.122	74.0
36	0.1275	0.3037	74.03

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	5
Location	Jefferson Junction, WI	Start	11:20 PM
Stack ID	Fan #3 Outlet	Stop	11:30 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.17	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft³
Theta	60	min	Vwstd	0.59	ft³
O2	20.9	%	Bwo	0.0274	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.54	lb/lb-mole
Cp	0.84		Vs	20.24	ft/s
Tm		° F	Qs	25,423	acfm
(DP)½	0.3589		Qs	1,529,078	scfh
Ts	73.4	° F	Qs(d)	24,786	dscfm
Vm		ft³			
Dn		in	C3H8	0.017	lb/hr
As	20.94	ft²	Carbon	0.014	lb/hr
Yd			Carbon	0.06	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	5
Location	Jefferson Junction, WI	Start	11:20 PM
Stack ID	Fan #3 Outlet	Stop	11:30 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
F-1	0.065	0.255	69.0
2	0.085	0.292	72.0
3	0.085	0.292	72.0
4	0.060	0.245	73.0
5	0.045	0.212	73.0
6	0.035	0.187	73.0
E-1	0.070	0.265	70.0
2	0.095	0.308	72.0
3	0.105	0.324	73.0
4	0.105	0.324	73.0
5	0.050	0.224	74.0
6	0.080	0.283	74.0
D-1	0.165	0.406	74.0
2	0.170	0.412	74.0
3	0.140	0.374	74.0
4	0.045	0.212	74.0
5	0.060	0.245	74.0
6	0.115	0.339	74.0
C-1	0.195	0.442	73.0
2	0.205	0.453	74.0
3	0.200	0.447	74.0
4	0.155	0.394	74.0
5	0.105	0.324	74.0
6	0.160	0.400	74.0
B-1	0.210	0.458	74.0
2	0.220	0.469	74.0
3	0.215	0.464	74.0
4	0.145	0.381	74.0
5	0.125	0.354	74.0
6	0.165	0.406	74.0
A-1	0.235	0.485	74.0
2	0.240	0.490	74.0
3	0.225	0.474	74.0
4	0.205	0.453	74.0
5	0.195	0.442	74.0
6	0.150	0.387	74.0
36	0.1368	0.3589	73.42

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	5
Location	Jefferson Junction, WI	Start	11:45 PM
Stack ID	Fan #4 Outlet	Stop	11:55 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.19	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0290	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.52	lb/lb-mole
Cp	0.84		Vs	20.35	ft/s
Tm		° F	Qs	25,560	acfm
(DP)½	0.3602		Qs	1,532,574	scfh
Ts	75.1	° F	Qs(d)	24,803	dscfm
Vm		ft^3			
Dn		in	C3H8	0.018	lb/hr
As	20.94	ft^2	Carbon	0.014	lb/hr
Yd			Carbon	0.06	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	5
Location	Jefferson Junction, WI	Start	11:45 PM
Stack ID	Fan #4 Outlet	Stop	11:55 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.225	0.474	76.0
2	0.230	0.480	76.0
3	0.240	0.490	76.0
4	0.235	0.485	76.0
5	0.195	0.442	76.0
6	0.180	0.424	76.0
B-1	0.210	0.458	75.0
2	0.220	0.469	76.0
3	0.230	0.480	76.0
4	0.240	0.490	76.0
5	0.180	0.424	76.0
6	0.125	0.354	76.0
C-1	0.215	0.464	76.0
2	0.235	0.485	76.0
3	0.240	0.490	76.0
4	0.260	0.510	76.0
5	0.205	0.453	76.0
6	0.105	0.324	76.0
D-1	0.145	0.381	75.0
2	0.165	0.406	76.0
3	0.195	0.442	76.0
4	0.200	0.447	76.0
5	0.160	0.400	76.0
6	0.085	0.292	76.0
E-1	0.075	0.274	74.0
2	0.095	0.308	74.0
3	0.115	0.339	75.0
4	0.125	0.354	76.0
5	0.120	0.346	76.0
6	0.090	0.300	76.0
F-1	0.005	0.071	69.0
2	0.010	0.100	70.0
3	0.005	0.071	71.0
4	0.005	0.071	73.0
5	0.005	0.071	73.0
6	0.010	0.100	74.0
36	0.1494	0.3602	75.08

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	5
Location	Jefferson Junction, WI	Start	11:35 PM
Stack ID	Fan #5 Outlet	Stop	11:45 PM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.18	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0301	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.51	lb/lb-mole
Cp	0.84		Vs	17.42	ft/s
Tm		° F	Qs	21,885	acfm
(DP)½	0.3080		Qs	1,309,593	scfh
Ts	76.2	° F	Qs(d)	21,170	dscfm
Vm		ft^3			
Dn		in	C3H8	0.015	lb/hr
As	20.94	ft^2	Carbon	0.012	lb/hr
Yd			Carbon	0.05	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	5
Location	Jefferson Junction, WI	Start	11:35 PM
Stack ID	Fan #5 Outlet	Stop	11:45 PM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
F-1	0.065	0.255	74.0
2	0.050	0.224	75.0
3	0.050	0.224	75.0
4	0.045	0.212	76.0
5	0.050	0.224	76.0
6	0.040	0.200	76.0
E-1	0.065	0.255	75.0
2	0.070	0.265	75.0
3	0.060	0.245	76.0
4	0.060	0.245	76.0
5	0.060	0.245	76.0
6	0.085	0.292	76.0
D-1	0.085	0.292	75.0
2	0.085	0.292	75.0
3	0.080	0.283	76.0
4	0.080	0.283	76.0
5	0.085	0.292	77.0
6	0.120	0.346	77.0
C-1	0.115	0.339	76.0
2	0.110	0.332	77.0
3	0.115	0.339	77.0
4	0.105	0.324	77.0
5	0.110	0.332	77.0
6	0.120	0.346	77.0
B-1	0.135	0.367	75.0
2	0.145	0.381	76.0
3	0.135	0.367	76.0
4	0.110	0.332	76.0
5	0.100	0.316	77.0
6	0.110	0.332	77.0
A-1	0.175	0.418	77.0
2	0.170	0.412	77.0
3	0.165	0.406	77.0
4	0.145	0.381	77.0
5	0.125	0.354	77.0
6	0.115	0.339	77.0
36	0.0983	0.3080	76.17

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	6
Location	Jefferson Junction, WI	Start	02:05 AM
Stack ID	Fan #1 Outlet	Stop	02:15 AM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.18	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0276	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.54	lb/lb-mole
Cp	0.84		Vs	18.34	ft/s
Tm		° F	Qs	23,042	acfm
(DP)½	0.3252		Qs	1,385,253	scfh
Ts	73.7	° F	Qs(d)	22,450	dscfm
Vm		ft^3			
Dn		in	C3H8	0.016	lb/hr
As	20.94	ft^2	Carbon	0.013	lb/hr
Yd			Carbon	0.06	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	6
Location	Jefferson Junction, WI	Start	02:05 AM
Stack ID	Fan #1 Outlet	Stop	02:15 AM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
F-1	0.060	0.245	74.0
2	0.065	0.255	74.0
3	0.070	0.265	74.0
4	0.055	0.235	74.0
5	0.050	0.224	74.0
6	0.035	0.187	74.0
E-1	0.075	0.274	73.0
2	0.080	0.283	73.0
3	0.085	0.292	73.0
4	0.095	0.308	73.0
5	0.075	0.274	74.0
6	0.055	0.235	74.0
D-1	0.110	0.332	73.0
2	0.115	0.339	73.0
3	0.120	0.346	73.0
4	0.080	0.283	73.0
5	0.105	0.324	74.0
6	0.125	0.354	74.0
C-1	0.135	0.367	73.0
2	0.145	0.381	73.0
3	0.140	0.374	74.0
4	0.115	0.339	74.0
5	0.120	0.346	74.0
6	0.115	0.339	74.0
B-1	0.155	0.394	73.0
2	0.160	0.400	74.0
3	0.140	0.374	74.0
4	0.115	0.339	74.0
5	0.105	0.324	74.0
6	0.095	0.308	74.0
A-1	0.195	0.442	73.0
2	0.190	0.436	74.0
3	0.175	0.418	74.0
4	0.150	0.387	74.0
5	0.125	0.354	74.0
6	0.110	0.332	74.0
36	0.1094	0.3252	73.67

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	6
Location	Jefferson Junction, WI	Start	01:10 AM
Stack ID	Fan #2 Outlet	Stop	01:20 AM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.32	in H2O			
Vlc	12.5	g	Ps	30.32	in Hg
VOC	0.1	ppmv	Vmstd		ft^3
Theta	60	min	Vwstd	0.59	ft^3
O2	20.9	%	Bwo	0.0316	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.49	lb/lb-mole
Cp	0.84		Vs	25.25	ft/s
Tm		° F	Qs	31,720	acfm
(DP)½	0.4457		Qs	1,893,238	scfh
Ts	77.7	° F	Qs(d)	30,555	dscfm
Vm		ft^3			
Dn		in	C3H8	0.022	lb/hr
As	20.94	ft^2	Carbon	0.018	lb/hr
Yd			Carbon	0.08	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	6
Location	Jefferson Junction, WI	Start	01:10 AM
Stack ID	Fan #2 Outlet	Stop	01:20 AM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
F-1	0.005	0.071	77.0
2	0.005	0.071	78.0
3	0.005	0.071	78.0
4	0.005	0.071	78.0
5	0.005	0.071	78.0
6	0.005	0.071	78.0
E-1	0.010	0.100	78.0
2	0.005	0.071	78.0
3	0.015	0.122	78.0
4	0.020	0.141	78.0
5	0.020	0.141	78.0
6	0.005	0.071	78.0
D-1	0.115	0.339	78.0
2	0.145	0.381	78.0
3	0.175	0.418	78.0
4	0.195	0.442	78.0
5	0.185	0.430	78.0
6	0.075	0.274	78.0
C-1	0.350	0.592	77.0
2	0.485	0.696	78.0
3	0.535	0.731	78.0
4	0.575	0.758	78.0
5	0.475	0.689	78.0
6	0.370	0.608	78.0
B-1	0.530	0.728	78.0
2	0.585	0.765	78.0
3	0.620	0.787	78.0
4	0.580	0.762	78.0
5	0.405	0.636	78.0
6	0.315	0.561	78.0
A-1	0.435	0.660	76.0
2	0.545	0.738	76.0
3	0.595	0.771	77.0
4	0.585	0.765	77.0
5	0.545	0.738	77.0
6	0.495	0.704	77.0
36	0.2783	0.4457	77.72

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	6
Location	Jefferson Junction, WI	Start	01:45 AM
Stack ID	Fan #3 Outlet	Stop	01:55 AM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.10	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft³
Theta	60	min	Vwstd	0.59	ft³
O2	20.9	%	Bwo	0.0257	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.56	lb/lb-mole
Cp	0.84		Vs	40.93	ft/s
Tm		° F	Qs	51,414	acfm
(DP)½	0.7273		Qs	3,102,774	scfh
Ts	71.5	° F	Qs(d)	50,384	dscfm
Vm		ft³			
Dn		in	C3H8	0.035	lb/hr
As	20.94	ft²	Carbon	0.029	lb/hr
Yd			Carbon	0.13	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	6
Location	Jefferson Junction, WI	Start	01:45 AM
Stack ID	Fan #3 Outlet	Stop	01:55 AM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.985	0.992	72.0
2	0.910	0.954	73.0
3	0.830	0.911	73.0
4	0.720	0.849	73.0
5	0.615	0.784	73.0
6	0.635	0.797	73.0
B-1	0.925	0.962	72.0
2	0.910	0.954	72.0
3	0.825	0.908	72.0
4	0.375	0.612	72.0
5	0.435	0.660	73.0
6	0.590	0.768	73.0
C-1	0.885	0.941	72.0
2	0.870	0.933	72.0
3	0.850	0.922	72.0
4	0.435	0.660	72.0
5	0.295	0.543	72.0
6	0.710	0.843	72.0
D-1	0.805	0.897	71.0
2	0.760	0.872	71.0
3	0.675	0.822	71.0
4	0.550	0.742	71.0
5	0.230	0.480	71.0
6	0.415	0.644	71.0
E-1	0.580	0.762	71.0
2	0.615	0.784	71.0
3	0.495	0.704	71.0
4	0.270	0.520	71.0
5	0.180	0.424	71.0
6	0.150	0.387	71.0
F-1	0.305	0.552	70.0
2	0.325	0.570	70.0
3	0.285	0.534	70.0
4	0.195	0.442	70.0
5	0.235	0.485	70.0
6	0.325	0.570	70.0
36	0.5610	0.7273	71.53

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	6
Location	Jefferson Junction, WI	Start	01:25 AM
Stack ID	Fan #4 Outlet	Stop	01:35 AM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.15	in H2O			
Vlc	12.5	g	Ps	30.31	in Hg
VOC	0.1	ppmv	Vmstd		ft³
Theta	60	min	Vwstd	0.59	ft³
O2	20.9	%	Bwo	0.0315	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.50	lb/lb-mole
Cp	0.84		Vs	29.62	ft/s
Tm		° F	Qs	37,206	acfm
(DP)½	0.5228		Qs	2,220,533	scfh
Ts	77.5	° F	Qs(d)	35,845	dscfm
Vm		ft³			
Dn		in	C3H8	0.026	lb/hr
As	20.94	ft²	Carbon	0.021	lb/hr
Yd			Carbon	0.09	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	6
Location	Jefferson Junction, WI	Start	01:25 AM
Stack ID	Fan #4 Outlet	Stop	01:35 AM

Flow Averages Calcs >>>>>>>

	Delta p	Sqrt Delta p	Ts (°F)
F-1	0.005	0.071	73.0
2	0.005	0.071	75.0
3	0.005	0.071	76.0
4	0.005	0.071	77.0
5	0.005	0.071	77.0
6	0.010	0.100	77.0
E-1	0.180	0.424	76.0
2	0.225	0.474	77.0
3	0.255	0.505	78.0
4	0.270	0.520	78.0
5	0.255	0.505	78.0
6	0.195	0.442	78.0
D-1	0.335	0.579	78.0
2	0.370	0.608	78.0
3	0.395	0.628	78.0
4	0.415	0.644	78.0
5	0.325	0.570	78.0
6	0.195	0.442	78.0
C-1	0.490	0.700	77.0
2	0.515	0.718	78.0
3	0.525	0.725	78.0
4	0.540	0.735	78.0
5	0.455	0.675	78.0
6	0.235	0.485	78.0
B-1	0.435	0.660	78.0
2	0.475	0.689	78.0
3	0.505	0.711	78.0
4	0.515	0.718	78.0
5	0.405	0.636	78.0
6	0.285	0.534	78.0
A-1	0.495	0.704	78.0
2	0.490	0.700	78.0
3	0.505	0.711	78.0
4	0.445	0.667	78.0
5	0.410	0.640	78.0
6	0.385	0.620	78.0
36	0.3211	0.5228	77.53

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	6
Location	Jefferson Junction, WI	Start	01:35 AM
Stack ID	Fan #5 Outlet	Stop	01:45 AM

Meter Box	N/A				
Pb	30.30	in Hg			
Static	0.21	in H2O			
Vlc	12.5	g	Ps	30.32	in Hg
VOC	0.1	ppmv	Vmstd		ft³
Theta	60	min	Vwstd	0.59	ft³
O2	20.9	%	Bwo	0.0272	
CO2	0.0	%	Below Sat.	NO	
N2	79.1	%	Md	28.84	lb/lb-mole
DH		in H2O	Ms	28.54	lb/lb-mole
Cp	0.84		Vs	25.57	ft/s
Tm		° F	Qs	32,120	acfm
(DP)½	0.4536		Qs	1,932,892	scfh
Ts	73.2	° F	Qs(d)	31,339	dscfm
Vm		ft³			
Dn		in	C3H8	0.022	lb/hr
As	20.94	ft²	Carbon	0.018	lb/hr
Yd			Carbon	0.08	tpy

Client	Ladish Malting Company	Date	11/15/95
Unit	Kiln No. 15 Malt Dryer Exhaust	Run	6
Location	Jefferson Junction, WI	Start	01:35 AM
Stack ID	Fan #5 Outlet	Stop	01:45 AM

Flow Averages Calcs >>>>>>>

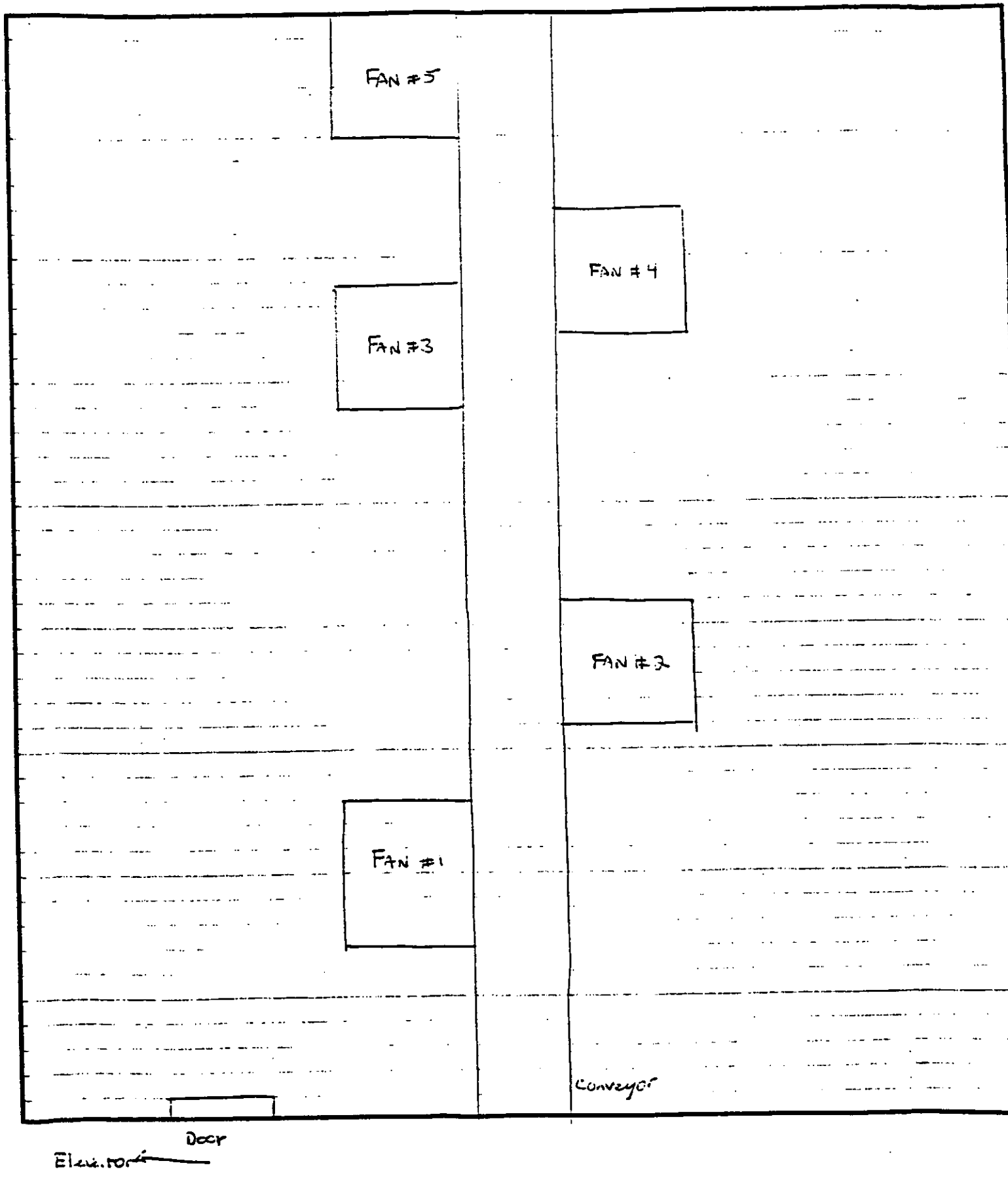
	Delta p	Sqrt Delta p	Ts (°F)
A-1	0.425	0.652	75.0
2	0.385	0.620	75.0
3	0.365	0.604	75.0
4	0.295	0.543	75.0
5	0.280	0.529	75.0
6	0.195	0.442	75.0
B-1	0.345	0.587	74.0
2	0.340	0.583	74.0
3	0.280	0.529	74.0
4	0.225	0.474	74.0
5	0.230	0.480	74.0
6	0.290	0.539	74.0
C-1	0.265	0.515	72.0
2	0.270	0.520	72.0
3	0.255	0.505	73.0
4	0.205	0.453	73.0
5	0.275	0.524	73.0
6	0.345	0.587	73.0
D-1	0.225	0.474	73.0
2	0.215	0.464	73.0
3	0.195	0.442	73.0
4	0.180	0.424	73.0
5	0.175	0.418	73.0
6	0.310	0.557	74.0
E-1	0.145	0.381	72.0
2	0.135	0.367	72.0
3	0.145	0.381	72.0
4	0.120	0.346	72.0
5	0.090	0.300	73.0
6	0.270	0.520	73.0
F-1	0.065	0.255	72.0
2	0.075	0.274	72.0
3	0.070	0.265	72.0
4	0.065	0.255	72.0
5	0.065	0.255	72.0
6	0.070	0.265	72.0
36	0.2190	0.4536	73.19

APPENDIX B

Field Data

Fluid Management, Inc.

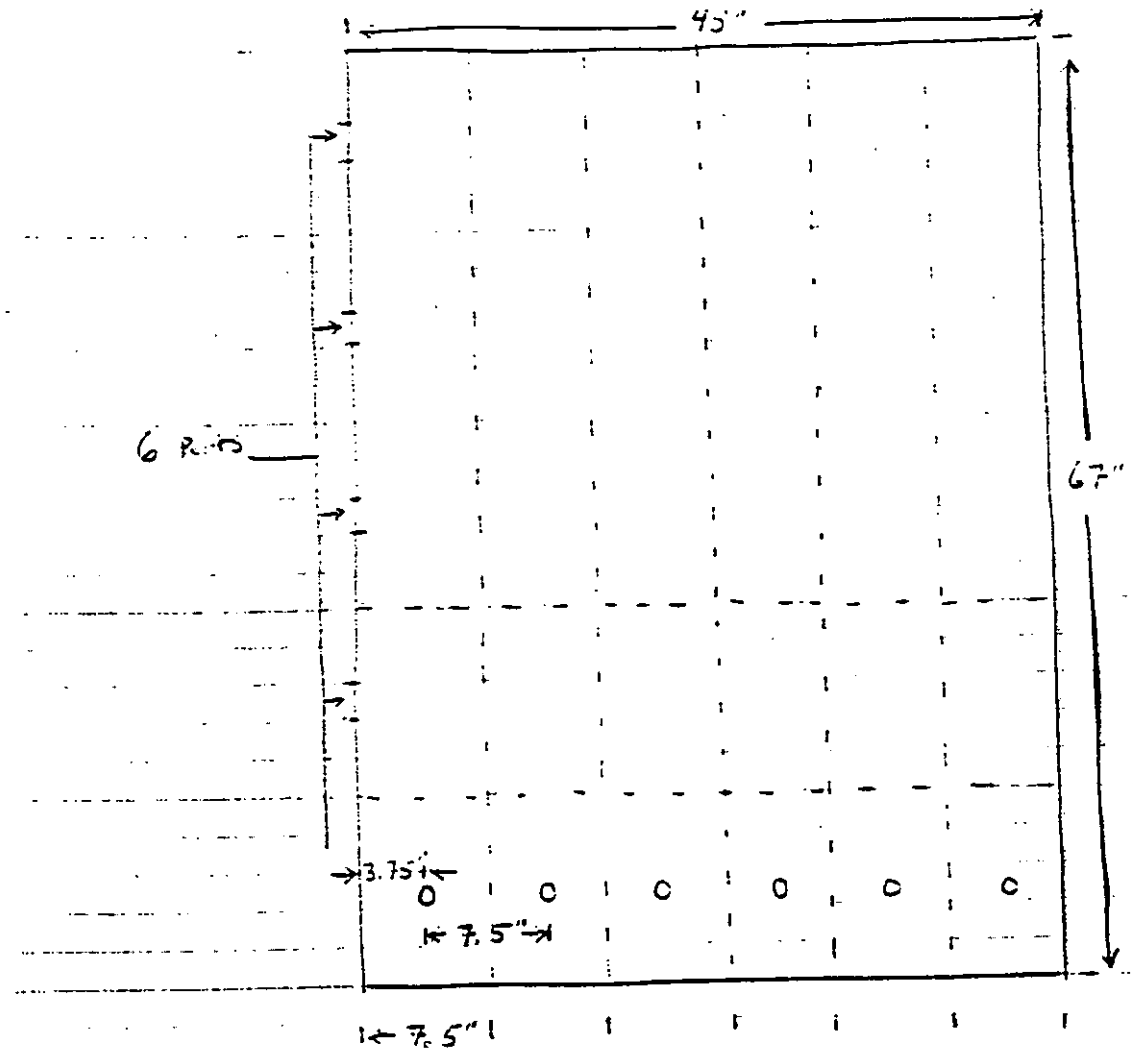
PROJECT Lavish Melting — NO.
SHEET NO. VOC Testing — OF Floor Layout
CALCULATED BY: — DATE 11-14-95
CHECKED BY: — DATE



Fluid Management, Inc.

PROJECT Ludish Mahway NO.
SHEET NO. VOC Testing OF Traverse Point Location
CALCULATED BY: JKA DATE 11-19-15
CHECKED BY: DATE

"Traverse Point Location"



Point #	Distance (inches)
1	3.75
2	11.25
3	18.75
4	26.25
5	33.75
6	41.25

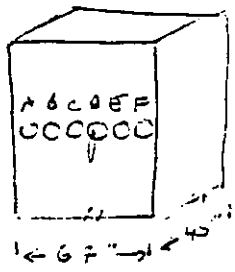
(Five Ducts)

Fluid Management, Inc.

Air Sciences & Engineering Group

VELOCITY TRAVERSE DATA SHEET

CLIENT	[illegible]	DATE 11-19-95	TEST NO. 1
FMI Project #	95.502		
FMI Personnel	JKA / MBW		
Plant Location	[illegible]		
Stack ID	#3 Kiln	Fan #3	
Stack Diameter (ft)	4.5" x 6.5"		
Stack X-Area (ft²)	20.90		
Pitot ID #	6' elbow	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	54°F
# of Traverse Points (n)	6 x 6		
Differential Static Press (in H2O)	TO.05		
Differential Static Press (in Hg)		Stack Press	
Start Time	1050	Stop Time	1015



Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1A	1D	0.640	.470	69	71		1st pt not exact due to infra-structure
2	2	.665	.415	70	71		
3	3	.585	.495	70	71		
4	4	.485	.285	70	72		
5	5	.470	.450	70	72		
6	6	.455	.450	70	72		
1B	1E	.545	.310	71	71		
2	2	.545	.305	71	71		
3	3	.365	.320	71	72		
4	4	.280	.280	71	72		
5	5	.295	.225	71	72		
6	6	.335	.335	71	72		
1C	1F	.515	.225	70	72		
2	2	.530	.220	71	72		
3	3	.575	.215	71	72		
4	4	.325	.140	71	72		
5	5	.460	.095	71	72		
6	6	.395	.070	71	72		
							Bags on @ 10am
							Bags off @ 11:20 am
							Fans @ 10:00
AVERAGE							~65%

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - |(% O2) + (% CO2) + (% CO)|
Md = [0.44 * (% CO2)| + [0.32 * (% O2)| + [0.28 * ((% N2)+(% CO))|
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * |(Vm* Pm)/Tm|
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT|Ts/(Ps * Ms)|
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

Fluid Management, Inc.

Air Sciences & Engineering Group

VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish Mfg	DATE	11/9/95
FMI Project #	95-20-5		
FMI Personnel	JKA / MBW		
Plant Location	Cudahy		
Stack ID	#15 Kiln Fan #2		
Stack Diameter (ft)	45" x 63"		
Stack X-Area (ft²)	20.94		
Pitot ID #	6' Alentec	Pitot Cp	0.84
Pre-Pitot Leak Check	OK	Post-Pitot Leak Check	
Bar Press (in Hg)	30.30	Amb. Temp.	
# of Traverse Points (n)	6 x 6		
Differential Static Press (in H2O)	TC.016		
Differential Static Press (in Hg)		Stack Press	
Start Time	1115	Stop Time	1200

TEST NO. 1

Same as Fan #1

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1 A	1 D	1.05	73	726	71	
2	2	1.10	73	730	71	
3	3	1.15	73	730	73	
4	4	1.10	73	725	72	
5	5	1.30	73	745	73	
6	6	1.15	73	730	73	
1 B	1 E	9.30	73	1.10	71	
2	2	.985	73	1.30	73	
3	3	.975	73	1.65	73	
4	4	1.05	72	1.05	72	
5	5	1.15	73	1.65	72	
6	6	.640	73	1.085	73	
1 C	1 E	.470	73	.680	71	
2	2	.665	73	1.05	73	
3	3	.870	73	1.25	72	
4	4	1.05	73	1.75	73	
5	5	1.165	72	1.015	72	
6	6	1.620	73	1.010	73	
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar - Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) - (% CO)]
Md = [0.44 * (% CO2)] - [0.32 * (% O2)] - [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

MBWVELOCITY.WK1

Ladish Fan ID #'s opposite of FMI's
(i.e. 1 → 5 Ladish
5 → 1 FMI)

Fluid Management, Inc.

Air Sciences & Engineering Group

VELOCITY TRAVERSE DATA SHEET

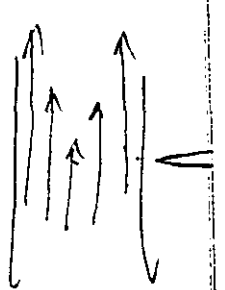
CLIENT	Lehigh Heidelberg	DATE	11-14-95
FMI Project #	95-503		
FMI Personnel	JKA JMB JW		
Plant Location	Tulsa, OK		
Stack ID	#15 Kiln Fan #3		
Stack Diameter (ft)	45" x 6.5"		
Stack X-Area (ft²)	20.94		
Pitot ID #	6' effective	Pitot Cp	0.84
Pre-Pitot Leak Check	OK	Post-Pitot Leak Check	
Bar Press (in Hg)	30.30	Amb. Temp.	69
# of Traverse Points (n)	6 x 5		
Differential Static Press (in H2O)	+0.04		
Differential Static Press (in Hg)		Stack Press	
Start Time	1030	Stop Time	1050

TEST NO. 1

same as FAN #1

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P		COMMENTS
1	1D	.900	73	.675	74		1st pt not exact due to infra-structure
2	2	.890	73	.665	74		
3	3	.870	73	.645	74		
4	4	.560	73	.405	74		
5	5	.440	73	.285	74		
6	6	.500	73	.345	74		
1	1E	.850	73	.635	74		
2	2	.860	73	.645	74		
3	3	.840	74	.625	74		
4	4	.620	74	.405	74		
5	5	.475	73	.285	74		
6	6	.575	74	.385	74		
1	1F	.955	74	.735	74		
2	2	.775	74	.555	74		
3	3	.766	74	.545	74		
4	4	.380	74	.165	74		
5	5	.240	74	.025	74		
6	6	.660	74	.185	74		
AVERAGE							



CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar – Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) – (% CO)]
Md = [0.44 * (% CO2)] – [0.32 * (% O2)] – [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

NEWVELOCITY.WK4

Fluid Management, Inc.

Air Sciences & Engineering Group

VELOCITY TRAVERSE DATA SHEET

CLIENT [illegible]	DATE 11-15-95	TEST NO.	
FMI Project # 95 [illegible]			SAME AS RUN 1
FMI Personnel [illegible]			
Plant Location [illegible]			
Stack ID [illegible]			
Stack Diameter (ft) [illegible]			
Stack X-Area (ft²) 20.74			
Pitot ID # [illegible]	Pitot Cp 0.84		
Pre-Pitot Leak Check [illegible]	Post-Pitot Leak Check		
X Bar Press (in Hg) 30.30	Amb. Temp. 64		
# of Traverse Points (n) 6 x 6			
Differential Static Press (in H2O) [illegible]			
Differential Static Press (in Hg)	Stack Press		
Start Time 1120	Stop Time 1140		Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1A	1D	.840	76	610	76	Sulfuron @ 10-15-10-20
2	2	.865	76	625	76	
3	3	.830	76	595	76	
4	4	.805	76	565	76	
5	5	.640	76	365	76	
6	6	.550	76	.375	76	
1B	1E	.735	76	.455	76	
2	3	.720	75	.495	76	
3	3	.710	75	.560	76	
4	4	.705	75	.585	76	
5	5	.695	76	.575	76	
6	6	.705	76	.305	76	
1C	1F	.760	75	.050	76	
2	2	.750	75	.030	76	
3	3	.840	76	.030	76	
4	4	.910	76	.060	76	
5	5	.685	76	.005	76	
6	6	.335	76	.004	76	
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar – Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) – (% CO2) – (% CO)]
Md = [0.44 * (% CO2)] – [0.32 * (% O2)] – [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts – 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

Fluid Management, Inc.

Air Sciences & Engineering Group

VELOCITY TRAVERSE DATA SHEET

CLIENT	Lafarge Midlothian	DATE 11-14-05	TEST NO.
FMI Project #	515-502		SAME AS FAN # 1
FMI Personnel	JKA / MBC		
Plant Location	Te Hexas		
Stack ID	#5 Kiln Fan #5		
Stack Diameter (ft)	45" x 27"		
Stack X-Area (ft²)	20.70		
Pitot ID #	L effective	Pitot Cp	0.84
Pre-Pitot Leak Check	OK	Post-Pitot Leak Check	
X Bar Press (in Hg)	30.30	Amb. Temp.	60
# of Traverse Points (n)	6 x 6		
Differential Static Press (in H2O)	+0.06		
Differential Static Press (in Hg)		Stack Press	
Start Time	1100	Stop Time	1115

Stack Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	SQRT DELTA P (°R)		COMMENTS
1A	1D	.620	74	.430	74	
2	2	.670	74	.470	74	
3	3	.605	74	.315	74	
4	4	.600	74	.300	74	
5	5	.350	74	.240	74	
6	6	.440	74	.570	74	
1B	1E	.555	74	.225	74	
2	2	.560	73	.210	73	
3	3	.515	74	.265	74	
4	4	.305	74	.205	74	
5	5	.380	74	.135	74	
6	6	.475	74	.425	74	
1C	1F	.455	73	.100	73	
2	2	.470	73	.105	73	
3	3	.135	74	.110	73	
4	4	.135	74	.085	74	
5	5	.525	74	.075	74	
6	6	.505	74	.100	74	
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

Fluid Management, Inc.

Air Sciences & Engineering Group

VELOCITY TRAVERSE DATA SHEET

CLIENT	Lehigh Valley Co	DATE	10/14/95
FMI Project #	T95-17	TEST NO.	2
FMI Personnel	JK/AP/Mum		
Plant Location	Jefferson		
Stack ID	Path (Ld #5)		
Stack Diameter (ft)	4.5' x 6.7'		
Stack X-Area (ft²)	29.94		
Pitot ID #	6' effective	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	64
# of Traverse Points (n)	6x6		
Differential Static Press (in H2O)	+0.083		
Differential Static Press (in Hg)		Stack Press	
Start Time	1450	Stop Time	1505

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)		(°R)	SQRT DELTA P	COMMENTS
1 A	1 D	1.55	72	780	73			
2	2	1.45	72	1.30	73			
3	3	1.40	72	1.00	73			
4	4	1.000	73	.775	73			
5	5	.750	73	.570	73			
6	6	.860	73	.900	73			
1 B	1 E	1.35	72	.770	73			
2	2	1.20	72	.780	73			
3	3	.980	73	.740	73			
4	4	1.000	73	.635	73			
5	5	.765	73	.305	73			
6	6	.830	73	.435	73			
1 C	1 F	1.75	72	.325	73			
2	2	1.20	72	.470	73			
3	3	1.05	73	.465	73			
4	4	.525	73	.405	73			
5	5	.835	73	.245	73			
6	6	.910	73	.335	73			
AVERAGE								

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar − Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) − (% CO2) − (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457 * (Ts − 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish Malleable	DATE	11-14-95
FMI Project #	1195.502		
FMI Personnel	JKA/MBa		
Plant Location	Jefferson		
Stack ID	Fan #8 (Ladish Co. #5)		
Stack Diameter (ft)	45" x 65"		
Stack X-Area (ft²)	20.96		
Pitot ID #	6' Effectum	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.50	Amb. Temp.	64
# of Traverse Points (n)	6x6		
Differential Static Press (in H2O)	+.71		
Differential Static Press (in Hg)		Stack Press	
Start Time	1350	Stop Time	1405

TEST NO. 2

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)		SQRT DELTA P (°R)	COMMENTS
1A	1D	.011	71	170	72	Bags on @ 1350
2	2	.026	71	1.55	72	
3	3	.014	71	2.0	73	
4	4	.005	71	2.15	73	
5	5	.011	71	1.55	73	
6	6	.015	71	1.10	73	
1B	1E	.070	70	2.15	72	
2	2	.060	71	2.20	73	
3	3	.065	71	2.25	73	
4	4	.230	71	2.85	73	
5	5	.150	71	2.05	73	
6	6	.065	71	1.85	73	
1C	1F	.060	71	2.50	73	
2	2	.865	71	3.00	73	
3	3	1.10	72	3.05	73	
4	4	1.30	72	3.45	73	
5	5	1.15	72	3.30	73	
6	6	.825	72	2.90	73	Bags off @ 1450
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT Cadillac Malleable	DATE 11-14-95	TEST NO. 2	
FMI Project # 95-507			
FMI Personnel JCA/MBW			
Plant Location Jefferson			
Stack ID Can 3 (Unit 3)			
Stack Diameter (ft) 45" x 27"			
Stack X-Area (ft²) 20.70			
Pitot ID # 6' Effect Corr	Pitot Cp 0.84		
Pre-Pitot Leak Check ok	Post-Pitot Leak Check ok		
Bar Press (in Hg) 29.36	Amb. Temp. 64		
# of Traverse Points (n) 6 x 6			
Differential Static Press (in H2O) ÷0.425			
Differennial Static Press (in Hg)	Stack Press		
Start Time 1425	Stop Time 1450	Stack / Port Drawing	

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1 A	1 D	0.95	74	155	74		
2	2	0.85	74	150	74		
3	3	0.75	75	150	74		
4	4	0.70	75	145	75		
5	5	0.60	75	155	75		
6	6	1.15	75	150	75		
1 B	1 E	1.55	74	165	75		
2	2	1.90	74	165	75		
3	3	1.40	75	160	75		
4	4	.755	75	.680	75		
5	5	.810	75	.310	75		
6	6	1.35	75	.580	75		
1 C	1 F	0.85	75	.496	75		
2	2	0.80	75	.525	75		
3	3	1.55	75	.415	75		
4	4	.905	75	.310	75		
5	5	.515	75	.300	75		
6	6	1.30	75	.440	75		

AVERAGE

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts - 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Lafarge	DATE	11-14-95
FMI Project #	95.502		
FMI Personnel	JK+/mpm;		
Plant Location	Jefferson		
Stack ID	Fan 4 (Lafarge #2)		
Stack Diameter (ft)	4.5 x 6.71		
Stack X-Area (ft²)	30.19		
Pitot ID #	6 effective	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	64
# of Traverse Points (n)	6 x 6		
Differential Static Press (in H2O)	-0.09		
Differential Static Press (in Hg)		Stack Press	
Start Time	1405	Stop Time	1420

TEST NO. 2

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1A	1D	1.30	74	1.30	74		
2	2	1.35	74	1.40	75		
3	3	1.15	74	1.05	75		
4	4	1.10	74	1.00	75		
5	5	1.00	74	0.960	75		
6	6	1.00	74	.510	75		
1B	1E	1.15	74	.810	74		
2	2	1.10	74	.910	74		
3	3	1.05	74	.940	74		
4	4	1.00	74	.705	75		
5	5	0.95	74	.775	75		
6	6	0.75	74	.460	75		
1C	1F	1.60	74	.010	74		
2	2	1.70	74	.010	74		
3	3	1.60	74	.005	74		
4	4	1.50	74	.050	74		
5	5	1.40	74	.250	74		
6	6	1.30	74	.220	75		
AVERAGE							

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish Malleable	DATE	11-14-95
FMI Project #	95-562		
FMI Personnel	JKA / MOU		
Plant Location	Jefferson		
Stack ID	Fan 5 (Unit 2)		
Stack Diameter (ft)	45-7.7"		
Stack X-Area (ft²)	20.70		
Pitot ID #	6 effective	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	64
# of Traverse Points (n)	6 x 6		
Differential Static Press (in H2O)	T 0.52		
Differential Static Press (in Hg)		Stack Press	
Start Time	1425	Stop Time	1435

TEST NO. 2

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1A	1D	1.30	73	.790	74		
2	2	1.15	73	.810	74		
3	3	1.05	73	.820	74		
4	4	.675	73	.630	74		
5	5	.690	73	.535	74		
6	6	.880	73	.825	74		
1B	1E	1.10	73	.745	74		
2	2	1.05	73	.700	75		
3	3	.915	73	.675	75		
4	4	.560	73	.650	75		
5	5	.855	73	.730	75		
6	6	.900	73	.720	75		
1C	1F	.850	73	.720	75		
2	2	.700	73	.685	73		
3	3	.810	74	.660	74		
4	4	.670	74	.655	74		
5	5	.610	74	.650	74		
6	6	1.05	74	.765	74		
AVERAGE							

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Lehigh Valley	DATE	1-4
TEST NO.	3		
FMI Project #	345.502		
FMI Personnel	JKT/MJSW.		
Plant Location	Fan #1 (Load = 5)		
Stack ID	Jefferson		
Stack Diameter (ft)	49.5" x 67"		
Stack X-Area (ft²)	20.74		
Pitot ID #	6' effert	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.50	Amb. Temp.	64
# of Traverse Points (n)	6x6		
Differential Static Press (in H2O)	-0.320		
Differential Static Press (in Hg)		Stack Press	
Start Time	1810	Stop Time	1820

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1 F	1 C	.310	69	.620	70		Bags on @ 1810
2	2	.365	69	.715	70		
3	3	.370	69	.650	70		
4	4	.190	69	.375	70		
5	5	.130	69	.515	70		
6	6	.160	69	.625	70		Bags off @ 1918
1 E	1 B	.455	69	.625	70		
2	2	.440	69	.665	70		
3	3	.420	69	.510	70		
4	4	.425	69	.360	70		
5	5	.205	69	.470	70		
6	6	.255	69	.625	70		
1 D	1 A	.555	69	.570	70		
2	2	.565	70	.530	70		
3	3	.520	70	.755	70		
4	4	.240	70	.680	70		
5	5	.585	70	.625	70		
6	6	.550	70	.560	70		
AVERAGE							

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Cadish Mill	DATE	TEST NO. 3
FMI Project #	T95-507		
FMI Personnel	JK + MPC		
Plant Location	Tunica, MS		
Stack ID	Jackson		
Stack Diameter (ft)	4.5' x 17'		
Stack X-Area (ft²)	20.70		
Pitot ID #	6' Alberthin	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	64
# of Traverse Points (n)	6 x 2		
Differential Static Press (in H2O)	+0.340		
Differential Static Press (in Hg)		Stack Press	
Start Time	1405	Stop Time	1415

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1 A	1 D	1.05	71	515	11	
2	2	1.15	71	575	71	
3	3	1.15	71	580	71	
4	4	1.20	71	825	71	
5	5	1.15	71	565	72	
6	6	.920	71	605	72	
1 B	1 E	.905	71	070	72	
2	2	.930	71	080	72	
3	3	1.05	71	190	72	
4	4	1.25	71	120	72	
5	5	.790	71	.040	72	
6	6	.550	71	.040	72	
1 C	1 F	.545	71	.010	71	
2	2	.775	71	.005	71	
3	3	.965	71	.010	71	
4	4	1.20	71	.015	71	
5	5	.945	71	.010	71	
6	6	.665	71	.005	71	
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - |(% O2) + (% CO2) + (% CO)|
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish Malleable	DATE	11-14-95
FMI Project #	345.507		
FMI Personnel	JK + MHL		
Plant Location	Jefferson		
Stack ID	Fan 3 Lead #3		
Stack Diameter (ft)	45" X 6"		
Stack X-Area (ft²)	1320.00		
Pitot ID #	6' Effective	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	60
# of Traverse Points (n)	6 X 2		
Differential Static Press (in H2O)	+0.095		
Differential Static Press (in Hg)		Stack Press	
Start Time	1820	Stop Time	1830

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)		SQRT DELTA P (°R)	COMMENTS
1 A	1 D	1.10	72	780	72		
2	2	1.05	72	830	73		
3	3	.970	72	.740	73		
4	4	.790	72	.575	73		
5	5	.740	72	.720	73		
6	6	.705	72	.615	72		
1 B	1 E	1.15	72	.595	72		
2	2	1.10	72	.550	72		
3	3	1.05	72	.570	72		
4	4	.530	72	.505	72		
5	5	.470	72	.475	72		
6	6	.690	72	.345	72		
1 C	1 F	1.10	72	.230	72		
2	2	1.05	72	.255	72		
3	3	1.05	72	.265	73		
4	4	.570	72	.190	72		
5	5	.320	72	.250	72		
6	6	.755	72	.765	73		
AVERAGE							

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar - Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwi/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish	DATE	11-10-95
FMI Project #	95-507		
FMI Personnel	JKL / MMW		
Plant Location	Jefferson		
Stack ID	Fan #4 Inlet #2		
Stack Diameter (ft)	45.1 x 87"		
Stack X-Area (ft²)	20.64		
Pitot ID #	6 effective	Pitot Cp	0.84
Pre-Pitot Leak Check	OK	Post-Pitot Leak Check	OK
Bar Press (in Hg)	30.50	Amb. Temp.	69
# of Traverse Points (n)	6 x 2		
Differential Static Press (in H2O)	+0.045		
Differential Static Press (in Hg)		Stack Press	
Start Time	1850	Stop Time	1900

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1 A	1 D	1.05	72	.8515	72	
2	2	1.10	72	.8551	72	
3	3	1.05	72	.8501	72	
4	4	1.00	72	.8420	72	
5	5	.590	72	.7110	72	
6	6	.685	72	.7951	73	
1 B	1 E	.940	72	.8201	72	
2	2	1.05	72	.8565	72	
3	3	1.15	72	.8701	72	
4	4	1.05	72	.8551	72	
5	5	.795	72	.7601	72	
6	6	.550	72	.7201	73	
1 C	1 F	1.15	72	.8701	72	
2	2	1.10	72	.8557	72	
3	3	1.10	72	.8701	72	
4	4	1.10	72	.8151	72	
5	5	.825	72	.8201	72	
6	6	.545	72	.7401	72	
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar – Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) – (% CO2) – (% CO)]
Md = [0.44 * (% CO2)] – [0.32 * (% O2)] – [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) – 18 * Bwo
Bwo = Vwl/(Vm – Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts – 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish Malleable	DATE	6-14-95
FMI Project #	J95507	TEST NO.	3
FMI Personnel	JK / MBW		
Plant Location	Jefferson		
Stack ID	Fan #5 (exh #1)		
Stack Diameter (ft)	45" x 6.7"		
Stack X-Area (ft²)	20.94		
Pitot ID #	6' Extended	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	67
# of Traverse Points (n)	6 x 6		
Differential Static Press (in H2O)	+0.355		
Differential Static Press (in Hg)		Stack Press	
Start Time	1535	Stop Time	1845

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)		SQRT DELTA P (°R)	COMMENTS
1	A	1 D	.865	70	.565	71	
2		2	.795	71	.505	71	
3		3	.740	71	.525	71	
4		4	.560	71	.485	71	
5		5	.510	71	.725	72	
6		6	.560	71	.605	72	
1	B	1 E	.710	71	.305	71	
2		2	.685	71	.350	71	
3		3	.550	71	.345	71	
4		4	.410	71	.325	71	
5		5	.540	71	.140	72	
6		6	.705	71	.310	72	
1	C	1 F	.615	71	.145	72	
2		2	.675	71	.155	72	
3		3	.605	71	.125	72	
4		4	.445	71	.105	72	
5		5	.395	71	.110	72	
6		6	.755	71	.215	72	
AVERAGE							

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT		DATE 11-14-95	TEST NO. 4
FMI Project #	195.502		
FMI Personnel	JK/AEW		
Plant Location	Jefferson		
Stack ID	Fan #1 Cell #3		
Stack Diameter (ft)	45" x 27"		
Stack X-Area (ft²)	20.44		
Pitot ID #	16 effective	Pitot Cp	0.84
Pre-Pitot Leak Check	OK	Post-Pitot Leak Check	OK
Bar Press (in Hg)	30.30	Amb. Temp.	64
# of Traverse Points (n)	6 x 6		
Differential Static Press (in H2O)	TO.155		
Differential Static Press (in Hg)		Stack Press	
Start Time	2205	Stop Time	2215

Stack Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1	A 1 C	.155	74	73		
2	2	.135	74	73		
3	3	.120	74	73		
4	4	.110	74	73		
5	5	.100	74	73		
6	6	.090	74	73		
1	B 1 E	.105	73	72		
2	2	.110	73	72		
3	3	.105	73	73		
4	4	.085	73	73		
5	5	.075	73	73		
6	6	.070	73	73		
1	C 1 A	.100	73	73		
2	2	.110	73	73		
3	3	.110	74	73		
4	4	.085	74	73		
5	5	.085	74	73		
6	6	.080	74	73		
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwi/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Ludlow Wallcovering	DATE	11-14-95
FMI Project #	395.502	TEST NO.	4
FMI Personnel	TIC + Tim Bell		
Plant Location	Jefferson, IN		
Stack ID	Lam #2 (Lam #4)		
Stack Diameter (ft)	4'7" x 6'7"		
Stack X-Area (ft²)	24.94		
Pitot ID #	6' effective	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	60
# of Traverse Points (n)	6 x 2		
Differential Static Press (in H2O)	+0.20		
Differential Static Press (in Hg)		Stack Press	2115
Start Time	2105	Stop Time	2115

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)		(°R)	SQRT DELTA P	COMMENTS
1 A	1 D	0.005	72	0.130	73		Bags on @ 2105
2	2	0.010	72	.160	73		
3	3	0.010	72	.165	73		
4	4	0.005	72	.180	73		
5	5	0.010	72	.155	73		
6	6	0.015	72	.125	73		
1 B	1 E	0.005	71	.165	73		
2	2	0.005	71	.180	73		
3	3	0.010	72	.200	73		
4	4	0.015	72	.165	73		
5	5	0.020	72	.130	73		
6	6	0.005	72	.115	73		Bags off @ 2205
1 C	1 F	0.020	72	.165	73		
2	2	0.025	71	.185	73		
3	3	0.025	71	.200	73		
4	4	0.050	72	.185	73		
5	5	0.060	72	.180	73		
6	6	0.050	73	.175	73		
AVERAGE							

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar - Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) - (% CO2) - (% CO)]
Md = [0.44 * (% CO2)] - [0.32 * (% O2)] - [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) - 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts - 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish Malleable	DATE	11-14-95
FMI Project #	195.502		TEST NO. 4
FMI Personnel	JK / MDL		
Plant Location	Cudahy		
Stack ID	Fan E 3 (of 3)		
Stack Diameter (ft)	45" x 67"		
Stack X-Area (ft²)	20.94		
Pitot ID #	L electric	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.20	Amb. Temp.	64
# of Traverse Points (n)	6 x 6 = 12		
Differential Static Press (in H2O)	0.125		
Differential Static Press (in Hg)		Stack Press	
Start Time	1750	Stop Time	2200

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1 A	1 R	.160	72	72		
2	2	.155	72	72		
3	3	.165	73	73		
4	4	.115	73	73		
5	5	.120	73	73		
6	6	.115	73	73		
1 B	1 B	.100	71	64		
2	2	.165	72	70		
3	3	.170	73	71		
4	4	.105	73	72		
5	5	.095	73	73		
6	6	.110	73	73		
1 C	1 A	.105	72	73		
2	2	.155	72	73		
3	3	.150	73	73		
4	4	.115	73	73		
5	5	.090	73	73		
6	6	.105	73	73		
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwi/(Vm + Vmc)
Vm(std) = [7.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish Malleable	DATE	11-14-95
FMI Project #	J95.502	TEST NO.	1
FMI Personnel	JK + Mush		
Plant Location	Jackson, MI		
Stack ID	Can #4 (Lad #2)		
Stack Diameter (ft)	45" x 61"		
Stack X-Area (ft²)	20.74		
Pitot ID #	6 effective	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.50	Amb. Temp.	84
# of Traverse Points (n)	6 x 6		
Differential Static Press (in H2O)	+0.05		
Differential Static Press (in Hg)		Stack Press	
Start Time	2120	Stop Time	2130

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1 F	1 C	.005	66	74		
2	2	.005	67	75		
3	3	.005	69	75		
4	4	.005	70	75		
5	5	.005	71	76		
6	6	.005	73	76		
1 E	1 B	.055	74	74		
2	2	.070	75	75		
3	3	.085	75	75		
4	4	.090	76	76		
5	5	.090	76	76		
6	6	.060	76	76		
1 D	1 A	.105	74	75		
2	2	.120	75	75		
3	3	.130	75	75		
4	4	.145	76	75		
5	5	.125	76	75		
6	6	.065	76	75		
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

NEWVELOCITY.WK4

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish Malleable	DATE	11-14-95
FMI Project #	395.502	TEST NO.	1
FMI Personnel	TIGA / MIKE		
Plant Location	Jefferson		
Stack ID	Fan #5 (Last 1)		
Stack Diameter (ft)	45" x 67"		
Stack X-Area (ft²)	20.70		
Pitot ID #	16' effective	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	60
# of Traverse Points (n)	6 x 6		
Differential Static Press (in H2O)	TO.16C		
Differential Static Press (in Hg)		Stack Press	
Start Time	2135	Stop Time	2145

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1	C	.030	73	.050	73	
2	2	.040	73	.050	73	
3	3	.035	76	.055	75	
4	4	.035	75	.050	75	
5	5	.040	75	.050	75	
6	6	.035	75	.055	75	
1	B	.050	76	.055	75	
2	2	.055	75	.060	73	
3	3	.050	75	.060	74	
4	4	.045	75	.055	74	
5	5	.050	75	.050	75	
6	6	.070	75	.075	75	
1	A	.060	74	.120	74	
2	2	.060	74	.130	75	
3	3	.065	75	.130	75	
4	4	.060	75	.120	75	
5	5	.070	75	.105	75	
6	6	.055	75	.070	75	
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish Holding	DATE	11-9-05
FMI Project #	05-522		
FMI Personnel	JK / MSW		
Plant Location	Jefferson, WI		
Stack ID	Can #1 (Last)		
Stack Diameter (ft)	45" x 67		
Stack X-Area (ft²)	9.90		
Pitot ID #	6 effective	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	64
# of Traverse Points (n)	12		
Differential Static Press (in H2O)	-0.15		
Differential Static Press (in Hg)		Stack Press	
Start Time	1305	Stop Time	2315

Stack / Port Drawing

TRAVERSE Point #			DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1	E	1 C	0.160	74	135	73	Bags on @ 1105
2		3	0.165	74	165	73	
3		5	.170	74	140	74	
4		6	.055	74	115	74	
5		5	.050	74	120	74	
6		6	.055	74	115	74	
1	E	1 B	.075	73	153	73	
2		2	.080	73	160	74	
3		3	.085	73	140	74	
4		4	.095	73	115	74	
5		5	.075	74	105	74	
6		6	.055	74	095	74	
1	D	1 A	.110	73	135	73	
2		2	.115	73	140	74	
3		3	.120	73	175	74	
4		4	.080	73	160	74	
5		5	.105	74	125	74	
6		6	.125	74	110	74	
							Bags off @ 1205
AVERAGE							

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwi/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

NEWVELOCITY.WK4

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VELOCITY TRAVERSE DATA SHEET

CLIENT		DATE 11-14-95	TEST NO. 5
FMI Project #	95.502		
FMI Personnel			
Plant Location			
Stack ID			
Stack Diameter (ft)	6.5' x 6'		
Stack X-Area (ft²)	30.94		
Pitot ID #		Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.35	Amb. Temp.	60
# of Traverse Points (n)	6 x 6		
Differential Static Press (in H2O)	+0.15		
Differential Static Press (in Hg)		Stack Press	
Start Time	2355	Stop Time	0005

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1 E	1 C	.250	74	.085	73		
2	2	.275	75	.070	73		
3	3	.255	75	.025	74		
4	4	.250	75	.050	74		
5	5	.265	75	.060	74		
6	6	.250	75	.025	74		
1 E	1 B	.245	74	.000	73		
2	2	.270	75	.045	73		
3	3	.255	75	.010	73		
4	4	.255	75	.020	74		
5	5	.185	75	.015	74		
6	6	.160	75	.010	74		
1 D	1 A	.185	74	.005	72		
2	2	.225	73	.005	72		
3	3	.255	74	.010	73		
4	4	.250	75	.010	73		
5	5	.225	75	.005	74		
6	6	.180	75	.015	74		
AVERAGE							

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar − Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) − (% CO2) − (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwl/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm* Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts − 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

MSWVELOCITY.WK4

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VELOCITY TRAVERSE DATA SHEET

CLIENT	Cargill Hastings	DATE	11-14-95
FMI Project #	195.502	TEST NO.	5
FMI Personnel	JR + Mark		
Plant Location	Hastings, NE		
Stack ID	Fan 3 (Fan #3)		
Stack Diameter (ft)	45" x 6'		
Stack X-Area (ft²)	20.76		
Pitot ID #	6' EPT	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	64
# of Traverse Points (n)	12 x 6		
Differential Static Press (in H2O)	+0.165		
Differential Static Press (in Hg)		Stack Press	
Start Time	2320	Stop Time	2330

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1 E	1 C	.065	69	.25	73		
2	2	.085	72	.295	76		
3	3	.095	72	.300	76		
4	4	.060	73	.255	76		
5	5	.045	73	.215	76		
6	6	.035	73	.195	76		
1 E	1 B	.070	70	.270	76		
2	2	.095	72	.320	76		
3	3	.105	72	.325	76		
4	4	.105	72	.325	76		
5	5	.090	72	.305	76		
6	6	.080	70	.285	76		
1 D	1 A	.165	76	.355	76		
2	2	.170	76	.360	76		
3	3	.140	76	.325	76		
4	4	.090	76	.265	76		
5	5	.065	76	.225	76		
6	6	.115	76	.295	76		
AVERAGE							

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwi/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

Fluid Management, Inc.

Air Sciences & Engineering Group

VELOCITY TRAVERSE DATA SHEET

CLIENT	[illegible]	DATE	11-4-95
FMI Project #	193-591	TEST NO.	5
FMI Personnel	[illegible]		
Plant Location	Jefferson [illegible]		
Stack ID	[illegible]		
Stack Diameter (ft)	45.67 [illegible]		
Stack X-Area (ft²)	[illegible]		
Pitot ID #	[illegible]	Pitot Cp	0.84
Pre-Pitot Leak Check	ok	Post-Pitot Leak Check	ok
Bar Press (in Hg)	30.30	Amb. Temp.	64
# of Traverse Points (n)	6x6		
Differential Static Press (in H2O)	+0.185		
Differential Static Press (in Hg)	—	Stack Press	
Start Time	2545	Stop Time	2355

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)		STACK TEMPERATURE (°F)		(°R)	SQRT DELTA P	COMMENTS
1 A	1 D	.225	76	.145	75			
2	2	.230	76	.165	76			
3	3	.240	76	.195	76			
4	4	.235	76	.200	76			
5	5	.155	76	.160	76			
6	6	.180	76	.055	76			
1 B	1 E	.210	75	.075	74			
2	2	.222	76	.095	74			
3	3	.230	76	.115	75			
4	4	.240	76	.175	76			
5	5	.180	76	.120	76			
6	6	.125	76	.070	76			
1 C	1 F	.215	75	.005	69			
2	2	.235	76	.010	70			
3	3	.240	76	.005	71			
4	4	.260	76	.005	73			
5	5	.265	76	.005	73			
6	6	.165	76	.010	74			
AVERAGE								

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwi/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 63.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

MBWVELOCITY.WK4

Fluid Management, Inc.

Air Sciences & Engineering Group

VELOCITY TRAVERSE DATA SHEET

CLIENT	Ladish Malleable	DATE	11/4/95
FMI Project #	95-505	TEST NO.	5
FMI Personnel	MC + MaRW		
Plant Location	Jefferson, WI		
Stack ID	Lime Kiln #1		
Stack Diameter (ft)	4.5' x 6'		
Stack X-Area (ft²)	20.94		
Pitot ID #	6' effective	Pitot Cp	0.84
Pre-Pitot Leak Check	OK	Post-Pitot Leak Check	OK
Bar Press (in Hg)	30.30	Amb. Temp.	60
# of Traverse Points (n)	12		
Differential Static Press (in H2O)	+0.15C		
Differential Static Press (in Hg)		Stack Press	
Start Time	1358	Stop Time	2345

Stack / Port Drawing

TRAVERSE Point #		DELTA P (in H2O)	STACK TEMPERATURE (°F)	(°R)	SQRT DELTA P	COMMENTS
1 F	1 C	.105	74	115	76	
2	2	.095	75	111	77	
3	3	.050	75	115	77	
4	4	.065	76	105	77	
5	5	.050	76	116	77	
6	6	.040	76	110	77	
1 E	1 B	.085	75	155	76	
2	2	.070	75	145	76	
3	3	.060	75	155	76	
4	4	.060	76	110	76	
5	5	.060	76	100	77	
6	6	.085	76	110	77	
1 D	1 A	.085	75	105	77	
2	2	.085	75	150	77	
3	3	.080	76	165	77	
4	4	.080	76	145	77	
5	5	.085	77	125	77	
6	6	.120	77	115	77	
AVERAGE						

CO2 (%)	Molecular Weight - Md
O2 (%)	Velocity - Vs (ft/min)
N2 (%)	Flow Rate - Q (scfm)

EQUATIONS:

Ps = Pbar + Pstatic/(13.6 in. H2O/in. Hg)
%N2 = 100 - [(% O2) + (% CO2) + (% CO)]
Md = [0.44 * (% CO2)] + [0.32 * (% O2)] + [0.28 * ((% N2)+(% CO))]
Ms = Md * (1-Bwo) + 18 * Bwo
Bwo = Vwi/(Vm + Vmc)
Vm(std) = 17.467 * [(Vm * Pm)/Tm]
Vs = 85.49 * (Cp) * (AVG(SQRT dP) * SQRT[Ts/(Ps * Ms)]
Qs = 60.529 * Vs * As * (1-Bwo) * (Ps/Ts)
Cp = 2.205^-6 lb/mg * (Mp/Vm(std))
ERp = Qs * Cp
% ISO = 100 * (0.09457* (Ts + 460) * Vm(std) / ((Ps) * vs * ((0.5 * Dn)^2 * 3.141716 / 144) * theta * (1 - Bwo / 100)))

Date:
Client:
Site Location: Jefferson
Port Location:
Port Direction: Fan 1 (East)
Project No.: Rem
Test Crew:
Run No.:
Control Box No.:
Delta H@:
Meter Correction (Yd):

Fluid Management, Inc.
Air Sciences & Engineering Group
STACK SAMPLING DATA SHEET

Barometric Press: 30.30
Static Press, Ps: +0.175
Ambient Temp:

Assumed Moisture:
Calculator Multiplier, or "K" Factor:

Start Time: 0205
Stop Time: 0215
Sample Box No.:
Probe No.: 11-15-95
Filter No.:
Filter Type:
Stack Diameter: 45" x 67"
Umbilical Length:
Stack Area: ft² 20.94
Nozzle Dia:
Pilot Correction: 0.84

Point	Time	Meter Reading (dry) (ft³)	Velocity Head Delta P (in. H2O)	Square Root Delta P	Orifice (in. H2O) Required	Delta H (in. H2O) Actual	Meter Vacuum Vm (in. Hg)	Stack Temp. Ts (°F)	Probe Temp. Tp (°F)	Oven Temp. To (°F)	Imp. To (°F) Out	Temp. Ti (°F) In	Meter Tmo (°F) Out	Temp. Tmi (°F) In	Comments
	0	ΔP	ΔP	ΔP	Top										
1-E	1-C	.060	74	.135	73										
2	2	.065	74	.145	73										
3	3	.070	74	.140	74										
4	4	.055	74	.115	74										
5	5	.050	74	.110	74										
6	6	.035	74	.155	73										
1-E	1-B	.075	73	.160	74										
2	2	.080	73	.140	74										
3	3	.085	73	.115	74										
4	4	.095	73	.105	74										
5	5	.075	74	.095	74										
6	6	.055	74	.145	73										
1-D	1-A	.110	73	.150	74										
2	2	.115	73	.135	74										
3	3	.120	74	.175	74										
4	4	.080	74	.190	74										
5	5	.105	74	.125	74										
6	6	.125	74	.110	74										

Sample Train Leak Check

	In Hg	Rate
Before		
After		

Pitot Leak Check

Red X		
Black X		

Gas Analysis

	1	2	3	Average
O2				
CO2				
CO				
N2				

Moisture Analysis

Impinger No.	Grams Final	Grams Initial	Difference
1			
2			
3			
4		Total	

Date:
Client:
Site Location:
Port Location: Fan 2 Cell #4
Port Direction:
Project No.: Run 6
Test Crew:
Run No.:
Control Box No.:
Delta H@:
Meter Correction (Yd):

Fluid Management, Inc.
Air Sciences & Engineering Group
STACK SAMPLING DATA SHEET

Barometric Press: 30.30
Static Press, Ps: -0.320
Ambient Temp: 64

Assumed Moisture:
Calculator Multiplier, or "K" Factor:

Start Time: 0110
Stop Time: 0120
Sample Box No.:
Probe No.: 11-5=95
Filter No.:
Filter Type:
Stack Diameter: 45" x 67"
Umbilical Length:
Stack Area: ft² 20.84
Nozzle Dia:
Pitot Correction: 0.84

Point	Time	Meter Reading [dry] ΔVp	Velocity Head Delta P (in. H2O)	Square Root Delta P ΔP	Orifice (in. H2O) Required	Delta H (in. H2O) Actual	Meter Vacuum Vm (in. Hg)	Stack Temp. Ts (°F)	Probe Temp. Tp (°F)	Oven Temp. To (°F)	Imp. To (°F) Out	Temp. Ti (°F) In	Meter Tmo (°F) Out	Temp. Tmi (°F) In	Comments
0	0														Bags on 0100
1 F	1 C	.005	77	.38	77										
2	2	.005	78	.185	78										
3	3	.005	78	.535	78										
4	4	.005	78	.575	78										
5	5	.005	78	.475	78										
6	6	.005	78	.370	78										
1 E	1 B	.010	78	.530	78										
2	2	.005	78	.585	78										Bags off 0200
3	3	.015	78	.620	78										
4	4	.020	78	.560	78										
5	5	.020	78	.405	78										
6 D	1 K	.005	78	.315	78										
1	2	.115	78	.435	78										
2	3	.145	78	.545	78										
3	4	.175	78	.545	77										
4	5	.185	78	.585	77										
5	6	.185	78	.545	77										
6		.1075	78	.495	77										

Sample Train Leak Check

	in Hg	Rate
Before		
After		

Pitot Leak Check

Red X	ok	ok
Black X	ok	ok

Gas Analysis

	1	2	3	Average
O2				
CO2				
CO				
N2				

Moisture Analysis

Impinger No.	Grams Final	Grams Initial	Difference
1			
2			
3			
4			
		Total	

Fluid Management, Inc.
Air Sciences & Engineering Group

STACK SAMPLING DATA SHEET

Date:
Client:
Site Location:
Port Location:
Port Direction: Fan 3 (Lad 3)
Project No.:
Test Crew:
Run No.: Run 6
Control Box No.:
Delta H@:
Meter Correction (Yd):

Barometric Press: 30.30
Static Press, Ps: +0.095
Ambient Temp: 64

Assumed Moisture:
Calculator Multiplier, or "K" Factor:

Start Time: 0148
Stop Time: 0155
Sample Box No.: 5
Probe No.: 11
Filter No.:
Filter Type:
Stack Diameter: 95"x67"
Umbilical Length:
Stack Area: ft² 20.94
Nozzle Dia:
Pitot Correction: 0.84

Point	Time	Meter Reading (dcy) (ft³)	Velocity Head Delta P (in. H2O)	Square Root Delta P	Orifice (in. H2O) Required	Delta H (in. H2O) Actual	Meter Vacuum Vm (in. Hg)	Stack Temp. Ts (°F)	Probe Temp. Tp (°F)	Oven Temp. To (°F)	Imp. To (°F) Out	Temp. Ti (°F) In	Meter Tmo (°F) Out	Temp. Tmi (°F) In	Comments
	0		ΔP		ΔH										
1 A	1 D	.985	.72	.805	71										
2	2	.910	.73	.760	71										
3	3	.830	.73	.675	71										
4	4	.770	.73	.550	71										
5	5	.715	.73	.230	71										
6	6	.635	.73	.415	71										
1 B	1 E	.925	.72	.580	71										
2	2	.910	.72	.615	71										
3	3	.825	.72	.195	71										
4	4	.375	.72	.270	71										
5	5	.135	.72	.180	71										
6	6	.590	.73	.150	71										
1 C	1 F	.885	.72	.305	70										
2	2	.870	.72	.325	70										
3	3	.851	.72	.285	70										
4	4	.435	.72	.195	70										
5	5	.795	.72	.235	70										
6	6	.710	.72	.325	70										

Sample Train Leak Check

	In Hg	Rate
Before		
After		

Pitot Leak Check

Red X
Black X

Gas Analysis

	1	2	3	Average
O2				
CO2				
CO				
N2				

Moisture Analysis

Impinger No.	Grams Final	Grams Initial	Difference
1			
2			
3			
4			
		Total	

Date:
Client:
Site Location:
Port Location: Fan 4 (Lead 2)
Port Direction:
Project No.: Run 6
Test Crew:
Run No.:
Control Box No.:
Delta H@:
Meter Correction (Yd):

Fluid Management, Inc.
Air Sciences & Engineering Group
STACK SAMPLING DATA SHEET

Barometric Press: 30.30
Static Press, Ps: -0.145
Ambient Temp: 64

Assumed Moisture:
Calculator Multiplier, or "K" Factor:

Start Time: 0125
Stop Time: 0135
Sample Box No.:
Probe No.: 11755
Filter No.:
Filter Type:
Stack Diameter: 45"x67
Umbilical Length:
Stack Area: ft² 20.94
Nozzle Dia:
Pitot Correction: 0.84

Point	Time	Meter Reading (dry) (ft³)	Velocity Head Delta P (in. H2O)	Square Root Delta P	Orifice (in. H2O) Required	Delta H (in. H2O) Actual	Meter Vacuum Vm (in. Hg)	Stack Temp. Ts (°F)	Probe Temp. Tp (°F)	Oven Temp. To (°F)	Imp. To (°F) Out	Temp. Ti (°F) In	Meter Tmo (°F) Out	Temp. Tmi (°F) In	Comments
	0	0	14	ΔP	14										
1 E	1 C	.005	73	.490	77										
2	2	.005	75	.515	78										
3	3	.005	76	.525	78										
4	4	.005	77	.540	78										
5	5	.005	77	.555	78										
6	6	.010	77	.535	78										
1 E	1 B	.185	76	.435	78										
2	2	.205	77	.475	78										
3	3	.255	78	.505	78										
4	4	.270	78	.515	78										
5	5	.255	78	.505	78										
6	6	.195	78	.485	78										
1 D	1 A	.335	78	.495	78										
2	2	.350	78	.490	78										
3	3	.395	78	.505	78										
4	4	.415	78	.445	78										
5	5	.325	78	.410	78										
6	6	.195	78	.385	78										

Sample Train Leak Check

	In Hg	Rate
Before		
After		

Pitot Leak Check

Red X		
Black X		

Gas Analysis

	1	2	3	Average
O2				
CO2				
CO				
N2				

Moisture Analysis

Impinger No.	Grams Final	Grams Initial	Difference
1			
2			
3			
4		Total	

Date:
Client:
Site Location:
Port Location:
Port Direction:
Project No.: Fan 5 (Lvl 1)
Test Crew:
Run No.: Run 6
Control Box No.:
Delta H@:
Meter Correction (Yd):

Fluid Management, Inc.
Air Sciences & Engineering Group

STACK SAMPLING DATA SHEET

Barometric Press: 30.30
Static Press, Ps: +0.210
Ambient Temp:

Assumed Moisture:
Calculator Multiplier, or "K" Factor:

Start Time: 0135
Stop Time: 0145
Sample Box No.:
Probe No.: 11-15
Filter No.:
Filter Type:
Stack Diameter: 45"x67"
Umbilical Length:
Stack Area: ft² 20.94
Nozzle Dia:
Pilot Correction: 0.84

Point	Time	Meter Reading (dry) (ft³)	Velocity Head Delta P (in. H2O)	Square Root Delta P	Orifice (in. H2O) Required	Delta H (in. H2O) Actual	Meter Vacuum Vm (in. Hg)	Stack Temp. Ts (°F)	Probe Temp. Tp (°F)	Oven Temp. To (°F)	Imp. To (°F) Out	Temp. Ti (°F) In	Meter Tmo (°F) Out	Temp. Tmi (°F) In	Comments
	0	0	.74	Δp	.74										
1 A	1 D	.375	.75	.225	73										
2	2	.385	.75	.245	73										
3	3	.395	.75	.195	73										
4	4	.295	.75	.180	73										
5	5	.280	.75	.175	73										
6	6	.295	.75	.210	74										
1 B	1 E	.345	.74	.145	72										
2	2	.340	.74	.135	72										
3	3	.280	.74	.145	72										
4	4	.225	.74	.120	72										
5	5	.230	.74	.090	73										
6	6	.290	.74	.270	73										
1 C	1 F	.265	.72	.065	72										
2	2	.270	.72	.076	72										
3	3	.255	.73	.070	72										
4	4	.205	.73	.065	72										
5	5	.275	.73	.065	72										
6	6	.345	.73	.070	72										

Sample Train Leak Check

	In Hg	Rate
Before		
After		

Pitot Leak Check

Red X		
Black X		

Gas Analysis

	1	2	3	Average
O2				
CO2				
CO				
N2				

Moisture Analysis

Impinger No.	Grams Final	Grams Initial	Difference
1			
2			
3			
4			
		Total	

APPENDIX C

Sample Chromatograms

Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 00:16:19
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F4R12.CHR (c:\peakwin)
Sample: Fan #4 Run #1
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

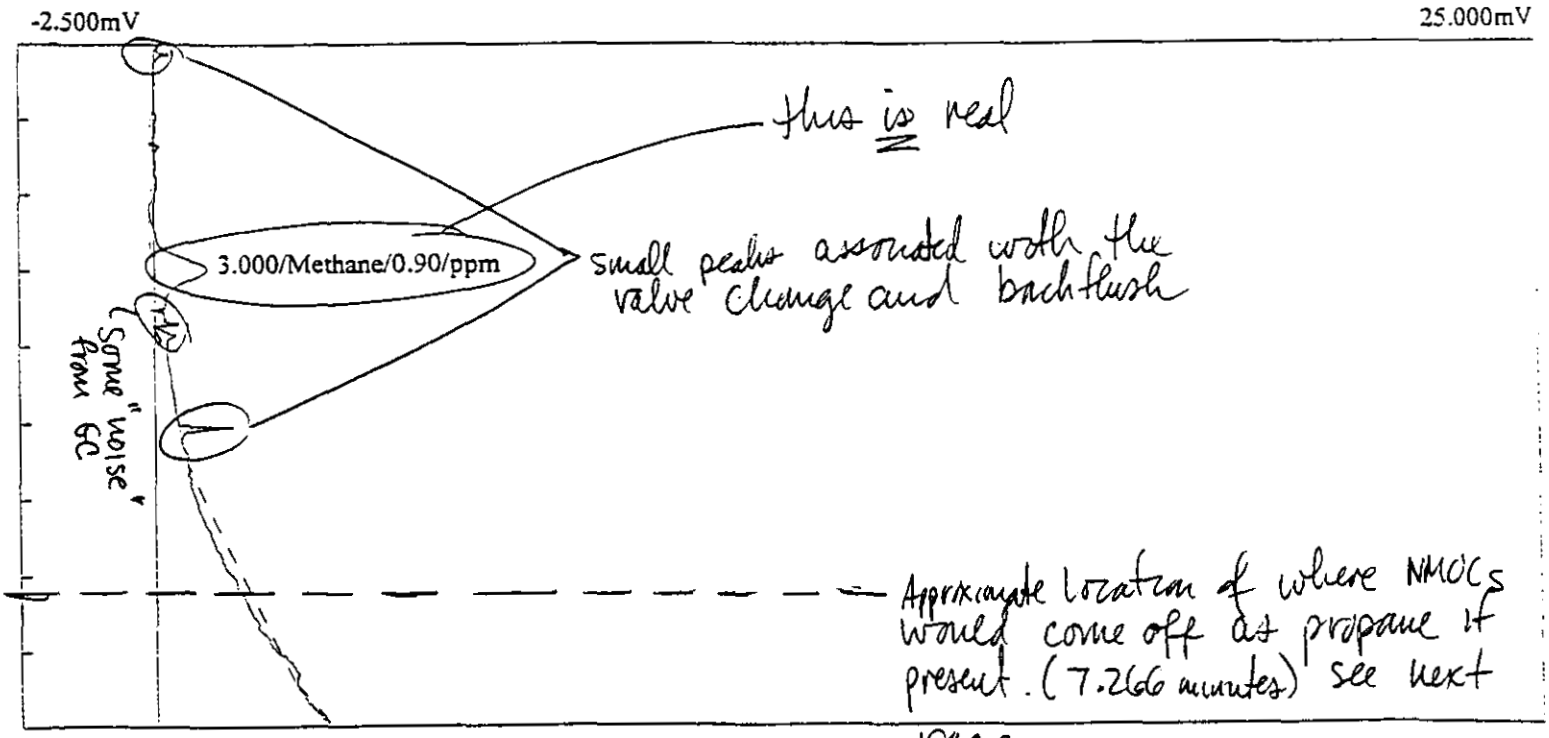
DRAFT

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	28.826	0.90	ppm

29 1

Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 17:57:20
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: C3H83.CHR (c:\peakwin)
Sample: C3H8 std
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

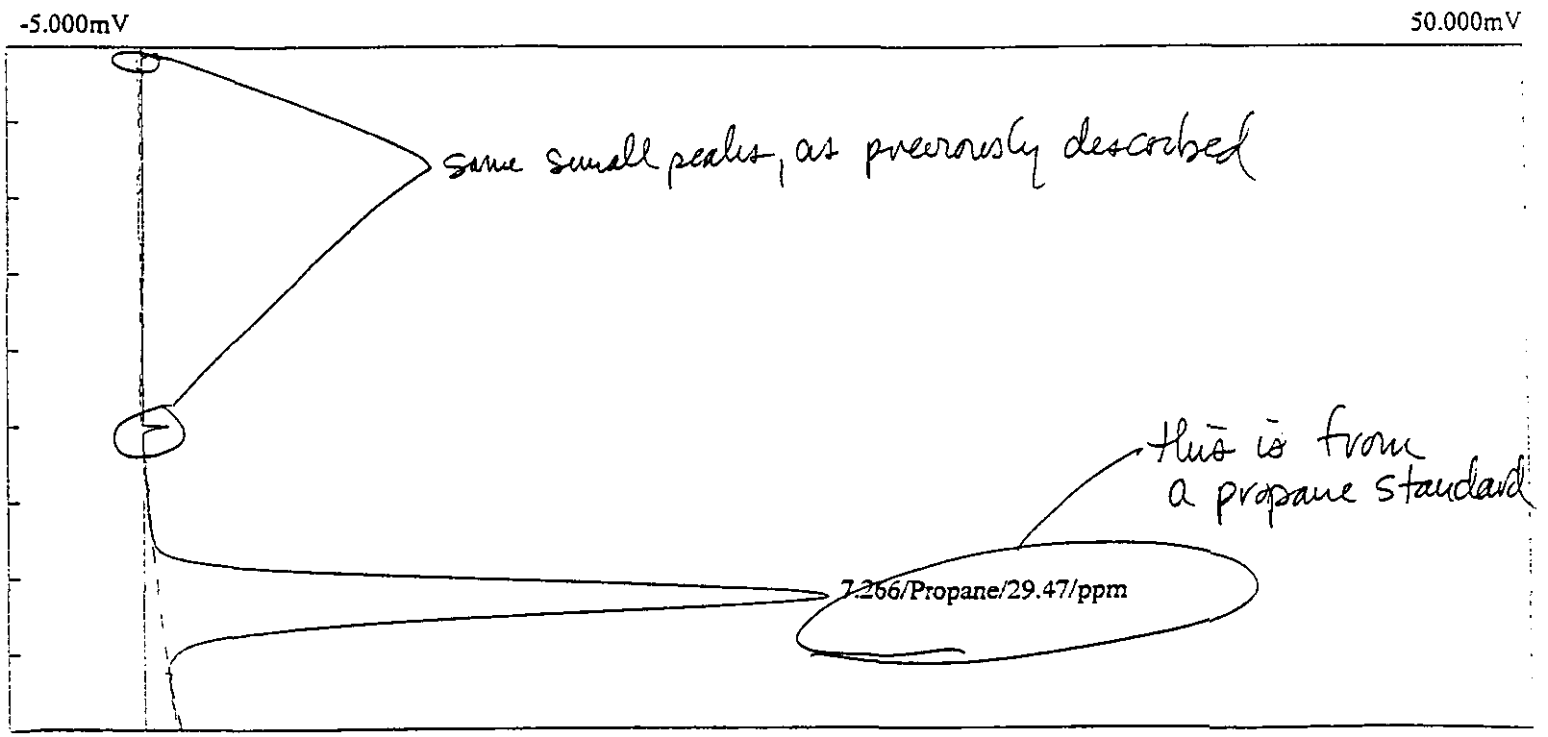
DRAFT

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Propane	7.266	774.786	29.47	ppm
		775	29	

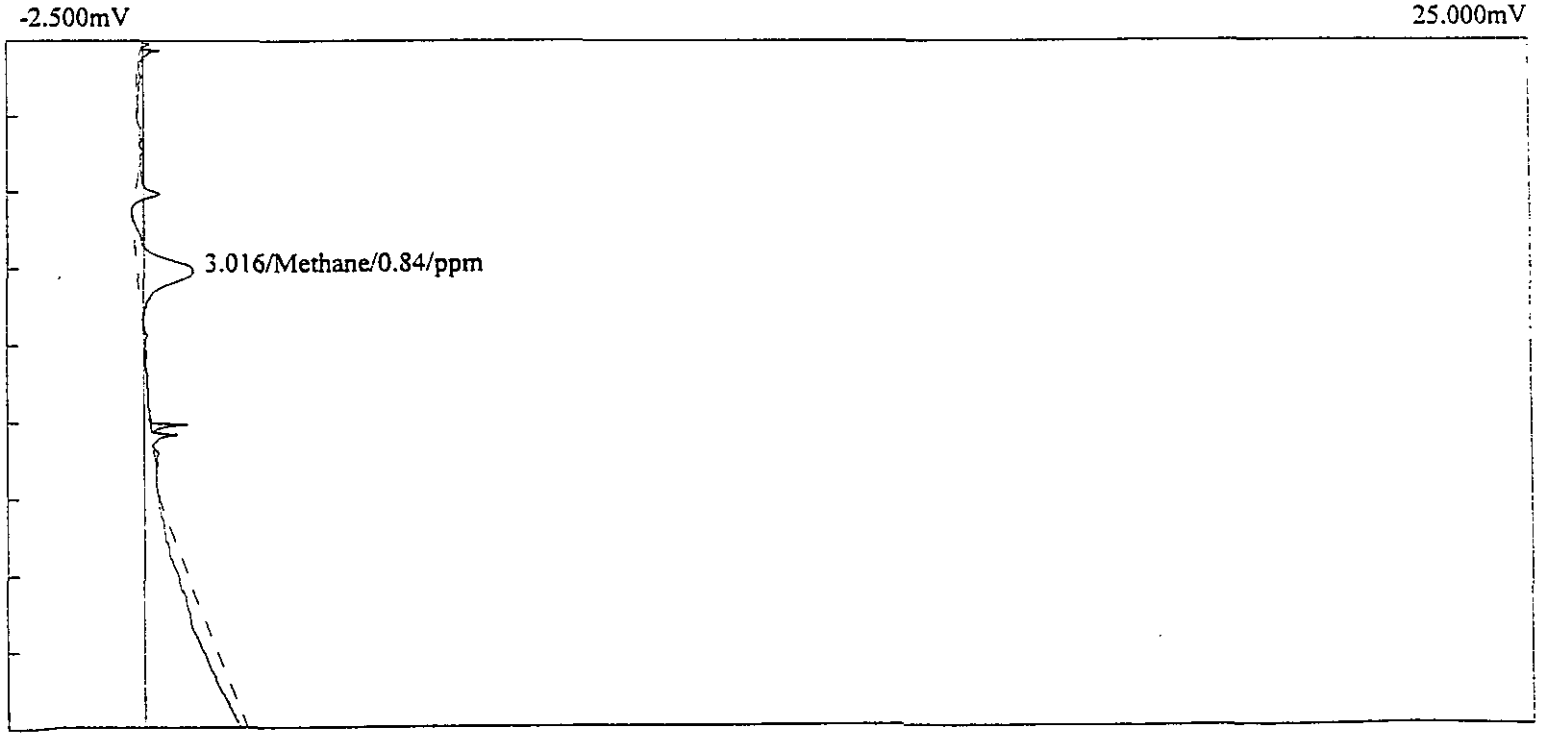
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 16:12:50
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F1R25.CHR (c:\peakwin)
Sample: Fan #1 Run 2
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.016	26.644	0.84	ppm
		27	1	

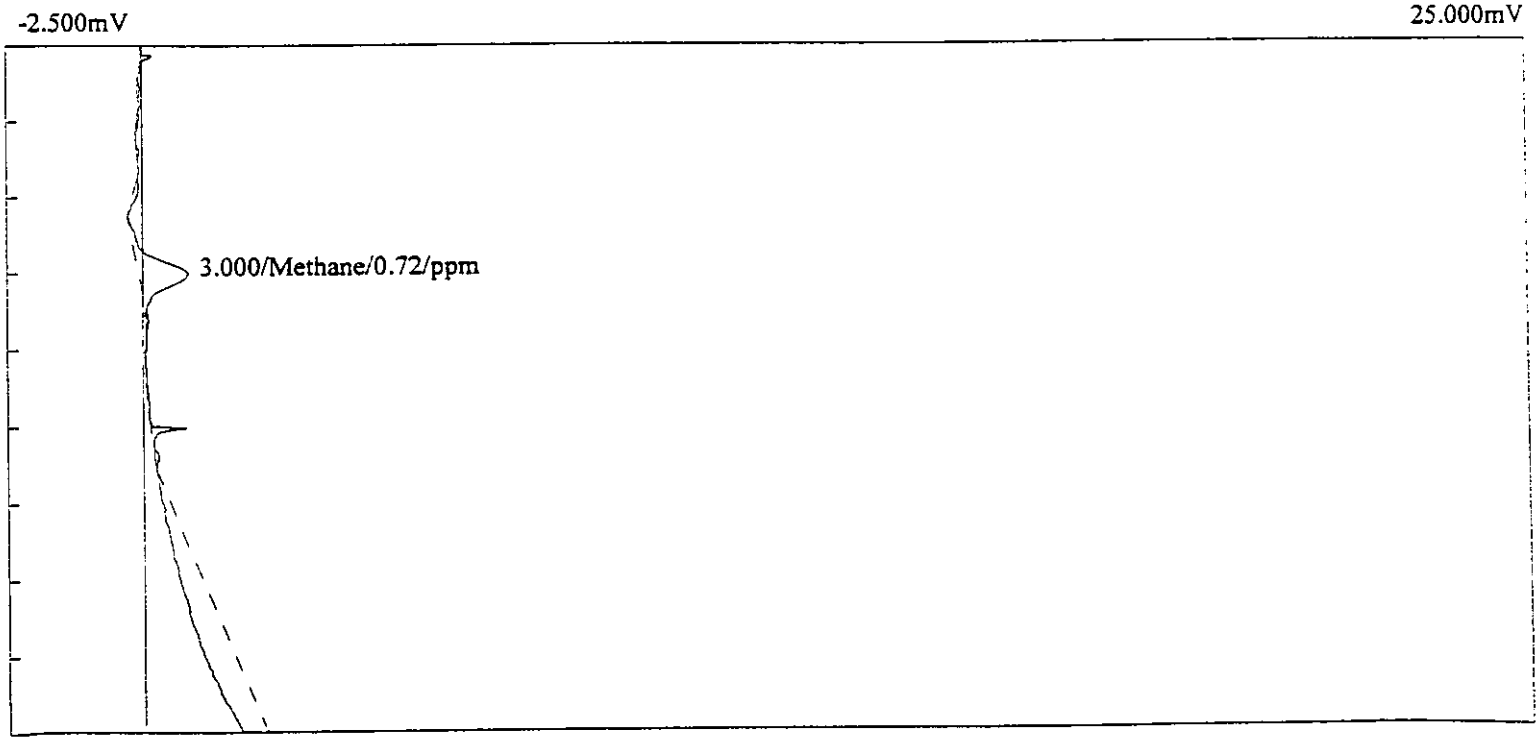
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 20:44:04
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F1R32.CHR (c:\peakwin)
Sample: Fan #1 Run #3
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	22.854	0.72	ppm

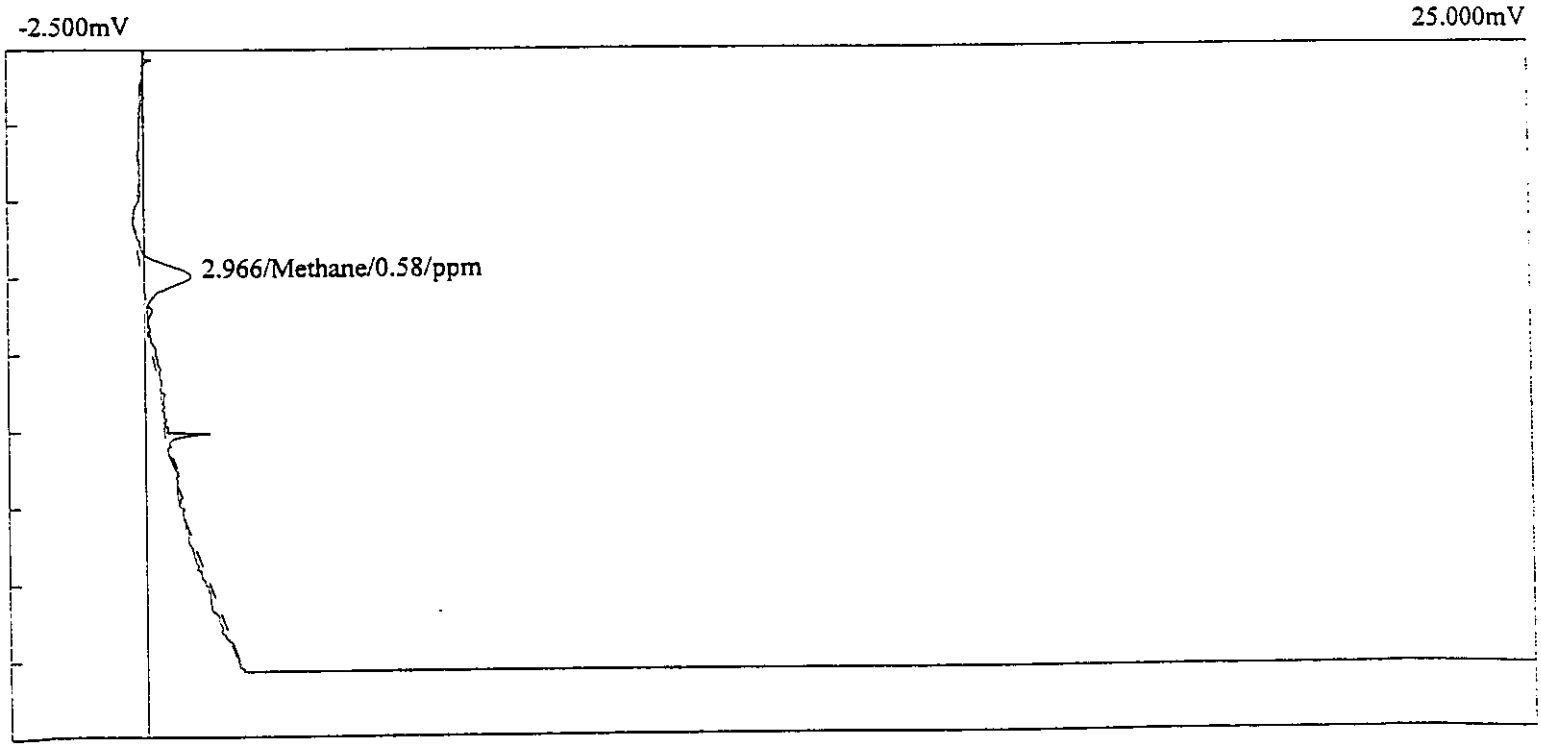
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 00:43:46
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F1R42.CHR (c:\peakwin)
Sample: Fan #1 Run #4
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

	PeakName	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.966	18.500	0.58	ppm
		18	1	

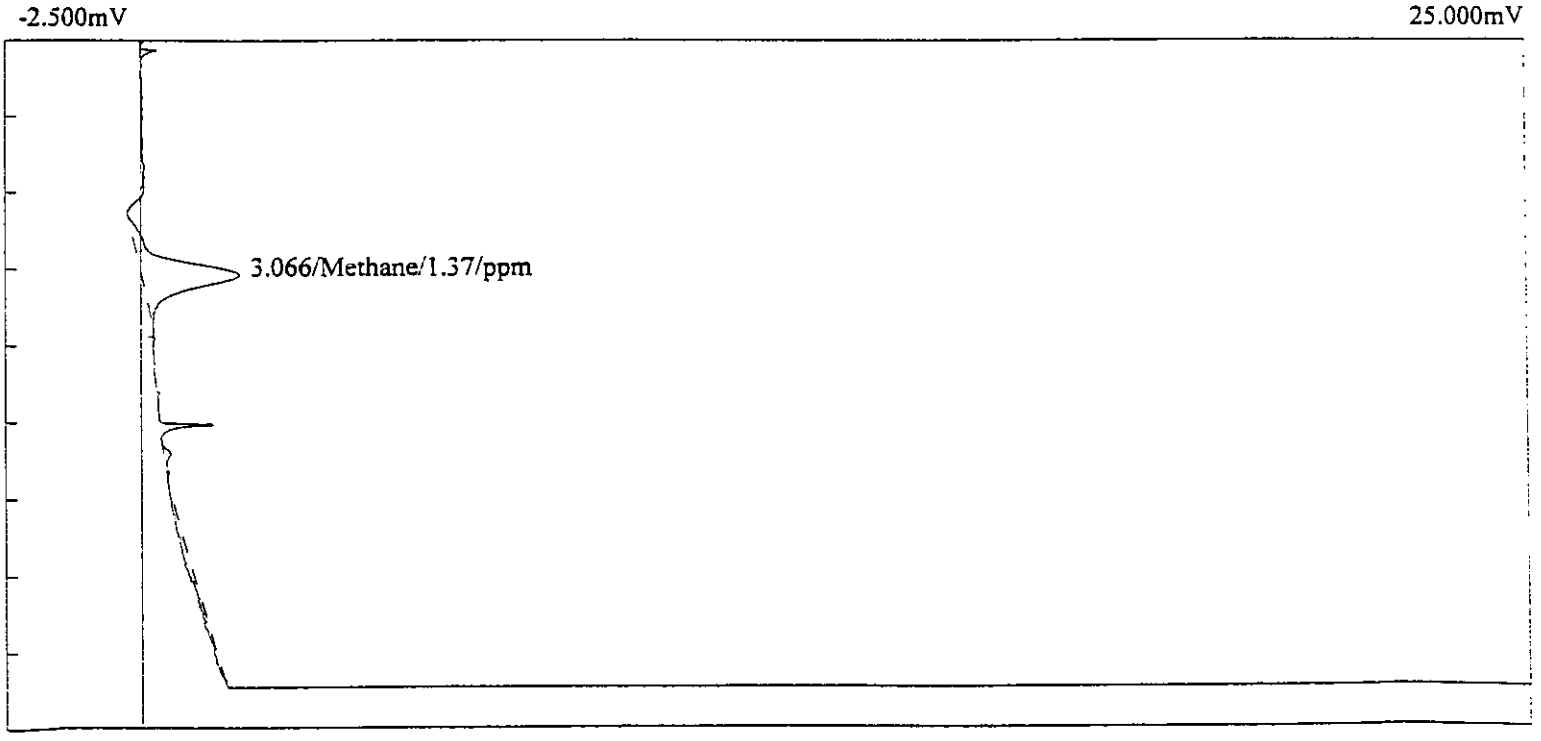
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 05:39:35
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F1R52.CHR (c:\peakwin)
Sample: Fan #1 Run #5
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.066	43.735	1.37	ppm
		44	1	

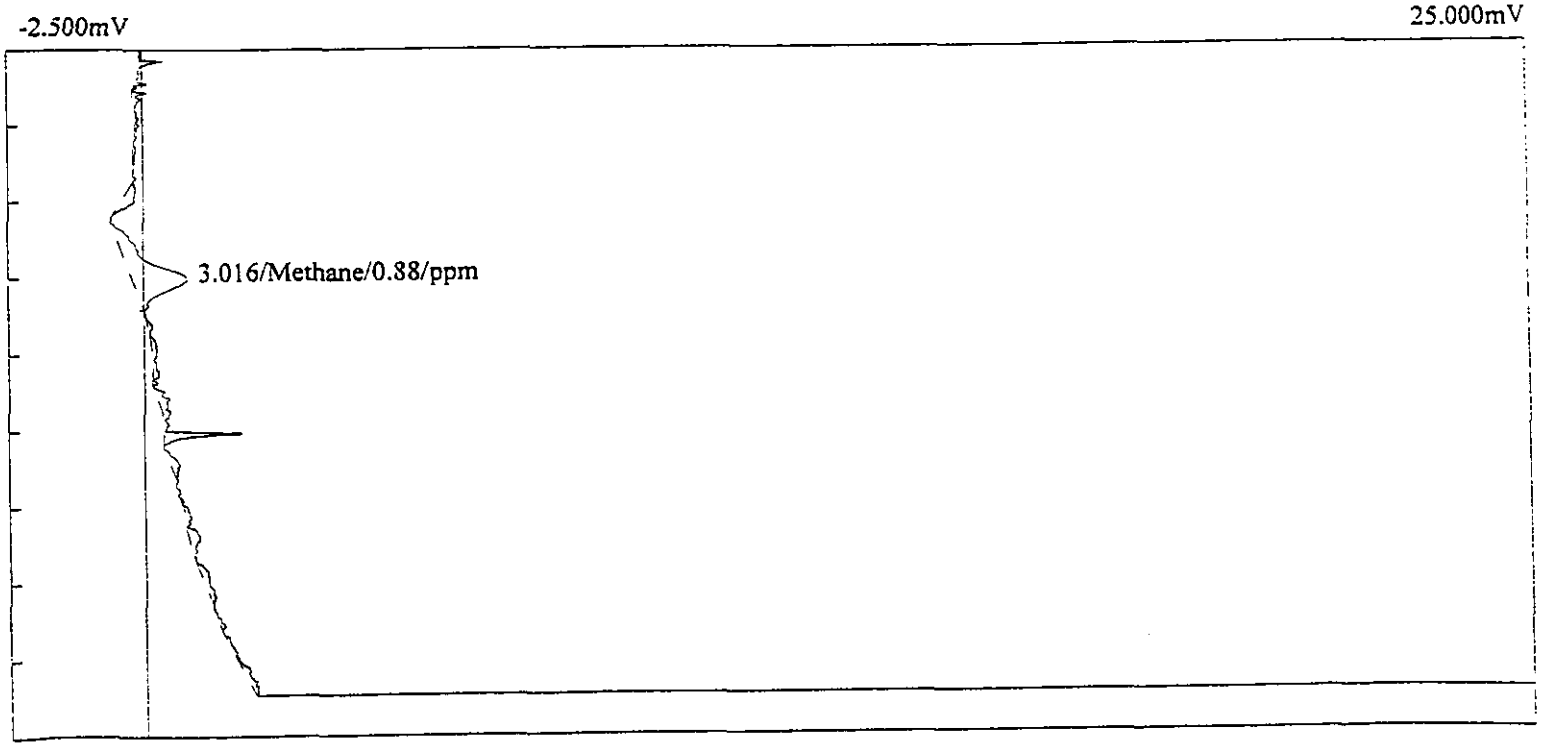
Lab name: Fluid Management, Inc,
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 14:33:04
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F1R62.CHR (c:\peakwin)
Sample: Fan #1 Run #6
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

	PeakName	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.016	28.154	0.88	ppm
		28	1	

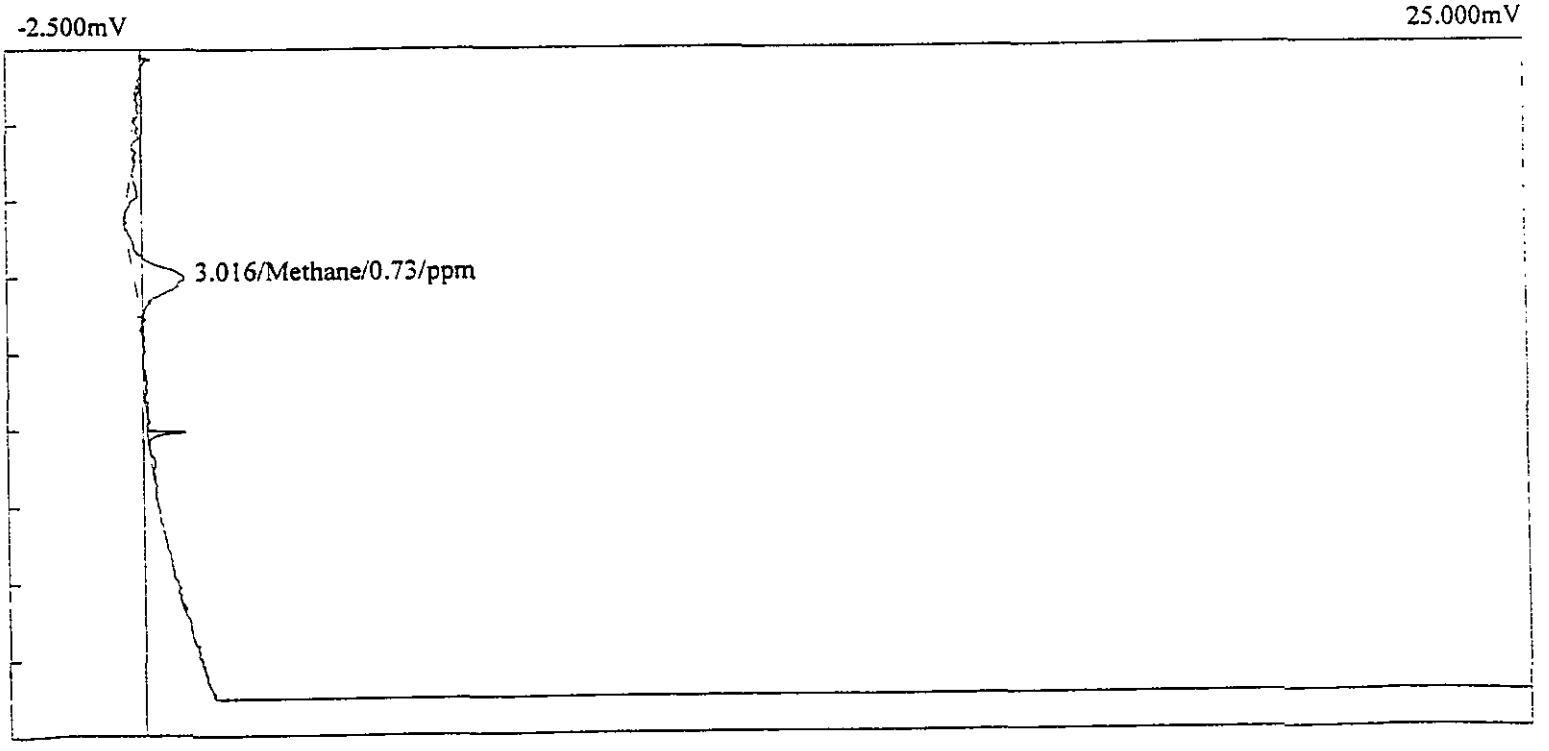
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 20:07:05
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F2R12.CHR (c:\peakwin)
Sample: Fan #2 Run #1
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.016	23.274	0.73	ppm
		23	1	

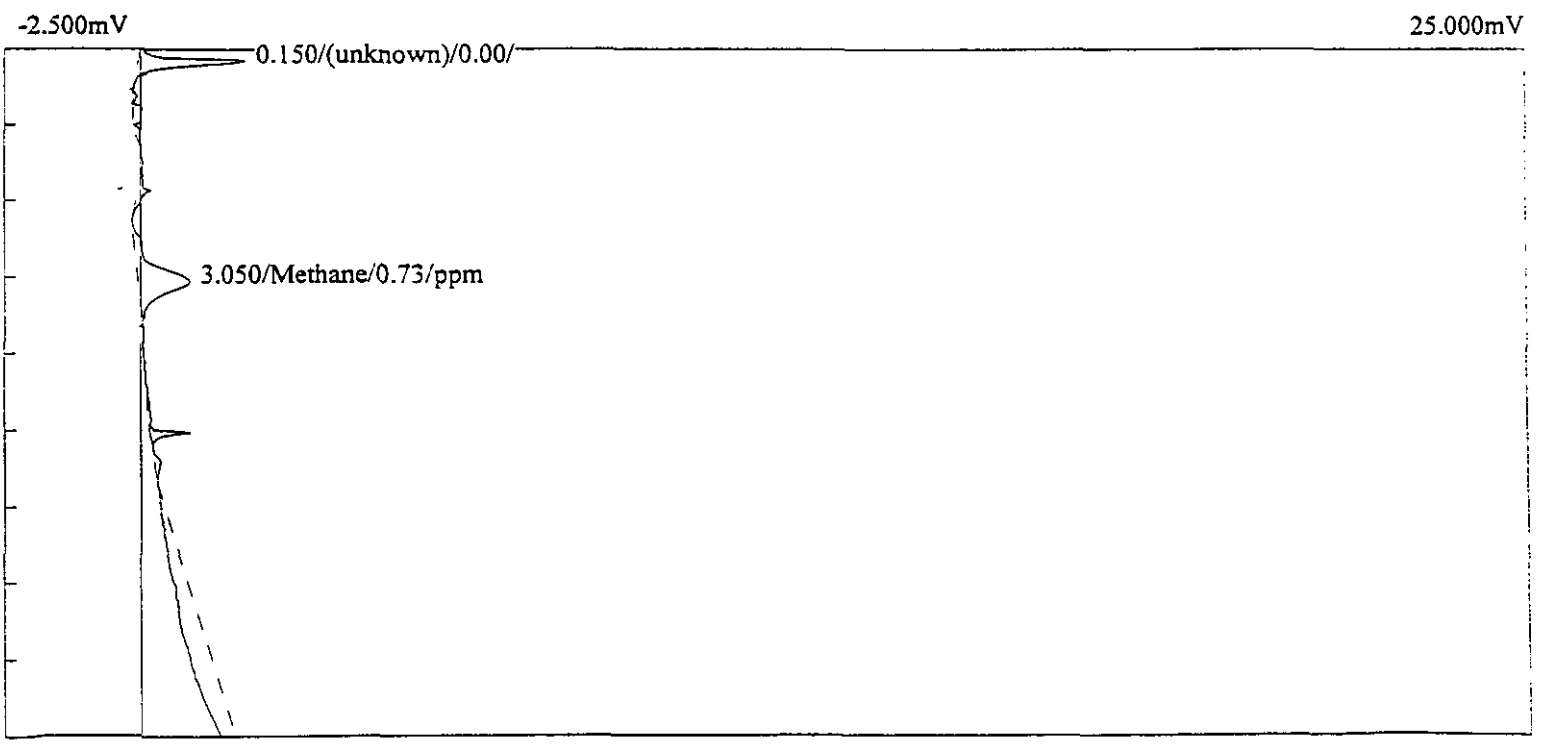
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 16:29:05
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F2R22.CHR (c:\peakwin)
Sample: Fan #2 Run 2
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
(unknown)	0.150	14.076	0.00	
Methane	3.050	23.392	0.73	ppm
		37	0	

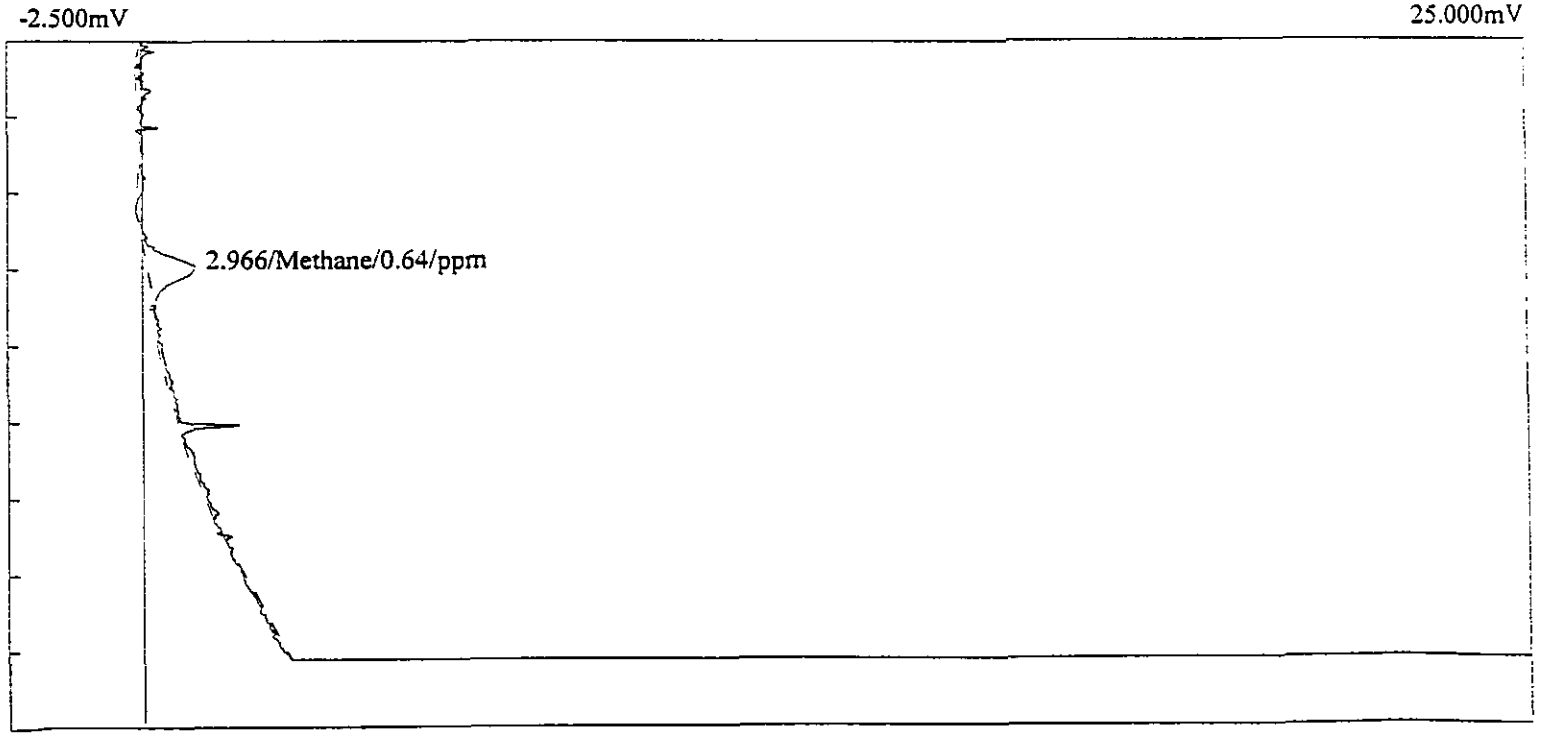
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 22:21:44
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F2R32.CHR (c:\peakwin)
Sample: Fan #2 Run #3
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.966	20.532	0.64	ppm
		21	1	

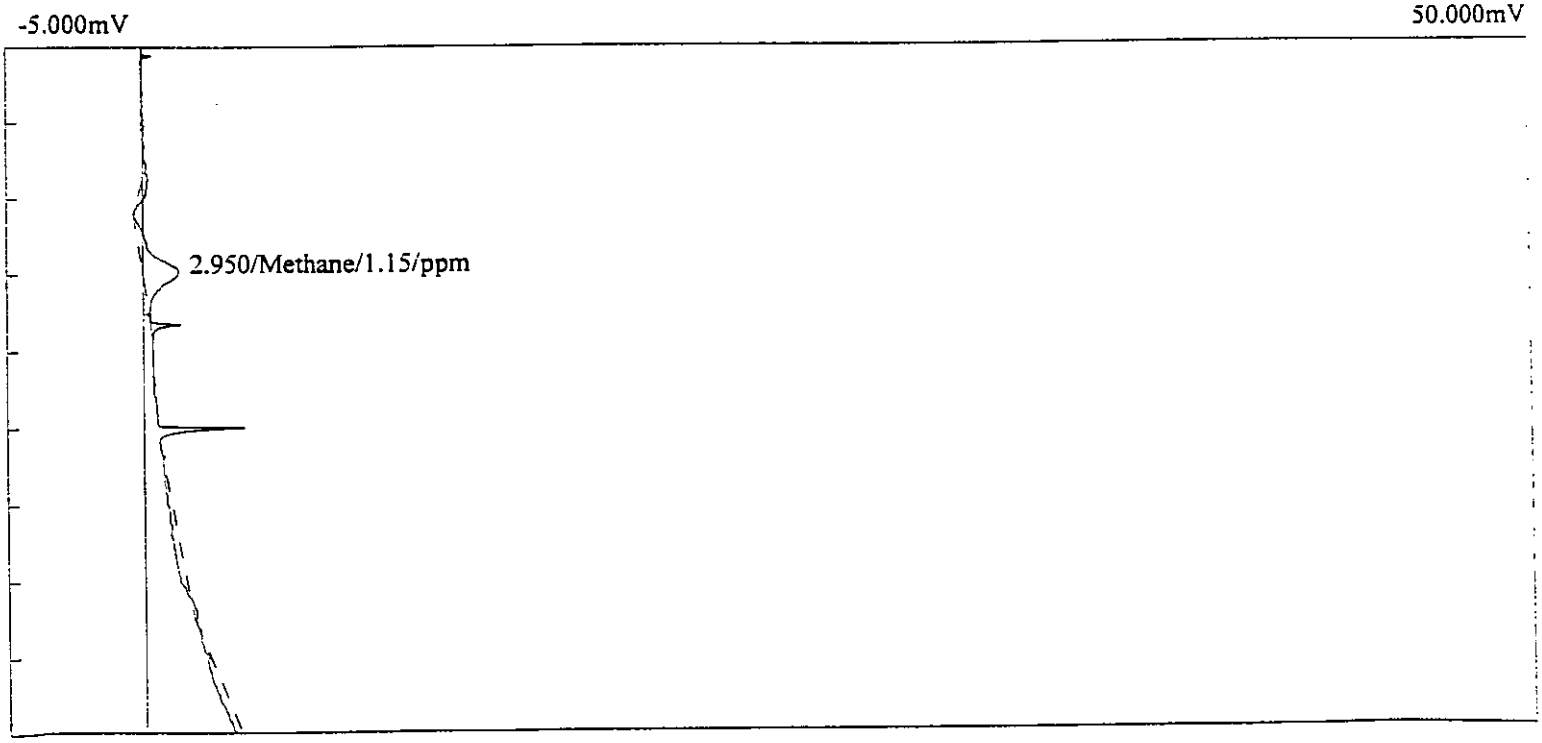
Lab name: Fluid Management Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 14:37:42
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F2R44.CHR (c:\peakwin)
Sample: Fan #2 Run #4
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.950	36.797	1.15	ppm
		37	1	

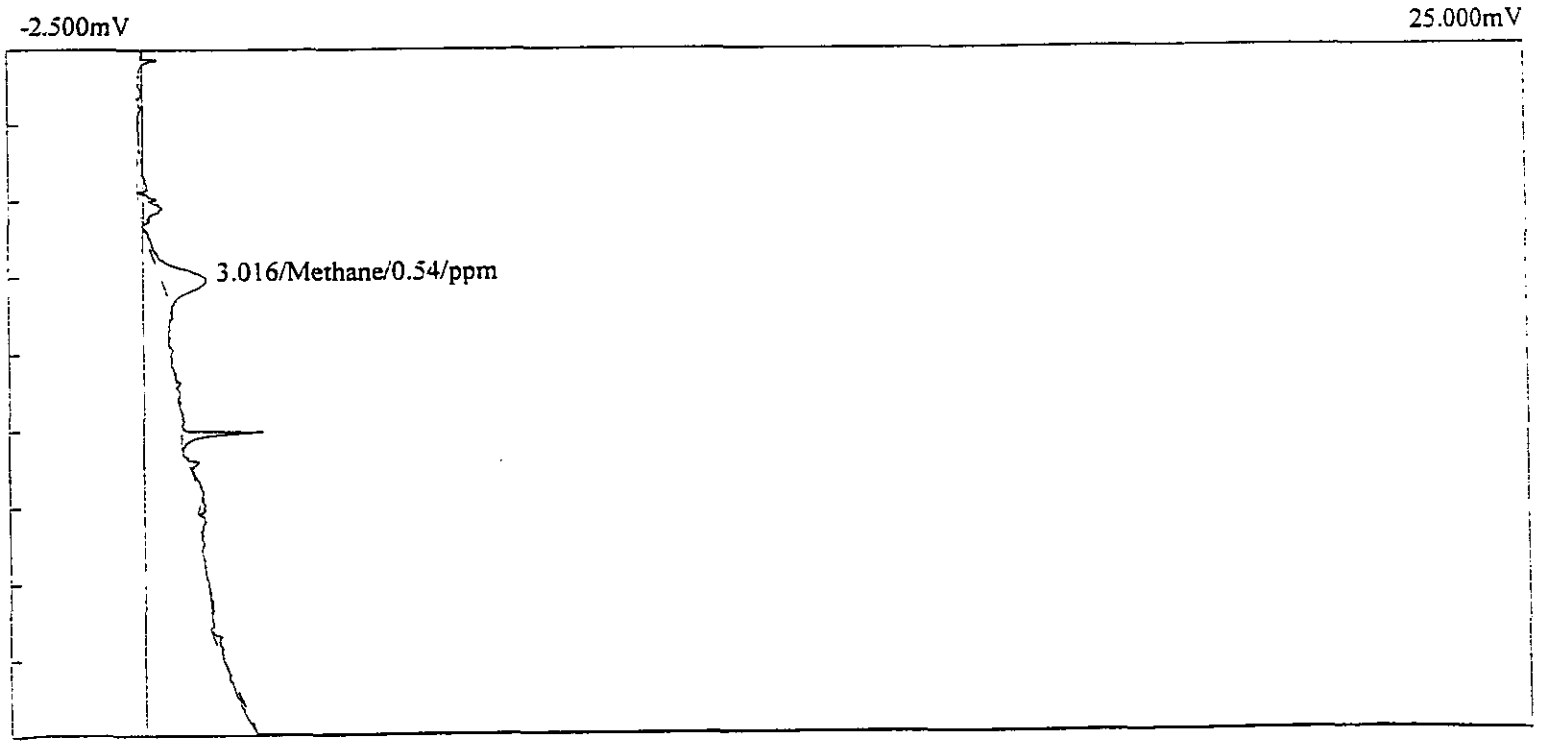
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 05:51:33
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F2R52.CHR (c:\peakwin)
Sample: Fan #2 Run #5
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.016	17.364	0.54	ppm
		17	1	

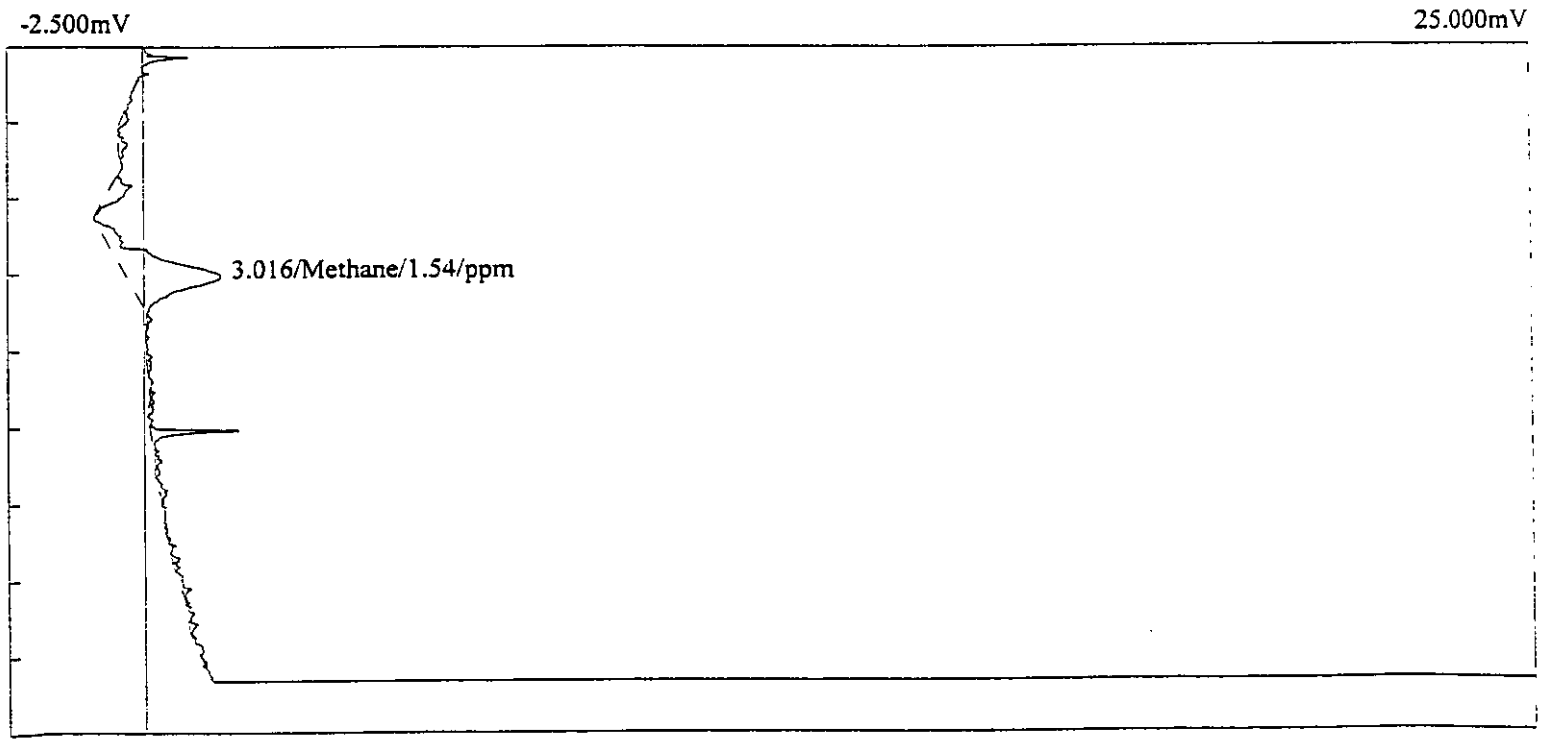
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 14:47:14
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F2R62.CHR (c:\peakwin)
Sample: Fan #2 Run #6
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

	PeakName	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.016	49.176	1.54	ppm
		49	2	

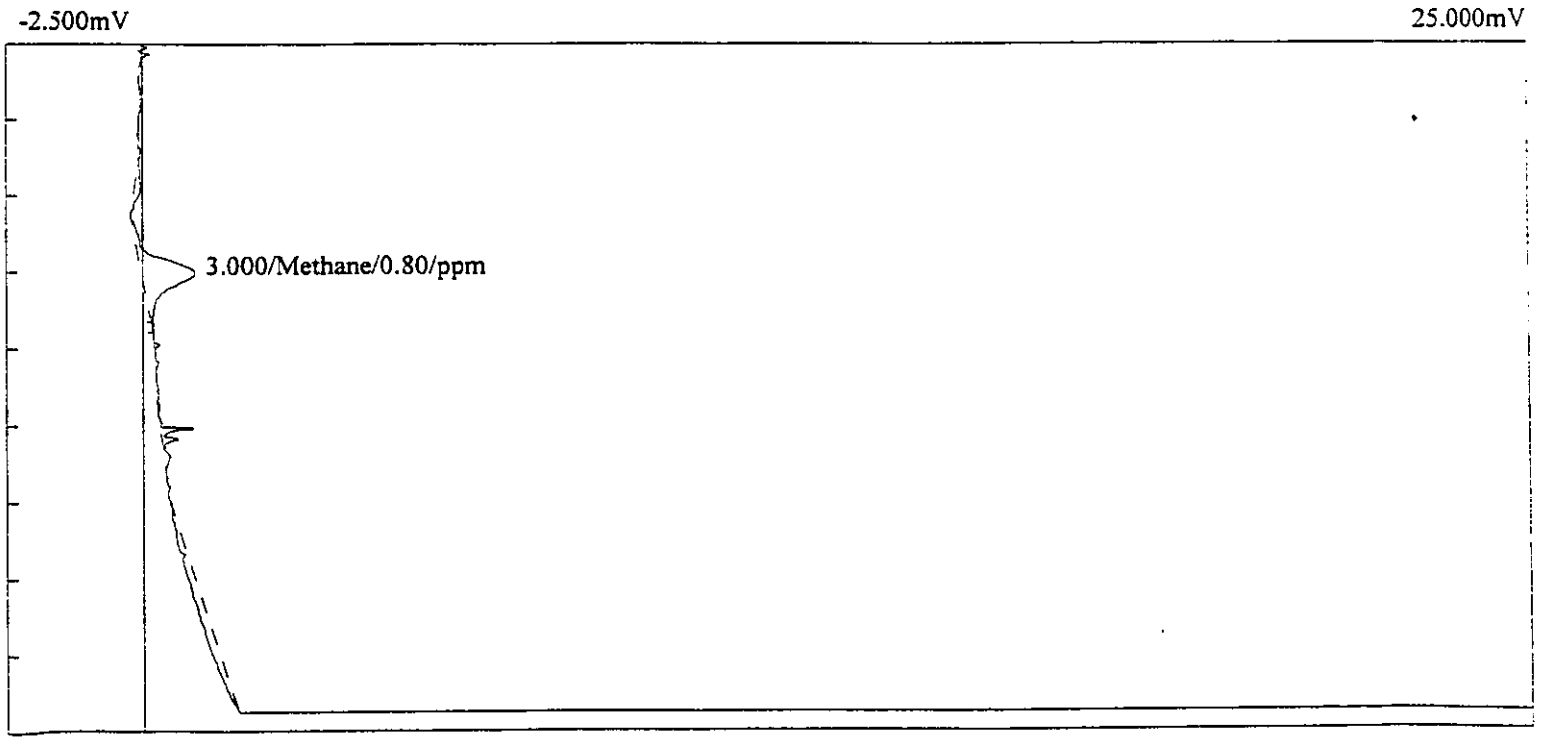
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 20:19:38
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F3R12.CHR (c:\peakwin)
Sample: Fan #3 Run #1
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

	PeakName	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	25.345	0.80	ppm
		25	1	

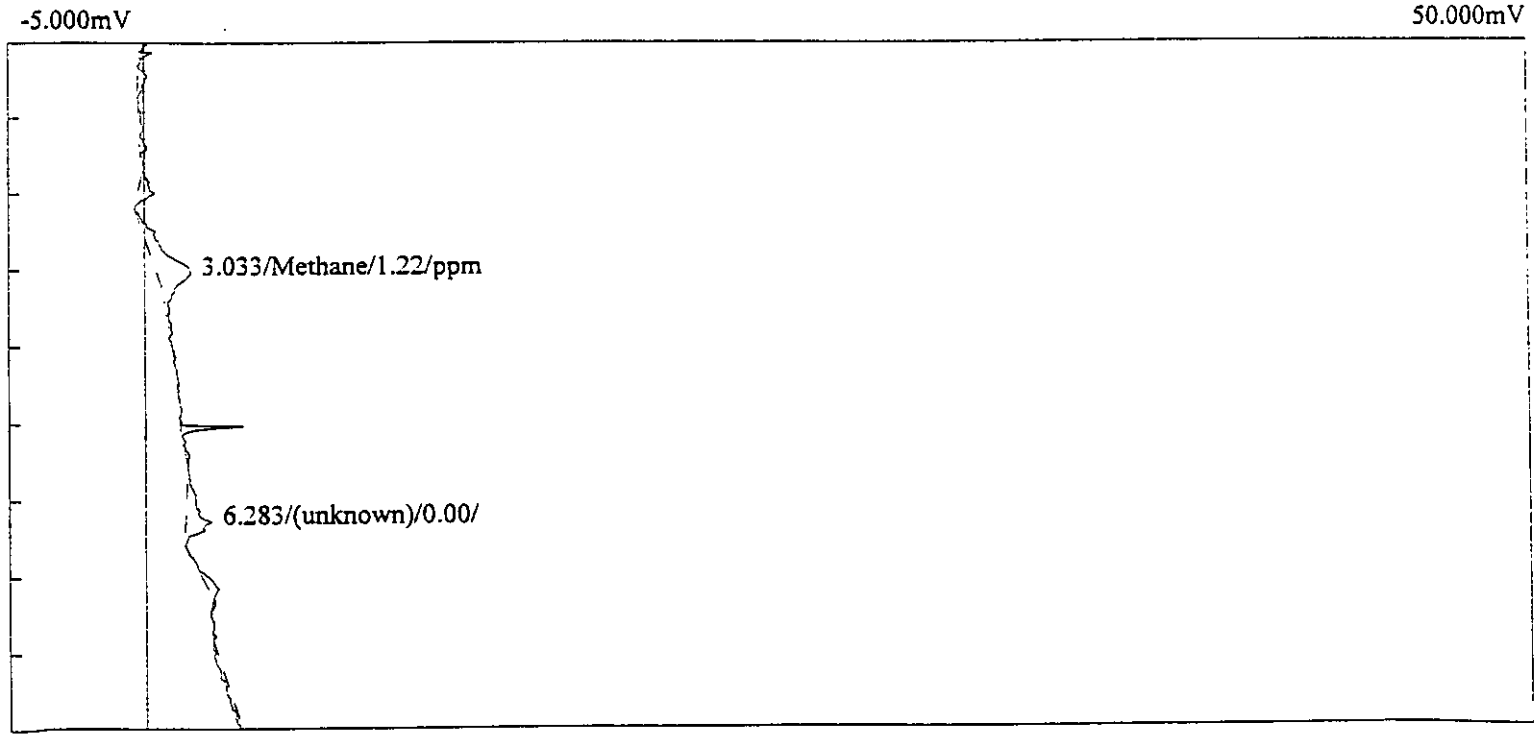
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 13:13:10
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F3R24.CHR (c:\peakwin)
Sample: Fan #3 Run 2
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

	PeakName	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.033	38.880	1.22	ppm
(unknown)	6.283	19.394	0.00	
		58	0	

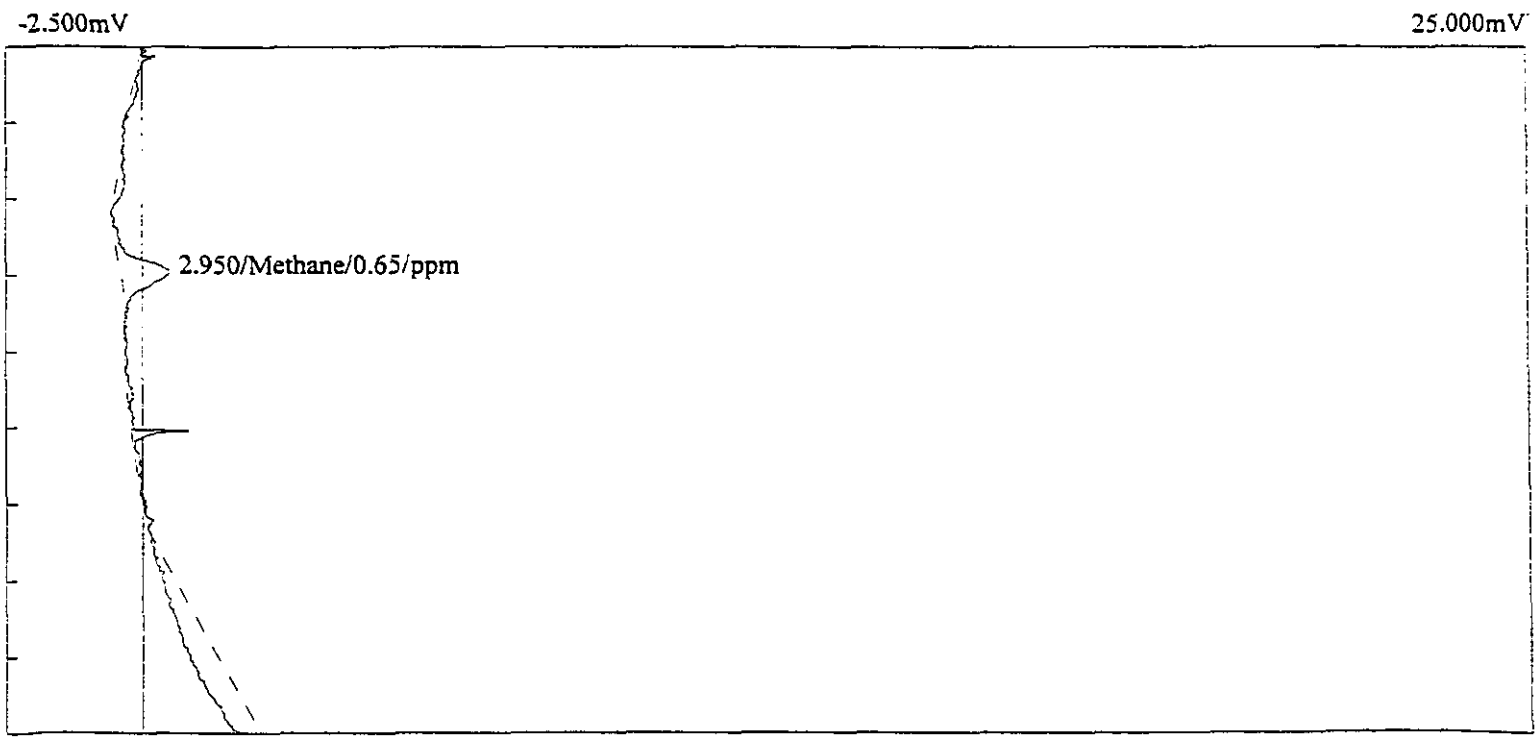
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 22:33:09
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F3R32.CHR (c:\peakwin)
Sample: Fan #3 Run #3
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.950	20.760	0.65	ppm
		21	1	

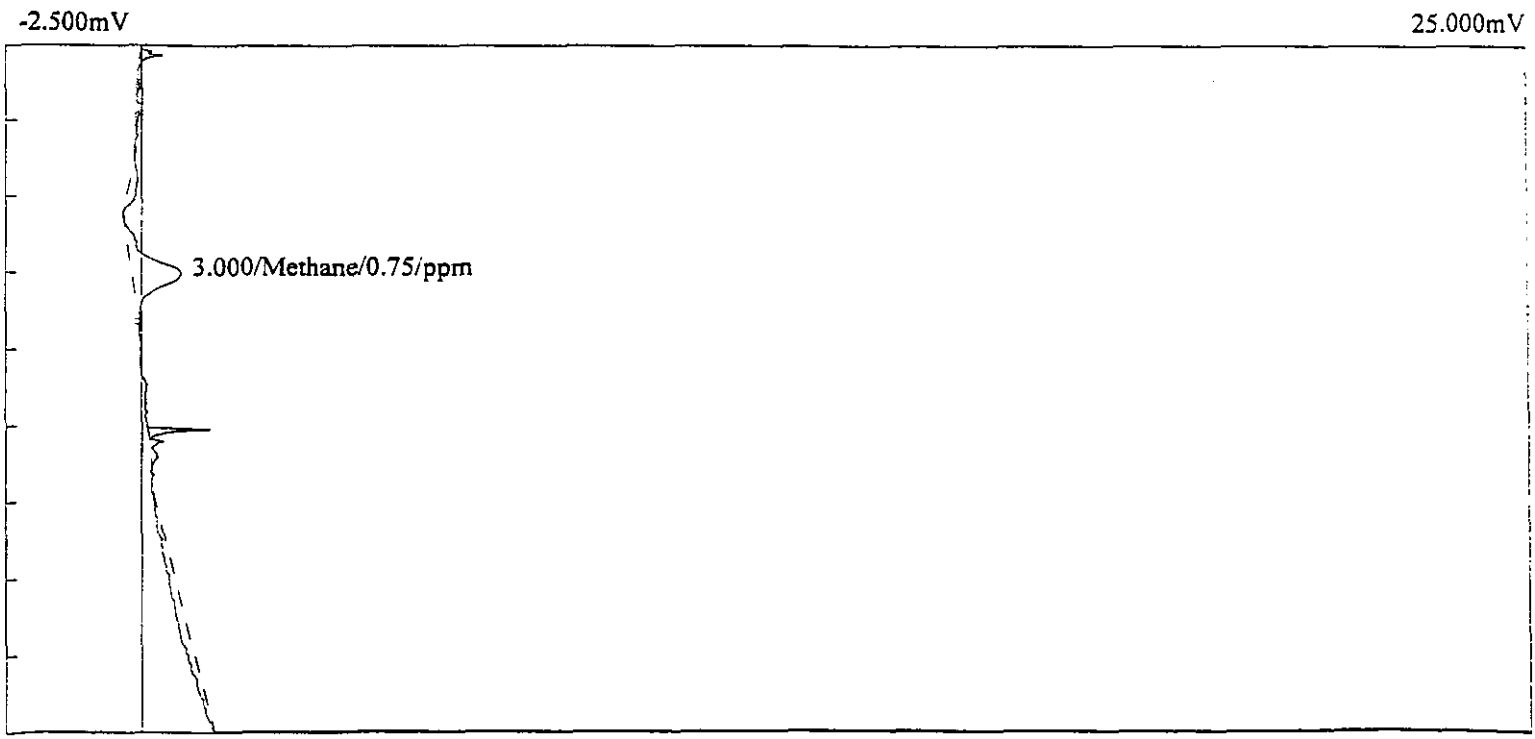
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 04:25:36
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F3R42.CHR (c:\peakwin)
Sample: Fan #3 Run #4
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	23.862	0.75	ppm
		24	1	

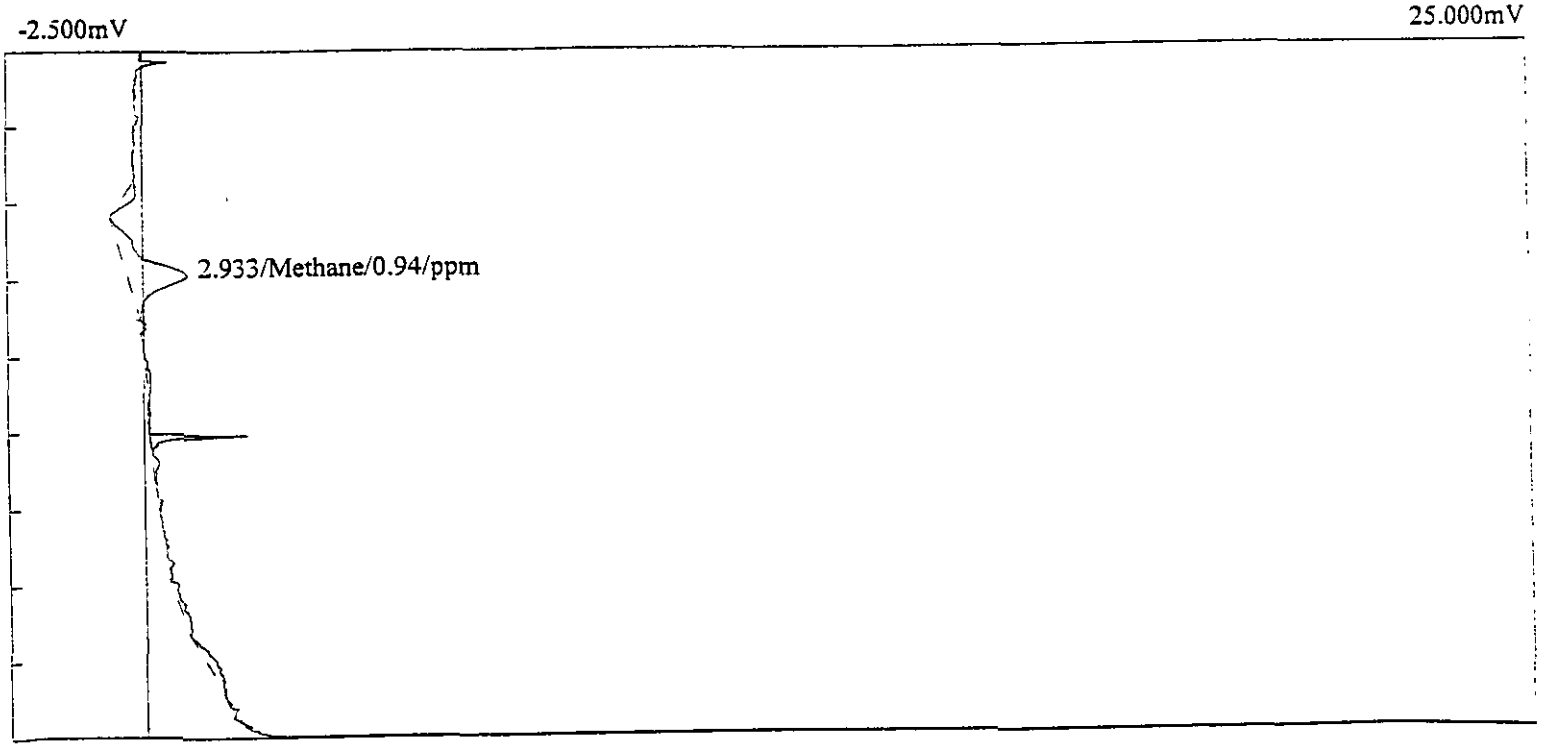
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 13:35:45
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F3R53.CHR (c:\peakwin)
Sample: Fan #3 Run #5
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.933	30.066	0.94	ppm

30 1

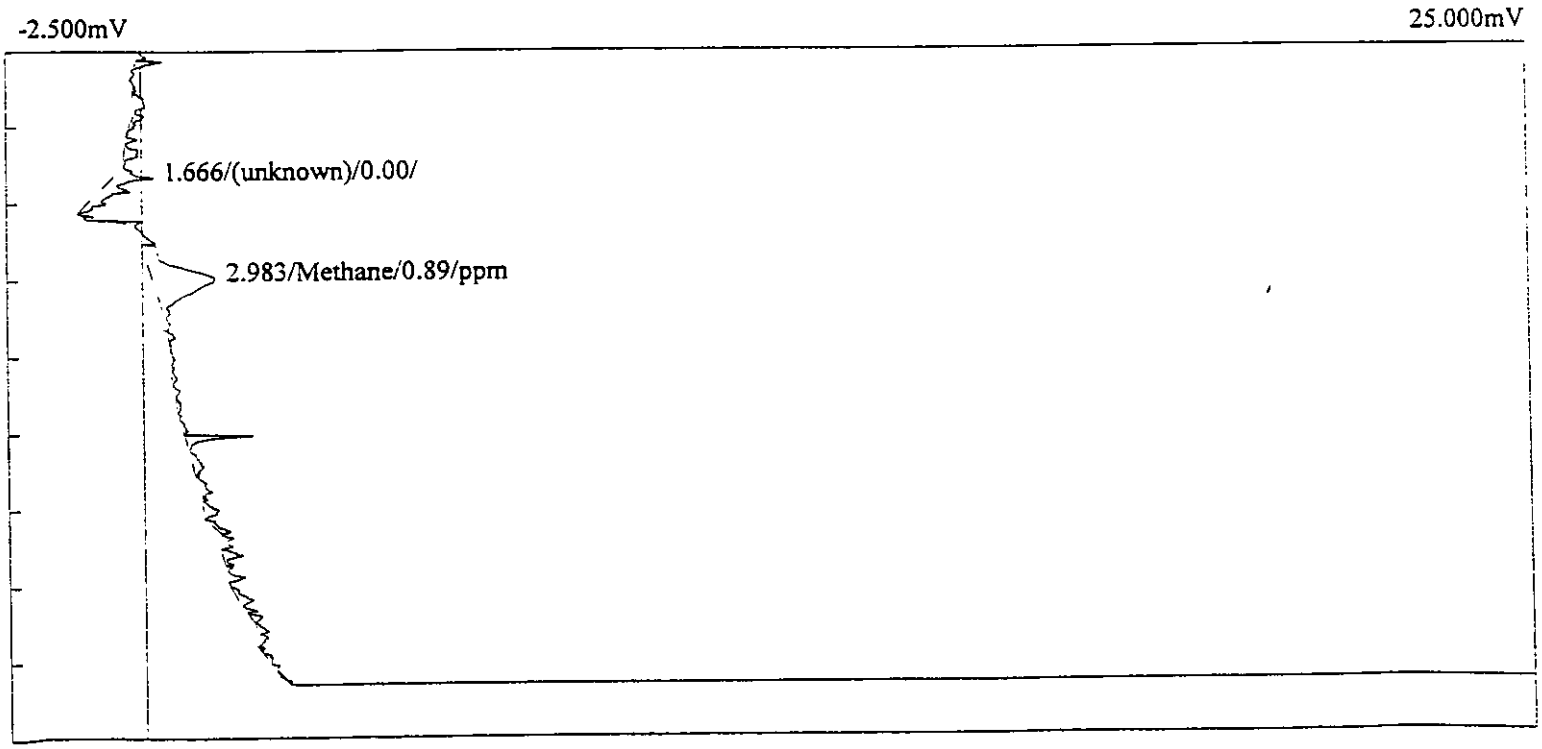
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 14:59:09
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F3R62.CHR (c:\peakwin)
Sample: Fan #3 Run #6
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

	PeakName	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
(unknown)	1.666	10.576	0.00	
Methane	2.983	28.473	0.89	ppm
		39	0	

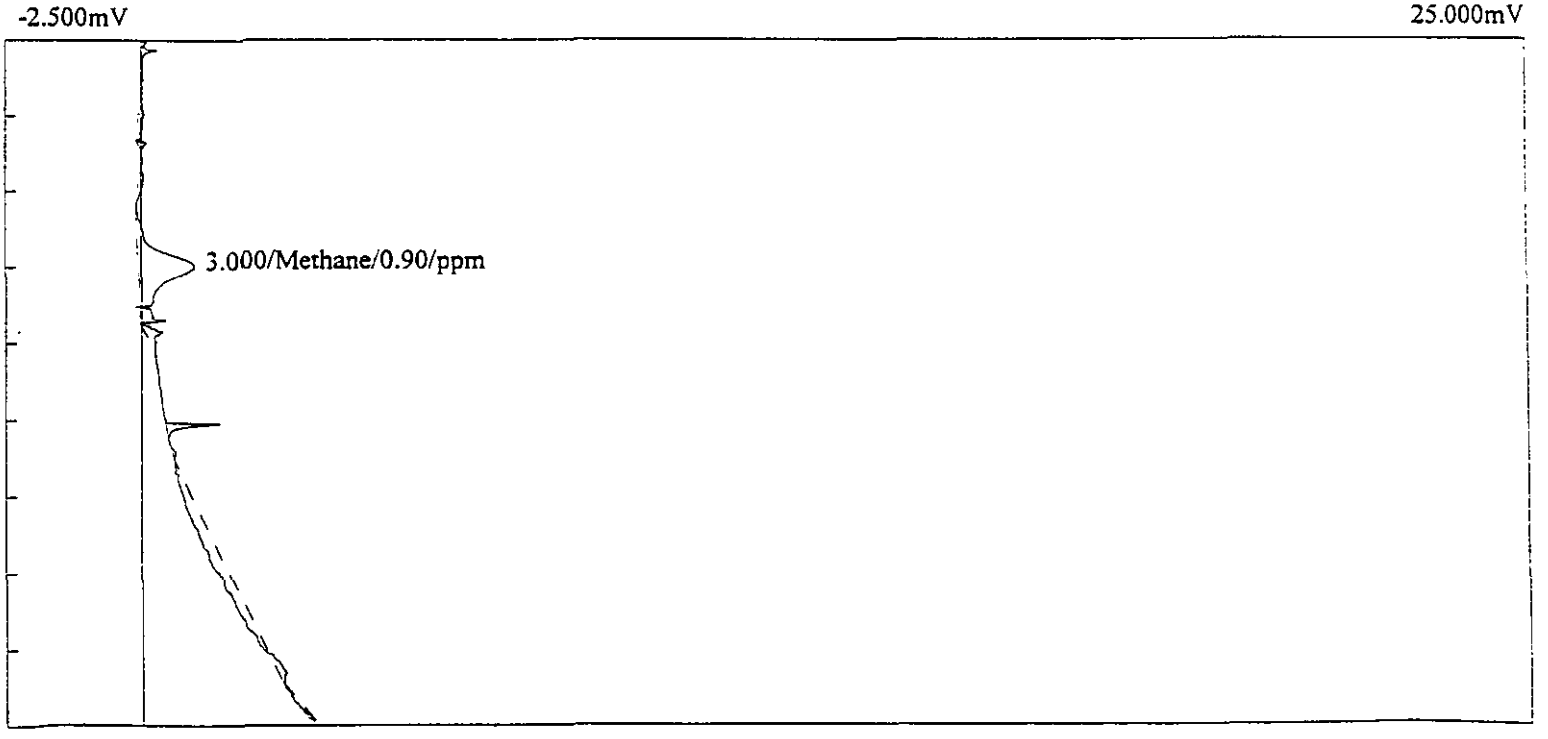
Lab name: Fluid Management, Inc,
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 00:16:19
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F4R12.CHR (c:\peakwin)
Sample: Fan #4 Run #1
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	28.826	0.90	ppm

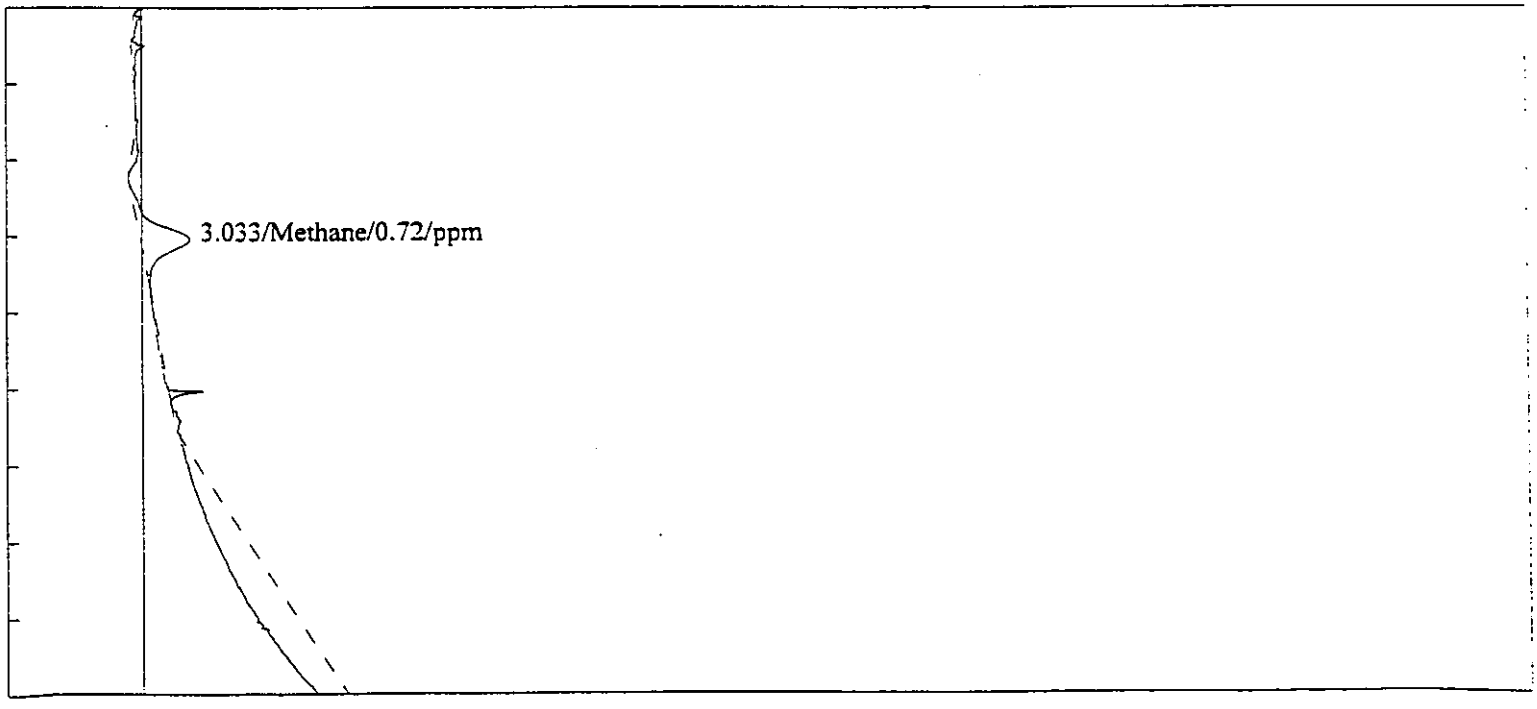
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 19:40:05
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F4R22.CHR (c:\peakwin)
Sample: Fan #4 Run #2
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.033	23.068	0.72	ppm
		23	1	

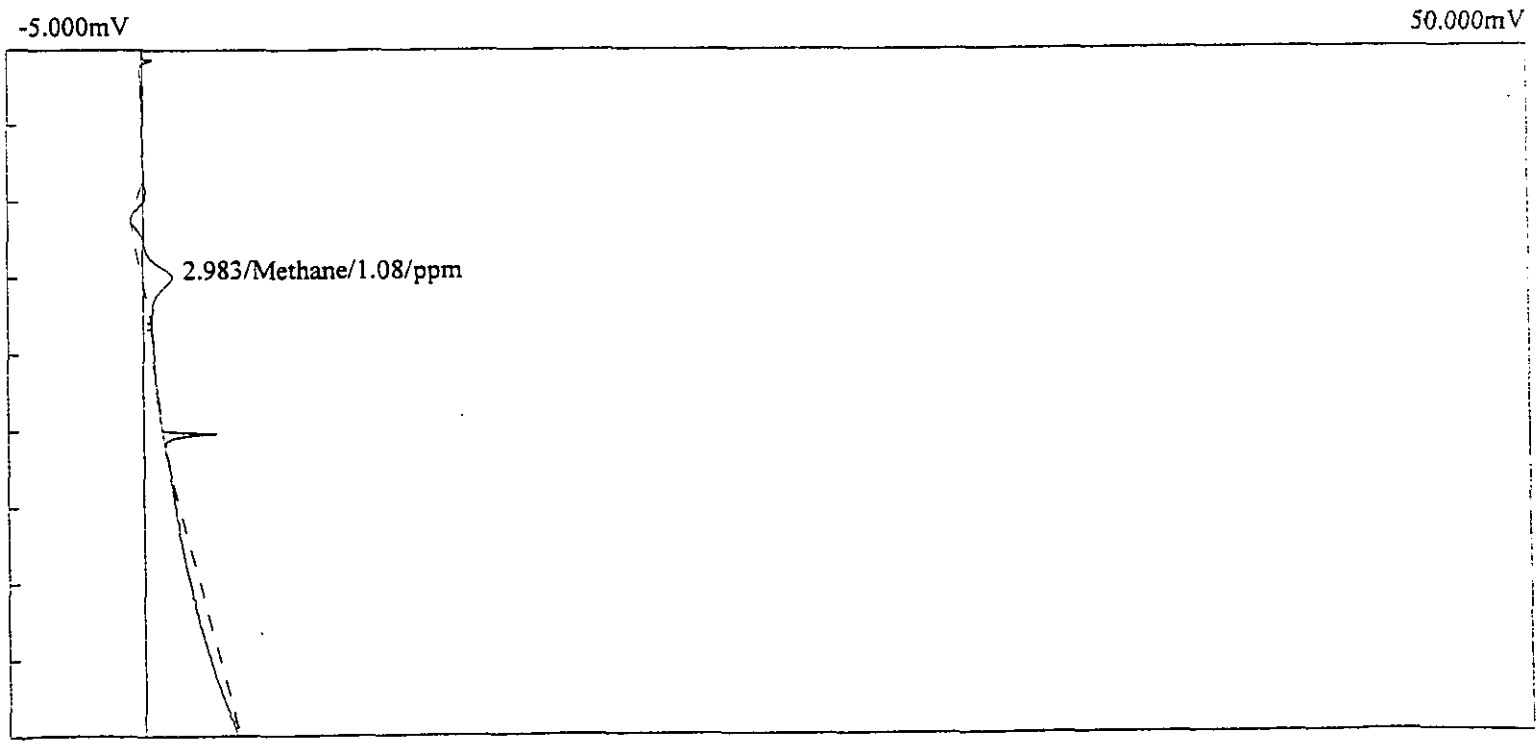
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 13:32:33
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F4R33.CHR (c:\peakwin)
Sample: Fan #4 Run #3
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.983	34.558	1.08	ppm
		35	1	

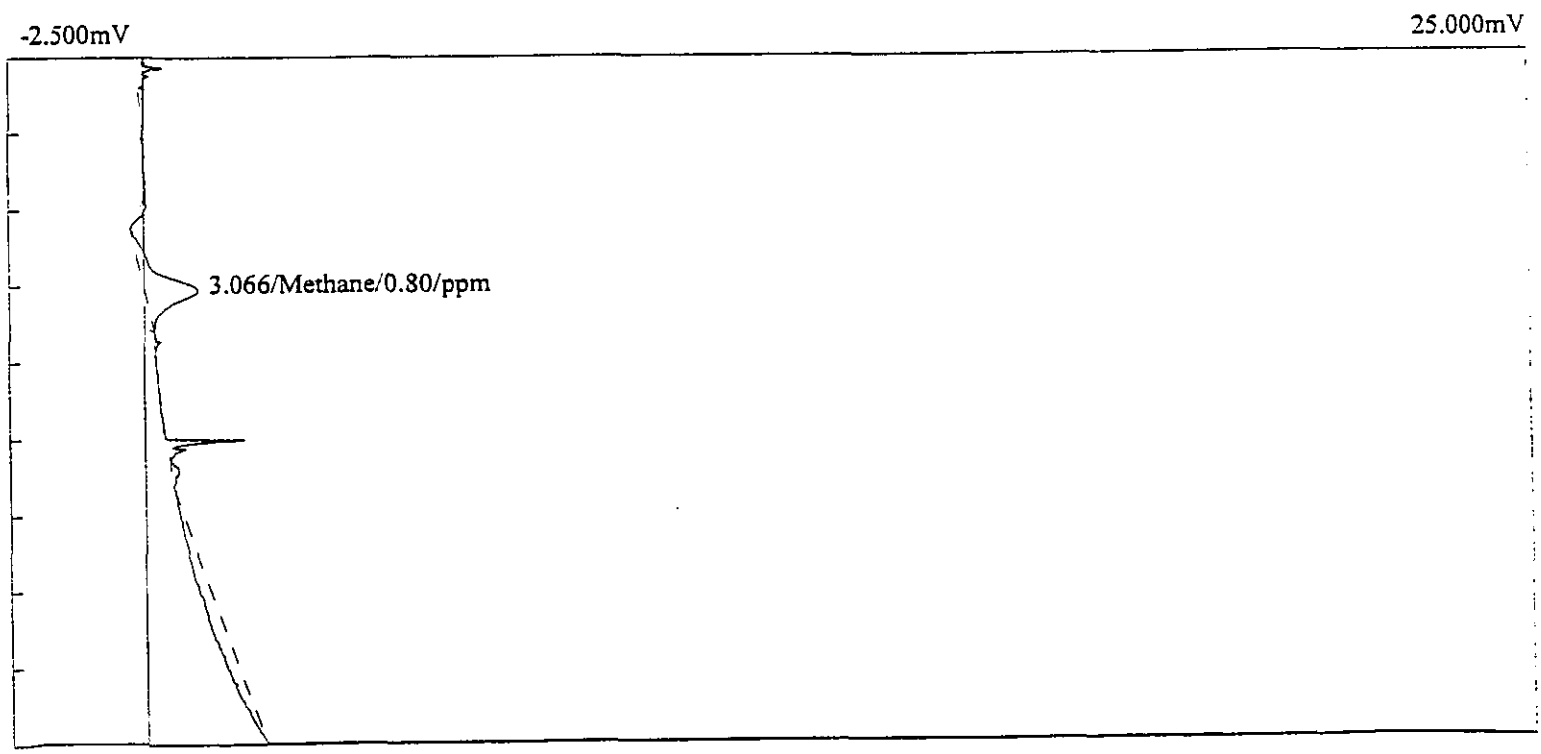
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 05:12:15
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F4R42.CHR (c:\peakwin)
Sample: Fan #4 Run #4
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.066	25.471	0.80	ppm
		25	1	

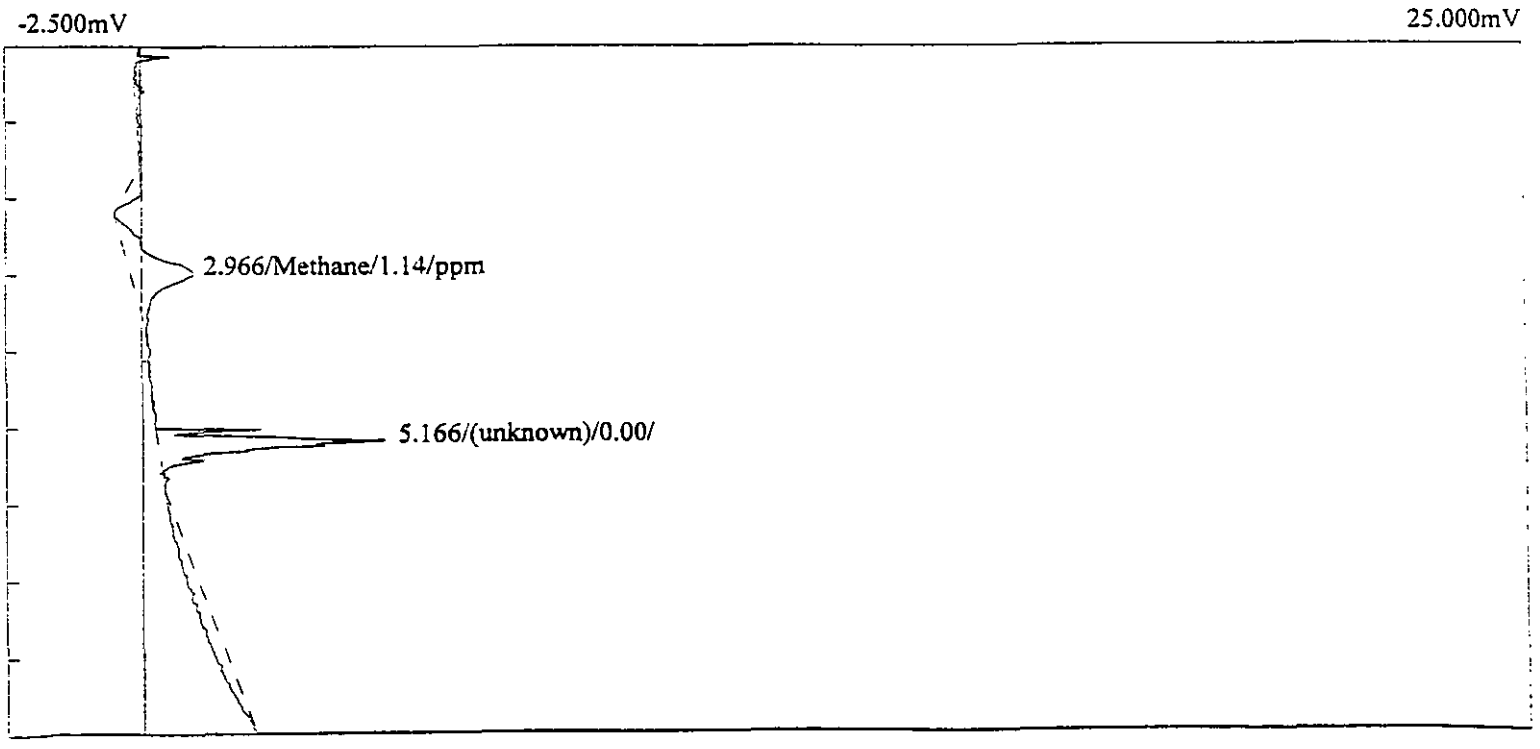
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 14:00:54
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F4R52.CHR (c:\peakwin)
Sample: Fan #4 Run #5
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.966	36.424	1.14	ppm
(unknown)	5.166	44.460	0.00	
		81	0	

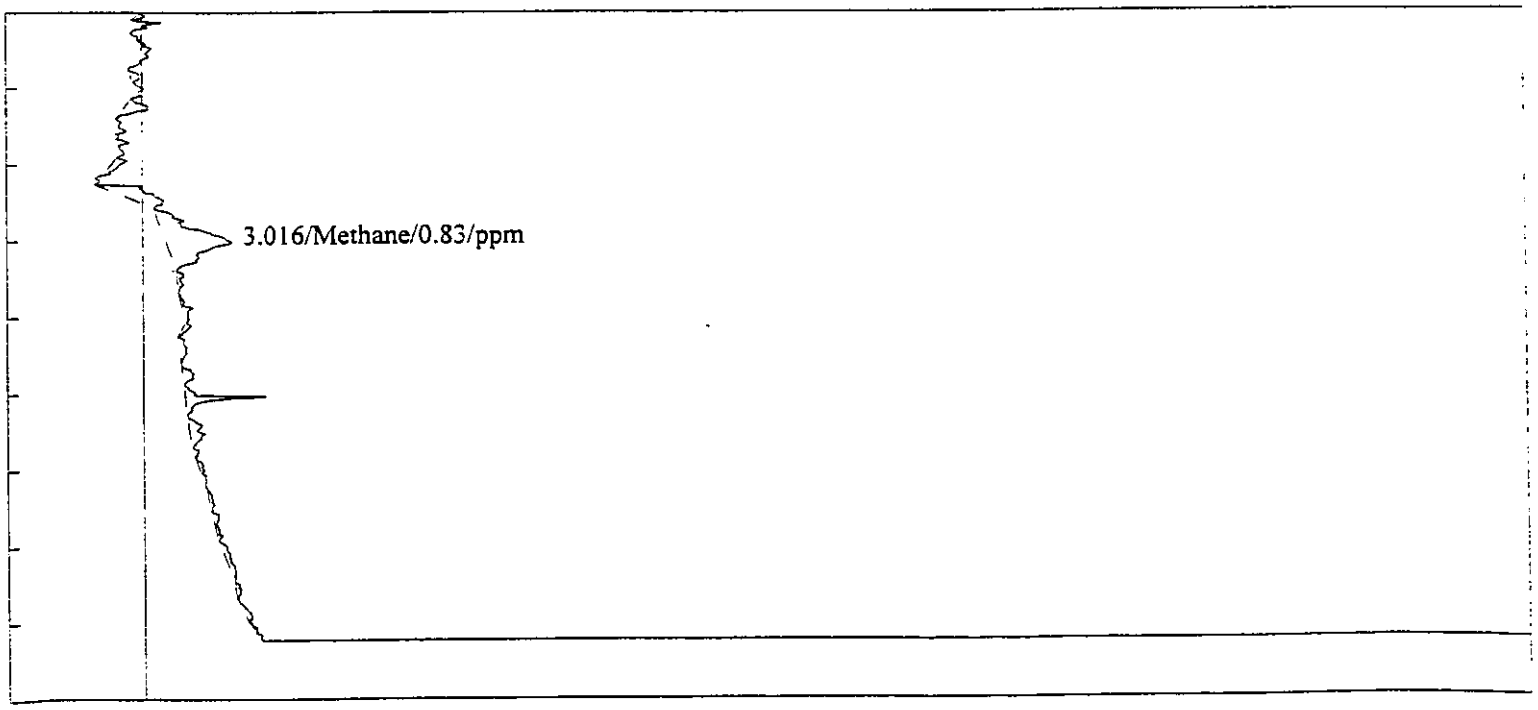
Lab name: Fluid Management, Inc,
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 15:11:47
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F4R62.CHR (c:\peakwin)
Sample: Fan #4 Run #6
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.016	26.404	0.83	ppm

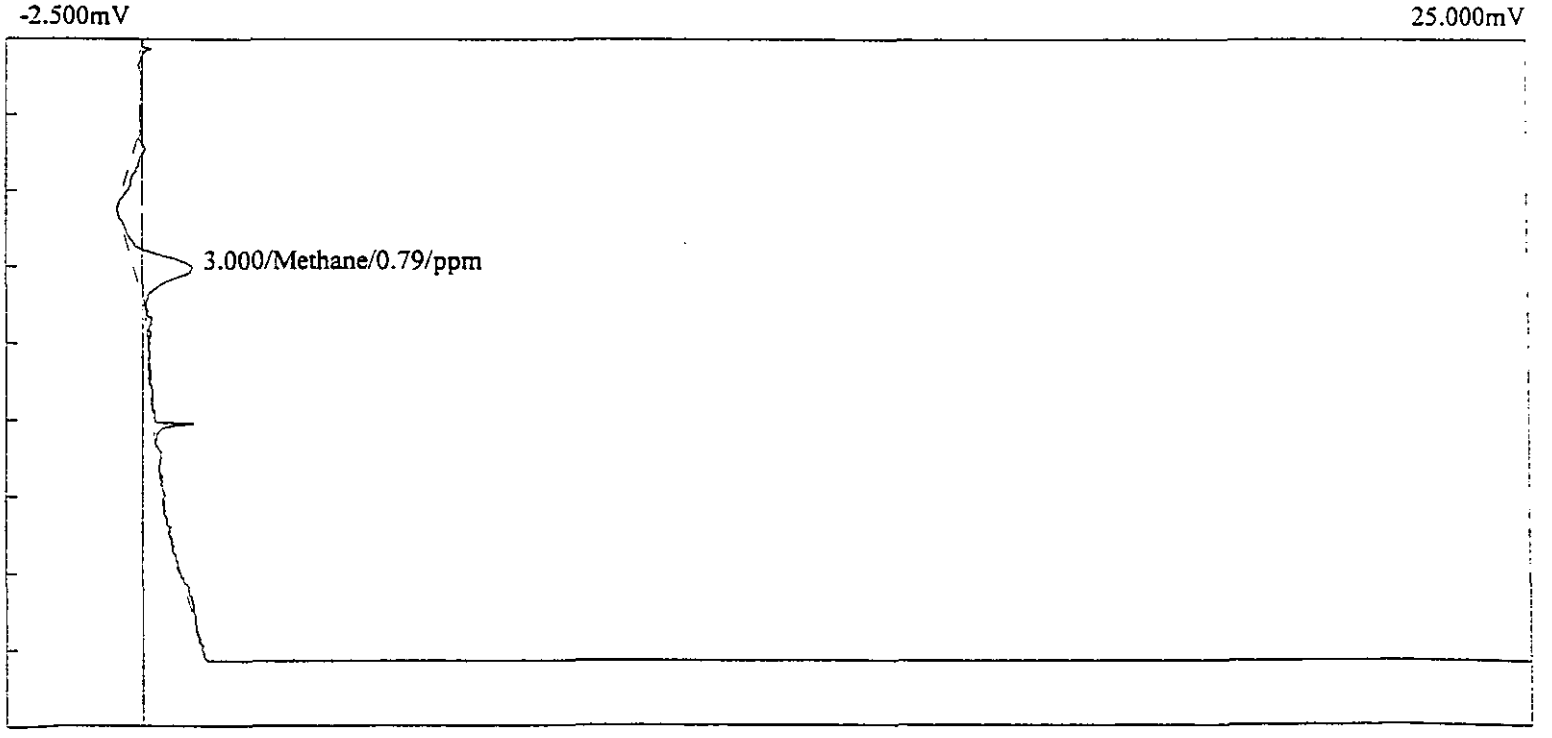
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 20:31:53
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F5R12.CHR (c:\peakwin)
Sample: Fan #5 Run #1
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	25.140	0.79	ppm
		25	1	

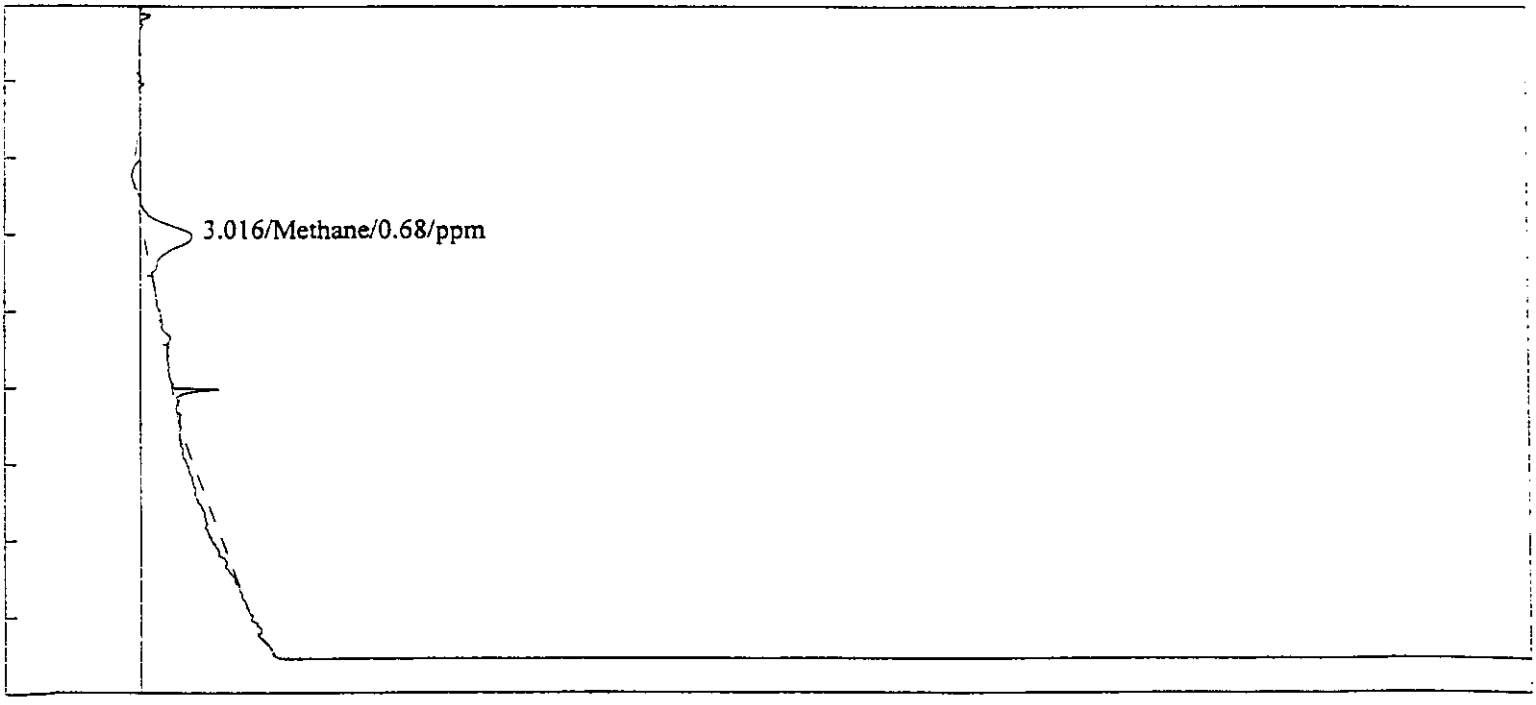
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 19:54:54
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F5R22.CHR (c:\peakwin)
Sample: Fan #5 Run #2
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.016	21.808	0.68	ppm
		22	1	

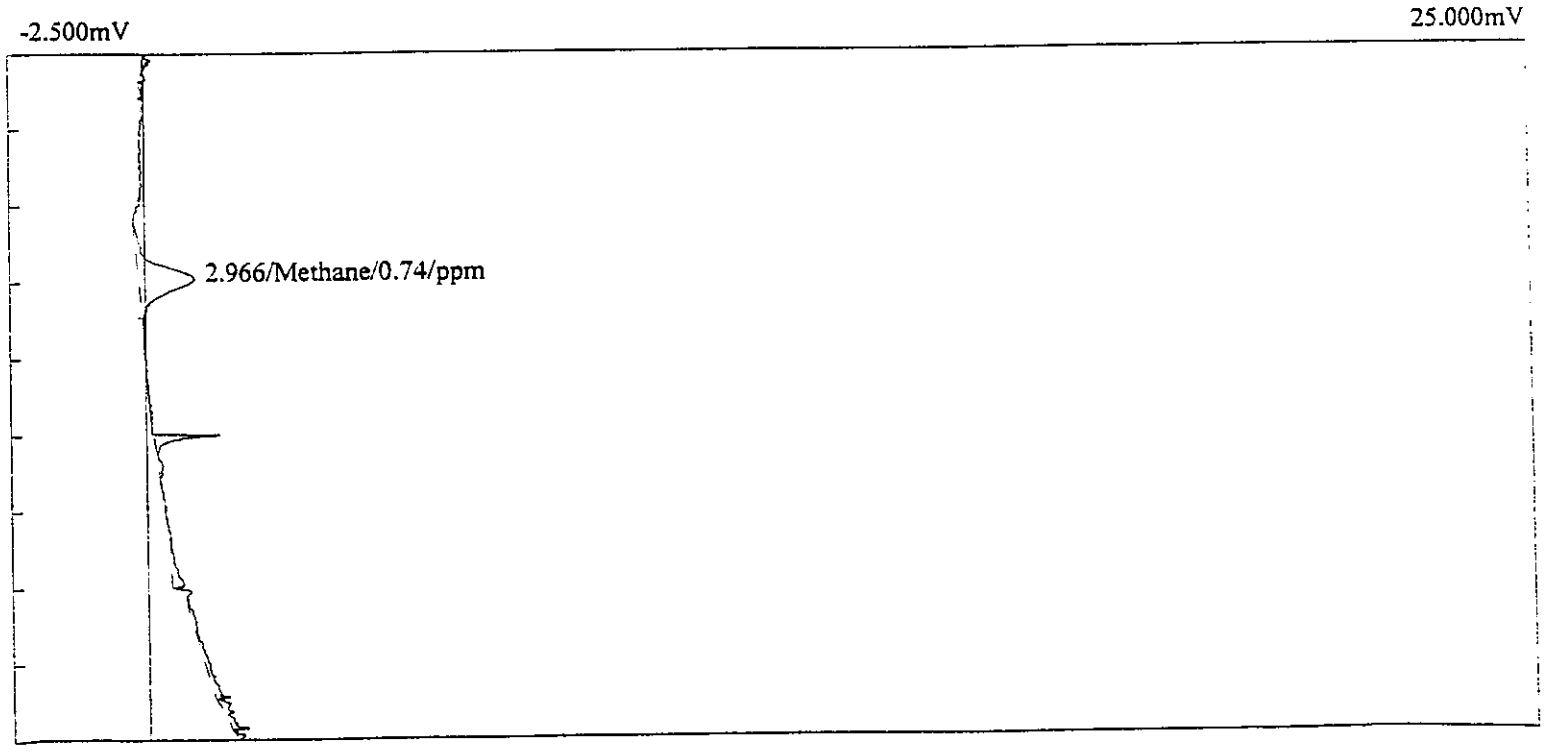
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 00:30:04
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F5R32.CHR (c:\peakwin)
Sample: Fan #5 Run #3
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

	PeakName	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.966	23.722	0.74	ppm
		24	1	

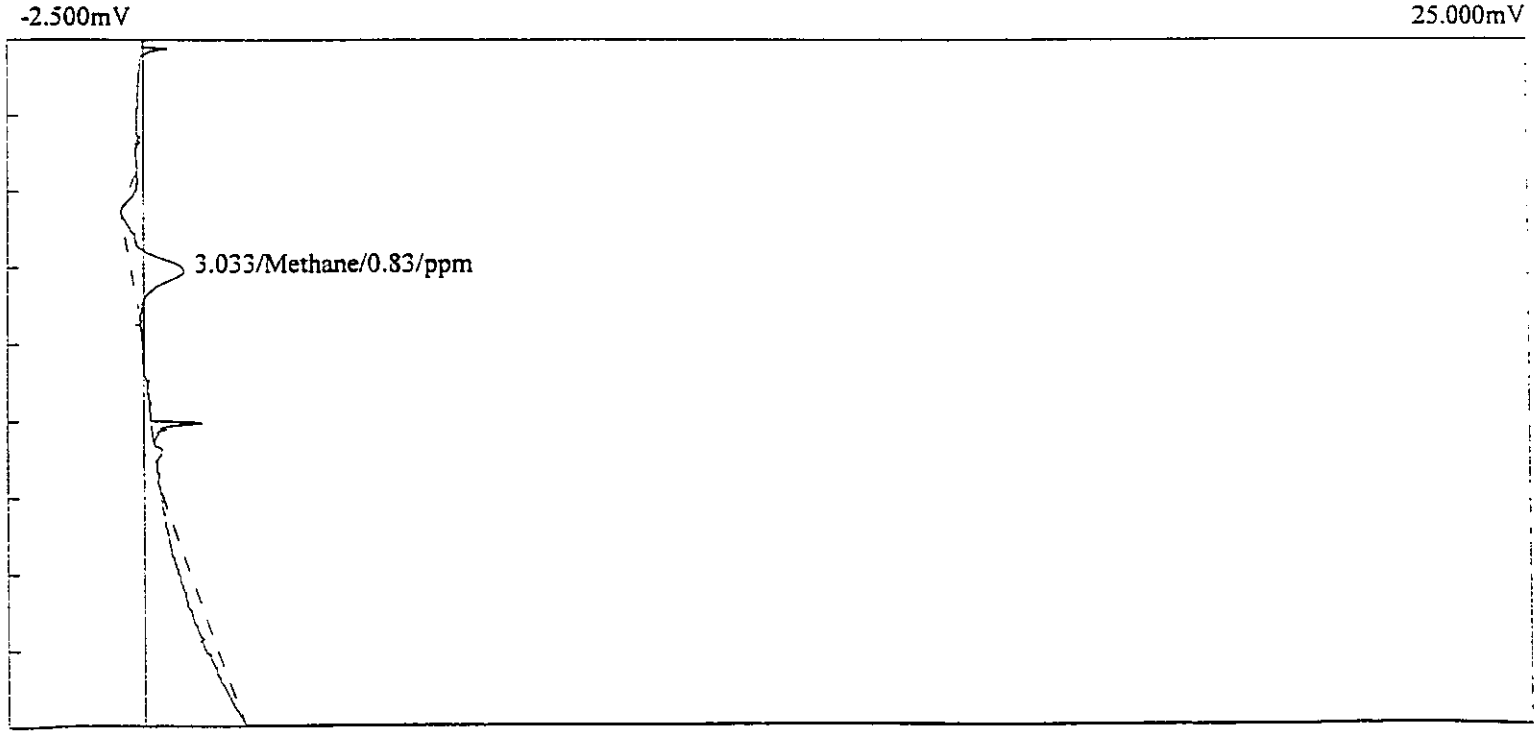
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 05:24:44
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F5R42.CHR (c:\peakwin)
Sample: Fan #5 Run #4
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

	PeakName	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.033	26.576	0.83	ppm
		27	1	

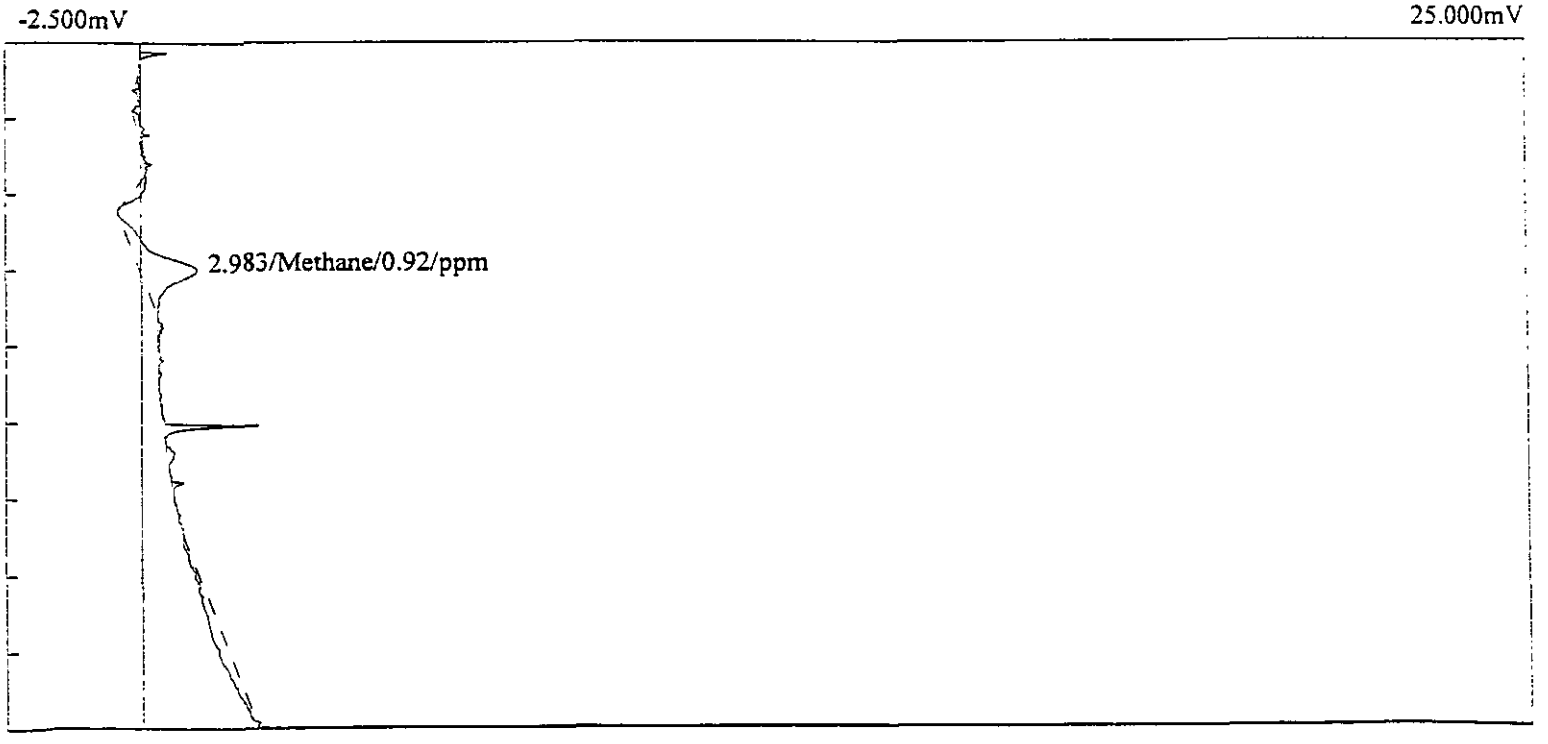
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 14:20:15
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F5R52.CHR (c:\peakwin)
Sample: Fan #5 Run #5
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

	PeakName	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.983	29.272	0.92	ppm
		29	1	

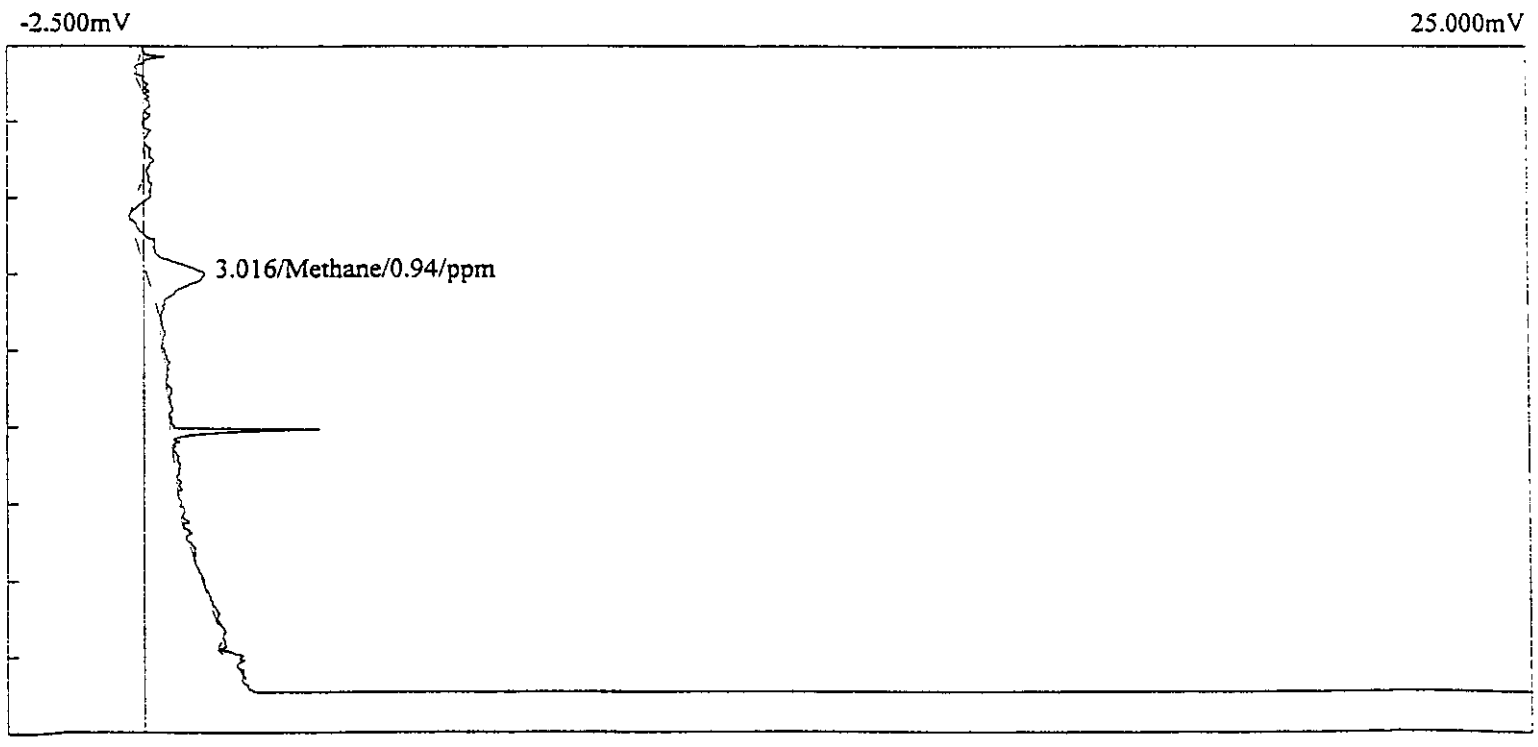
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/15/1995 15:23:46
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: F5R62.CHR (c:\peakwin)
Sample: Fan #5 Run #6
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.016	30.044	0.94	ppm
		30	1	

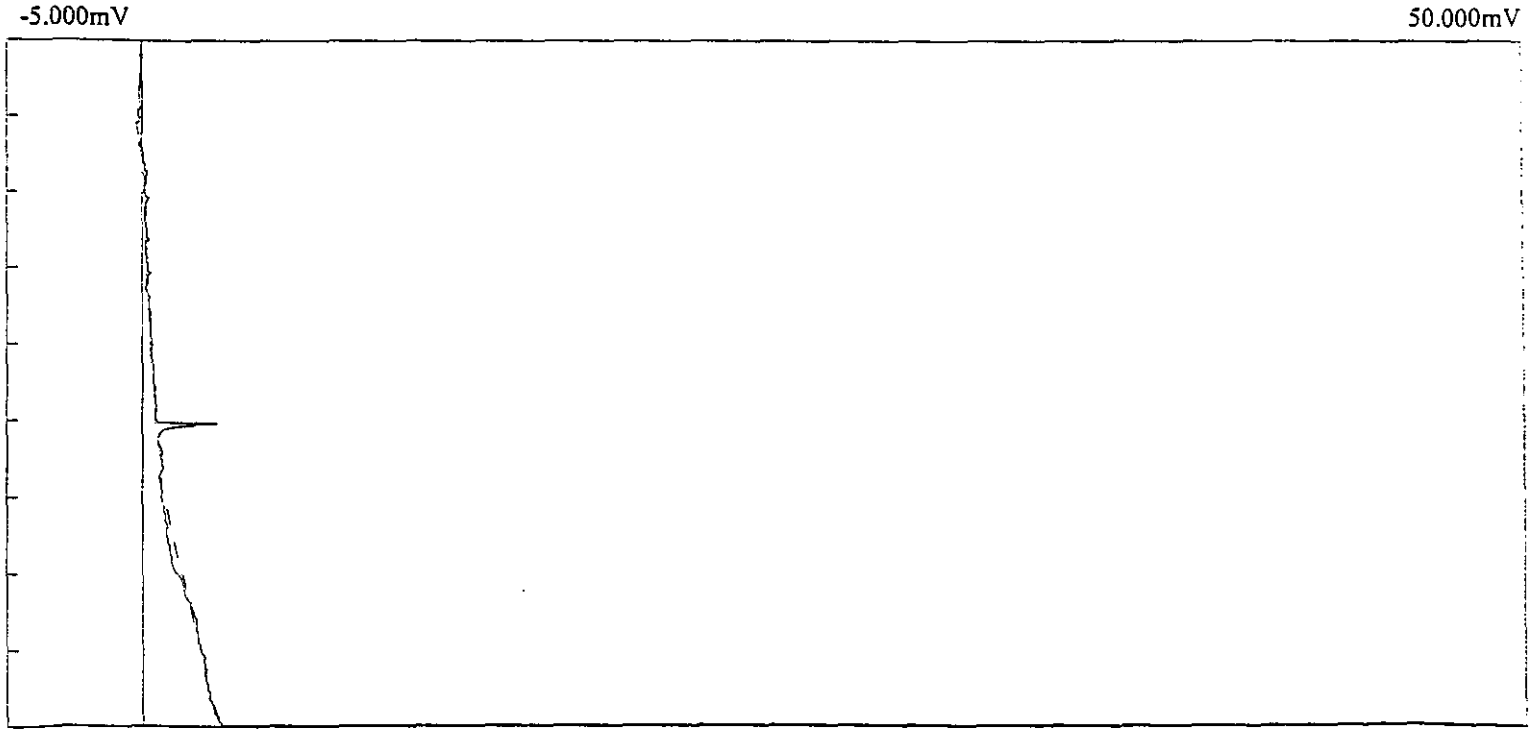
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 09:42:07
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: N2BLNK2.CHR (c:\peakwin)
Sample: N2 Blank Run
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
		0	0	

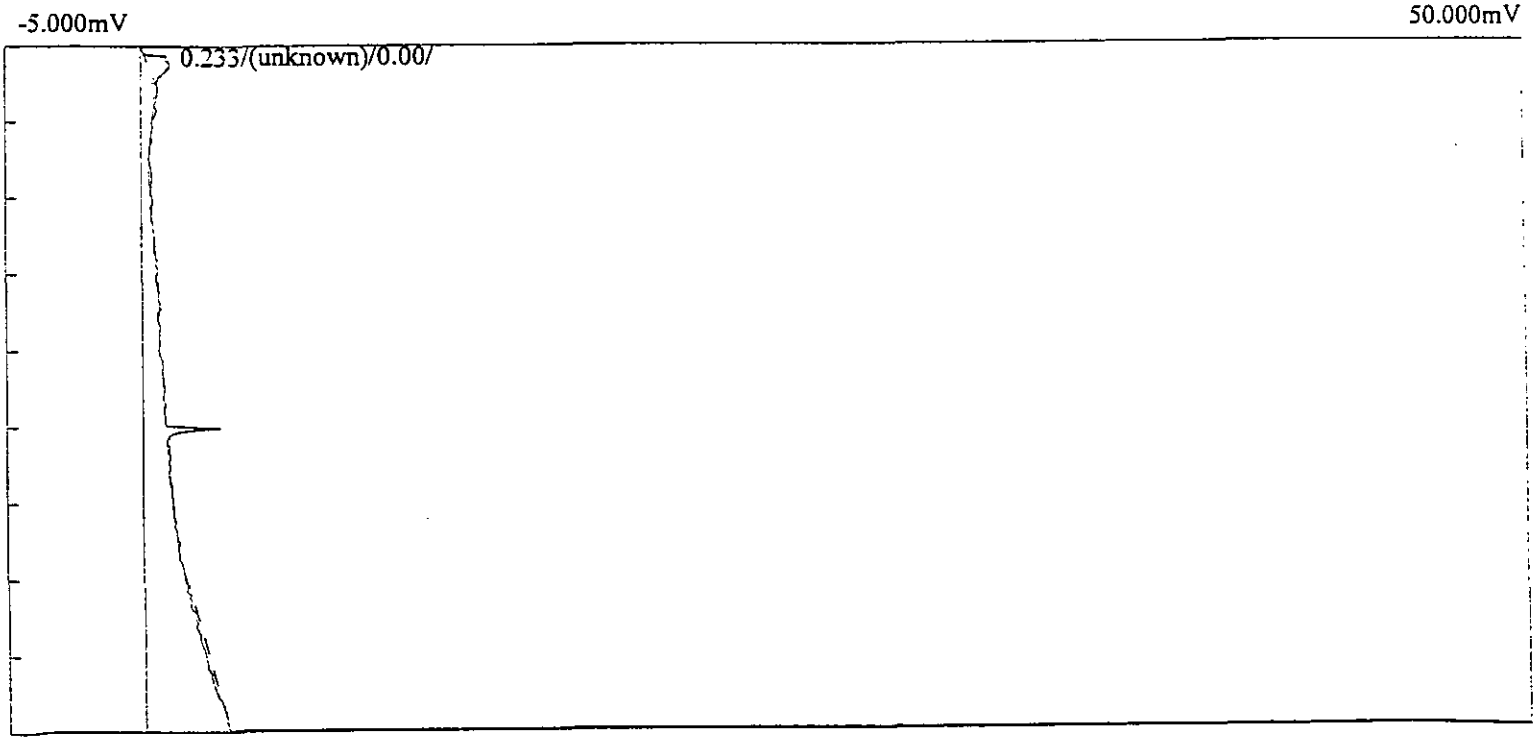
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 09:59:17
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: N2BLNK3.CHR (c:\peakwin)
Sample: N2 Blank Run
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
(unknown)	0.233	10.802	0.00	
		11	-1	

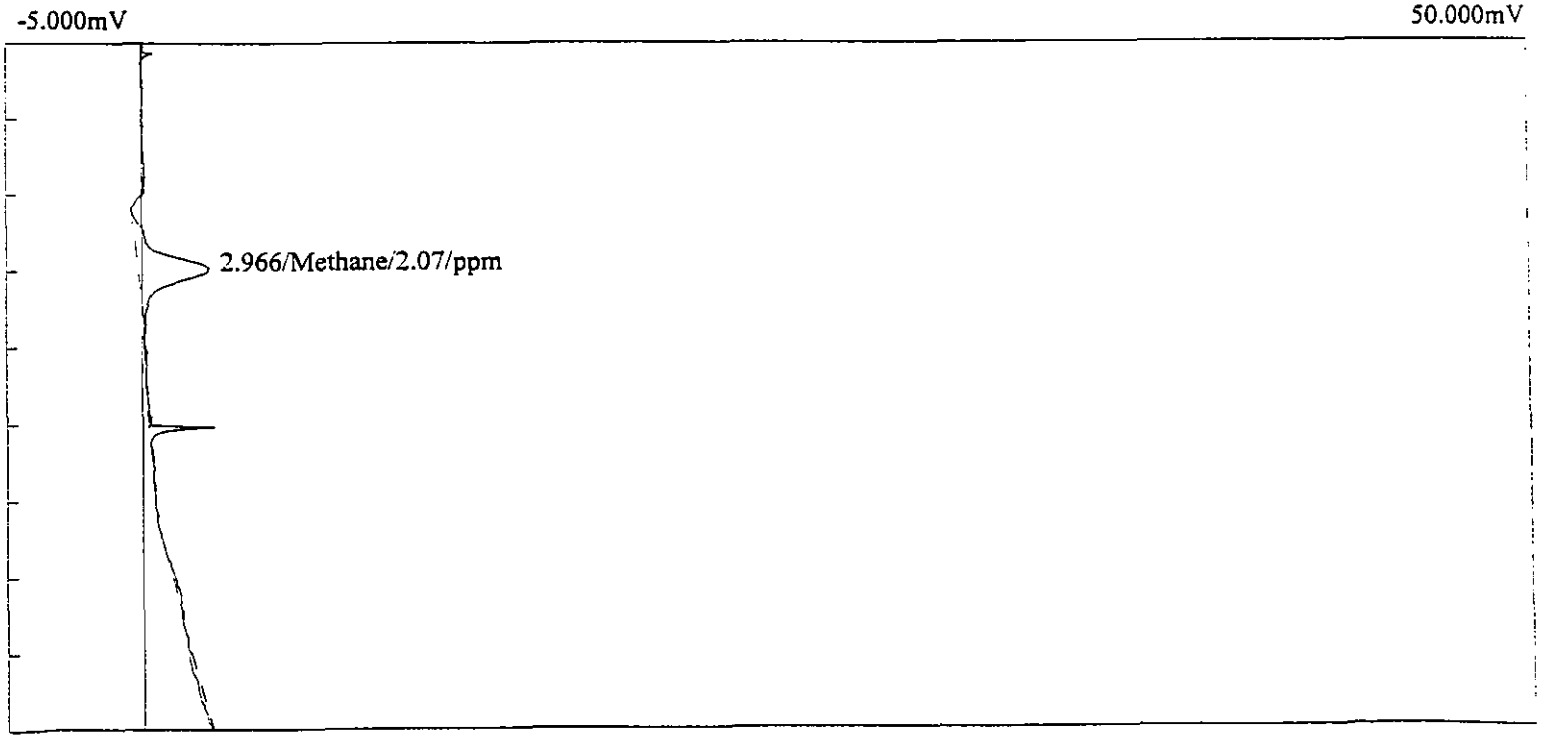
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 14:53:45
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: PROGLY2.CHR (c:\peakwin)
Sample: Propylene glycol
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.966	66.124	2.07	ppm
		66	2	

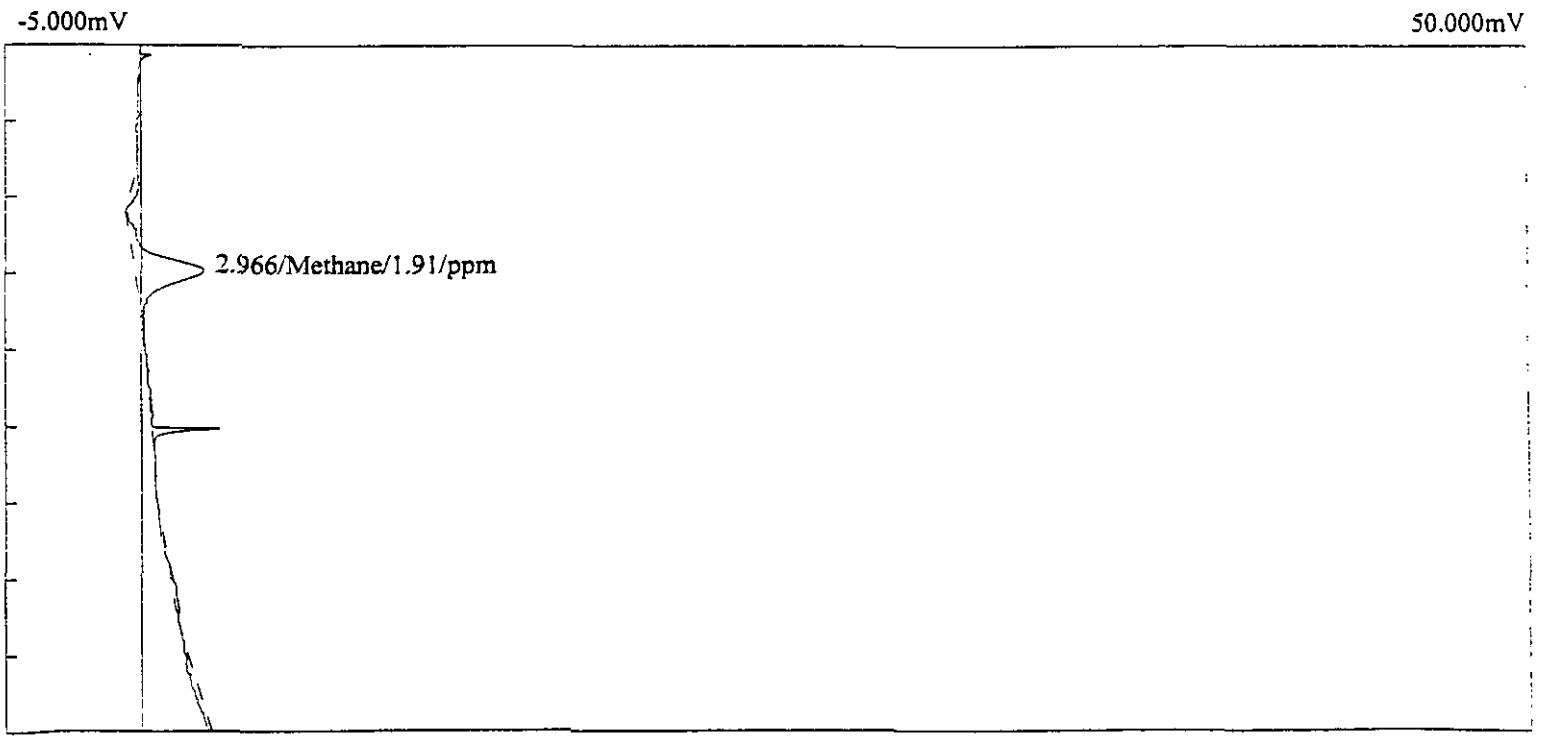
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 15:08:24
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: PROGLY3.CHR (c:\peakwin)
Sample: Propylene glycol
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.966	61.022	1.91	ppm
		61	2	

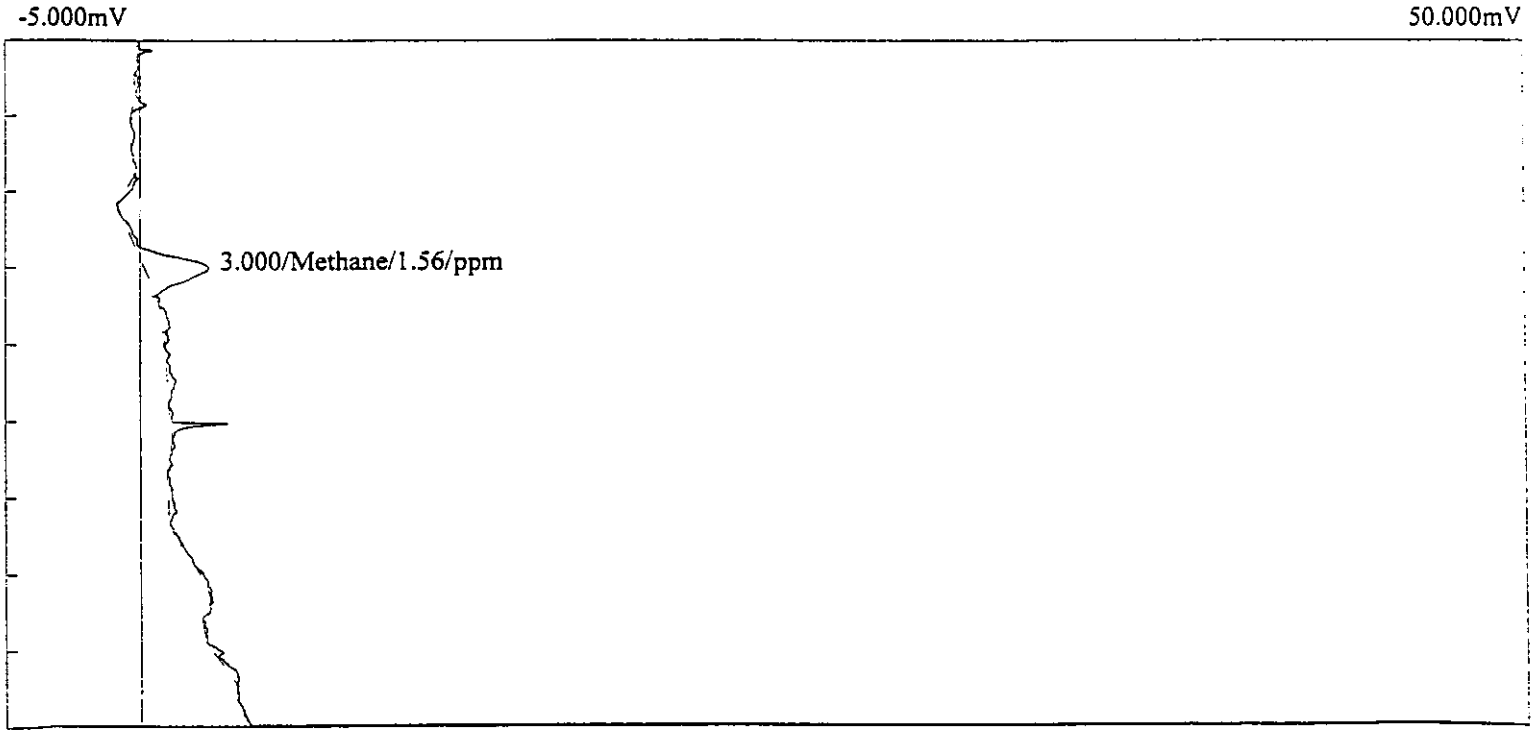
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 12:45:54
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: SULF2.CHR (c:\peakwin)
Sample: Burnt raw sulfur
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	49.832	1.56	ppm
		50	2	

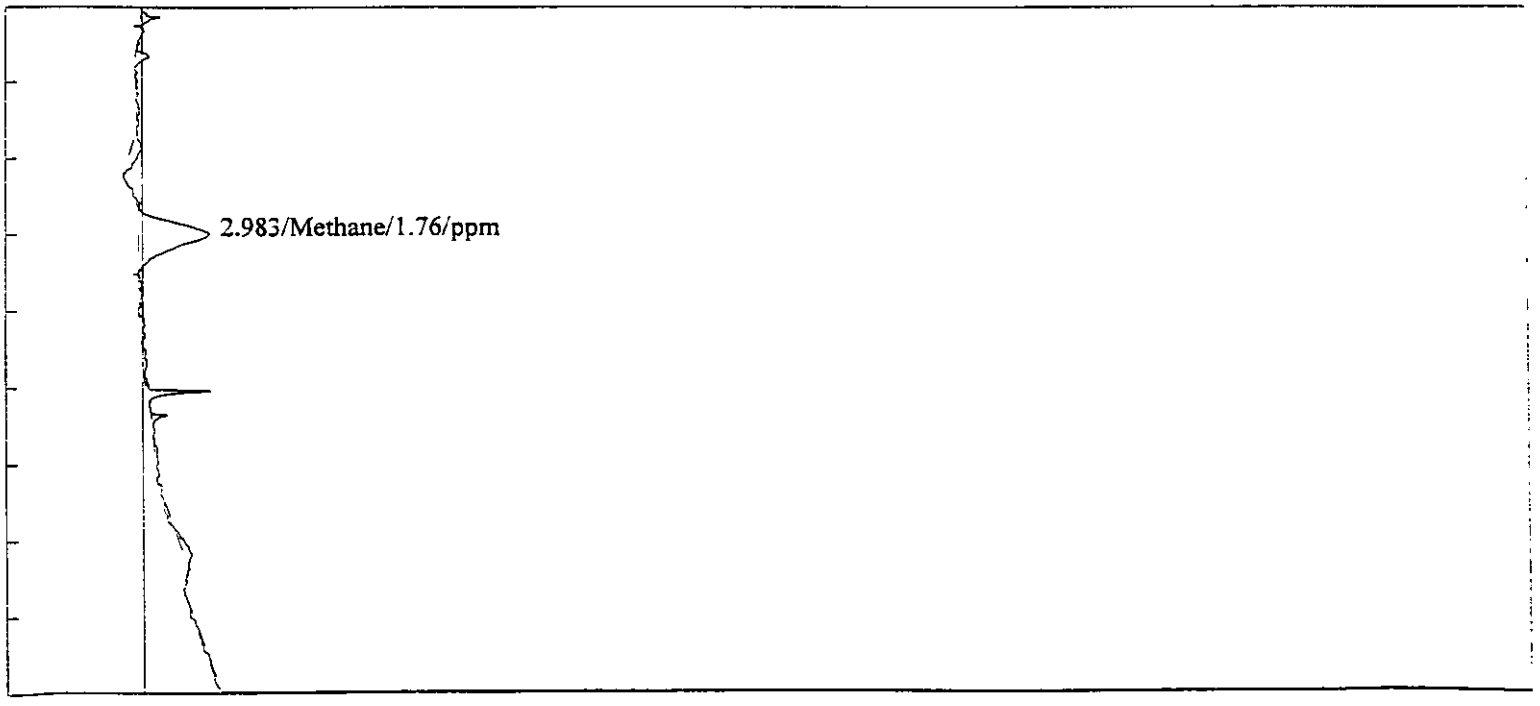
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 12:59:06
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: SULF3.CHR (c:\peakwin)
Sample: Burnt raw sulfur
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	2.983	56.250	1.76	ppm
		56	2	

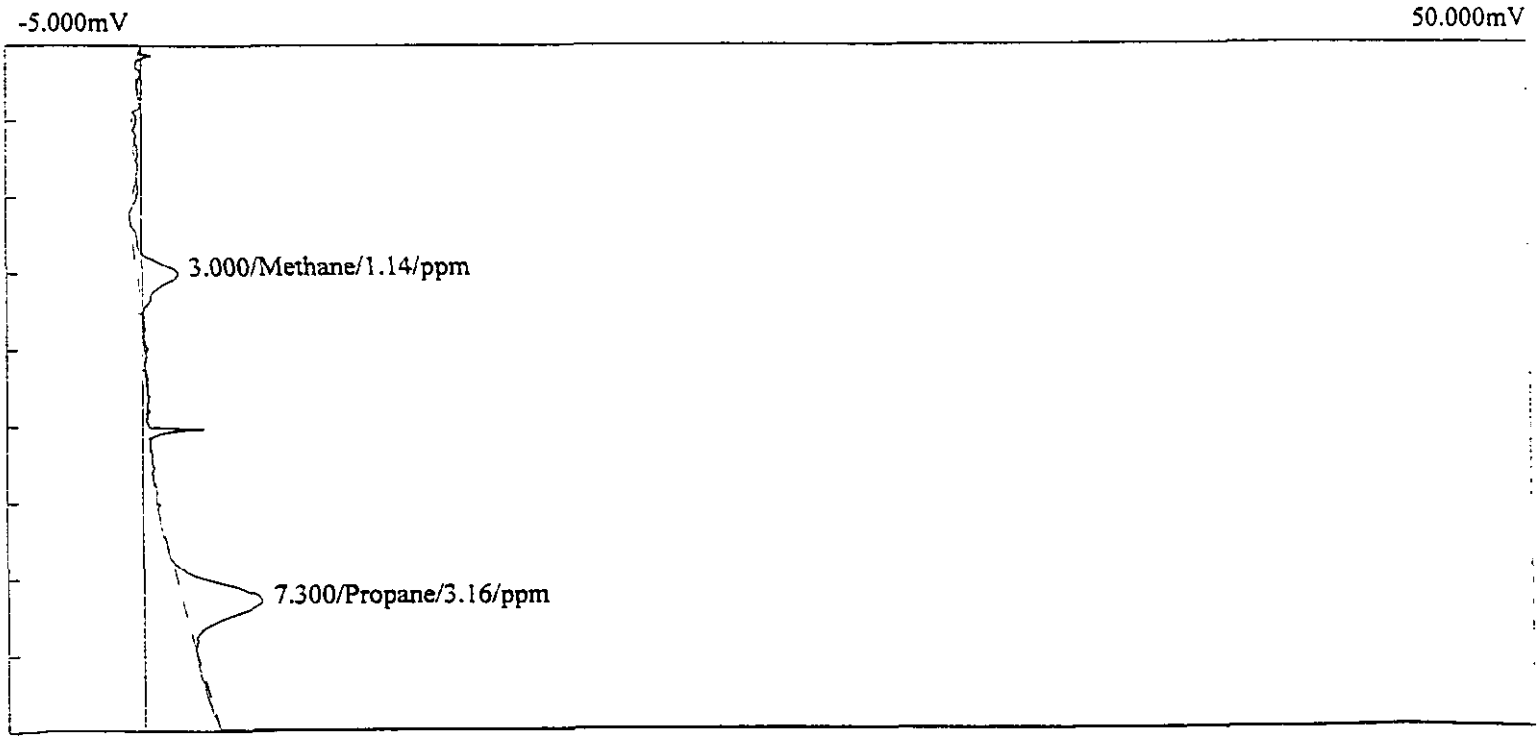
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 11:50:01
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: STD22.CHR (c:\peakwin)
Sample: Std 2 - 2.98ppm
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	36.491	1.14	ppm
Propane	7.300	83.112	3.16	ppm

120 4

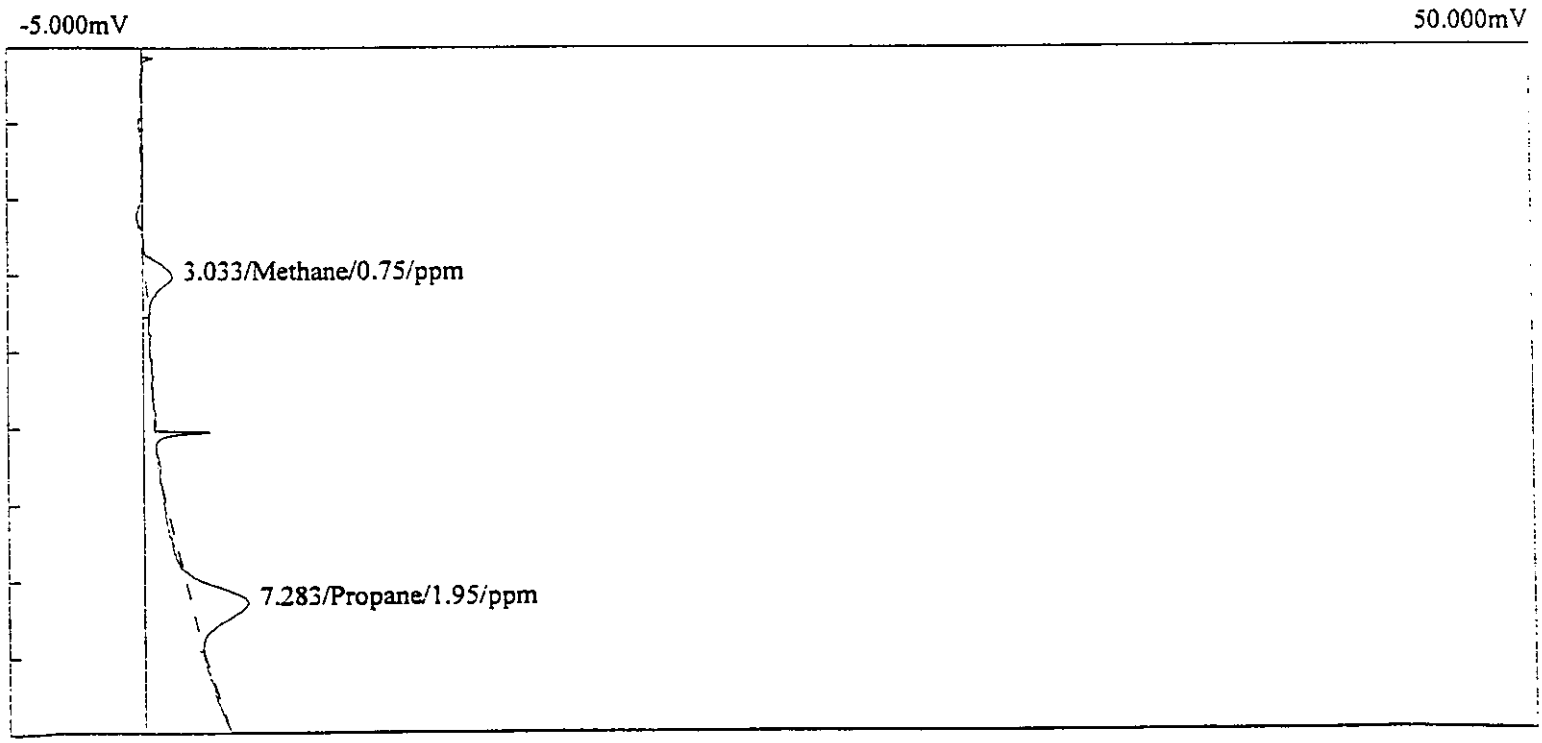
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 12:03:23
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: STD23.CHR (c:\peakwin)
Sample: Std 2 - 2.98ppm
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.033	23.822	0.75	ppm
Propane	7.283	51.289	1.95	ppm
		75	3	

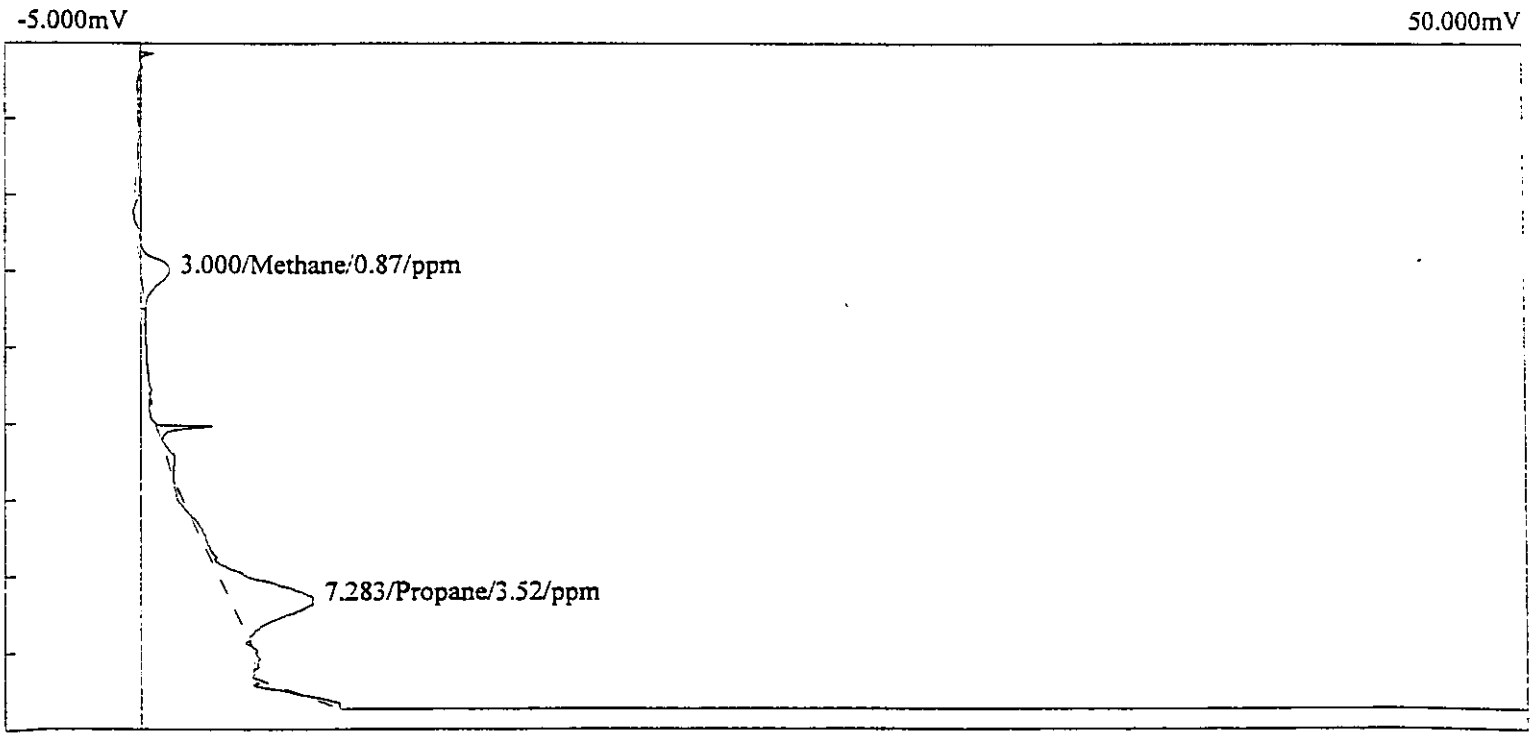
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 12:16:38
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: STD24.CHR (c:\peakwin)
Sample: Std 2 - 2.98ppm
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	27.614	0.87	ppm
Propane	7.283	92.669	3.52	ppm
		120	4	

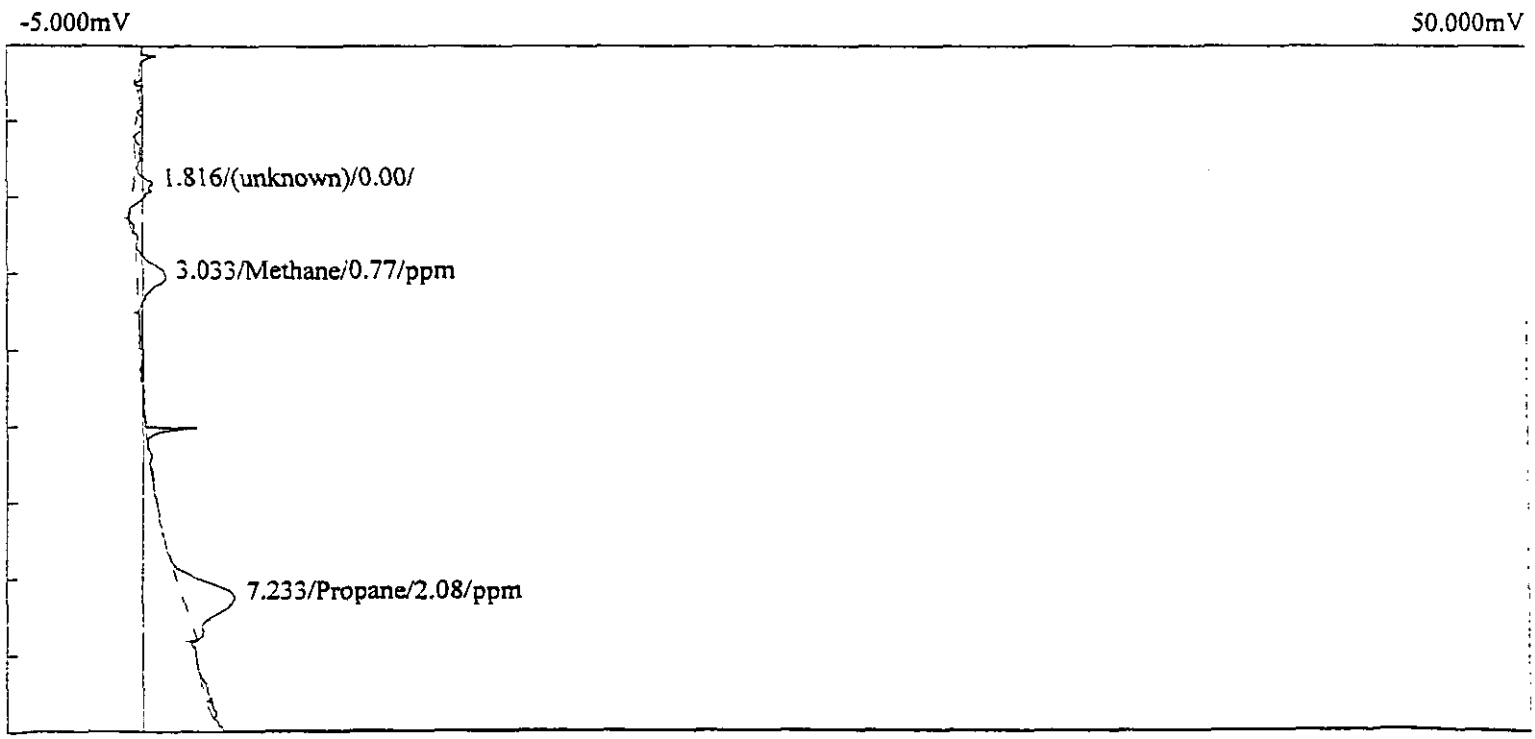
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 12:32:35
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: STD25.CHR (c:\peakwin)
Sample: Std 2 - 2.98ppm
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
(unknown)	1.816	12.008	0.00	
Methane	3.033	24.493	0.77	ppm
Propane	7.233	54.809	2.08	ppm
		91	2	

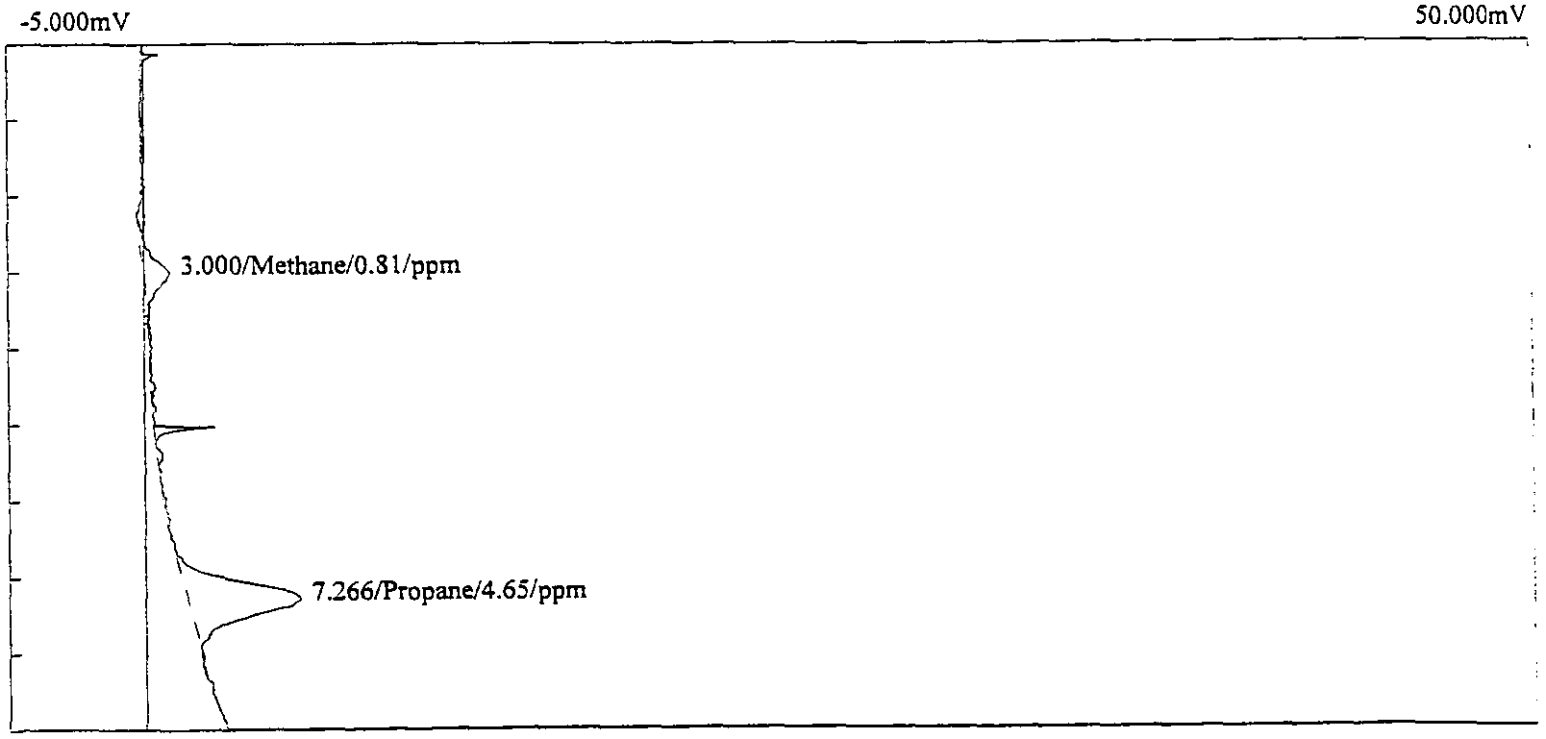
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 10:41:47
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: STD13.CHR (c:\peakwin)
Sample: Std 1 - 5.91ppm
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	25.921	0.81	ppm
Propane	7.266	122.220	4.65	ppm

148 5

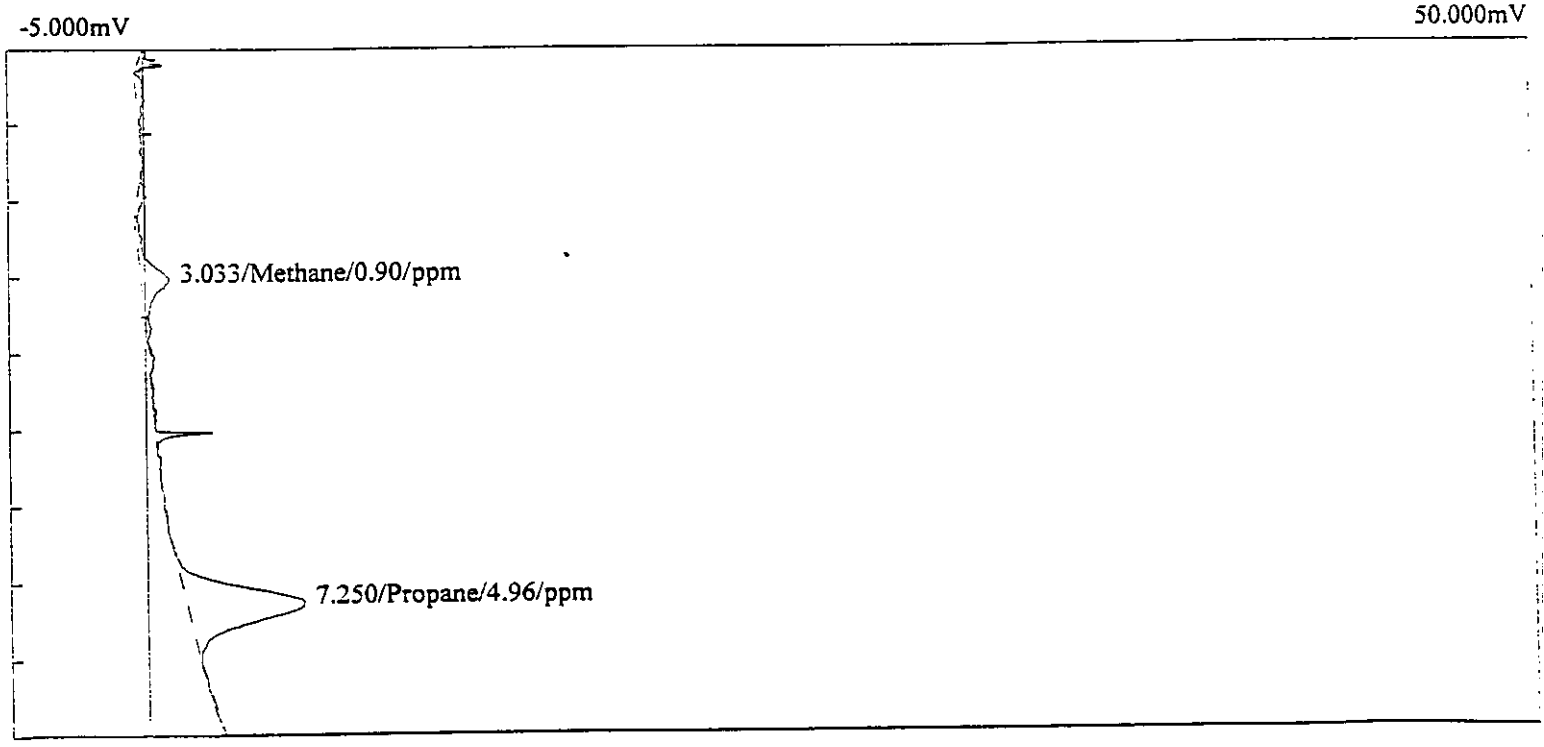
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 10:54:46
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: STD14.CHR (c:\peakwin)
Sample: Std 1 - 5.91ppm
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.033	28.789	0.90	ppm
Propane	7.250	130.344	4.96	ppm
		159	6	

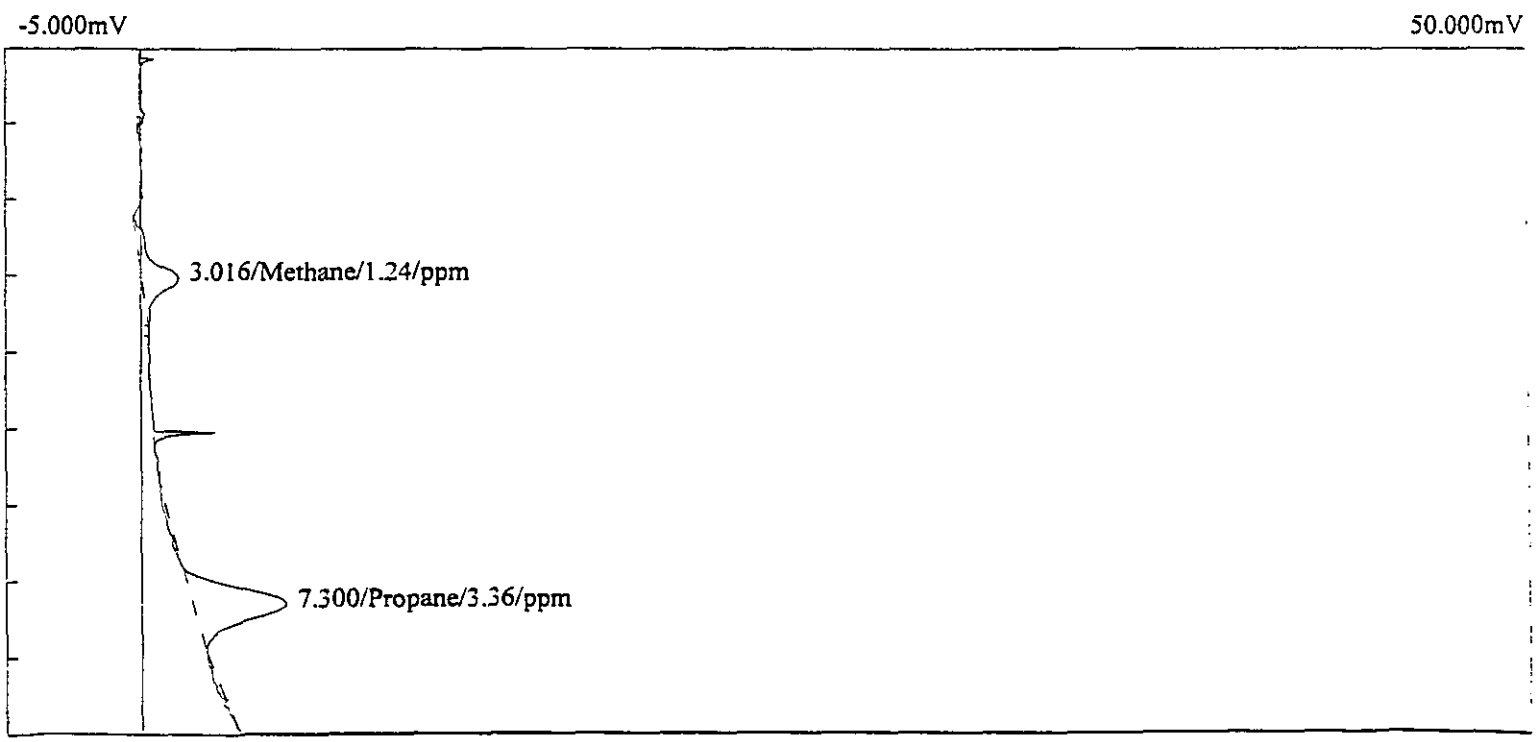
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 11:09:15
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: STD15.CHR (c:\peakwin)
Sample: Std 1 - 5.91ppm
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.016	39.430	1.24	ppm
Propane	7.300	88.446	3.36	ppm
		128	5	

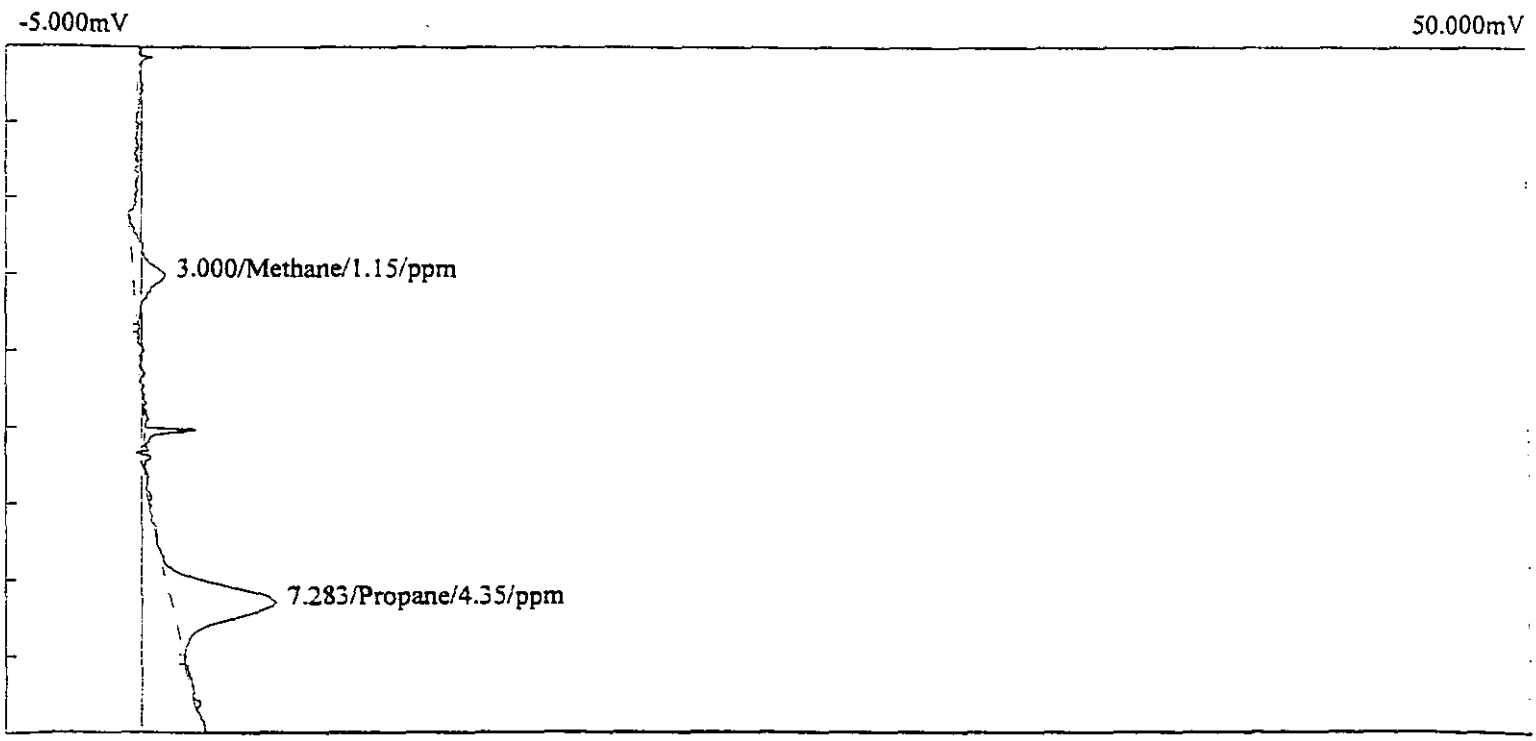
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/17/1995 11:23:20
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI2.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: STD16.CHR (c:\peakwin)
Sample: Std 1 - 5.91ppm
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Methane	3.000	36.698	1.15	ppm
Propane	7.283	114.420	4.35	ppm

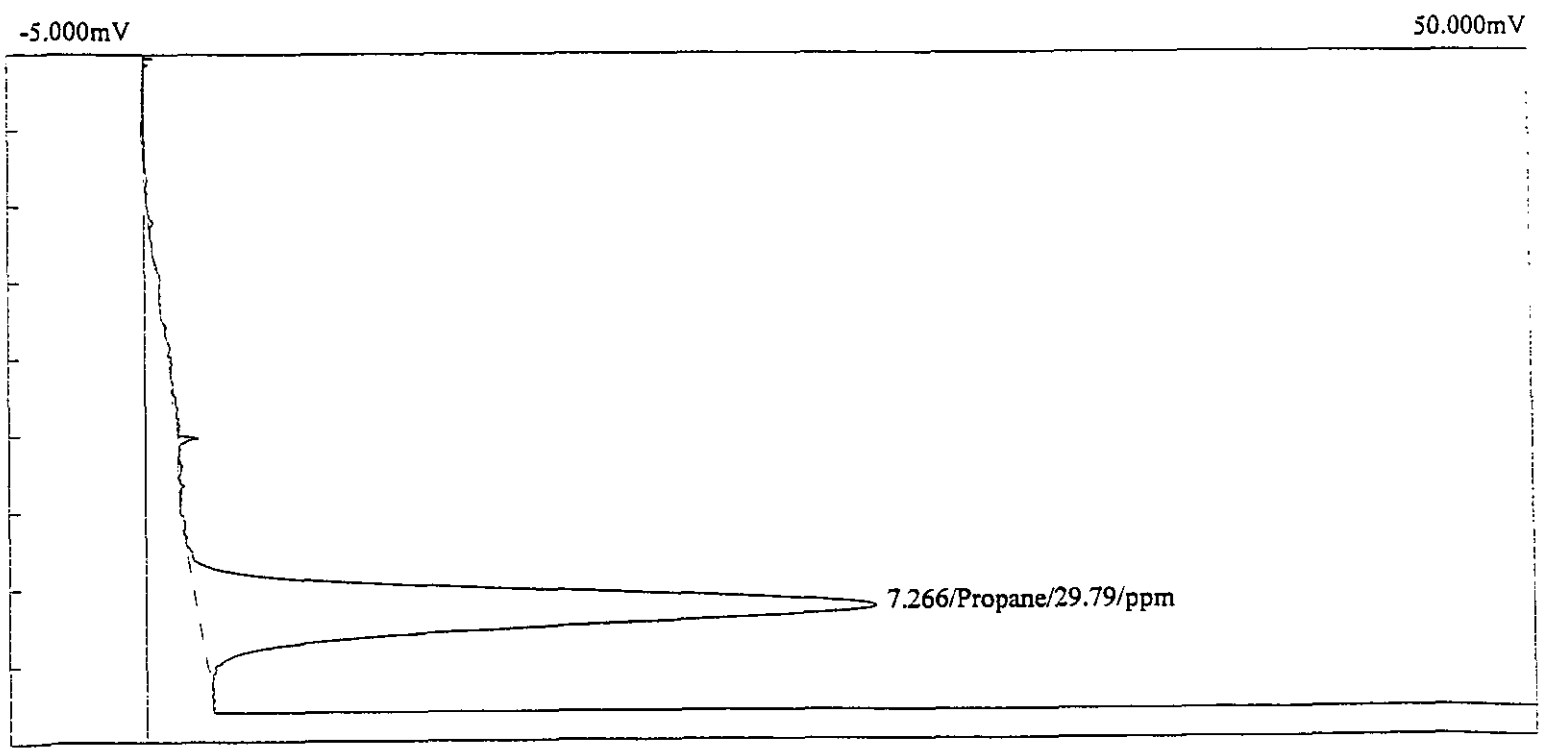
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 17:45:00
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: C3H82.CHR (c:\peakwin)
Sample: C3H8 std
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Propane	7.266	783.254	29.79	ppm
		783	30	

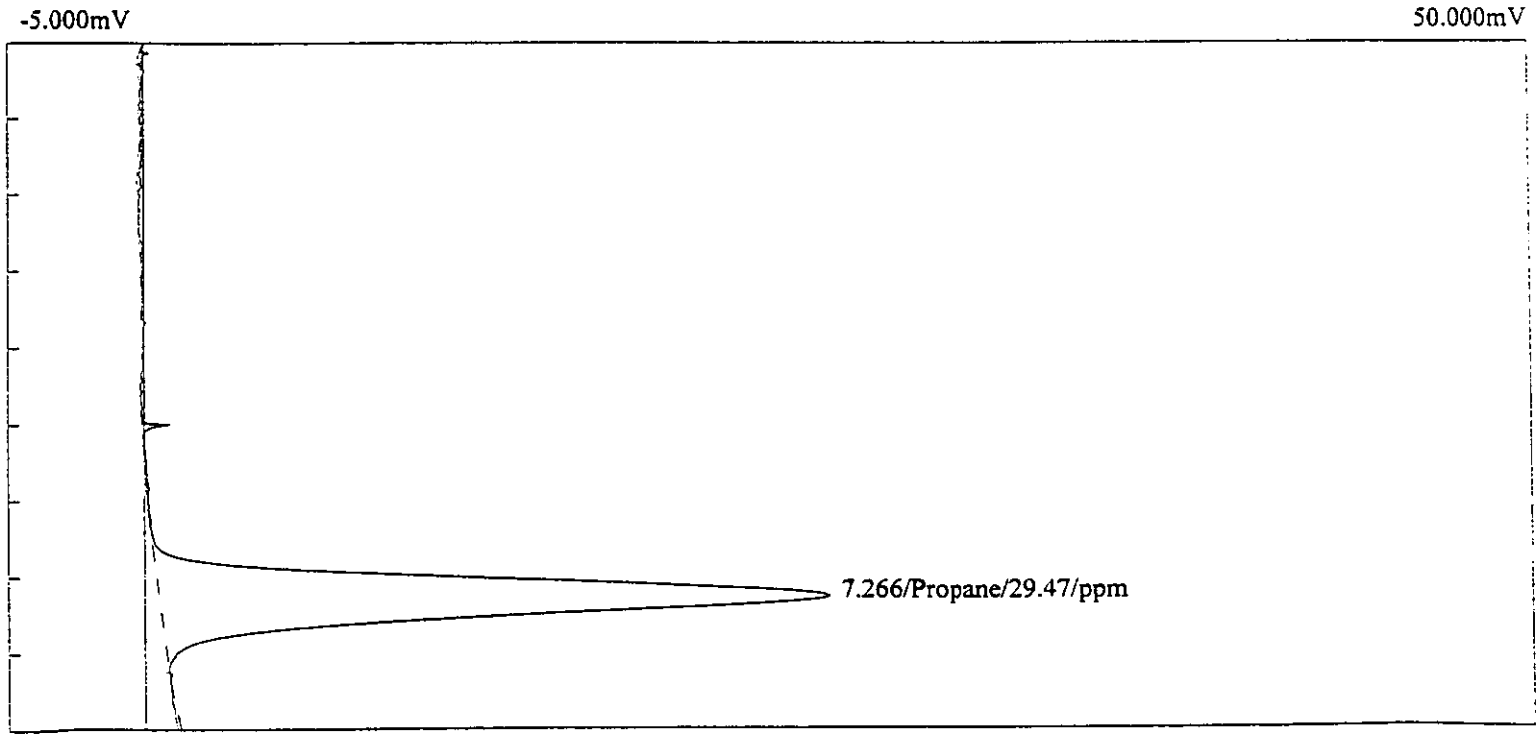
Lab name: Fluid Management, Inc.
Client: Ladish Malting Co.
Client ID: J95.502AQ
Collected: 11/14/95
Analysis date: 11/14/1995 17:57:20
Method: Mod. USEPA Method 18
Description: Ch. 1 FMI-FID
Column: 3' Silica Gel
Carrier: N2 at 300 on dial
Temp. prog: FMI.TEM
Components: FMI.CPT
Control file: DEFAULT.CON
Data file: C3H83.CHR (c:\peakwin)
Sample: C3H8 std
Operator: Michael B. Weiner
Comments: 10-port Valco valve with 1.0 ml loop and backflush

Temperature program:

Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Components:

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm



Component	Retention	Area	External	Units
Propane	7.266	774.786	29.47	ppm
		775	29	

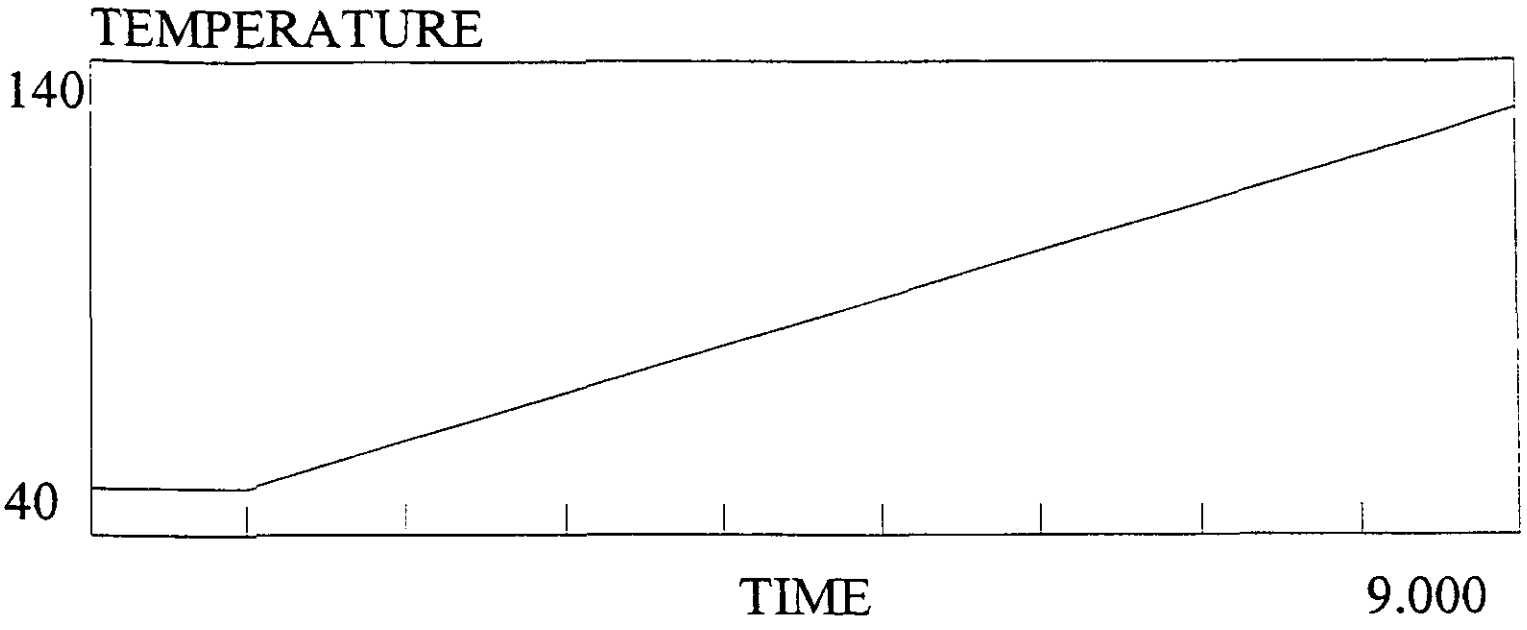
APPENDIX D

Calibration Data

Event file: FMI.EVT

Time	Event
0.000	ZERO
0.100	G ON (Load to Inject)
0.150	G OFF (Load to Inject)
5.000	H ON (Inject to Load)
5.100	H OFF (Inject to Load)
5.150	INTEG BASED

Temperature control file: FMI.TEM

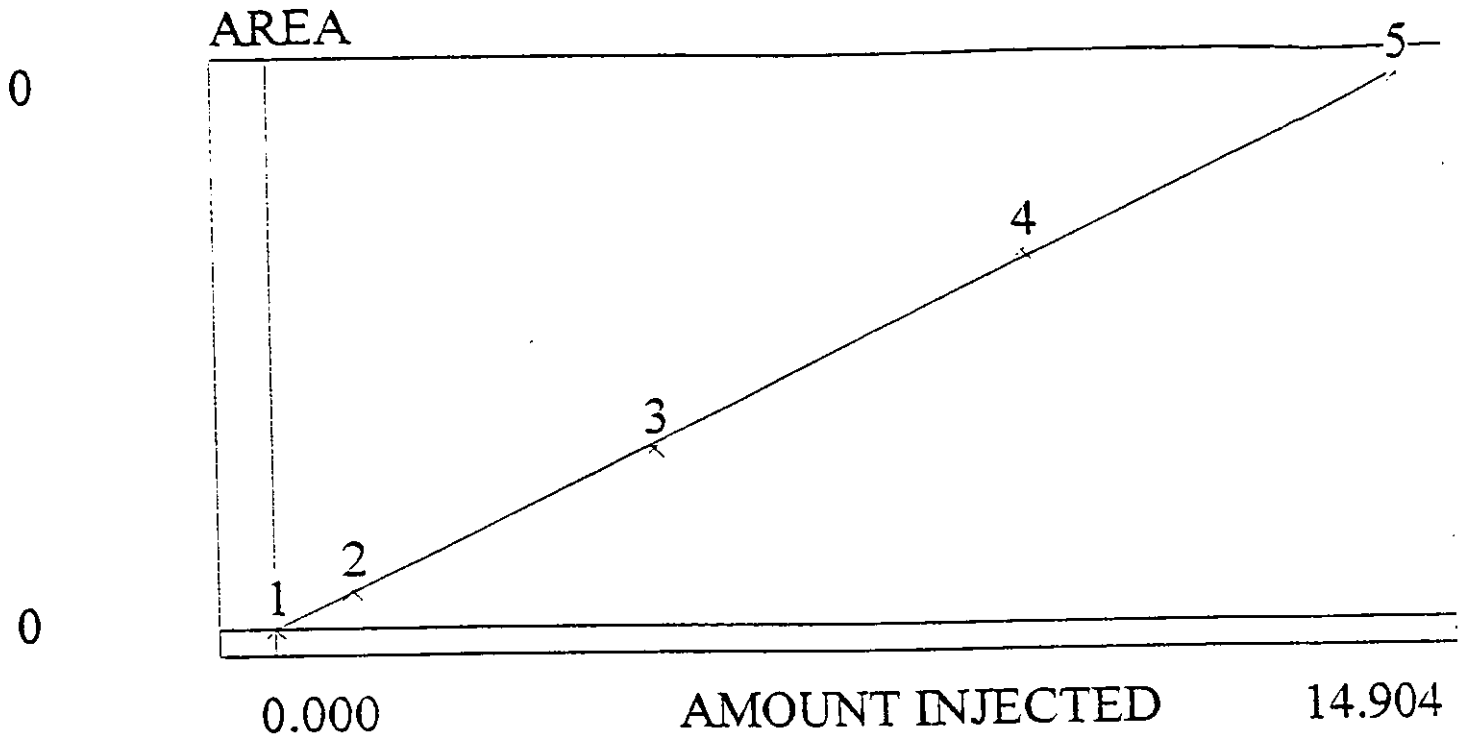


Init temp	Hold	Ramp	Final temp
50	1.000	10.000	130

Component file: FMI.CPT

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Methane	2.850	3.150	CH4.CAL	0.000	ppm
2	Propane	7.150	7.450	C3H8.CAL	0.000	ppm

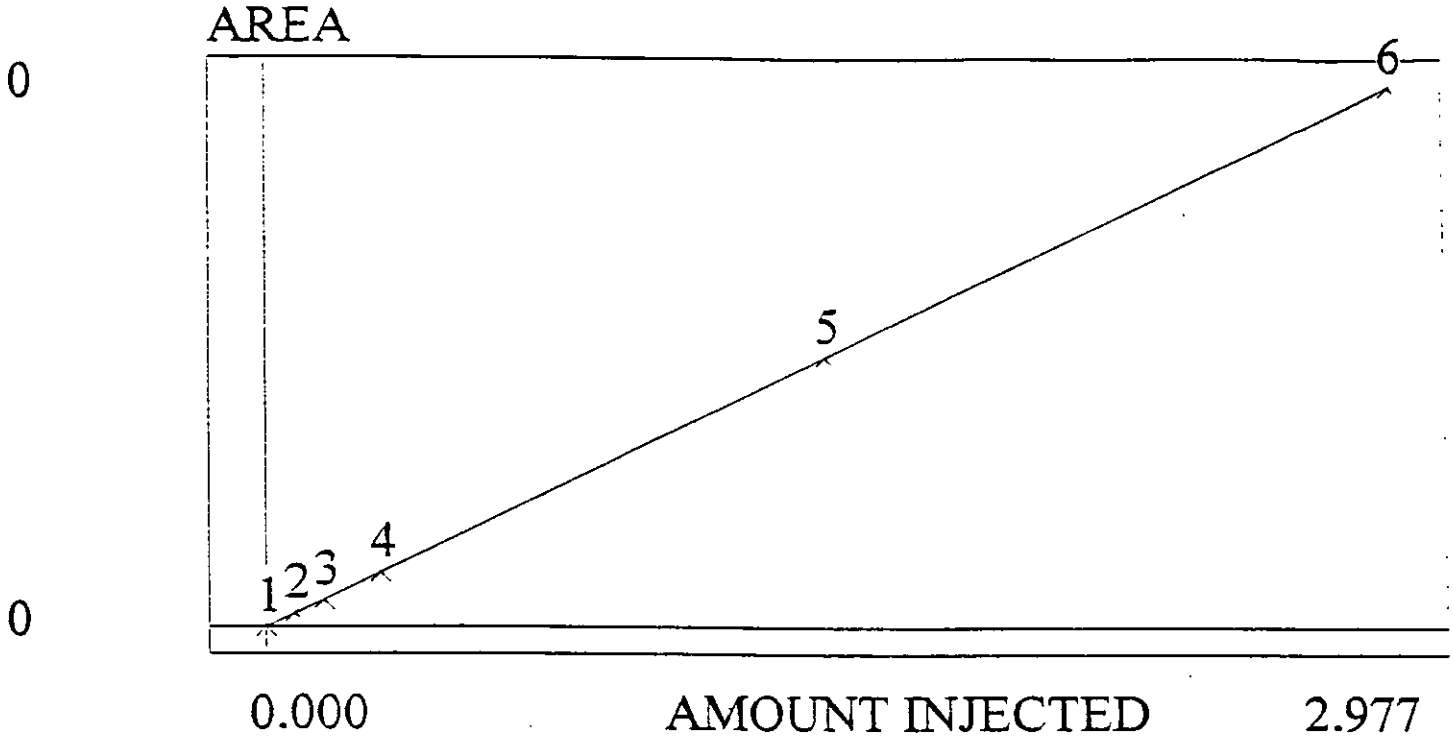
Calibration file: CH4.CAL



Avg slope of curve: 31.87
Y-axis intercept: 0.00
Linearity: 1.00
Number of levels: 5
SD/rel SD of CF's: 14.3/56.0
Y=0.0314X
r2: 0.9996

Lvl	Area/ht.	Amount	CF
1	0.000	0.000	0.000
2	33.000	1.000	33.000
3	155.000	5.000	31.000
4	325.000	10.000	32.500
5	475.000	15.000	31.667

Calibration file: C3H8.CAL



Avg slope of curve: 26.29
Y-axis intercept: 0.00
Linearity: 1.00
Number of levels: 6
SD/rel SD of CF's: 10.8/49.0
Y=0.0380X
r2: 1.0000

Lvl.	Area/ht.	Amount	CF
1	0.000	0.000	0.000
2	1.975	0.074	26.689
3	3.920	0.149	26.309
4	7.825	0.298	26.258
5	39.160	1.489	26.300
6	78.250	2.978	26.276

APPENDIX E

Process Data

FAX Transmission

From:	Gail A. Smith	Ladish Malting Co.
Questions?	Call 414-674-3730 Fax 414-674-6158	N5355 Junction Road Jefferson, WI 53549
To:	Michael Weiner	
Company:	Fluid Management, Inc.	
Address:	250 E. Wisconsin, Ave. Milwaukee, WI 53202	
Date:	November 16, 1995	
Time:	4:32 PM	Pages: 2 (including this one)

Message: Here is the data on average coil temperatue and fan output for the period of time when you were measuring. If there is any other data you need to complete this project, please call.

TEMPERATURES & FAN SPEEDS FOR 15 KILN

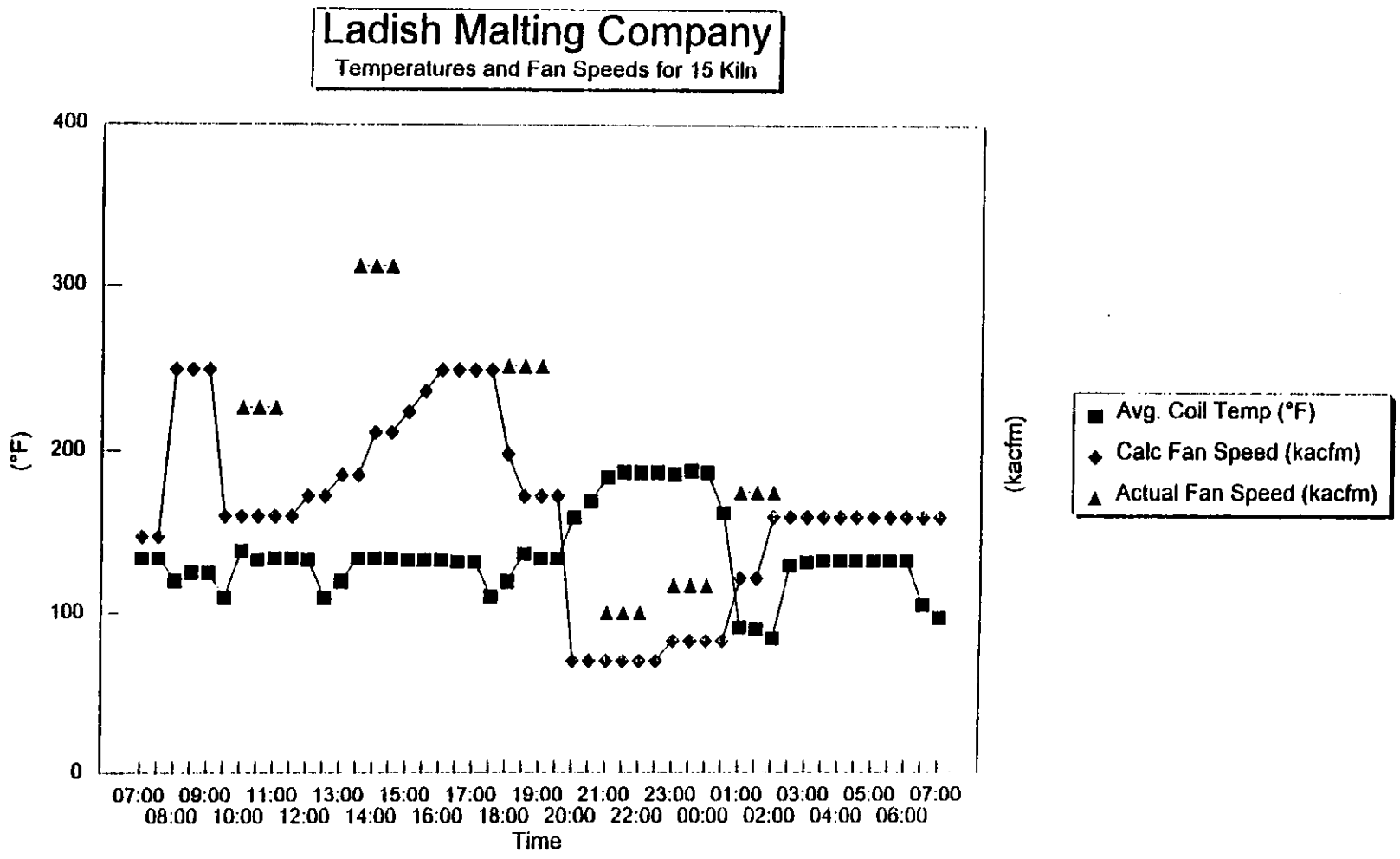
NOVEMBER 14 & 15, 1995 FROM 7 AM TO 7 AM

TIME	AVG COIL TEMP.	% FAN OUTPUT	TIME	AVG COIL TEMP.	% FAN OUTPUT
07:00 AM	134	60	19:30	134	70
07:30	134	60	20:00	160	30
08:00	120	100	20:30	170	30
08:30	125	100	21:00	185	30
09:00	125	100	21:30	188	30
09:30	110	65	22:00	188	30
10:00	139	65	22:30	188	30
10:30	133	65	23:00	187	35
11:00	134	65	23:30	189	35
11:30	134	65	00:00	188	35
12:00 PM	133	70	00:30	162	35
12:30	110	70	01:00 AM	92	50
13:00	120	75	01:30	91	50
13:30	134	75	02:00	85	65
14:00	134	85	02:30	130	65
14:30	134	85	03:00	132	65
15:00	133	90	03:30	133	65
15:30	133	95	04:00	133	65
16:00	133	100	04:30	133	65
16:30	132	100	05:00	133	65
17:00	132	100	05:30	133	65
17:30	111	100	06:00	133	65
18:00	120	80	06:30	106	65
18:30	137	70	07:00	98	65
19:00	134	70			

DRY CYCLE FOR 15 KILN 11/14-11/15

7000 BUSHELS ON EACH FLOOR-TWO FLOORS
UPPER FLOOR MALT GOES FROM 45-48 % MOISTURE TO 15-20 % DURING 24 HOURS
LOWER FLOOR MALT GOES FROM 15-20 % MOISTURE TO 3.5-4.3 % DURING 24 HOURS

7 AM TO 7:30 PM Holding heats
7:30-830 PM First high heat
8:30 PM to 12:30 AM Second high heats
12:30 AM to 1:00 AM Cool down
1:00 AM Kiln dumped
1:30-3:00 AM Upper floor is empty
3:30-5:00 AM Upper floor is being loaded
Note: At 1:00 AM the fans may have been off for 10-15 min. while the kiln floors were dumped

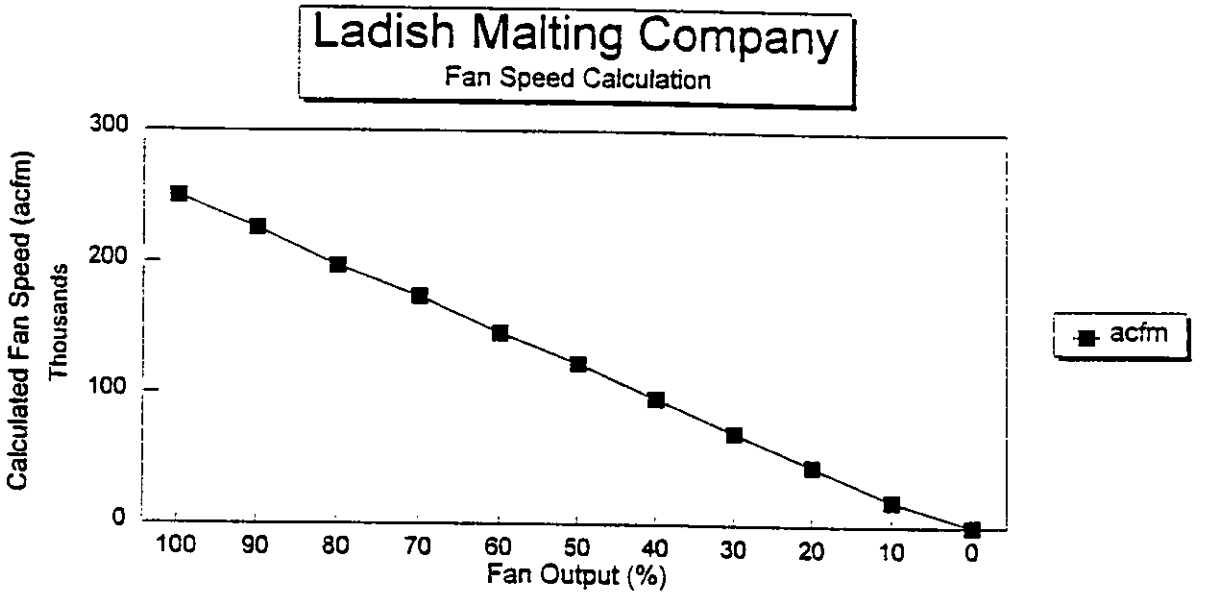

Ladish Malting Company
Temperatures and Fan Speeds for 15 Kiln
400
300
200
100
0
(°F)
(kacfm)
07:00 09:00 11:00 13:00 15:00 17:00 19:00 21:00 23:00 01:00 03:00 05:00 07:00
08:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00 00:00 02:00 04:00 06:00
Time
Avg. Coil Temp (°F)
Calc Fan Speed (kacfm)
Actual Fan Speed (kacfm)

% Fan Output	Calculated acfm
100	250,000
90	226,000
80	197,000
70	174,000
60	146,000
50	123,000
40	96,200
30	70,543
20	44,886
10	19,229
0	0

Regression Output:

Constant		-6428.57
Std Err of Y Est		1576.615
R Squared		0.999138
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	2565.714	
Std Err of Coef.	37.6883	

$y = mx + b$



APPENDIX F

Key Personnel

List of Personnel

Source Testing Personnel
Michael B. Weiner (FMI)
Jeffrey K. Anderson (FMI)

Plant Personnel
Roger Ziegler (Ladish Malting Company)
Gail Smith (Ladish Malting Company)

Regulatory Personnel
James Crawford (WDNR)