

ASTM D1946, ASTM D1945, and EPA 3C Permanent Gases

ASTM D1946, D1945, and EPA 3C are used for the analysis of permanent gases (also called fixed gases) and light hydrocarbons at the percentage level in all types of samples. The samples can be collected in canisters, Tedlar bags, or other approved containers. Samples are analyzed by gas chromatography with a thermal conductivity detector (TCD). The methods for ASTM D1945, ASTM D1946, and EPA 3C are the same, but there are different QC criteria and compounds specified for each method. These methods were originally designed for high-level source analysis and have been modified for environmental analysis. The results for ASTM D1946 and D1945 are normalized to 100% when all compounds are analyzed.

The modifications done by EAS include the calibration and QC criteria.

Table 13.10a
Summary of QC Criteria for ASTM D1946/D1946 Modified

Parameter	EAS D1945 Modified	ASTM D1945
Initial Calibration	3point calibration RSD <20% to establish linearity	
Calibration Check Sample (CCS)	Pure air has nitrogen at 78.1% and Oxygen at 21.9% (includes argon)	
Daily Calibration	One or more daily calibration standard(s) are run for quantitation. The standard is run to bracket results 50% to 150% 1% standard used for MDL to 2%. 10% standard used for 2% to 50%. 100% standard used for 50% to 100%.	Reference standard within ½ concentration of and 10 mol % of target compounds. <1% for duplicate runs of CCV
Method Blank	Oxygen <0.3% Nitrogen < 1% Others <0.001%	Not Specified
Laboratory Control Spike	1 per Daily Batch	Not Specified
Duplicate Lab Control Dup Sample Dup	Duplicate with each 20 samples	Not Specified
Sum of Components	80% - 110% results normalized to 100% for full list	
Canister Holding Times	30 days	Not Specified

Table 13. 10b
Method ASTM D1946/D1945 Compound List

Analyte	RL %	RL ppmV	Criteria		
			ICAL %D	LCS %R	Duplicate %RPD
Oxygen	0.01	100	<20	80-120	<20
Nitrogen	0.01	100	<20	80-120	<20
Methane	0.005	50	<20	80-120	<20
Carbon Monoxide	0.005	50	<20	80-120	<20
Carbon Dioxide	0.005	50	<20	80-120	<20
Special Request					
Hydrogen	0.01	100	<20	80-120	<20
Helium	0.01	100	<20	80-120	<20
Ethene	0.005	50	<20	80-120	<20
Ethane	0.005	50	<20	80-120	<20
Ethylene	0.005	50	<20	80-120	<20
Propene	0.005	50	<20	80-120	<20
Propane	0.005	50	<20	80-120	<20

ASTM D1945 Permanent Gases

ASTM D1945 is similar to ASTM D1946 for permanent gases and light hydrocarbons, but has additional hydrocarbons on the compound list. EAS normally analyzed these additional hydrocarbons by Method 18 Modified for source samples, and TO-3 modified for ambient air samples. These methods use GC/FID and are more suited to reporting more detailed hydrocarbon analysis.

EPA 3C Permanent Gases

The EPA 3C method is similar to the ASTM D1945 except it is a source test method and has specific QC requirements. This method is used for source testing and landfill gas testing. The modifications to the EPA 3C method include the calibration and QC criteria. Verify modifications with regulatory body before using for a compliance test. EAS can run the unmodified method.

Table 13.10c
Summary of QC Criteria for EPA 3C Modified

Parameter	EAS 3C Modified	EPA 3C
Initial Calibration	3 Point calibration,	3-Point Calibration for suspected range of concentration for the samples.
Continuing Calibration Verification (CCV)	Daily See Table 13.10d	Within 20% of the sample component concentration.
Method Blank	Oxygen <0.3% Nitrogen < 1% Others <0.001%	Not Specified
Laboratory Control Spike	1 per Daily Batch See Table 13.10d	Not Specified
Sample Duplicate	With each 10 samples. See Table 13.10d	Each sample run twice and an average is calculated. <5% D between two consecutive injections.
Canister Holding Times	30 days from sampling date	Not specified
Sample Analysis	Single analysis reported. Duplicate with each 10 samples	Each sample run twice and an average is calculated. <5% D between two consecutive injections.

Table 13.10d
Method EPA 3C Compound List

Analyte	RL %	RL ppmV	Criteria		
			ICAL/ CCV %D	LCS %R	Duplicate %RPD
Oxygen	0.01	100	<20	80-120	<20
Nitrogen	0.01	100	<20	80-120	<20
Methane	0.005	50	<20	80-120	<20
Carbon Dioxide	0.005	50	<20	80-120	<20

