

# VOC Reference Guide

from Teledyne Tekmar

Analytical Instrumentation for VOC, TOC and SVOC Analysis

## EPA METHODS

Purge and Trap — Water Analysis							
Method	Sample Size	Tekmar Trap	Purge Time/Temp/Flow	Desorb Time/Temp	Specified Column(s)	Suitable Temp Program(s)	Detector(s)
501.3* Trihalomethanes	25 ml	#9 or K	11.0 ± 0.1 min. @ ambient @ 30-40 ml/min.	4.0 ± 0.1 min. @ 250 °C	30 m x 0.53 DB-624 w/3 µm coating or equivalent	10 °C, hold 5 min., 5 °C/min. to 180 °C, hold 10 min.	Electrolytic Conductivity Detector
502.2* Purgeable Organics	5 ml	#9 or K	11.0 ± 0.1 min. @ ambient @ 40 ml/min.	4.0 ± 0.1 min. @ 250 °C	105 m x 0.53 mm RTX 502.2 w/3 µm coating or equivalent	35 °C, hold 10 min., 4 °C/min. to 220 °C	Photoionization and Electrolytic Conductivity
503.1* Aromatic and Unsaturated Organics	5 ml	#9 or #1	11.0 ± 0.1 min. @ ambient @ 40 ml/min.	4.0 ± 0.1 min. @ 180 °C	30 m x 0.53 DB-624 w/3 µm coating or equivalent	40 °C, hold 5 min., 3 °C/min. to 135 °C	Photoionization Detector
524.2* Purgeable Organics by GC/Mass Spectrometry	25 ml	#9 or K	11.0 ± 0.1 min. @ ambient @ 25-40 ml/min.	2.0 ± 0.1 min. @ 250 °C	20 m x 0.18 RTX - 624 w/1 µm coating or equivalent	10 °C, hold 5 min., 5 °C/min. to 160 °C	Mass Spectrometer capable of scanning 35-260 AMU
524.3/524.4* Purgeable Organics by GC/Mass Spectrometry	5 ml	#9 or K	8.0 ± 0.1 min. @ 55 ml/min	1.0 ± 0.1 min. @ 250 °C	20 m x 0.18 RTX - 624 w/1 µm coating or equivalent	35 °C, hold 4 min., 15 °C/min. to 85 °C, 25 °C/min. to 225 °C	Mass Spectrometer capable of scanning 35-260 AMU
601** Purgeable Halocarbons	5 ml	#9 or K	11.0 ± 0.1 min. @ ambient @ 40 ml/min.	4.0 ± 0.1 min. @ 250 °C	30 m x 0.53 DB-624 w/3 µm coating or equivalent	10 °C, hold 5 min., 5 °C/min. to 180 °C, hold 10 min.	Electrolytic Conductivity Detector
602** Purgeable Aromatics	5 ml	#9 or #1	12.0 ± 0.1 min. @ ambient @ 40 ml/min.	4.0 ± 0.1 min. @ 180 °C	30 m x 0.53 mm DB-624 w/3 µm coating or equivalent	10 °C, hold 5 min., 5 °C/min. to 180 °C, hold 10 min.	Photoionization Detector
603** Acrolein & Acrylonitrile	5 ml	#9 or #1	15.0 ± 0.1 min. @ ambient @ 20 ml/min.	1.5 ± 0.1 min. @ 180 °C	30 m x 0.53 Stabliwax w/1 µm coating or equivalent	50 °C Isothermal	Flame Ionization Detector
624** Purgeable Organics by GC/Mass Spectrometry	5 ml	#9 or K	11.0 ± 0.1 min. @ ambient @ 30-40 ml/min.	2.0 ± 0.1 min. @ 250 °C	20 m x 0.18 RTX - 624 w/1 µm coating or equivalent	35 °C, hold 8 min., 10 °C/min. to 200 °C, hold 3 min.	Mass Spectrometer capable of scanning 10-250 AMU
1624** Volatiles by Isotope Dilution	5 ml	#2	11.0 ± 0.1 min. @ ambient @ 30-40 ml/min.	2.0 ± 0.1 min. @ 180 °C	20 m x 0.18 RTX - 624 w/1 µm coating or equivalent	35 °C, hold 8 min., 10 °C/min. to 200 °C, hold 3 min. (Dependent upon choice of column)	Mass Spectrometer capable of scanning 10-250 AMU
1666** Purgeable Organics for the Pharmaceutical Industry	5 ml or 5 g with 5 ml of water	#2	11.0 ± 0.1 min. @ 45 ± 2 °C @ 40 ± 4.0 ml/min.	2.0 ± 0.1 min. @ 180 °C	20 m x 0.18 RTX - 624 w/1 µm coating or equivalent	35 °C, hold 10 min., 4 °C/min. to 220 °C	Mass Spectrometer capable of scanning 10-250 AMU

\* These methods are specified Drinking Water methods.  
\*\* These methods are specified as Waste Water methods.

Purge and Trap — Solid Waste Analysis							
Method	Sample Size	Tekmar Trap	Purge Time/Temp/Flow	Desorb Time/Temp	Specified Column(s)	Suitable Temp Program(s)	Detector(s)
8010* Halogenated Volatile Organics	5 ml	#3	11.0 ± 0.1 min. @ 40 °C for low levels; otherwise, ambient	4 min. ± 0.1 min. @ 180 °C	105 m x 0.53 mm RTX 502.2 w/3.0 µm coating or equivalent	35 °C, hold 10 min., 4 °C/min. to 220 °C	Electrolytic Conductivity
8015* Non-Halogenated Volatile Organics	25 ml	#1	15.0 ± 0.1 min. @ 85 °C @ 20 ml/min.	4 min. ± 0.1 min. @ 180 °C	30 m x 0.53 mm I.D. DB-624 w/3.0 µm coating or equivalent	10 °C, hold 5 min., 5 °C/min. to 180 °C, hold 10 min.	Flame Ionization
8020* Aromatic Volatile Organics	5 ml	#1	12.0 ± 0.1 min. @ 40 °C for low levels; otherwise, ambient	4 min. ± 0.1 min. @ 180 °C	105 m x 0.53 mm RTX 502.2 w/3.0 µm coating or equivalent	35 °C, hold 10 min., 4 °C/min. to 220 °C	Photoionization
8021* Purgeable Organics	5 ml	#9 or K	11.0 ± 0.1 min. @ 40 °C @ 40 ml/min.	2 min. ± 0.1 min. @ 180 °C	20 m x 0.18 RTX-624 w/1 µm coating or equivalent	35 °C, hold 8 min., 10 °C/min. to 200 °C, hold 3 min.	Electrolytic Conductivity and Photoionization
8240 Gas Chromatography/Mass Spectrometry for Volatile Organics by Purge and Trap (packed)	5 ml	#3	11.0 ± 0.1 min. @ 40 °C for low levels; otherwise, ambient	2 min. ± 0.1 min. @ 180 °C	20 m x 0.18 RTX-624 w/1 µm coating or equivalent	35 °C, hold 8 min., 10 °C/min. to 200 °C, hold 3 min. (Dependent upon choice of column and GC/MS configuration)	Mass Spectrometer capable of scanning 35-260 AMU
8260* Purgeable Organics by GC/Mass Spectrometry	5 ml/25 ml	#9 or K	11.0 ± 0.1 min. @ 40 °C @ 40 ml/min.	4 min. ± 0.1 min. @ 180 °C	75 m x 0.53 mm I.D. DB-624 w/3.0 µm film or equivalent	35 °C for 8 min., 10 °C/min. to 200 °C Hold 3 min.	Mass Spectrometer capable of scanning 35-300 AMU

\* These methods are specified as extraction methods; Purge and Trap parameters reported for each method are found in EPA Method 5030.

## NON-TRADITIONAL METHODS

Purge and Trap Methods							
Method	Sample Size	Tekmar Trap	Purge Time/Temp/Flow	Desorb Time/Temp	Column	Suitable Temp Program	Detectors
Geosmin/2-MIB	25 ml	#1	10 min @ ambient @ 100 ml/min.	2 min. @ 225 °C	DB-VRX 30 m x 0.25 mm x 1.4 µm	40 °C for 2 min., 16 °C/min. to 160 °C, no hold, 20 °C/min. to 240 °C, hold for 5 min.	MS
RSK 175 (Modified for P&T)	5 ml	#9	1.5 min @ ambient @ 20 ml/min.	2 min. @ 100 °C	RT-U-PLOT 30 m x 0.53 mm	50 °C, no hold, 10 °C/min. to 190 °C	FID
1,4-Dioxane	5 or 25 mL	#9	5 min @ ambient @ 100 ml/min.	1 min. @ 250 °C	624 or VMS 20 m x 0.18 mm x 1 µm	35 °C for 3 min., 12 °C/min. to 100 °C, no hold, 50 °C/min. to 240 °C, hold 0.38 min.	MS
Epichlorohydrin	25 mL	KTrap	11 min @ ambient @ 200 ml/min.	2 min. @ 185 °C	624 or VMS 20 m x 0.18 mm x 1 µm	35 °C, hold 3 min., 15 °C/min. to 100 °C, no hold, 25 °C/min. to 240 °C, no hold	MS
VOCs in bottled water	25 mL	#9	11 min @ ambient @ 40 ml/min.	2 min. @ 250 °C	624 or VMS 20 m x 0.18 mm x 1 µm	35 °C, hold 2 min., 10 °C/min. to 200 °C, no hold, 50 °C/min. to 240 °C, no hold	MS
VOCs in soft drinks	5 mL (in vial)	#9	11 min @ ambient @ 40 ml/min.	2 min. @ 250 °C	VRX 30 m x 0.25 mm x 1.4 µm	35 °C, hold 4 min., 16 °C/min. to 85 °C, no hold, 30 °C/min. to 210 °C, hold 3 min.	MS
Trans-2-nonenal	10 mL (in vial)	#1A	10 min @ 70 °C @ 25 ml/min.	0.5 min. @ 225 °C	624 or VMS 20 m x 0.18 mm x 1 µm	95 °C, no hold, 3.5 °C/min. to 145 °C, no hold, 15 °C/min. to 240 °C, hold 3 min.	MS
2,4,6-trichloroanisole	5 ml or 5 mg (in vial)	#1	10 min @ ambient @ 100 ml/min.	2 min. @ 225 °C	624 or VMS 20 m x 0.18 mm x 1 µm	40 °C, hold 2 min., 16 °C/min. to 160 °C, no hold, 20 °C/min. to 240 °C, no hold	MS

Headspace Methods							
Method	Sample Size	Static/Dynamic	Static Parameters	Dynamic Parameters	Column	Suitable Temp Program	Detectors
VOCs from Food Packaging	3x3 cm or 0.5 g	Static	100 °C Platen for 20 min., Mix level 5 for 5 min., 1 min. injection	N/A	VMS 20 m x 0.18 mm x 1 µm	140 °C, hold 4 min., 18 °C/min. to 100 °C, hold 1 min., 40 °C/min. to 230 °C, hold 10 min.	MS
Fuel Oxygenates in Soil	5 g	Static/Dynamic	60 °C platen for 10 min., 1 min. injection	60 °C platen for 10 min., 8 min. purge on #9 trap, 2 min. desorb at 250 °C	VMS 20 m x 0.18 mm x 1 µm	35 °C, hold 3 min., 10 °C/min. to 85 °C, no hold, 30 °C/min. to 210 °C, hold 2 min.	MS
VOCs from High Temp Polymers	1-8 g	Static	280 °C platen for 30 min., 1 min. injection	N/A	RTX-200 30 m x 0.32 mm x 1.5 µm	40 °C, hold 1 min., 15 °C/min. to 120 °C, no hold, 30 °C/min. to 240 °C, hold 2 min.	FID
Analysis of Synthetic Drugs	50 mg	Static	100 °C Platen for 20 min., 1 min. injection	N/A	5 ms SQC, 15 m x 0.25 mm x 0.25 µm	35 °C, hold 2 min., 12 °C/min. to 320 °C, hold 10 min.	MS
VOCs in Orange Juice	1-5 ml	Static/Dynamic	40 °C platen for 20 min., 1 min. injection	10 min. purge on K trap, 2 min. desorb at 250 °C	VMS 20 m x 0.18 mm x 1 µm	35 °C, hold 1 min., 14 °C/min. to 100 °C, no hold, 30 °C/min. to 200 °C, hold 5 min.	MS
BTEX in Olive Oil	10 g	Static/Dynamic	90 °C platen for 20 min., 0.5 min. injection	90 °C platen for 10 min., 10 min. purge on K trap, 2 min. desorb at 250 °C	ZB-624 30 m x 0.32 mm x 1.8 µm	35 °C, hold 2 min., 10 °C/min. to 130 °C, no hold, 20 °C/min. to 240 °C, hold 2 min.	MS
RSK 175	5 ml	static	64 °C platen for 30 min., 0.5 min. injection	N/A	RT-U-BOND 15 m x 0.53 mm x 1.5 µm	35 °C, hold 4 min., 20 °C/min. to 190 °C, hold 2 min.	FID
USP 467	N/A	static	80 °C for 45 min., 2 min. injection	N/A	ZB-624 30 m x 0.32 mm x 1.8 µm ZB-WAXplus 30 m x 0.32 mm x 0.25 µm	35 °C, hold 20 min., 10 °C/min. to 240 °C, hold 2 min. 50 °C, hold 20 min., 6 °C/min. to 165 °C, hold 20 min.	FID
Blood Alcohol	1 ml	static	70 °C for 10 min., 0.5 min. injection	N/A	ZB-BAC-1 30 m x 0.53 mm x 3 µm	40 °C, constant	FID

## QUICK REFERENCE

Trap No.	Description	What it Traps	Tekmar Traps					Condition parameters
			Common Problems	Dry Purge Time	Desorb Preheat Temp. (°C)	Desorb Temp. (°C)	Bake Time and Temp. (°C)	
0	Blank	-	-	-	-	-	-	-
1	Tenax	Everything from methylene chloride and heavier	Low Response on Brominated Compounds High back pressure Outgassing of benzene, toluene and ethyl benzene	0.5-2 min.	220	225	230	225 °C for 180 min.
1A	Tenax (Larger Mesh)	Everything from methylene chloride and heavier	Low Response on Brominated Compounds High back pressure Outgassing of benzene, toluene and ethyl benzene	0.5-2 min.	220	225	230	225 °C for 180 min.
2	Tenax Silica Gel	Everything except freons	Low Response on Brominated Compounds High back pressure Outgassing of benzene, toluene and ethyl benzene	Not advised	220	225	230	225 °C for 180 min.
3	Tenax Silica Gel Charcoal	Everything including freons	Low Response on Brominated Compounds High back pressure Outgassing of benzene, toluene and ethyl benzene	Not advised	220	225	230	225 °C for 180 min.
4	Tenax Charcoal	Everything including freons	Low Response on Brominated Compounds High back pressure Outgassing of benzene, toluene and ethyl benzene	0.5-2 min.	220	225	230	225 °C for 180 min.
5	OV-1 Tenax Silica Gel Charcoal	Everything including freons	Low Response on Brominated Compounds High back pressure Outgassing of benzene, toluene and ethyl benzene	Not advised	220	225	230	225 °C for 180 min.
6	OV-1 Tenax Silica Gel	Everything including freons	Low Response on Brominated Compounds High back pressure Outgassing of benzene, toluene and ethyl benzene	Not advised	220	225	230	225 °C for 180 min.
7	OV-1 Tenax	Everything from methylene chloride and heavier	Low Response on Brominated Compounds High back pressure Outgassing of benzene, toluene and ethyl benzene	0.5-2 min.	220	225	230	225 °C for 180 min.
8	Carbopak B Carboxieve S III	Everything including freons	Loss of carbon tetrachloride Trap may need up to 11 min of dry purge to remove water	0.5-2 min.	245	250	260	260 °C for 90 min.
9	Proprietary	Everything including freons	Unknown	0.5-2 min.	245	250	260	270 °C for 120 min.
10	Tenax Silica Gel Carboxieve III	Everything including freons	Unknown	Not advised	220	225	230	225 °C for 180 min.
11	VPH Trap (Proprietary)	Volatile petroleum hydrocarbons	Unknown	0.5-2 min.	245	250	260	270 °C for 120 min.
Vocabr 3000 (K)	Carbopak B Carboxen 1000 Carboxen 1001	Everything including freons	Decomposition of bromoform can occur To prevent, reduce desorb temp to 240 °C	0.5-2 min.	245	250	260	270 °C for 120 min.
Vocabr 4000	Carbopak C Carbopak B Carboxen 1000 Carboxen 1001	Everything except 2-chloro-ethyl-vinyl ether (2-Cleve)	High backpressure Low response of chlorinated compounds	0.5-2 min.	245	250	260	270 °C for 120 min.
BTEXTRAP	Carbopak B Carbopak C	Everything down to benzene (Does not trap MeOH)	Unknown	0.5-2 min.	245	250	260	270 °C for 120 min.
BTEX+MTBE	Carbopak B Carbopak C	Everything down to benzene + MTBE (Does not trap MeOH)	Unknown	0.5-2 min.	245	250	260	270 °C for 120 min.

Conversions	
ppm = mg/kg; mg/L; µg/ml; ng/µL	
ppb = µg/kg; ng/ml; pg/µL	
1 kg = 1000 g	
1 g = 1000 mg	
1 mg = 1000 µg	
1 µg = 1000 ng	
1 ng = 1000 pg	
1 g/ml = mg/µg	

USEPA 8260 Sample Size			
Expected Concentration	Sample Size	Recommended Sparger	Heated Purge Required?
0.005 mg/kg to 0.2 mg/kg	5 g	25 ml	Yes
0.1 mg/kg to 1.0 mg/kg	1 g	5 ml	Yes

Dilutions	
A. To determine Volume (ml) of Stock Standard use: 1000 ppm Stock Standard, 10 ml Final Volume, 1 ppm Final Concentration 1 ppm/1000 ppm x 10 ml = 0.01 ml or 10 µL.	
B. To determine Concentration of Stock Standard prepare: 1000 ppm Stock Standard, 10 ml Final Volume, 0.01 ml Stock Standard, in 10 ml 0.01 ml/10 ml x 1000 ppm = 1 ppm	

## COMMON VOLATILES ANALYZED

Compound	Primary Ion (m/z)	Secondary Ions (m/z)	Density g/ml	Boiling Point °C
Acetone	43	58	0.788	56.3
Acetonitrile	41	40	0.786	81.6
Acetophenone	105	120,77,51	1.03	202.1
Acrolein	27	56,55	0.839	52.5
Acrylonitrile	53	26,52	0.806	77.4
Benzaldehyde	77	51,105,106	1.044	178.9
Benzene	78	77	0.879	80.1
Benzyl Alcohol	79	91,107,108	1.042	205.5
Bromobenzene	77	156,158	1.49	156.2
Bromochloromethane	130	128	1.991	67.8
Bromodichloromethane	83	85	1.98	89.2
Bromofluorobenzene	192	111	1.6302	196
Bromomethane	173	171,175	2.894	149
Bromomethane	94	96	1.73	3.6
Butanol-2	45	59,73	0.807	99.6
n-Butyl Acetate	43	56,73	0.883	126.1
n-Butylbenzene	91	92,134	0.8604	183.1
sec-Butylbenzene	105	134	0.8608	173.5
tert-Butylbenzene	119	91,134	0.8669	168.5
n-Butyl Chloride	56	27,41	0.887	78.4
Carbon disulfide	76	78	1.2632	46.5
Carbon tetrachloride	119	117,121	1.589	76.8
Chlorobenzene	112	77,114	1.107	131.7
Chloroethane	64	66	0.9214	12.3
2-Chloroethylvinylether	63	27,43	1.053	109
Chloroform	83	47,85	1.484	61.2
Chloromethane	50	52	1.3712	-23.7
2-Chlorotoluene	91	126,128	1.0826	159
4-Chlorotoluene	91	126,128	1.0697	162
Crotonaldehyde	41	70,39	0.853	104.1
Cyclohexane	56	41,84	0.779	80.7
Cyclopentane	42	55,70	0.746	49.3
Dibromochloromethane	129	127	2.42	150.2
1,2-Dibromo-3-chloropropane	75	155,157	1.553	196
1,2-Dibromoethane	107	109	2.18	131
Dibromomethane	174	172,176	1.5419	97
m-Dichlorobenzene	146	111,148	1.306	173
p-Dichlorobenzene	146	111,148	1.341	174.1
o-Dichlorobenzene	146	111,148	1.306	180.5
Dichlorodifluoromethane	85	50,101	N/A	-29.8
1,1-Dichloroethane	63	65	1.168	57.3
1,2-Dichloroethane	62	64	1.256	83.5
1,1-Dichloroethene	96	98	1.2129	31.7
cis-1,2-Dichloroethene	96	98	1.4435	60
trans-1,2-Dichloroethene	96	98	1.28	47.2
1,2-Dichloropropane	63	65	1.159	95
1,3-Dichloropropane	76	78	1.156	96
2,2-Dichloropropane	77	97,99	1.143	87
1,1-Dichloropropene	75	77,110	1.22	108
cis-1,3-Dichloropropene	75	77,110		