



STATEMENT OF QUALIFICATIONS



AIR HYGIENE

COMBUSTION ENGINE AIR TESTING SERVICES

www.airhygiene.com

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INTRODUCTION

AIR HYGIENE INTERNATIONAL, INC. (AIR HYGIENE) is a privately held, professional service firm based in Tulsa, Oklahoma. **AIR HYGIENE** specializes in air emission testing services for combustion turbines throughout the United States and internationally.

AIR HYGIENE has testing laboratories which serve a wide area of the United States. Each mobile laboratory is equipped with the following equipment and capabilities:

1. State-of-the-Art air emission analyzers, computers, and datalogging software. All designed into an efficient system to provide the fastest, most reliable information possible!
2. On-board printers to provide hard copies of testing information on-site!
3. Networking capabilities to provide real-time emission data directly into the control room!

In addition, **AIR HYGIENE** offers the deluxe emission testing laboratory with multiple combustion analyzer systems to conduct simultaneous emission testing on multiple sources or dual location sampling on a single source.

AIR HYGIENE is known for the following:

- Providing superior, cost saving services to our clients!
- High quality emission testing personnel with service oriented, friendly attitude!
- Meeting our client's needs whether it is 24 hour a day testing or short notice mobilization!
- Using great equipment that is maintained and dependable!
- Knowing air emission test methods inside and out!
- Understanding the unique startup and operational needs associated with combustion turbines!

MISSION STATEMENT

Our mission is to provide innovative, practical, and top-quality services that allow companies to increase operating efficiency, save money, and comply with federal/state requirements. We believe our first responsibility is to the client. In providing our unique services, the owners of **AIR HYGIENE** demand ethical conduct from each employee of the company. The character and integrity of **AIR HYGIENE** employees allows our clients to feel confidence in the air testing services of **AIR HYGIENE**. Through a long-term commitment to this mission, **AIR HYGIENE** is known as a company committed to improving our clients' operations.

AIR HYGIENE ... Does work worth paying for every time!
 ... Is well known for our emission testing services and uncompromising efforts to serve our clients!
 ... Does work that matters!
 ... Is proud of our emission testing capabilities!
 ... Provides exciting growth opportunities for energetic individuals!



COMPRESSOR ENGINE TESTING SERVICES BROCHURE

Thank you for your consideration of the natural gas industry testing services of Air Hygiene International, Inc. (AHI). The following list details some of the testing services and extras AHI includes with each testing job.

Types of Air Testing Services for Compressor Engines:

- Periodic monitoring for NO_x, CO, VOCs (quarterly, semi-annual, annual, biennial)
- Engine Compliance Testing to meet state and federal requirements (PSD, RACT, BACT, MACT, Permit)
- Pre and Post Catalyst testing for pollutant destruction efficiency
- Engine performance testing to verify manufacturer's emission guarantees
- Research and Development (R&D) emission data research and engine optimization
- Initial permit compliance testing for PM, PM-10, PM-2.5, SO₂, NO_x, CO, exhaust flow, moisture, O₂, CO₂, Formaldehyde, other HAPs



AHI will provide the following on engine equipment tests:

- Our own power supply!
- On-site test data and report!
- Fuel F-Factor calculation data sheet!
- Experienced engine testing personnel!
- Flexible testing schedules to meet your needs!
- Electronic reports provided on CD upon request!
- Extensive experience with majority of state agencies in the U.S.
- EPA Protocol 1 Certified Gases (one percent accuracy) for precise calibration
- Low range (0-10 ppm) equipment calibration and measurement available
- Test protocol preparation, coordination with state agency, and site personnel
- Numerous mobile testing labs, which may be used for your projects across the U.S.
- State-of-the-art data logging technology to allow real-time examination of meaningful emission data



AHI is committed to providing testing teams that will take the time to meet your needs. We ensure the job is completed on time with the least amount of interruption to your job and site operation as possible. Thank you for considering our services.

TESTING EXPERIENCE

AIR HYGIENE personnel account for more than seventeen years of testing experience for a variety of industries. Our testing services have involved dealings with numerous state agencies and EPA regional offices, including the following:

- Alabama Department of Environmental Management (ADEM)
- Arizona Department of Environmental Quality (ADEQ)
- Arkansas Department of Pollution Control and Ecology (ADPC&E)
- California Air Resources Board (CARB)
- Colorado Department of Public Health and Environment (CDPHE)
- Florida Department of Environmental Protection (FDEP)
- Georgia Department of Environmental Quality (GDEQ)
- Kansas Department of Health and Environment (KDHE)
- Kentucky Division for Air Quality (KDAQ)
- Louisiana Department of Environmental Quality (LDEQ)
- Massachusetts Department of Environmental Protection (MDEP)
- Mississippi Department of Environmental Quality (MDEQ)
- Missouri Department of Natural Resources (MDNR)
- Michigan Department of Environmental Quality (MDEQ)
- Nebraska Department of Environmental Quality (NDEQ)
- New Mexico Environmental Department (NMED)
- Oklahoma Department of Environmental Quality (ODEQ)
- Pennsylvania Department of Environmental Protection (PDEP)
- South Coast Air Quality Management District (SCAQMD)
- Tennessee Department of Environment and Conservation (TDEC)
- Texas Natural Resource Conservation Commission (TNRCC)
- Utah Department of Environmental Quality (UDEQ)
- Virginia Department of Environmental Quality (VDEQ)
- Wyoming Department of Environmental Quality (WDEQ)



TESTING SUCCESS STORIES

AIR HYGIENE personnel have performed thousands of testing projects which have yielded significant benefits for our clients. The following project descriptions briefly discuss some of these emission testing projects.

- ***Currently perform quarterly engine testing in 10 states for over 500 engines per year following EPA Methods 3a (O₂ & CO₂), 7e (NO_x), 10 (CO), 19 (exhaust flow), and 25a (VOCs).***
- ***Small Natural Gas Fired Compressor Engines (Following EPA Methods CTM-030, CTM-034, 2, 3a, 4, 7e, 10, 19, and/or 25a) Selected methods depend on state and client preference.*** Over 5,000 engine tests in 25+ states.
- ***Combustion Turbine Testing and Add-On Services that include:***
 - Turbine emission mapping and emission performance testing
 - R&D emission data research and turbine control optimization
 - 40 CFR Part 60 Subpart GG – Turbine Compliance Testing
 - 40 CFR Part 75 – Acid Rain Classified Equipment Testing
 - RATA Testing on CEMS systems for NO_x, CO, SO₂, H₂S, O₂, Flow, and/or CO₂
 - Recordkeeping & Planning Documents (i.e. QA/QC and Monitoring Plans; Linearity Checks; Testing Protocols)
 - Permit compliance testing per state requirements for any/all of the following: Particulates as required (PM, PM-10, PM-2.5, and back-half condensables), SO₂, NO_x, CO, exhaust flow, moisture, O₂, CO₂, ammonia, formaldehyde, and others
- ***Certified portable analyzers for clients internal use and for state agency approval in New Mexico.***
- ***Combustion Source Compliance Test (natural gas fired turbines and reciprocating compressor engines (State required following EPA Methods 2 {exhaust flow}, 3a {O₂ & CO₂}, 4 {moisture}, 5 or 201a {PM or PM-10}, 7e or 20 {NO_x}, 9 {opacity}, 10 {CO}, 25a {THC}, CTM-027 {ammonia}, and EPA TO-11a or Celanese {Formaldehyde or other aldehyde species})***



INSTRUMENT CONFIGURATION AND OPERATIONS FOR GAS ANALYSIS

The sampling and analysis procedures used by **AIR HYGIENE** during tests conform in principle with the methods outlined in the Code of Federal Regulations, Title 40, Part 60, Appendix A, Methods 3a, 6c, 7e, 10, 19, 20, and 25a.

The flowchart on the next page depicts the sample system used by **AIR HYGIENE** for analysis of oxygen (O₂), carbon dioxide (CO₂), sulfur dioxide (SO₂), carbon monoxide (CO), nitrogen oxides (NO_x), and volatile organic compounds (VOC) tests. A heated stainless steel probe is inserted into the sample ports of the stack to extract gas measurements from the emission stream. The gas sample is continuously pulled through the probe and transported via 3/8 inch heat-traced Teflon® tubing to a stainless steel minimum-contact condenser designed to dry the sample through Teflon® tubing via a stainless steel/Teflon® diaphragm pump and into the sample manifold within the mobile laboratory. From the manifold, the sample is partitioned to the O₂, CO₂, SO₂, CO, and NO_x analyzers through glass and stainless steel rotameters that control the flow rate of the sample. The VOC sample is measured as a wet gas.

The flowchart shows that the sample system is also equipped with a separate path through which a calibration gas can be delivered to the probe and back through the entire sampling system. This allows for convenient performance of system bias checks as required by the testing methods.

All instruments are housed in an air-conditioned trailer (or van)-mounted mobile laboratory. Gaseous calibration standards are provided in aluminum cylinders with the concentrations certified by the vendor. EPA Protocol No. 1 is used to determine the cylinder concentrations where applicable (i.e. NO_x calibration gases).

All data from the continuous monitoring instruments are recorded on a Logic Beach Hyperlogger which retrieves calibrated electronic data from each instrument every second and reports an average of the collected data every 30 seconds and 10 seconds. The averaging time can be selected to meet the clients needs. **This data is available instantaneously for printout, statistical analysis, viewable by actual values, or examined by a trending graph!**

The number of test runs, test loads, and length of runs is based upon federal and state requirements for the facility. Typical run times associated with emission testing are as follows:

<u>Type of Test</u>	<u># of runs</u>	<u>Length of runs</u>
O ₂ Traverse (GG)- turbine	1 run @ 30% load (8 – 48 points)	1 - 2 minutes per point
Subpart GG - turbine	3 runs @ 4 loads (30%, 50%, 75%, & 100%)	15 – 20 minutes per run
RACT compliance testing	3 runs @ normal/peak load	1 hour per run
Initial State Permit Test (gases)	3 runs @ normal/peak load	30 – 60 minutes per run
Periodic assurance testing	3 runs @ normal/peak load	15 - 30 minutes per run

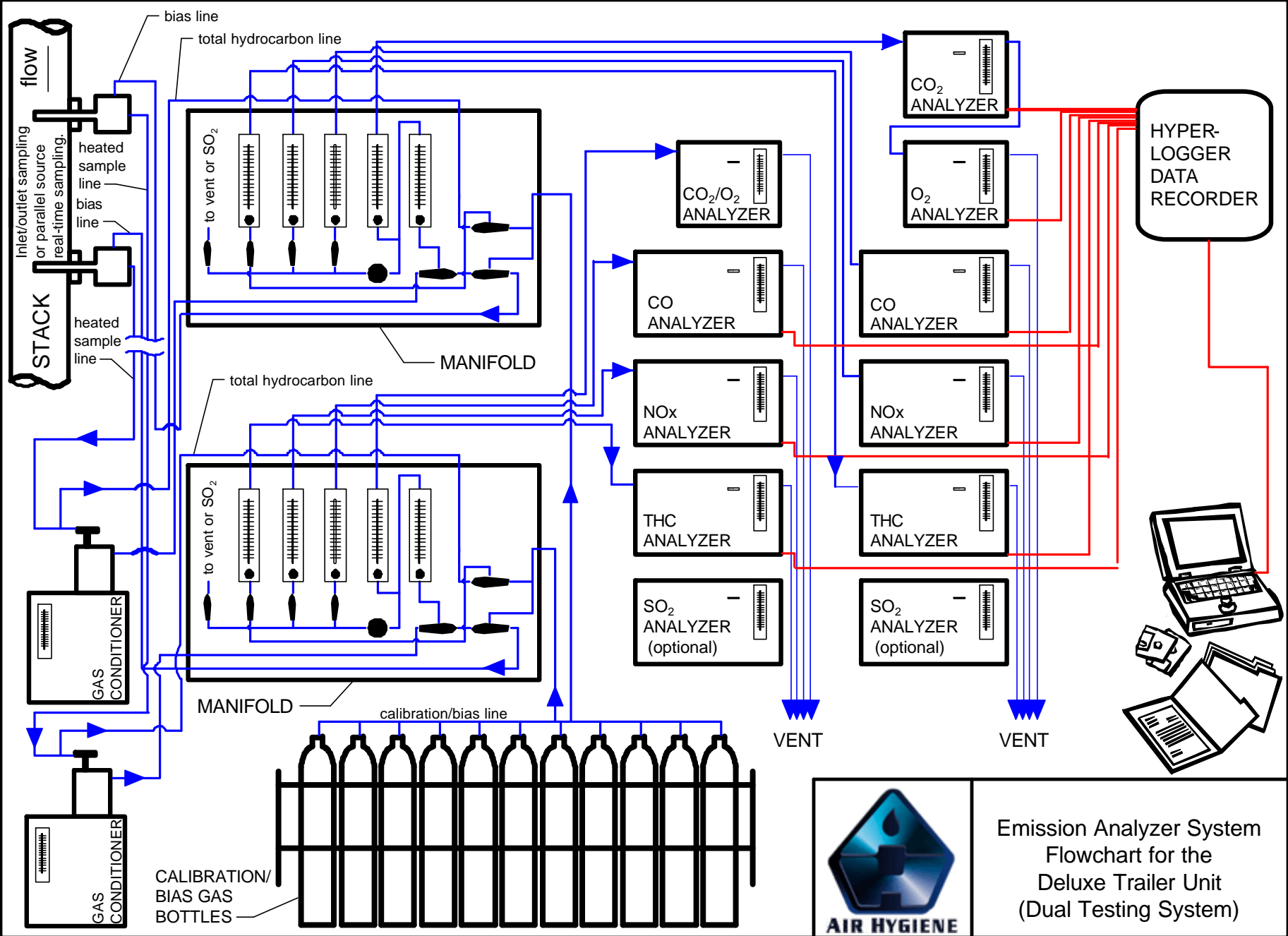
The stack gas analysis for O₂ concentrations is performed in accordance with procedures set forth in EPA Method 3a. The O₂ analyzer uses a paramagnetic cell detector.

Analysis for CO₂ concentrations is performed in accordance with procedures set forth in EPA Method 3a. The CO₂ analyzer uses an infrared detector.

CO emission concentrations are quantified in accordance with procedures set forth in EPA Method 10. A continuous nondispersive infrared (NDIR) analyzer is used for this purpose.

NO_x emission concentrations are measured in accordance with procedures set forth in EPA Method 7e (engines) or 20 (turbines). A chemiluminescence analyzer is used to determine the nitrogen oxides concentration in the gas stream.

Total hydrocarbons (THC) are analyzed and converted to VOC in accordance with procedures set forth in EPA Method 25a. A flame ionization detector calibrated with propane is used to determine the THC concentration in the gas stream and VOCs are calculated based upon the weight percent content of VOCs determined in the fuel gas analysis.



Emission Analyzer System Flowchart for the Deluxe Trailer Unit (Dual Testing System)

ENGINE TESTING QUALITY ASSURANCE ACTIVITIES

A number of quality assurance activities are undertaken before, during, and after turbine testing projects. This section describes each of those activities.

Each instrument's response is checked and adjusted in the field prior to the collection of data via multi-point calibration. The instrument's linearity is checked by first adjusting its zero and span responses to zero nitrogen and an upscale calibration gas in the range of the expected concentrations. The instrument response is then challenged with other calibration gases of known concentration and accepted as being linear if the response of the other calibration gases agreed within \pm two percent of range of the predicted values.

NO₂ to NO conversion is checked via direct connect with a EPA Protocol certified concentration of NO₂ in a balance of nitrogen. Conversion is verified to be above 90 percent.

Instruments are both factory tested and periodically field challenged with interference gases to verify the instruments have less than a two percent interference from CO₂, SO₂, CO, NO, and O₂.

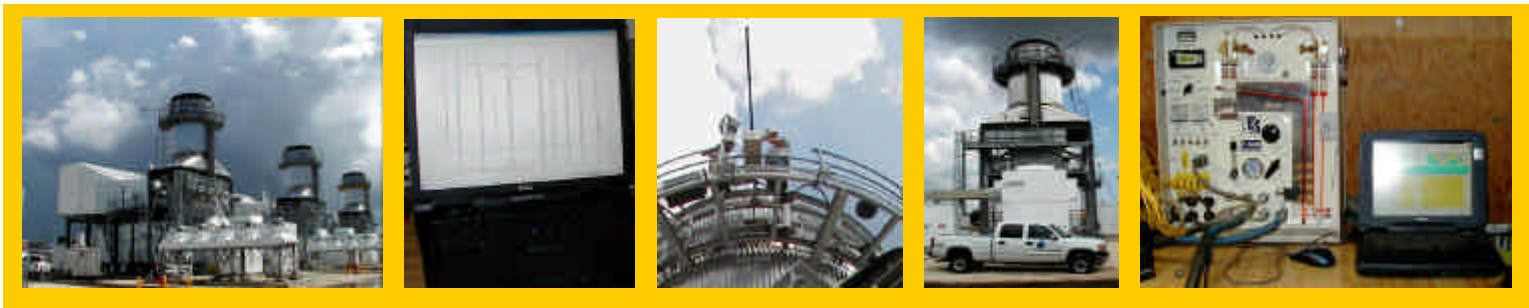
After each test run, the analyzers are checked for zero and span drift. This allows each test run to be bracketed by calibrations and documents the precision of the data collected. The criterion for acceptable data is that the instrument drift is no more than three percent of the full-scale response. Quality assurance worksheets summarize all multipoint calibration linearity checks and the zero to span checks performed during the tests are included in the test report.

The sampling systems is leak-checked by demonstrating that a vacuum greater than 10 in. Hg can be held for at least one minute with a decline of less than one in. Hg. A leak test is conducted after the sample system is set up and before the system is dismantled. This test is conducted to ensure that ambient air does not dilute the sample. Any leakage detected prior to the tests is repaired and another leak check conducted before testing will commence.

The absence of leaks in the sampling system is also verified by a sampling system bias check. The sampling system's integrity is tested by comparing the responses of the analyzers to the responses of the calibration gases introduced via two paths. The first path is directly into the analyzer and the second path via the sample system at the sample probe. Any difference in the instrument responses by these two methods is attributed to sampling system bias or leakage. The criterion for acceptance is agreement within five percent of the span of the analyzer.

The control gases used to calibrate the instruments are analyzed and certified by the compressed gas vendors to \pm one percent accuracy for all gases. EPA Protocol No. 1 is used, where applicable, to assign the concentration values traceable to the National Institute of Standards and Technology (NIST), Standard Reference Materials (SRM). The gas calibration sheets as prepared by the vendor are included in the test report.





ENGINE QUALITY ASSURANCE PROGRAM SUMMARY

AIR HYGIENE ensures the quality and validity of its emission measurement and reporting procedures through a rigorous quality assurance (QA) program. The program is developed and administered by an internal QA team and encompasses five major areas:

1. QA reviews of reports, laboratory work, and field testing;
2. Equipment calibration and maintenance;
3. Chain-of-custody;
4. Training; and
5. Knowledge of current test methods.

QA Reviews

AIR HYGIENE's review procedure includes review of each source test report, along with laboratory and fieldwork, by the QA Team.

The most important review is the one that takes place before a test program begins. The QA Team works closely with technical division personnel to prepare and review test protocols. Test protocol review includes selection of appropriate test procedures, evaluation of interferences or other restrictions that might preclude use of standard test procedures, and evaluation and/or development of alternate procedures.

Equipment Calibration and Maintenance

The equipment used to conduct the emission measurements is maintained according to the manufacturer's instructions to ensure proper operation. In addition to the maintenance program, calibrations are carried out on each measurement device according to the schedule outlined by the Environmental Protection Agency. Quality control checks are also conducted in the field for each test program.

Chain-of-Custody

AIR HYGIENE maintains full chain-of-custody documentation on all samples and data sheets. In addition to normal documentation of changes between field sample custodians, laboratory personnel, and field test personnel, **AIR HYGIENE** documents every individual who handles any test component in the field (e.g., probe wash, impinger loading and recovery, filter loading and recovery, etc.). Samples are stored in a locked area to which only **AIR HYGIENE** personnel have access. Field data sheets are secured at **AIR HYGIENE**'s offices upon return from the field.

Training

Personnel's training is essential to ensure quality testing. **AIR HYGIENE** has formal and informal training programs, which include:

1. Participation in EPA-sponsored training courses;
2. A requirement for all technicians to read and understand Air Hygiene Incorporated's QA manual;
3. In-house training relating to 40 CFR Part 60 Appendix A methods and QA meetings on a regular basis; and
4. Maintenance of training records.

Knowledge of Current Test Methods

With the constant updating of standard test methods and the wide variety of emerging test procedures, it is essential that any qualified source tester keep abreast of new developments. **AIR HYGIENE** subscribes to services, which provide updates on EPA reference methods, rules, and regulations. Additionally, source test personnel regularly attend and present papers at testing and emission-related seminars and conferences. **AIR HYGIENE** personnel maintain membership in various relevant organizations associated with gas fired turbines.

F-Factor Datasheet and Fuel Gas Analysis

Company: [XYZ Power](#)
Location: [XYZ Power Plant](#)
Date: [April 9, 2001](#)

Values to enter from fuel gas analysis by GPA 2166.

Font Scheme:
 Blue Font = enter new data
 Black Font = calculated data
 Green Font = Labels for columns & rows
 Red Font = Important results with notes

Gas Component		Mole (%)	Molecular Weight (lb/lb-mole)	lb Component per lb-Mole of Gas	Weight % of Component	Fuel Heat Value [HHV] (Btu/scf) ¹	Fuel Heat Value [LHV] (Btu/scf) ¹
Methane	CH4	96.491	16.04	15.477	92.97	974.27	877.20
Ethane	C2H6	2.115	30.07	0.636	3.82	37.41	34.22
Propane	C3H8	0.186	44.1	0.082	0.49	4.68	4.31
iso-Butane	iC4H10	0.019	58.12	0.011	0.07	0.62	0.57
n-Butane	nC4H10	0.023	58.12	0.013	0.08	0.75	0.69
Iso-Pentane	iC5H12	0.008	72.15	0.006	0.03	0.32	0.30
n-Pentane	nC5H12	0.005	72.15	0.004	0.02	0.20	0.19
Hexanes	C6H14	0.025	86.18	0.022	0.13	1.19	1.10
Heptanes	C7H16	0.000	100.21	0.000	0.00	0.00	0.00
Octanes	C8H18	0.000	114.23	0.000	0.00	0.00	0.00
Carbon Dioxide	CO2	0.510	44.01	0.224	1.35	0.00	0.00
Nitrogen	N2	0.618	28.01	0.173	1.04	0.00	0.00
Hydrogen Sulfide	H2S	0.000	34.08	0.000	0.00	0.00	0.00
Oxygen	O2	0.000	32	0.000	0.00	0.00	0.00
Helium	He	0.000	4	0.000	0.00	0.00	0.00
Hydrogen	H2	0.000	2	0.000	0.00	0.00	0.00
Totals (dry)		100.000		16.648	100.00	1019.44	918.57
Totals (wet)						1001.66	902.55

¹ Standardized to 60°F and 1 atm to match fuel flow data

If total is not 100.000 then the mol% data was either entered incorrectly or the gas analysis is incomplete. Sometimes small differences are due to rounding error.

High Heat Value of dry gas (HHV-dry)
This is the primary fuel heat value used in emission testing calculations.

Low Heat Value of dry gas. LHV-dry

High Heat Value of wet Gas. HHV-wet

Low Heat Value of wet gas. LHV-wet

Characteristics of Fuel Gas	
Molecular Weight of gas =	16.648 lb/lb-mole
Btu per lb. of gas =	23239.7689 gross (HHV)
Btu per lb. of gas =	20940.2961 net (LHV)
wt % VOC in fuel gas =	0.83 %
Specific Gravity =	0.5749

Value used to convert THC readings to VOC.

Component	Weight %
carbon	73.71
oxygen	0.98
hydrogen	24.27
nitrogen	1.04
helium	0.00
sulfur	0.00
Total	100.00

F-Factor (scf dry exhaust per MMBtu [HHV] = 8641.17
(Based on EPA RM-19) at 68°F and 1 atm

Fuel Specific F-Factor. Note that EPA Method 19 lists natural gas's F-factor as 8710.

F-Factor Calculation:

$$F\text{-Factor} = 1,000,000 \cdot ((3.64\%H) + (1.53\%C) + (0.57\%S) + (0.14\%N) - (0.46\%O)) / GCV$$

%H, %C, %S, %N, & %O are percent weight values calculated from fuel analysis and have units of (scf/lb)/%

GCV = Gross Btu per lb. of gas (HHV)



EMISSION TESTING TEAM

Air Hygiene International, Inc. (**AIR HYGIENE**) intends to exceed your expectations on every project. From project management to field-testing teams, we're committed to hard work on your behalf. The job descriptions and flowchart below outline **AIR HYGIENE's** client management strategy for your testing services.

AIR HYGIENE's **President** provides support for client needs as requested by a client or project manager.

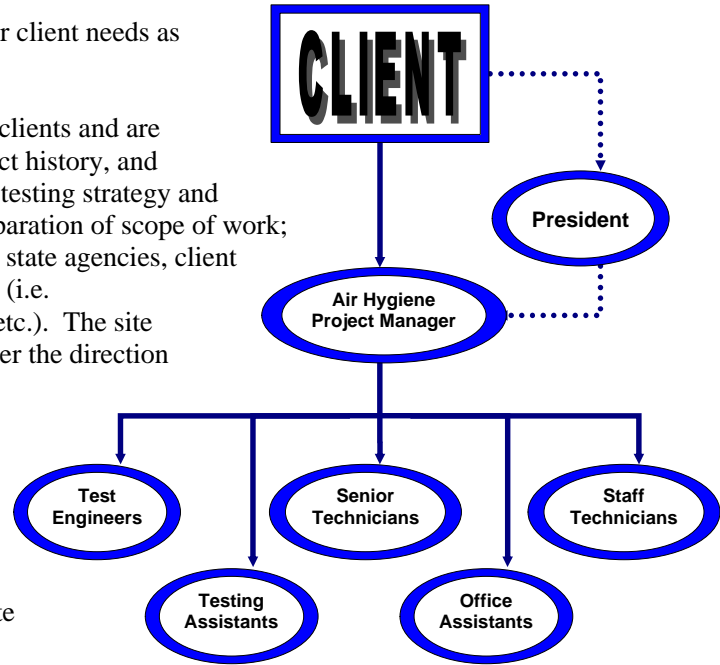
Project Managers are the primary contact for clients and are selected based upon industry experience, contact history, and availability. The project manager prepares the testing strategy and organization for the project. This includes preparation of scope of work; budget; testing protocol; and coordination with state agencies, client representatives, and any interested third parties (i.e. environmental consultants, engineering firms, etc.). The site testing and report preparation are executed under the direction of the project manager from start to finish.

Test Engineers have significant background and understanding of emission testing or related services. Test Engineers prepare pre-test drawings for port location, ensure on-site logistics for electrical and mechanical/structural needs, and conduct on site testing as directed by project managers. Test Engineers often have special understanding of process and/or regulations applicable to specific testing jobs, which provide great value to both the client and project manager in testing strategies.

Senior Technicians have performed over 500 emission tests and have a basic understanding of both particulate and gaseous sampling strategies. Senior Technicians have significant testing experience with **AIR HYGIENE** equipment along with a variety of industries and source equipment. Senior Technicians often operate isokinetic sampling trains or gas analyzers on-site under the direction of the project manager and assist with preparation of field reports and quality assurance procedures.

Staff Technicians are entry-level personnel who have performed 100 to 500 emission tests. Staff Technicians perform pre-test equipment preparation, on-site test preparation, and testing assistance under the direction of project manager. At least one Staff Technician is assigned to every project to assist the project manager. Staff Technicians often connect sampling probes to ports, assist with leak checks, raise and lower equipment to and from sampling platform, and other support activities under the direction of the project manager.

Testing Assistants are entry-level personnel who have performed less than 100 emission tests. Testing Assistants help with equipment set-up, teardown, and simple testing procedures (i.e. move probe, fill ice bath, clean impingers, etc.) as directed. Testing Assistants also provide office administrative assistance with report copying, binding, and work paper preparation.



CLIENT REFERENCES

The following are current clients who represent the various companies for whom **AIR HYGIENE** has performed testing services. Please feel free to call and discuss our services with them.

Ed Mize
Williams Gas Pipelines – Central
Tulsa, OK
(918) 633-2788

Jim Haught
ONEOK Power Marketing
Tulsa, OK
(918) 588-7640

Doug Russell
Williams Gas Pipelines - Transco
Jackson, LA
(225) 654-2047

John Daniels
J-W Operating Company
Addison, TX
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Terry Christian
Compressor Systems, Inc.
Midland, TX
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Donny Wallis
ONEOK Gas Distribution
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Lynn Martin
Duke Energy Field Services
Oklahoma City, OK
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David Zimbleman
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Gillette, WY
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Eric Booth
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Mary Beth Whitfield
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