

SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

RULE 4309 - DRYERS, DEHYDRATORS, AND OVENS

(Adopted December 15, 2005)

1.0 Purpose

The purpose of this rule is to limit emissions of oxides of nitrogen (NO_x) and carbon monoxide (CO) from dryers, dehydrators, and ovens.

2.0 Applicability

This rule applies to any dryer, dehydrator, or oven that is fired on gaseous fuel, liquid fuel, or is fired on gaseous and liquid fuel sequentially, and the total rated heat input for the unit is 5.0 million British thermal units per hour (5.0 MMBtu/hr) or greater.

3.0 Definitions

3.1 APCO: as defined in Rule 1020 (Definitions).

3.2 ARB: California Air Resources Board.

3.3 Bake: to cook food in a unit with dry heat.

3.4 Btu: British thermal unit, the amount of heat required to raise the temperature of one pound of water from 59°F to 60°F at one atmosphere.

3.5 CEMS: continuous emission monitoring system.

3.6 CFR: the Code of Federal Regulations.

3.7 Charbroiler: as defined in Rule 4692 (Commercial Charbroiling).

3.8 CO: carbon monoxide.

3.9 Dehydrator: a device that drives free water from products like fruits, vegetables, and nuts, at an accelerated rate without damage to the product.

3.10 Dryer: a device in which material is dried or cured in direct contact with the products of combustion.

3.11 Fry: to cook food over direct heat in oil or fat.

3.12 Gaseous Fuel: a fuel that is a gas at standard conditions.

- 3.13 Heat Input: the heat, on an hhv basis, released due to fuel combustion in a unit, not including the sensible heat of incoming combustion air and fuel.
- 3.14 Higher Heating Value (hhv): the total heat liberated per mass of fuel burned, in Btu per pound, when fuel and dry air at standard conditions undergo complete combustion and all resulting products are brought to their standard states at standard conditions.
- 3.15 Liquid Fuel: a fuel that is a liquid at standard conditions.
- 3.16 MMBtu: one million (1,000,000) British thermal units.
- 3.17 Normal Business Hours: the time period Monday through Friday, 8:00 am to 5:00 pm.
- 3.18 NO_x: the sum of oxides of nitrogen in the flue gas, expressed as nitrogen dioxide (NO₂).
- 3.19 Oven: a chamber in which material is dried or cured in direct contact with the products of combustion.
- 3.20 Oxygen Correction Factor: the factor used to adjust measured emission readings to an emission rate at a reference oxygen (O₂) level. For purposes of this rule:
- 3.20.1 For units operating at measured O₂ concentrations 19.0 percent by volume (19.0 vol% O₂) or less, emission concentrations shall be corrected to 19.0 vol% O₂ using the appropriate equation in Section 8.1.
- 3.20.2 For units operating at measured O₂ concentrations greater than 19.0 vol% O₂, the corrected NO_x or CO concentration is equal to the measured NO_x or CO concentration.
- 3.21 Parts Per Million by Volume (ppmv): as defined in Rule 1020 (Definitions).
- 3.22 PTO: Permit to Operate issued by the District.
- 3.23 Public Utilities Commission (PUC) Quality Natural Gas: a gas-containing fuel where the sulfur content is no more than one-fourth (0.25) grain of hydrogen sulfide per one hundred (100) standard cubic feet and no more than five (5) grains of total sulfur per one hundred (100) standard cubic feet. PUC quality natural gas also means high methane gas (at least 80% methane by volume) as specified in PUC General Order 58-A.
- 3.24 PUC Quality Natural Gas Curtailment: a shortage in the supply of PUC quality natural gas, due solely to supply limitations or restrictions in distribution pipelines by the utility supplying the gas, and not due to the cost of natural gas.

- 3.25 Rated Heat Input: the heat input capacity specified on the nameplate of the unit. For the purposes of this rule, if the unit has been physically modified such that its maximum heat input differs from what is specified on the nameplate, the modified maximum heat input shall be considered as the rated heat input and made enforceable by PTO.
- 3.26 Re-ignition: the relighting of a unit after an unscheduled and unavoidable interruption or shut off of the fuel flow or electrical power, for a period of less than 30 minutes, due to reasons outside the control of the operator.
- 3.27 Shutdown: the period of time during which a unit is taken from an operational to a non-operational status by allowing it to cool down from its operating temperature to ambient temperature as the fuel supply to the unit is completely turned off.
- 3.28 Solid Fuel: a fuel that is a solid at standard conditions.
- 3.29 Standard Conditions: as defined in Rule 1020 (Definitions).
- 3.30 Start-up: the period of time during which a unit is brought from a shutdown status to its operating temperature and pressure, including the time required by the unit's emission control system to reach full operation.
- 3.31 Stationary Source: as defined in Rule 2201 (New and Modified Stationary Source Review Rule).
- 3.32 US EPA: the United States Environmental Protection Agency.
- 3.33 Unit: a dryer, dehydrator, or oven, or any combination of such devices, with one or more burners and one or more exhaust stacks, that are collectively operated as the source(s) of heat to dry or cure a product. Associated VOC control systems, such as thermal oxidizers or afterburners, are not considered part of the unit for purposes of this rule.

4.0 Exemptions

- 4.1 The requirements of this rule shall not apply to the following:
 - 4.1.1 Column-type or tower dryers used to dry grains, or tree nuts. This exemption does not apply to tunnel dryers, belt dryers, or tray dryers.
 - 4.1.2 Units used to pre-condition onions or garlic prior to dehydration.
 - 4.1.3 Smokehouses or units used for roasting.

- 4.1.4 Units used to bake or fry food for human consumption.
- 4.1.5 Charbroilers.
- 4.1.6 Units used to dry lint cotton or cotton at cotton gins.
- 4.1.7 Units with all of the following characteristics:
 - 4.1.7.1 No stack for the exhaust gas, and
 - 4.1.7.2 One or more sides open to the atmosphere.
- 4.2 The requirements of this rule shall not apply to units subject to any of the following rules:
 - 4.2.1 Rule 4305 (Boilers, Steam Generators, and Process Heaters – Phase 2)
 - 4.2.2 Rule 4306 (Boilers, Steam Generators, and Process Heaters – Phase 3)
 - 4.2.3 Rule 4307 (Small Boilers, Steam Generators, and Process Heaters – 2.0 MMBtu/hr to 5.0 MMBtu/hr)
 - 4.2.4 Rule 4351 (Boilers, Steam Generators, and Process Heaters – Phase 1)
- 4.3 The requirements of Section 5.1 and Section 5.2 shall not apply to a unit when burning any fuel other than PUC quality natural gas during PUC quality natural gas curtailment provided all of the following conditions are met:
 - 4.3.1 Fuels other than PUC quality natural gas are burned no more than 168 cumulative hours in a calendar year plus 48 hours per calendar year for equipment testing, as limited by PTO.
 - 4.3.2 NO_x emission shall not exceed 30 ppmv referenced at dry stack conditions and adjusted using the oxygen correction factor as defined in Section 3.0 or 0.215 lb/MMBtu. Demonstration of compliance with this limit shall be made by source testing, CEMS, an APCO-approved Alternate Monitoring System, or an APCO-approved portable NO_x analyzer.

5.0 Requirements

All ppmv emission limits specified in this section are referenced at dry stack gas conditions and adjusted using the oxygen correction factor as defined in Section 3.0.

- 5.1 Dehydrators shall be fired exclusively on PUC quality natural gas, except during periods of PUC quality natural gas curtailment.

- 5.1.1 All dehydrators shall be operated and maintained according to manufacturer's specifications or APCO-approved alternative procedures.
 - 5.1.2 Operation and maintenance records and manufacturer's specifications/APCO-approved alternative procedures shall be maintained in accordance with Section 6.1.3.
 - 5.1.3 During PUC quality natural gas curtailment, the dehydrator shall be in compliance with the provisions of Section 4.3.
- 5.2 For any unit subject to this rule, except dehydrators, NO_x emissions and CO emissions shall not exceed the limits specified in Table 1 on and after the full compliance schedules specified in Section 7.1, Table 2 compliance schedule, or Section 7.3, as appropriate.

Table 1 NO_x and CO Limits (Referenced at dry stack conditions and adjusted using the oxygen correction factor as defined in Section 3.0)

Process Description	NO _x Limit (in ppmv)		CO Limit (in ppmv)	
	Gaseous Fuel Fired	Liquid Fuel Fired	Gaseous Fuel Fired	Liquid Fuel Fired
Asphalt/Concrete Plants	4.3	12.0	42	64
Milk, Cheese, and Dairy Processing < 20 MMBtu/hr	3.5	3.5	42	42
Milk, Cheese, and Dairy Processing ≥ 20 MMBtu/hr	5.3	5.3	42	42
Other processes not described above	4.3	4.3	42	42

5.3 Start-up and Shutdown Provisions

The applicable emission limits in Section 5.2 shall not apply during start-up or shutdown provided an operator complies with the requirements specified below.

- 5.3.1 For units not equipped with a NO_x exhaust control system, the duration of each start-up and each shutdown shall not exceed one hour, except as provided in Section 5.3.3.
- 5.3.2 For units equipped with a NO_x exhaust control system, units shall meet both of the following requirements:
 - 5.3.2.1 The NO_x exhaust control system shall be in operation and emissions shall be minimized as much as technologically feasible during start-up or shutdown.
 - 5.3.2.2 The duration of each start-up and each shutdown shall not exceed two hours, except as provided in Section 5.3.3.

- 5.3.3 Notwithstanding the requirements of Section 5.3.1 or Section 5.3.2, the APCO, ARB, and US EPA may approve a longer start-up or shutdown duration, if an operator submits an application for a PTO condition which provides a justification for the requested additional duration.
 - 5.3.3.1 The maximum allowable duration of start-up or shutdown will be determined by the APCO, ARB, and US EPA.
 - 5.3.3.2 At a minimum, a justification for increased start-up or shutdown duration shall include the following:
 - 5.3.3.2.1 Clear identification of the control technologies or strategies to be utilized; and
 - 5.3.3.2.2 Description of what physical conditions prevail during start-up or shutdown periods that prevent the controls from being effective; and
 - 5.3.3.2.3 Reasonably precise estimate as to when the physical conditions will have reached a state that allows for the effective control of emissions; and
 - 5.3.3.2.4 Detailed list of activities to be performed during start-up or shutdown and a reasonable explanation for the length of time needed to complete each activity; and
 - 5.3.3.2.5 Description of the material process flow rates and system operating parameters the operator plans to evaluate during the process optimization and an explanation of how the activities and process flow affect the operation of the emissions control equipment; and
 - 5.3.3.2.6 Basis for the requested additional duration of start-up or shutdown.
- 5.3.4 PTO changes solely to include start-up or shutdown conditions may be exempt from the Best Available Control Technology (BACT) and emission offset requirements if the PTO change meets the requirements of Rule 2201 (New and Modified Stationary Source Review Rule) Section 4.2 (BACT Exemptions) and Rule 2201 Section 4.6 (Emission Offset Exemptions).

5.4 Monitoring Requirements

5.4.1 Except for dehydrators, the operator of any unit subject to the applicable emission limits in Sections 4.3.2, or 5.2 shall monitor emissions using one of the techniques specified in Sections 5.4.1.1 or 5.4.1.2.

5.4.1.1 Install and maintain an APCO-approved CEMS for NO_x, and oxygen that meets the requirements of Sections 5.4.1.1.1 through 5.4.1.1.6.

5.4.1.1.1 40 CFR Part 51, and

5.4.1.1.2 40 CFR Parts 60.7 and 60.13 (except subsection h), and

5.4.1.1.3 40 CFR Part 60 Appendix B (Performance Specifications), and

5.4.1.1.4 40 CFR Part 60 Appendix F (Quality Assurance Procedures), and

5.4.1.1.5 The applicable provisions of District Rule 1080 (Stack Monitoring).

5.4.1.1.6 The APCO shall only approve CEMS that meets the requirements of Sections 5.4.1.1.1 through 5.4.1.1.5 of this rule.

5.4.1.2 Install and maintain an alternate emission monitoring method that meets the requirements of Sections 5.4.1.2.1 through 5.4.1.2.3 of this rule.

5.4.1.2.1 The APCO shall not approve an alternative monitoring system unless it is documented that continued operation within ranges of specified emissions-related performance indicators or operational characteristics provides a reasonable assurance of compliance with applicable emission limits.

5.4.1.2.2 The approved alternate emission monitoring system shall monitor operational characteristics necessary to assure compliance with the emission limit. Operational characteristics shall be one or more of the following:

5.4.1.2.2.1 Periodic NO_x exhaust emission concentrations,

- 5.4.1.2.2.2 Periodic exhaust oxygen concentration,
- 5.4.1.2.2.3 Flow rate of reducing agent added to exhaust,
- 5.4.1.2.2.4 Catalyst inlet and exhaust temperature,
- 5.4.1.2.2.5 Catalyst inlet and exhaust oxygen concentration,
- 5.4.1.2.2.6 Periodic flue gas recirculation rate,
- 5.4.1.2.2.7 Other surrogate operating parameter(s) that demonstrate compliance with the emission limit.

5.4.1.2.3 The operator shall source test over the proposed range of surrogate operating parameter(s) to demonstrate compliance with the applicable emission limits.

5.4.2 Operators of a dehydrator shall maintain records that demonstrate, to the satisfaction of the APCO, ARB, and US EPA that the dehydrator is:

5.4.2.1 Fired exclusively on PUC quality natural gas, except during PUC quality natural gas curtailment, and

5.4.2.2 Properly operated and maintained according to manufacturer's specifications or APCO-approved alternative procedures.

5.4.3 Operators shall maintain records of emissions and emissions monitoring systems pursuant to Section 6.1.

5.5 Compliance Determination

5.5.1 All emissions measurements shall be made with the unit operating either at conditions representative of normal operations or conditions specified in the PTO.

5.5.2 Except for as provided in Section 5.5.3, no determination of compliance shall be established within two hours after a continuous period in which fuel flow to the unit is shut off for 30 minutes or longer, or within 30 minutes after a re-ignition as defined in Section 3.0.

- 5.5.3 Notwithstanding the requirements of Section 5.5.2, the APCO, ARB, and US EPA may approve a longer or shorter period before compliance determination, if an operator submits an application for a PTO condition which provides a justification for the requested duration.
- 5.5.4 All CEMS emissions measurements shall be averaged over a period of 15 consecutive minutes to demonstrate compliance with the applicable emission limits of this rule. Any 15-consecutive-minute block average CEMS measurement exceeding the applicable emission limits of this rule shall constitute a violation of this rule.
- 5.5.5 For emissions monitoring pursuant to Section 5.4.1.2.2.1, emission readings shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15-consecutive-minute sample reading or by taking at least five (5) readings evenly spaced out over the 15-consecutive-minute period.
- 5.5.6 For emissions source testing performed pursuant to Section 6.3.1 to determine compliance with an applicable emission limit of this rule, the arithmetic average of three (3) 30-consecutive-minute test runs shall apply. If two of the three runs individually demonstrate emissions above the applicable limit, the test cannot be used to demonstrate compliance for the unit, even if the averaged emissions of all three test runs is less than the applicable limit.

6.0 Administrative Requirements

6.1 Recordkeeping

- 6.1.1 For operators using CEMS to monitor emissions, the following records shall be kept on a daily basis:
 - 6.1.1.1 Total hours of operation.
 - 6.1.1.2 Type and quantity of fuel used during operations.
 - 6.1.1.3 NO_x emissions as tested.
 - 6.1.1.4 Stack gas oxygen content.
 - 6.1.1.5 NO_x emissions corrected to dry stack conditions and adjusted using the oxygen correction factor shall be reported in ppmv.
 - 6.1.1.6 CO emissions corrected to dry stack conditions and adjusted using the oxygen correction factor shall be reported in ppmv.

- 6.1.2 For operators using an alternate emission monitoring system, the following records shall be kept on a periodic basis:
 - 6.1.2.1 Total hours of operation.
 - 6.1.2.2 Type and quantity of fuel used during operations.
 - 6.1.2.3 Measurement for each surrogate parameter.
 - 6.1.2.4 Range of allowed values for each surrogate parameter.
 - 6.1.2.5 The period for recordkeeping shall be specified in the PTO conditions.
- 6.1.3 The operator of a dehydrator shall maintain the following records:
 - 6.1.3.1 Records that show the dehydrator is fired exclusively on PUC quality natural gas, except during PUC quality natural gas curtailment.
 - 6.1.3.2 Operation and maintenance records that demonstrate operation of the dehydrator within the limits of the manufacturer's specification and maintenance according to manufacturer's recommendation or APCO-approved alternative procedures.
 - 6.1.3.2.1 Operation records shall be maintained on a daily basis when the dehydrator is operating on that day.
 - 6.1.3.2.2 The operator shall keep maintenance records that verify that maintenance was performed in accordance with manufacturer's specifications or APCO-approved alternative procedures.
 - 6.1.3.3 A copy of the manufacturer's operation specifications and maintenance instruction manual or APCO-approved alternative procedures shall be maintained on-site during normal business hours.
 - 6.1.3.4 If the manufacturer's operation specifications or maintenance instruction manual are not available, the operator of a dehydrator shall submit alternative operation or maintenance procedures for approval by the APCO and US EPA by July 1, 2006.
- 6.1.4 The operator of a unit subject to Section 5.2 and performing start-up or shutdown of that unit shall keep records of the duration of each start-up and each shutdown.

- 6.1.5 The operator of any unit subject to this rule and operated under the exemption of Section 4.3 shall:
 - 6.1.5.1 Monitor and record, for each unit, the cumulative annual hours of operation on each fuel other than PUC quality natural gas during periods of natural gas curtailment and equipment testing.
 - 6.1.5.2 The NO_x emissions for each unit that is operated during periods of PUC quality natural gas curtailment shall be recorded, corrected to dry stack conditions and adjusted using the oxygen correction factor. NO_x emissions shall be reported in ppmv.
 - 6.1.5.3 Failure to maintain records required by Section 6.1.5.1 and Section 6.1.5.2 or information contained in the records that demonstrates noncompliance with the conditions for exemption under Section 4.3 will result in the loss of exempt status for the unit during PUC quality natural gas curtailment.
- 6.1.6 The records and manufacturer's specifications required by Sections 6.1.1 through 6.1.5 shall meet all of the following requirements.
 - 6.1.6.1 The records shall be maintained for five (5) calendar years,
 - 6.1.6.2 The records shall be made available on-site during normal business hours, and
 - 6.1.6.3 The records shall be submitted to the APCO upon request.
- 6.1.7 Failure to maintain records or information contained in the records that demonstrates noncompliance with the applicable requirements of this rule shall constitute a violation of this rule.

6.2 Test Methods

The following test methods shall be used unless otherwise approved by the APCO and US EPA.

- 6.2.1 Fuel hhv shall be certified by third party fuel supplier or determined by:
 - 6.2.1.1 ASTM D 240-87 or D 2382-88 for liquid hydrocarbon fuels;
 - 6.2.1.2 ASTM D 1826-88 or D 1945-81 in conjunction with ASTM D 3588-89 for gaseous fuels.
- 6.2.2 Oxides of nitrogen (ppmv) – US EPA Method 7E, or ARB Method 100.

6.2.3 Carbon monoxide (ppmv) – US EPA Method 10, or ARB Method 100.

6.2.4 Stack gas oxygen – US EPA Method 3 or 3A, or ARB Method 100.

6.2.5 Stack gas velocities – US EPA Method 2.

6.2.6 Stack gas moisture content – US EPA Method 4.

6.3 Compliance Demonstration

The operator with one or more units subject to this rule shall comply with the following requirements:

6.3.1 For purposes of demonstrating compliance, the operators of a dehydrator shall demonstrate that the unit meets the requirements of Section 5.4.2. No other requirement of Sections 6.3.2 through 6.3.9 shall apply for compliance determination of dehydrators.

6.3.2 Each unit subject to the requirements in Sections 4.3, or 5.2 shall be initially source tested to determine compliance with the applicable emission limits not later than the applicable full compliance schedule specified in Section 7.0. Thereafter, each unit subject to Section 5.2 emission limits shall be source tested at least once every 24 months. Units subject to Section 5.2 and operating less than 50 days per calendar year shall follow the source test frequency prescribed in Section 6.3.3.

6.3.3 For purposes of source testing, operators of a unit subject to Section 5.2 that operates less than 50 days per calendar year shall be initially source tested to determine compliance with the applicable emission limits not later than the applicable full compliance schedule specified in Section 7.0. Thereafter, the unit shall be tested at least once every 36 months.

6.3.4 Each exhaust stack of a unit subject to the requirements in Sections 4.3 or 5.2 shall be source-tested to demonstrate compliance with the applicable emission limits.

6.3.5 The APCO shall be notified according to the provisions of Rule 1081 (Source Sampling).

6.3.6 Emissions source testing shall be conducted with the unit operating either at conditions representative of normal operations or conditions specified in the PTO.

6.3.7 All test results for NO_x and CO shall be reported in ppmv, corrected to dry stack conditions and adjusted using the oxygen correction factor.

- 6.3.8 For the purpose of determining compliance with an applicable emission limit, the arithmetic average of three (3) 30-consecutive-minute test runs shall apply.
- 6.3.9 If two of the three runs specified by Section 6.3.8 individually demonstrate emissions above the applicable limit, the test cannot be used to demonstrate compliance for the unit, even if the averaged emissions of all three runs is less than the applicable limit.
- 6.4 In addition to the provisions of Section 6.3, asphalt/concrete plants shall choose one of the following options for source testing:
 - 6.4.1 Test the unit using locally mined aggregate in the dryer. If the source test using locally mined aggregate fails, the operator may re-run the source test using aggregate from a different source.
 - 6.4.2 Test the unit using aggregate from a source different from the source used during normal operations.
 - 6.4.3 Test the unit using a heat-absorbing material in the dryer, but no aggregate.
 - 6.4.4 Test the unit with no material in the dryer.

7.0 Compliance Schedule

- 7.1 Group 1 and Group 2 units, as defined in Sections 7.1.1 through 7.1.3, shall be in compliance with applicable requirements of this rule according to the schedule listed in Table 2, except for asphalt/concrete plants and dehydrators. Asphalt/concrete plants shall follow the compliance schedule outlined in Section 7.3. Dehydrators shall follow the compliance schedule outlined in Section 7.4.
 - 7.1.1 Operators with a single unit that becomes subject to this rule on December 15, 2005 shall comply with the compliance schedule for Table 2 Group 2 units.
 - 7.1.2 For operators of multiple units that become subject to this rule on December 15, 2005, Table 2 Group 1 units are those units selected by the operator to be to meet the compliance schedule soonest. The number of units in this group must be at least 50.0% of the total number of units that subject to this rule, rounded up to the next highest integer, where required.
 - 7.1.3 For operators of multiple units that become subject to this rule on December 15, 2005, Table 2 Group 2 units are the units subject to this rule and are not Table 2 Group 1 units.

Table 2 Compliance Schedule

Units to be in Compliance at a Stationary Source	Authority to Construct	Full Compliance
Group 1: 50% or more of the total number of units subject to this rule on December 15, 2005	January 1, 2007	December 1, 2007
Group 2: 100% of the total number of units subject to this rule on December 15, 2005	January 1, 2008	December 1, 2008

Units are considered to be subject to this rule if the rule is applicable to the units as defined in Section 2.0 and the units are not exempted in either Section 4.1 or Section 4.2.

7.2 As shown in Table 2, the column labeled:

7.2.1 "Authority to Construct" identifies the date by which the operator shall submit an Application for Authority to Construct for each unit subject to the rule that would require an Authority to Construct to order to comply with the requirements of this rule.

7.2.2 "Full Compliance" identifies the date by which the operator shall demonstrate that each unit is in compliance with this rule.

7.3 An operator of an asphalt/concrete unit subject to this rule shall meet the following compliance schedule.

7.3.1 The operator shall submit an Application for Authority to construct for each unit subject to the rule that would require an Authority to Construct in order to comply with the requirements of this rule by December 1, 2008.

7.3.2 The operator shall demonstrate that each unit subject to this rule is in full compliance with this rule by December 1, 2009.

7.4 An operator of a dehydrator subject to this rule shall be in compliance with this rule by July 1, 2006.

8.0 Calculations

- 8.1 If the measured O₂ is 19.0 vol% O₂ or less, all emission limits specified in Section 5.2 are referenced at dry stack gas conditions and 19.0 vol% O₂. Emission concentrations in ppmv shall be corrected 19.0 vol% O₂ as follows:

$$[\text{ppmvNOx}]_{\text{corrected}} = \frac{1.95\%}{20.95\% - [\%O_2]_{\text{measured}}} \times [\text{ppmvNOx}]_{\text{measured}}$$

$$[\text{ppmvCO}]_{\text{corrected}} = \frac{1.95\%}{20.95\% - [\%O_2]_{\text{measured}}} \times [\text{ppmvCO}]_{\text{measured}}$$