Thermal Desorption Tubes for DYNATHERM Instruments

Supelco offers a complete line of both prepacked and empty tubes for the DYNATHERM Thermal Desorbers. Each tube is individually numbered, thermally conditioned, and batch tested for back-pressure and background. The prepacked Standard Sampling Tubes are sealed in our exclusive TDS storage containers and the Fast-Flow Tubes are sealed with Swagelok fittings. All of the prepacked sampling tubes incorporate a glass frit at the inlet, which increases their performance. The FocusingTtubes are used to refocus the sample for better chromatography of the early eluting compounds.

DYNATHERM Standard Sampling Tubes

Fits: Models 850 / 890 TDU and ACEM-900 and MTDU.

TUBE	QTY	CAT. NO.	PRICE
6mm OD x 4.5" Long, 4mm ID			
Cabotrap 100	1	20872	
Cabotrap 150	1	20381	
Carbotrap 200	1	20873	
Carbotrap 217	1	20895-U	
Carbotrap 300	1	20875	
Carbotrap 302	1	20356	
Carbotrap 317	1	20877	
Carbotrap 349	1	20243	
Carbotrap 400	1	20882	
Tenax TA	1	20896-U	
Empty fritted tubes	3	20380-U	
Empty non-fritted tubes	5	20235-U	

Note: Tubes listed above also fit the OI Analytical Air Tube Desorber or DMP-16.

DYNATHERM Fast-Flow Sampling Tubes

These tube have a 7mm ID that allow faster flow rates to pass through the tubes while sampling. Fits only ACEM-900 and MTDU equipped with the fast-flow option ("FF" designation). Sealed using Swagelok fittings.

TUBE	QTY	CAT. NO.	PRICE
10mm OD x 4.5" Long (6mm OD Ends) 7mm ID			
Carbotrap 217	1	20724	
Carbotrap 317	1	20881	
Tenax TA	1	20894	
Empty fritted FF Tube	1	20893-U	

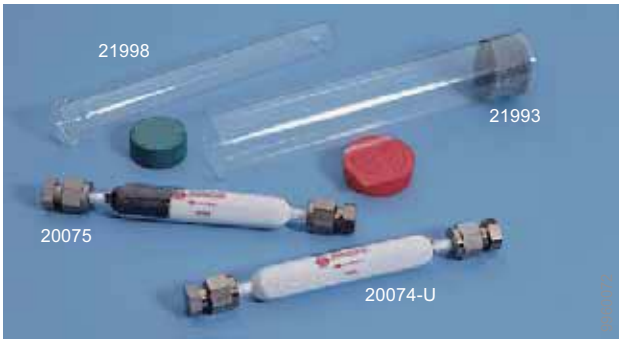
DYNATHERM Focusing Tubes

TUBE	QTY	CAT. NO.	PRICE
FITS: MODEL 850 / 890 TDU			
6mm OD x 4.5" Long 2mm ID			
Carbotrap 200	1	20244	
Carbotrap 300	1	20382	
Carbotrap 370	1	20373	
Empty tube w/taper	3	20386	
Empty tube straight bore	5	20237	
6mm OD x 4.5" Long 1mm ID			
Carbotrap 201	1	20361	
Carbotrap 301	1	20354	
Empty tube w/taper	3	20385	
FITS: ACEM-900			
6mm OD x 7.25" Long 1mm ID			
Carbotrap 201	1	20865	
Empty tube w/taper	1	20892-U	

Tube Conditioning Units

These units allow you to re-condition your DYNATHERM Standard Tubes (6mm OD x 11.5cm long)

DESCRIPTION	CAT. NO.	PRICE
Single-Tube Conditioning Unit, 115 VAC	22832	
Six-Tube Conditioning Unit, 115 VAC	22833	



VOST Stack Sampling Tubes

VOST Tubes (Volatile Organic Sampling Train) are designed to meet the specifications in US EPA SW-846, Method 0030. Each tube is individually numbered, pre-conditioned, and sealed with stainless steel Swagelok fitting before being placed in a glass storage container. Each lot is tested for background and backpressure. 16mm OD x 5" Long (1/4" OD Ends)

TUBE	QTY	CAT. NO.	PRICE
VOST 100			
Tenax TA 35/60 mesh	1	20074-U	
VOST 200			
Tenax TA:Petroleum Charcoal, 2:1	1	20075-U	
Empty VOST Tube	1	21993	
VOST Storage Container (Screw Cap Glass)	1	21998	

Air Monitoring
Thermal Desorption Tubes

Thermal Desorption Tubes PerkinElmer Instruments

Supelco offers both Stainless Steel and Glass prepacked sampling tubes that are fully compatible with the ATD-50 the ATD-400 and the new TurboMatrix™ instrument. Each tube has a unique number. The tubes are thermal conditioned and tested for background and backpressue. The tubes are sold in packs of 10 Each tube is sealed with Swagelok fittings.

Fits: ATD-50, ATD-400 and TurboMatrix. 1/4" OD x 3.5" Long. Stainless steel 5mm ID, glass 4mm ID.

P000802-3

TUBE	QTY	CAT. NO.	PRICE
STAINLESS STEEL			
Cabotrap-100 (Carbotrap- B)	10	25052	
Cabotrap-202	10	25058-U	
Carbotrap-300	10	25050	
Carbotrap-349	10	25057-U	
Air Toxics™	10	25051	
Carbosieve SIII°	10	25053	
Tenax GR	10	25054	
Tenax TA	10	25055	
Chromosorb-106	10	25056-U	
Empty Tubes			
Empty Tube without caps	1	25049	
Empty Tubes with TMX Brass Storage Caps	10	28014-U	
Empty Tubes with TMX Brass Storage Caps	50	28015-U	
GLASS			
Cabotrap 100 (Carbotrap B)	10	25087	
Cabotrap 202	10	25093-U	
Carbotrap 300	10	25085	
Carbotrap 349	10	25092-U	
Air Toxics™	10	25086	
Carbosieve S-III™	10	25088	
Tenax GR	10	25089	
Tenax TA	10	25090-U	
Chromosorb 106	10	25091	
Empty Tubes			
Empty Tube without caps	1	25084	
Empty Tubes with TMX Brass Storage Caps	10	28013-U	

Thermal Desorption Tubes for Tekmar-Dohrmann Instruments

Supelco offers both stainless steel and glass prepacked tubes for the Tekmar-Dohrman Instruments. The prepacked tubes are thermally conditioned and tested for background levels and backpressure. The 1/4" OD tubes are sealed in our exclusive TDS3 storage container. The 1/2" OD tubes are sealed in glass storage container.

Fits: AEROTrap 6000

P000848

TUBE	QTY	CAT. NO.	PRICE
STAINLESS STEEL, 1/4" OD X 7" LONG, 5mm ID			
Carbotrap-100	1	20241	
Carbotrap-300	1	20370-U	
Tenax TA	1	20913-U	
Empty Tube	1	20920-U	
GLASS, 1/4" OD X 7" LONG, 4mm ID			
Carbotrap-300	1	20912-U	
Tenax TA	1	20970-U	
Empty Tube	1	20918	
STAINLESS STEEL, 1/2" OD X 7" LONG, 12mm ID			
Tenax TA	1	20984	
Empty Tube	1	20924	
Glass Storage Container	1	20853	
GLASS, 1/2" OD X 7" LONG, 10mm ID			
Carbotrap-300	1	20983	
Tenax TA	1	20988	
Empty Tube	1	20922	
Glass Storage Container	1	20853	

Accessories for PerkinElmer Thermal Desorption Tubes

TUBE	QTY	CAT. NO.	PRICE
PASSIVE SAMPLING ACCESSORIES (STAINLESS STEEL TUBES ONLY)			
Diffusion Caps (Standard)	10	28017-U	
Diffusion Caps (w/ Silicone Membrane)	10	28018-U	
Pen Clips	10	28016-U	
STORAGE END CAPS (FITS GLASS OR SS TUBES)			
PTFE Storage End Caps for ATD-400	20	28019-U	
Brass Storage End Caps for TurboMatrix	20	28011-U	
Replacement PFA Ferrules for Brass Storage Caps	20	28012-U	


28011-U


28017-U


28018-U


28012-U

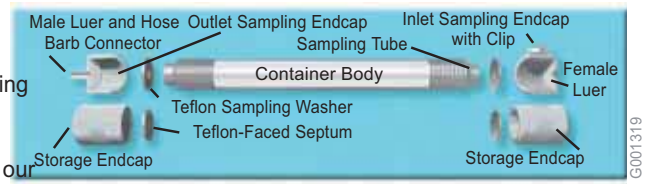
Thermal Desorption Tubes for the GERSTEL ThermoDesorption System

Supelco offers both stainless steel and glass prepacked sampling tubes that are fully compatible with the GERSTEL instrument. Each tube is thermally conditioned, and batch tested for back pressure and background. The prepacked tubes are sealed in our exclusive TDS[3] storage containers. All of the prepacked glass sampling tubes incorporate a glass frit at the inlet, which increases their performance, and are individually numbered. The stainless steel tubes use a SS screen at both inlet and outlet to keep the adsorbent beds secure during use. Fits: Models TDS A & TDS 2.

6mm OD x 7" Long, 4mm ID

TUBE	QTY	CAT. NO.	PRICE
STAINLESS STEEL			
Carbotrap 300	1	28273-U	
Carbosieve S-III	1	28274-U	
Tenax GR	1	28272-U	
Tenax TA	1	28271-U	
Chromosorb 106	1	28275-U	
Empty non-fritted tubes	1	28276-U	
Stainless Steel Screens (Fits both SS & glass tubes)	10	28277-U	
GLASS			
Carbotrap 300	1	28283-U	
Carbosieve S-III	1	28284-U	
Tenax GR	1	28282-U	
Tenax TA	1	28281-U	
Chromosorb 106	1	28285-U	
Empty fritted tubes	1	28286-U	
Empty non-fritted tubes [1]	1	28287-U	
Stainless Steel Screens (Fits both SS & glass tubes)	10	28277-U	

[1] Stainless Steel tube includes 2 SS screens



TDS[3] Thermal Desorption Storage Containers

Use our TDS[3] storage sampling system to simplify the Thermal Desorption sample prep process. The TDS[3] storage containers will maintain the sample integrity of both the tubes to be sampled or those which already have a sample adsorbed. The optional Sampling Caps convert the TDS[3] storage container into a convenient tube holder that makes connecting the tube to the sampling pump very easy.

MANUFACTURER	TUBE DIMENSIONS OD X LENGTH	CAT. NO.	PRICE
Perkin-Elmer	1/4" x 3.5"(8.9cm)	25097-U	
Markes Int'l Ltd.	1/4" x 3.5"(8.9cm)	25097-U	
Dynatherm**	6mm x 4.5" (11.5cm)	25096-U	
Entech	6mm x 4.5" (11.5cm)	25096-U	
OI Analytical	1/4" (6mm) x 4.5" (11.5cm)	25096-U	
Chrompack	6mm x 6.3" (16.0cm)	25098-U	
Gerstel	6mm X 7" (17.8cm)	25095-U	
Tekmar	1/4" X 7" (17.8cm)	25095-U	
Dynatherm***	6mm x 7.25" (18.4cm)*	25099-U	
CDS Analytical	1/4" x 8" (20.3cm)	25100-U	
Envirochem	6mm x 8" (20.3 cm)	25100-U	

Each TDS[3] container includes 10 replacement septa.

* Refocusing tube only.

** Standard sampling tubes

*** ACEM-900 focusing tube

Accessories for TDS[3] Storage Containers

TUBE	QTY	CAT. NO.	PRICE
Replacement Septa for Storage Caps	50	25073	
Sampling Caps Set (Includes one Inlet and one Outlet cap)	1	25069	
Adapters for Hose Connections			
Luer to Hose Barb For 1/4" Tubing	10	24856	
Luer to Hose Barb For 3/16" Tubing	20	23364	
Luer to Hose Barb For 1/8" Tubing	20	21016	
Luer Fittings			
Male Luer Coupler	20	25064-U	
Male Luer Plug (use to seal Inlet Sampling Cap)	12	504351	
Female Luer Plug (use to seal Oulet Sampling Cap)	12	57098	

Air Monitoring

ATIS Adsorbent Tube Injector System

P000849

ATIS™ Adsorbent Tube Injector System

The Supelco ATIS is a sample preparation device for adsorbent tubes. The Adsorbent Tube Injector System employs the technique of flash vaporization to vaporize the sample into a continuous flow of an inert gas, which carries the sample to the adsorbent tube. The sample pathway of the Adsorbent Tube Injector System is constructed of glass and stainless steel. The calibration standard is injected by a syringe through a replaceable septum in the center of the injection glassware, which is heated.

- Injecting calibration standards onto adsorbent tubes, to calibrate your analytical system
- Injecting surrogates and system monitoring compounds onto adsorbent tubes before or after sampling
- Removes moisture from tubes prior to analysis (Dry purging)
- Connect an air-sampling bag to the outlet of the ATIS to vaporize a calibration standards prior to assure complete vaporization.

The ATIS will accept either 1/4" or 6mm OD Thermal Desorption tubes. Included is a Luer/Hose Barb adapters to connect a variety of solvent desorption tubes.

The temperature range of the ATIS is ambient to 120°C. The flow range is 0 to 100mL/min.

The ATIS includes the injection glassware, a constant flow controller with a on/off valve, the heating source, spare parts along with all the necessary fittings and tubing. You simply plumb it to a regulated source of nitrogen or helium and plug it in to the appropriate electrical source.

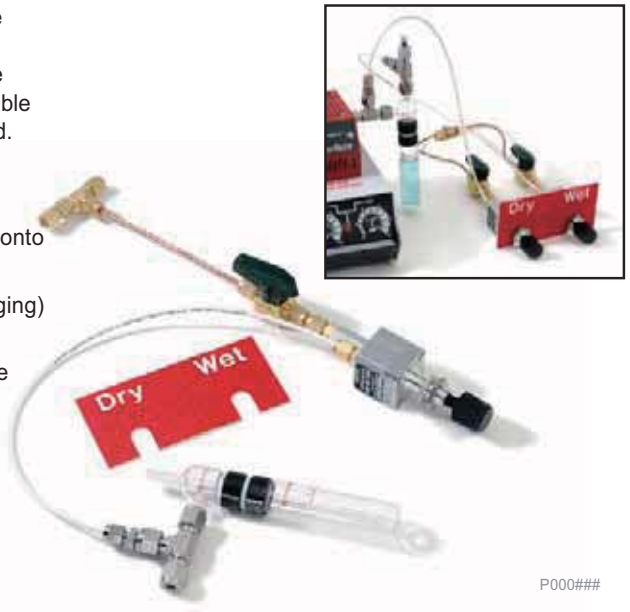
DESCRIPTION	CAT. NO	PRICE
110VAC Model	28520-U	
220VAC Model	28521-U	
Replacement Injection Glassware	28526-U	

P000850

Thermal Extraction Glassware

Use the ATIS to thermally extract samples onto an adsorbent tube. The opening in the glassware will accepts solid samples up to 1/2" (13mm) in diameter and up to 3" long (76mm) to be inserted into the glassware. The extraction glassware simply slides into the ATIS heating block. Two types of glass joints are available.

DESCRIPTION	CAT. NO	PRICE
20/20 Micro Connector	28523-U	
19/22 Ground Joint	28524-U	



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Purge and Trap/Humidifier Module for the ATIS

A separate module is available that will allow you to purge aqueous samples onto an adsorbent tube at ambient temperatures. This module can also be used to generate a dynamic humidified stream of the carrier gas for spiking calibration standards. The purge and trap module includes purge and trap glassware, and a separate flow controller that allows the user to set a separate purge (wet) flow rate independently of the dry flow rate. The purge and trap module accepts standard 22mL threaded vials to simplify your sample prep.

DESCRIPTION	CAT. NO	PRICE
Purge and Trap Humidifier Module	28522-U	
Replacement Purge & Trap Glassware	28527-U	

Air Monitoring
Solvent Desorption Tubes

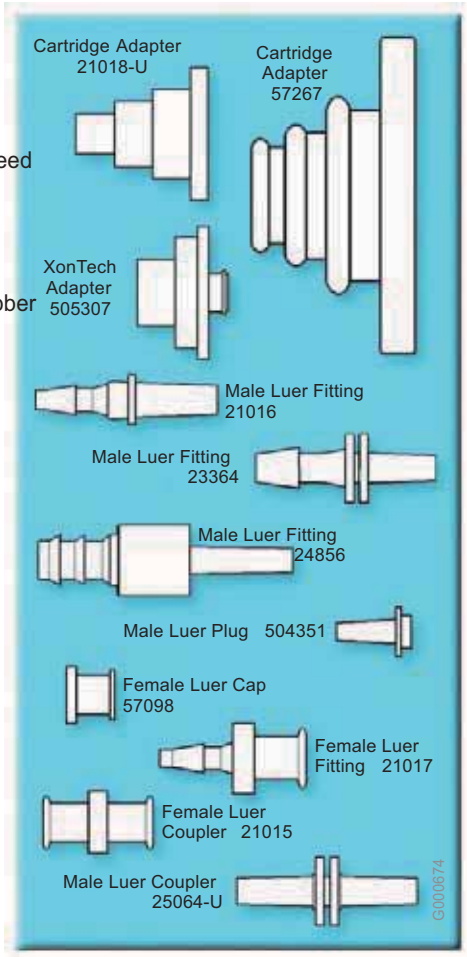
Introduction

In addition to capturing analytes of interest from air, a sampling device must ensure minimal background interference, sufficient capacity or breakthrough volume for the application for which it is intended, and provide an acceptable pressure drop during sampling. Supelco sampling media meet these requirements, and conform to NIOSH, OSHA, US EPA, and ASTM specifications as required. Consistency and reproducibility are met through our stringent quality control testing. Many of the adsorbents we manufacture are proprietary and have a unique and superior performance characteristics. Examples of these materials include our carbon molecular sieves and graphitized carbo

LpDNPH Cartridges

Use LpDNPH cartridges for sampling carbonyls (e.g., formaldehyde) in ambient, indoor, and industrial atmospheres. Carbonyls are trapped on a high purity silica adsorbent coated with 2,4-dinitrophenylhydrazine, where they are converted to the hydrazone derivatives. The derivatives are eluted from the cartridge in acetonitrile and are analyzed by HPLC. The S10x cartridge fits automated samplers (e.g., XonTech, Inc., ATEC Atmospheric Technology). Use in a XonTech unit requires a special, reusable adapter (Cat. No 505307). The S10L cartridge is for analysts who prefer the shorter dimensions and do not need an adapter for sampling. The cartridge, reversible and eluted by connecting it to a syringe barrel, acts as a reservoir for gravity-fed elution solvent. H10, H30, and H300 cartridges contain higher loadings of 2,4-DNPH, making them suitable for use in high concentration environments. The disposable ozone scrubber is similar to an S10L cartridge, containing 1.5g of high purity potassium iodide (ozone capacity at least 100,000ppb/hour).

SPECIFICATIONS				
PARAMETER	S10 SERIES	H10	H30	H300
Bed Wt.	350mg	350mg	1g	10g
mg DNPH/cartridge	1	3	8.6	86
Cartridge Volume (mL)	3	3	6	20
Cartridge Length (cm)	S10: 7.5 S10x: 3.8 S10L: 4.0	7.5	7.7	9.8
Pressure Drop (inches water@200cc/min)	<3.5	<3.5	<1	<1
Theoretical Capacity (µg total carbonyls/cartridge)	75	225	643	6400



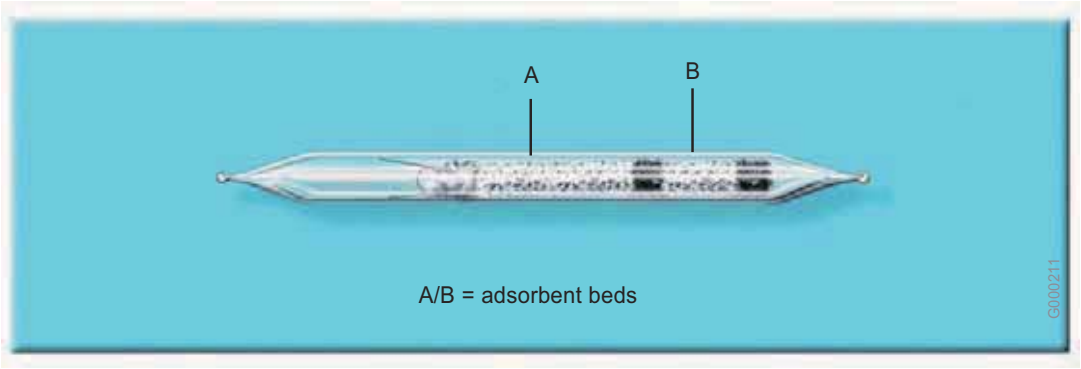
DESCRIPTION	QUANTITY	CAT. NO.	PRIC
S10	10	21026-U	
S10 Starter Kit[2]	10	21024-U	
S10	50	21014	
S10x	10	505293	
S10L	10	505358	
H10	10	505315	
H30	10	505323	
H300	10	505331	
Ozone Scrubber	10	505285	
Accessories			
Cartridge Adapters			
for S10, H10, H30	10	21018-U	
for H300	6	57267	
XonTech Adapters for S10x	10	505307	
Male Luer Fittings			
to 1/8” tubing	20	21016	
to 3/16” tubing	20	23364	
to 1/4” tubing	10	24856	
Female Luer Fittings	20	21017	
Female Luer Couplers	20	21015	
Male Luer Couplers	20	25064-U	
Lapel Clips	6	21019-U	
Bar Code Labels	100 nos	21012	
Polypropylene Tubes, 6mL[3]	30	57242	
Universal Elution Rack	1	21043-U	

[1] We recommend a 6mL polypropylene tube, Cat. No. 57242.

[2] 10 cartridges plus adapters and male luer fittings for various air sampling pumps.

[3] Reservoirs for S10L cartridges.

Air Monitoring
Solvent Desorption Tubes



ORBO NO.	ADSORBENT	BED WT. (mg) A/B	OD x LENGTH (mm)	SKC INC. EQUIVALENT	QTY.	CAT. NO.	PRICE
CHARCOAL							
32 large	Activated coconut charcoal (20/40)	400/200	8 x 100	226-09	50	20228	
32 small	Activated coconut charcoal (20/40)	100/50	6 x 75	226-01	50	20267-U	
33	Activated petroleum charcoal (20/40)	700/390	8 x 150	226-36	50	20259	
34	Activated coconut charcoal, specially treated	400/200	8 x 105	–	25	20211	
301[1]	Charcoal (20/40)	150	6 x 75	–	50	20039	
303[1]	Petroleum charcoal (20/40)	100/50	6 x 75	226-38	50	20040-U	
304[1]	Charcoal (low Ni) (20/40)	120/60	6 x 80	–	50	20041	
306[1]	Petroleum charcoal (20/40)	400/200	8 x 110	–	50	20073-U	
351[1]	4-tert-butyl catechol on charcoal	100/50	6 x 75	226-73	50	20042	
353[1]	HBr on petroleum charcoal	100/50	6 x 75	226-38-03	25	20044	
354[1]	Alkali-treated charcoal (AVL Barneby Cheney, 580-19)	100/50	6 x 75	226-67	50	20045	
355[1]	4-tert-butyl catechol on charcoal	110/55	6 x 75	–	50	20046	
356[1]	4-tert-butyl catechol on char coal	400/200	8 x 110	–	50	20047	
CARBON							
91	Carbosieve S-III carbon molecular sieve[2]	130/65	6 x 75	226-121	25	20360	
90	Carboxen-564[3] carbon molecular sieve[4]	160/80	6 x 75	226-81	25	20358	
92	Carboxen-564 carbon molecular sieve[4]	160/80	6 x 75	226-81	25	20362	
78	HBr on Carboxen-564 carbon molecular sieve	400/200	6 x 110	–	25	20355	
100	Carbotrap (20/40)	350/175	7 x 110	–	25	20255-U	
101	Carbotrap (20/40)	100/50	6 x 75	–	25	20254-U	
77[1]	H_2SO_4-treated carbon bead (20/30)	500/250	8 x 150	226-29	50	20036	
SILICA GEL							
52 small	Activated silica gel (20/40)	150/75	6 x 75	226-10	50	20229	
52 large	Activated silica gel (42/60)	150/150	8 x 75	226-48	50	20263	
507	Silica gel (20/40)	520/260	8 x 110	226-15	50	20870-U	
53	Activated silica gel (20/40) with glass fiber filter	400/200	7 x 100	226-10-03	50	20265	
502[1]	Activated silica gel (20/45)	100/50	6 x 75	226-51	50	20030-U	
504[1]	Activated silica gel (45/60)	150/75	6 x 75	–	50	20031	
506[1]	Activated silica gel (45/60)	300/150	8 x 75	226-10-04	50	20032	
554[1]	H_2SO_4-coated silica gel (20/40)	150/75	6 x 75	226-53	50	20033	
FLORISIL							
60	Florisil (30/45)	100/50	6 x 75	226-39	50	20351	
POROUS POLYMERS							
42 small	Supelpak 20E (20/40)	66/33	6 x 75	–	50	20262	
42 large	Supelpak 20P (20/40)	100/50	10 x 100	–	50	20264-U	
43	Supelpak 20U (20/40)[4]	100/50	8 x 100	226-30-04	50	20258	
44	Supelpak 20E (20/40)[4]	100/50	8 x 100	226-30-04	50	20260-U	
49P	Supelpak 20P (20/40) with glass fiber filter (OVS-2)	270/140	–	226-30-16	10	20350	
23	2-(Hydroxymethyl)piperidine on Supelpak 20N (20/40)	120/60	6 x 85	226-118	25	20257-U	
24	2-(Hydroxymethyl)piperidine on Supelpak 20N (20/40)	150/75	6 x 105	226-117	25	20231	

Air Monitoring
Solvent Desorption Tubes

ORBO NO.	ADSORBENT	BED WT. (mg) A/B	OD X LENGTH (mm)	SKC INC. EQUIVALENT	QTY.	CAT. NO.	PRICE
POROUS POLYMERS (CONT'D)							
25	2-(Hydroxymethyl)piperidine on Supelpak 20N (20/40)	450/225	8 x 115	226-27	25	20357	
70	5% Na_2CO_3 on Chromosorb P (30/60)	335/185	8 x 100	–	50	20256-U	
47	Supelpak 70	100/50	6 x 90	226-95	50	20349	
402	Tenax TA 35/60	100/50	8 x 100	226-35-03	50	20832-U	
403[1]	Tenax TA 60/80, acetone/methanol-treated	100/50	6 x 85	–	50	20034	
601[1]	Amberlite XAD-8 (16/50)	100	6 x 75	226-30-08	50	20048	
605[1]	Amberlite XAD-2 (20/50)	100/50	6 x 100	–	50	20049	
608[1]	Amberlite XAD-2 (20/50)	150/75	8 x 110	226-30-05	50	20050-U	
609[1]	Amberlite XAD-2 (20/50)	400/200	8 x 110	226-30-06	50	20051	
613[1]	Amberlite XAD-4	80/40	6 x 75	226-93	50	20052	
65M[1]	XAD-4 with MCE filter (OVS-2)	160/80	-	-	10	20028-U	
65P[1]	XAD-4 with glass fiber filter (OVS-2)	160/80	-	-	10	20029-U	
615[1]	Amberlite XAD-7 (15/50)	100/50	6 x 75	226-94	50	20053	
655[1]	Amberlite XAD-7 (20/60), H_3PO_4 (phosphoric acid)-treated	80/40	6 x 75	226-98	–	20054	
657[1]	Amberlite XAD-7, 1-(2-pyridyl)piperazine-coated	80/40	6 x 90	–	50	20055	
706[1]	Chromosorb 102 (20/40)	100/50	8 x 100	226-107	50	20057	
710[1]	Chromosorb 108 (60/80)	400/200	10 x 100	226-113	50	20058	
711[1]	Chromosorb 106 (60/80)	600/300	10 x 115	226-111	50	20059	
751[1]	Silvered Chromosorb P	30	6 x 20	–	50	20060	
1101[1]	Porapak QS (50/80)	100/50	6 x 75	226-59-09	50	20061	
1102[1]	Porapak P (50/80)	100/50	6 x 75	226-114	50	20062	
1103[1]	Porapak Q (50/80)	150/75	6 x 100	226-115	50	20063	
1104[1]	Porapak R (50/80)	70/35	6 x 75	226-59-04	50	20064	

ORBO NO.	DESCRIPTION	OD	SKC INC. EQUIVALENT	QTY.	CAT. NO.	PRICE
COATED FILTERS[5]						
80	1-(2-Pyridyl)piperazine on glass fiber filter	37mm	–	25	20811	
80 kit	ORBO-80 filter with cassettes (unassembled)	37mm	225-9002	25	20812-U	
828[6]	Silver nitrate-impregnated Whatman #4	37mm	225-9008	25	20070-U	

[1] Tubes made on request.
[2] German Pat. No. 1935500. Patent holder: Badische Anilin-& Soda-Fabrik Aktiengesellschaft.
[3] US Pat. No. 4,839,331.
[4] Similar tubes QA tested for different methods. Refer to Appendix to Technical Bulletin 769, Literature No. 411091).
[5] Assembled cassettes are available on request.
[6] Coated filters made on request.

ORBO Accessories

DESCRIPTION	CAT. NO.	PRICE
ORBO tube cutter	20596	
Replacement sapphire blade	20575	
Puller/inserter tool, pk. of 2	22406	

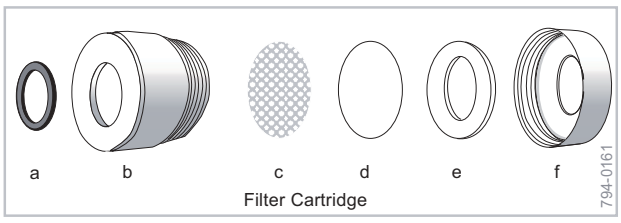
Puller/Inserter Tool
22406

ORBO Tube Cutter
20596

SPECIFICATIONS FOR SMALL PUF (LOW VOLUME)		
	ORBO-1000 Small PUF	ORBO-1500 PUF/XAD-2/PUF Layers
Dimensions	22mm OD x 7.6cm length	PUF: 22mm OD x 30mm length XAD-2: 1.5g PUF: 22mm OD x 30mm length
Sampling Rate	1-5L/min	1-5L/min
PUF Density	0.022g/cm ^{3}	0.022g/cm ^{3}
Applications	ASTM D4861 – Pesticides/PCBs ASTM D4947 – Chlordane/Heptachlor EPA IP-8 – Pesticides/PCBs EPA TO-10A – Pesticides/PCBs	Pesticides/PCBs

SPECIFICATIONS FOR LARGE PUF (HIGH VOLUME)		
	ORBO-2000 Large PUF	ORBO-2500 PUF/XAD-2/PUF Layers
Dimensions	6cm OD x 7.6cm length	PUF: 6cm OD x 50mm length XAD-2: 10g PUF: 6cm OD x 25mm length
Sampling Rate	20-225L/min	20-225L/min
PUF Density	0.022g/cm ^{3}	0.022g/cm ^{3}
Applications	ASTM D6209 - PAHs EPA IP-7 – PAHs EPA TO-4A – Pesticides/PCBs EPA TO-9A – Dioxins EPA TO-13A – PAHs	Pesticides/PCBs PAHs Dioxins

P000745



Filter Cartridge

ORBO PUF Cartridges

Several US EPA and ASTM methods require a polyurethane foam (PUF) adsorbent cartridge for monitoring semivolatiles in stack, ambient, indoor, and workplace atmospheres. A low pressure drop across the cartridge facilitates high volume sampling. Refer to the table for descriptions of our PUF cartridges. We thoroughly clean our PUF plugs, then test them to ensure absence of contamination.

DESCRIPTION	QTY.	CAT. NO.	PRICE
SMALL PUF CARTRIDGES AND COMPONENTS			
ORBO-1000 Assembled Cartridge – Glass holder with cleaned PUF plug	3	20557	
Cleaned PUF Plugs (7.6cm length)	3	20600-U	
ORBO-1500 Assembled Cartridge – Glass holder with cleaned X AD-2 resin and PUF plugs	3	21233-U	
Cleaned XAD-2 Resin (Supelpak-2)	100g	20279	
Glass Holder for Small PUFs	1	20556	
LARGE PUF CARTRIDGES AND COMPONENTS			
ORBO-2000 Assembled Cartridge – Glass holder, screen, and cleaned PUF plug	1	20037	
Cleaned PUF Plugs (7.6cm length)	1	20038	
ORBO-2500 Assembled Cartridge – Glass holder with cleaned XAD-2 resin and PUF plugs	1	21235-U	
Cleaned XAD-2 Resin (Supelpak-2)	100g	20279	
Glass Holder and Screen for Large PUFs	1	20563	
Stainless Steel Screens for Large PUFs (55mm diam.)	2	21008-U	

Filter Cartridge

An optional filter cartridge can be attached to the inlet of an ORBO-1000 or ORBO-1500 cartridge, to trap aerosol and particulate forms of semivolatiles. The filter cartridge contains a replaceable 32mm diameter quartz microfiber filter with a stainless steel support screen.

Filter Cartridge Assemblyincludes
1 O-ring (a), 1 filter cartridge body (b),
1 stainless steel screen (c), 1 quartz filter (d), 1 filter ring (e), 1 cartridge screw cap (f), and 2 end caps.

Filter Cartridge consists of 1 O-ring (a),
1 filter cartridge body (b),
1 filter ring (e), and 1 cartridge screw cap (f).

DESCRIPTION	QTY.	CAT. NO.	PRICE
Filter Cartridge Assembly		21031	
Filter Cartridge		21033	
Filter Cartridge Replacement Parts			
O-Rings (a)	2	21037	
Filter Cartridge Body (b)	1	21034	
Stainless Steel Screens, 32mm diam. (c)	2	21039-U	
Quartz Filters, 32mm diam. (d)	10	21038	
Filter Ring (e)	1	21035	
Cartridge Screw Cap (f)	1	21036	
End Caps	2	21041-U	

SUPELCO® Analytical

Air Monitoring

A Complete Line of Products for Air Monitoring

- Adsorbent Tubes
  Solvent Desorption
  Thermal Desorption
- Passive Sampling
- Whole Air Sampling
- Pumps and Accessories
- Chemical Standards

What's New in Air Monitoring

Radiello®.....page 31

Carbopack™ X Supel™-Inert Thermal Desorption Tubes.....page 21

BPE-DNPH Cartridge for Simultaneous Determination of Ozone and Aldehydes.....page 10

Adsorbent Kit with Bulk Media for Method Development.....page 6

DSD-DNPH Diffusive Sampler for Carbonyls .....page 38

Mercury Emissions Sampling Tubes.....page 17

Introduction

Supelco is proud to offer this comprehensive catalog featuring our air monitoring product line with new innovative products. We have more than 30 years expertise in adsorbent technology, which enables us to provide innovative solutions to meet a wide range of air monitoring needs for industrial hygiene, ambient air, and industrial source emissions applications.

Our sampling media are designed to meet sampling and analysis criteria according to NIOSH, OSHA, EPA, and ASTM methods. Our proprietary adsorbents, such as Carbopack™ graphitized carbon blacks and Carboxen™ carbon molecular sieves, exhibit unique and superior performance characteristics for a wide range of applications. Because we manufacture these materials on-site, we can assure both their quality and availability. We are an ISO 9001 company. Our highly qualified staff is dedicated to offering reliable products and customized solutions to meet your unique needs. This quality is also trusted by the National Aeronautics and Space Administration (NASA) who used Supelco materials for their space mission Cassini-Huygens to the Saturn moon, Titan and Galileo mission to Jupiter (To learn more, see page 9).

We are your one-stop supplier for your air monitoring needs and offer the complete solution from sample collection to analysis and quantification. We offer sampling pumps, sampling devices, chemical standards, vials, syringes, and chromatography columns. The convenience of a single, trusted source for all of your laboratory and air monitoring needs is unsurpassed. For a complete listing of complementary products, request a copy of our general products catalog or visit us online at *sigma-aldrich.com/supelco*

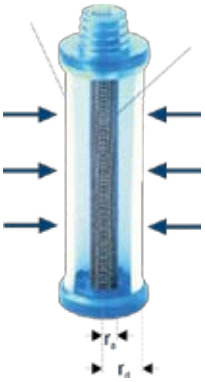
Types of Air Sampling

Active Sampling

Active

In active sampling, the air/gas sample is actively pumped or drawn into or through a sampling media. Media can be filters, adsorbent tubes, wash bottles, or gas sampling containers. In addition to capturing analytes of interest from the air, the active sampling device must ensure minimal background interference, exhibit sufficient capacity or breakthrough volume for the application for which it is intended, and provide an acceptable pressure drop during sampling.

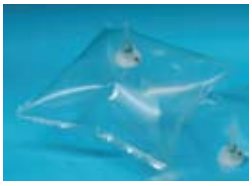
Passive Sampling



P001114

Passive/diffusive sampling relies on the unassisted molecular diffusion of gaseous agents (analytes) through a diffusive surface onto an adsorbent. Unlike active sampling, passive samplers require no pumps, have no moving parts, are simple to use, and offer results comparable to active samplers.

Whole Air Sampling



E000995

A whole air sample is collected when the air is drawn into some sort of containment vessel such as a Tedlar™ bag or glass bulb. The method of collection is easy and the compounds of interest are recovered directly from the vessel. Recovery is a function of several factors which include, the surface area of the vessel, the chemistry and vapor pressure of the contaminants, the influence of various matrix effects, and the ability to begin with a vessel free of contamination. Supelco offers Tedlar Gas Sampling Bags and Bulbs to meet your whole air sampling needs.

Table of Contents

Adsorbents for Air Monitoring

Carbon Adsorbent Materials

The commitment to carbon adsorbent technology at Supelco has been ongoing for more than two decades. This effort has been critical to the advancement of chromatography products like GC columns and sample preparation products. Today, Supelco has over 87 different carbons ranging in particle size from 1–1000 µm and surface areas from 1–1500 m^2/g. Our efforts have been broad in scope, and have ranged from purification process development to research focusing on the thermodynamic and kinetic properties of adsorbents. Understanding the performance characteristics of adsorbents has been our primary goal.

The unique and valuable characteristics of the Supelco carbons warranted their inclusion in NASA experiments on the 1995 Galileo Mission to Jupiter; the 2005 Cassini-Huygens Mission to Titan-the largest moon of Saturn; and the 2008 Phoenix Mission to Mars. If you do not see a specialty carbon adsorbent that meets your needs, contact our Technical Service group at ***techservice@sial.com*** to inquire about custom materials. In addition to our specialty carbon adsorbents, we also offer popular adsorbents, such as activated charcoal, polymer materials, and silica gel.

Graphitized Carbon Black (GCB)

Unlike activated charcoals, which are porous, graphitized carbon blacks (GCBs) are generally non-porous, highly hydrophobic. Consequently, the entire surface of these materials is available for interactions that depend solely on dispersion (London) forces. Because we prepare our GCBs at temperatures >2500 °C, the high purity nature of the resulting carbon material ensures effective release/desorption of the analyte of interest. Carbotrap™ signifies material that is 20/40-mesh size, whereas Carbopack signifies material that is smaller than this mesh/particle size.

Products containing Carbotrap B, Carbotrap C, and Carbotrap F graphitized carbon blacks trap a wide range of airborne organic compounds, from C4-C5 hydrocarbons to polychlorinated biphenyls and other large molecules. Carbotrap (formerly called Carbotrap B)adsorbent has a surface area of 100 m^2/g and can be used for monitoring many airborne C5-C12 compounds. The smaller surface areas of Carbotrap C and Carbotrap F adsorbents, 10 m^2/g and 5 m^2/g, respectively, make these materials useful for trapping and efficiently releasing larger molecules in the C9-C30 range.

Unlike most GCBs, Carbopack X is porous. Its surface area of 240 m^2/g provides greater adsorption strength than other GCBs; hence it is a unique bridge between GCBs and carbon molecular sieves. Carbopack Y, with a surface area of 24 m^2/g, bridges the characteristics of Carbopack B and Carbopack C.

These adsorbents offer excellent thermal stability, which ensures minimal bleed at thermal desorption temperatures, and their coarse 20/40 and 40/60 mesh particle size prevents high pressure drop across the tube. Hydrophobic properties minimize sample displacement by water, enabling you to obtain accurate samples despite high humidity. Trapped compounds can be desorbed by solvent or thermal desorption, at virtually 100% desorption efficiency.

Carbopack B, Carbopack C, and Carbopack F GCBs are essentially the same adsorbents as Carbotrap, Carbotrap C, and Carbotrap F, respectively, but in a 60/80 mesh size. These materials often are used in narrow bore tubes (1-2 mm I.D.) for sample refocusing or very low flow sampling (e.g., <20 mL/min).

Graphitized Carbon Blacks

Description	Pkg.	Cat. No.
Carbotrap		
20/40 mesh	10 g	**20287**
Carbopack B		
60/80 mesh	10 g	**20273**
Carbotrap C		
20/40 mesh	10 g	**20309**
20/40 mesh	500 g	**11047-U**
Carbopack C		
60/80 mesh	10 g	**10257**
Carbotrap X		
20/40 mesh	10 g	**10435-U**
Carbopack X		
40/60 mesh	10 g	**10436**
60/80 mesh	10 g	**10437-U**
Carbotrap Y		
20/40 mesh	10 g	**10460-U**
Carbopack Y		
40/60 mesh	10 g	**10461-U**
60/80 mesh	10 g	**10462**
Carbopack Z		
60/80 mesh	10 g	**11051-U**

Carbon Molecular Sieve (CMS)

Carbosieve

A carbon molecular sieve (CMS) particle is the carbon skeletal framework remaining after the pyrolysis of a polymeric precursor. These materials are primarily used for collecting very small molecular-sized compounds (C2, C5). The size and shape of the analyte molecule and the size and shape of the pores in the CMS particle determine how well the analyte is adsorbed and desorbed. Because our CMSs are prepared from high purity polymers, the resulting material is a high purity carbon, effective in the release/desorption of adsorbed analytes for quantification. Carbosieve S-III and our Carboxen carbon molecular sieves have upper temperature limits of at least 400 °C.

- **Carbosieve S-III** is a large surface area (approximately 820 m^2/g) and 15-40 Å pores make this spherical carbon molecular sieve excellent for trapping small airborne molecules, such as chloromethane. Although hydrophobic, it retains slightly more water during sampling than does Carboxen-569. The pure carbon framework permits thermal desorption of analyte molecules without loss.
- **Carbosieve S-II** (mostly used in GC columns) is recommended for analyzing mixtures of permanent gases (H_2, O_2, Ar, CO and CO_2) and C1-C2 hydrocarbons (methane, ethane, ethylene, acetylene). Maximum temperature 225 °C with oxygen-free carrier gas.
- **Carbosieve G** (mostly used in GC columns) is recommended for analyzing C1-C3 hydrocarbons. Maximum Temperature <200 °C with oxygen free carrier gas.

Carbon Molecular Sieves

Description	Pkg.	Cat. No.
Carbosieve S-II		
60/80 mesh	10 g	**10189**
Carbosieve S-III		
60/80 mesh	10 g	**10184**
Carbosieve G		
40/60 mesh	5 g	**10197**
60/80 mesh	5 g	**10198**

Carboxen

Carboxen carbon molecular sieves are hydrophobic, ensuring accurate sampling at high humidities. Carboxen-563 and Carboxen-564 are our preferred versions of Ambersorb® XE-340 and Ambersorb XE-347 adsorbents – the carboxen adsorbents have higher capacity (breakthrough volume) for many volatile organic compounds (VOCs). Carboxen-563 is used for analyzing water quality or airborne compounds. Its range for airborne compounds is similar to that of Carboxen-564, but with a somewhat lower capacity.

Carboxen-564 is effective for monitoring many C2-C5 VOCs.

Carboxen-569 is a 20/45-mesh material with no Ambersorb equivalent. High hydrophobicity makes it useful for sampling in high humidity (use a 4 mm I.D. or larger tube). Relative to Carboxen-563 and Carboxen-564, Carboxen-569 has greater capacity for organic molecules and less capacity for water.

NEW! **Carboxen-572** is a CMS possessing a tapered pore structure with open, throughput micropores. It is a highly efficient CMS and compares directly to the Carboxen-1000 (one of our most efficient CMS carbons used for purge-trap, and air sampling applications). The primary difference between the Carboxen-572 and the Carboxen-1000 is the particle size distribution (Carboxen-572 = 20/45 mesh and Carboxen-1000 = 60/80 mesh).

Carboxen-1000 is for low volume sampling of very volatile compounds, such as vinyl chloride. Its large surface area and optimized microporosity enable it to effectively and efficiently adsorb and desorb smaller molecular size compounds, providing excellent chromatography without a need for cryogenic cooling. This 60/80-mesh adsorbent is used primarily in narrow bore tubes that are desorbed directly into the chromatographic column.

Carboxen-1001 is a 60/80 mesh material used to trap and retain small compounds. It can be used as the final bed in multi-bed adsorbent tubes, to minimize breakthrough. It is similar to Carboxen-569 in strength and hydrophobicity.

Carboxen-1003 is a carbon molecular sieve with a large surface area and hydrophobic surface characteristics, which provide a combination of efficient adsorption/desorption and good hydrophobicity.

Carboxen *(Contd.)*

Carboxen-1012 is a highly-activated, inert carbon molecular sieve (CMS) possessing large micropores. It has been used effectively for aqueous phase adsorption of organic compounds, or for air sampling of C4-C6 compounds.

Carboxen-1018 is a microporous CMS possessing a large percentage of narrow (~6-7 angstroms) micropores for adsorption/desorption of small analytes such as ethane, acetylene, ethylene and the C3 hydrocarbons. This CMS is a hydrophobic, inert, strong adsorbing porous carbon, as is the Carboxen-1021. Both are used in **breath sampling tubes** developed for ethane, acetaldehyde and other small molecules present in exhaled breath samples.

Carboxen-1021 is a highly-microporous carbon molecular sieve designed for air sampling of small molecules. It is similar to Carboxen-1018, with a large percentage of small micropores (5-6 angstroms; smaller than the Carboxen-1018), and is more hydrophobic than the Carboxen-1018.

Carboxen

Description	Pkg.	Cat. No.
Carboxen-563		
20/45 mesh	10 g	**10263**
Carboxen-564		
20/45 mesh	10 g	**10264**
Carboxen-569		
20/45 mesh	10 g	**10269**
20/45 mesh	500 g	**11048-U**
NEW! Carboxen-572		
20/45 mesh	10 g	**11072-U**
Carboxen-1000		
40/60 mesh	50 g	**10477-U**
60/80 mesh	10 g	**10478-U**
Carboxen-1003		
40/60 mesh	10 g	**10471**
Carboxen-1016		
60/80 mesh	10 g	**11021-U**

Choosing Carbon Adsorbents

For multi-bed tubes, use the weaker adsorbent in front of the stronger adsorbent. For example, use Carbopack C in front of Carbopack B.

Relative Analyte Size▲	Recommended Materials (listed weakest to strongest)
>C20	Carbotrap F, Carbopack F
C12-C20	Carbotrap C, Carbopack C, Carbotrap Y, Carbopack Y
C5-C12	Carbotrap B, Carbopack B
C3-C9	Carboxen 1016, Carbotrap X, Carbopack X, Carbopack Z
C2-C5	Carboxen 569, Carbosieve G, Carboxen 1000, Carbosieve S-III, Carboxen 1021, Carboxen 1018, Carboxen 1003, Carboxen 1012

▲ Analyte size relative to n-Alkanes. Consider all atoms, not just Carbon. For example, even though 1,2-Dichloroethane is a C2, the two Chlorine atoms give it a relative size between C4 and C5.

NEW!
Carbon Adsorbent Sampler Kits

E000926

Often choosing the right adsorbent or combination of adsorbents can be difficult. The goal in selecting the proper adsorbent is to choose one or more that can retain a specific analyte, or group of analytes, for a specific sample volume. However, equally important is that the adsorbent(s) must also be able to release the analyte(s) during the desorption process.

By using one of the Supelco Carbon Adsorbent Sampler Kits, the method developer obtains a cost-effective way to evaluate several carbon adsorbents when designing adsorbent-based applications and products. Once the appropriate material has been identified, Supelco is ready to work with you to produce larger quantities to your specifications.

Carbon Adsorbent Sampler Kits

Description	Cat. No.
Graphitized Carbon Black Kit 20/40 Mesh	
5 g each of Carbotrap F, Carbotrap C, Carbotrap Y, Carbotrap B, Carbotrap X	**13027-U**
Graphitized Carbon Black Kit 60/80 Mesh	
5 g each of Carbopack F, Carbopack C, Carbopack Y, Carbopack B, Carbopack X, Carbopack Z	**13026-U**
Carbon Molecular Sieve Kit	
5 g each of Carboxen-569, Carboxen-1000, Carboxen-1003, Carboxen-1012, Carboxen-1016, Carboxen-1018, Carboxen-1021, Carbosieve G, Carbosieve S-III	**13028-U**

Physical Characteristics of Supelco Carbon Adsorbents

Adsorbent	BET Surface Area● (m^2/g)	Density (g/mL)	Porosity (mL/g) micro -	meso-	macro-	Micropore Diameter (Å)
Carbotrap Kit (20/40 mesh graphitized carbon black)						
Carbotrap F	5	0.69	-	-	-	-
Carbotrap C	10	0.68	-	-	-	-
Carbotrap Y	24	0.45	-	-	-	-
Carbotrap B	100	0.37	-	-	-	-
Carbotrap X	240	0.43	-	0.62	-	100
Carbopack Kit (60/80 mesh graphitized carbon black)						
Carbopack F	5	0.64	-	-	-	-
Carbopack C	10	0.68	-	-	-	-
Carbopack Y	24	0.42	-	-	-	-
Carbopack B	100	0.35	-	-	-	-
Carbopack Z	220	0.18	-	1.73	-	255
Carbopack X	240	0.41	-	0.62	-	100
Carbon Molecular Sieve Kit						
Carboxen-1016	75	0.40	-	0.34	-	-
Carboxen-569	485	0.58	0.20	0.14	0.10	5 - 8
Carboxen-1021▼	600	0.62	0.30	-	-	5 - 8
Carboxen-1018▼	675	0.60	0.35	-	-	6 - 8
Carbosieve S-III◆	975	0.61	0.35	0.04	-	4 - 11
Carboxen-1003	1000	0.46	0.38	0.26	0.28	5 - 8
Carbosieve G	1160	-	0.49	0.02	-	6 - 15
Carboxen-1000	1200	0.48	0.44	0.16	0.25	10 - 12
Carboxen-1012	1500	0.50	-	0.66	-	19 - 21

● Brunauer, Emmett, Teller (BET) surface area calculations

▼ microporous, monoporous carbon sieve

◆ closed pore structure

Polymeric Adsorbents

Supelpak™ Adsorbents

Supelpak-2 is a purified form of Amberlite® XAD®-2 resin, designed for minimal background interference when monitoring semivolatile contaminants. It has been cleaned to meet and exceed US EPA-recommended criteria for purity, as outlined in the EPA's Level 1 Environmental Assessment Procedures Manual. Supelpak-2 is used in the following US EPA methodologies: SW-846 Method 0010, Modified Method 5 Sampling Train for Principal Organic Hazardous Compounds (POHCs); TO-13 - PAHs in ambient air; and IP-7 - PAHs in indoor air. It is the best resin to use for standard air sampling methods requiring resin tested for background TCO (Total Chromatographic Organics) level.

Supelpak-2

Matrix:	styrene-divinylbenzene
Surface Area:	~300 m^2/g
Density:	1.02 g/mL, 25 °C (true wet) 1.07 g/mL, 25 °C (skeletal)
Particle Size:	20/60 mesh
Pore Volume:	~0.65 mL/g
Mean Pore Size:	90 Å
Max Temp.:	200 °C

Supelpak-2B is a form of Amberlite XAD-2 resin specially cleaned to USEPA specifications for the Great Lakes National Program Office (GLNPO) program, for sampling and analysis of PCBs from large volumes of water.

Supelpak-2SV is a form of purified Amberlite XAD-2 that has been specifically cleaned and tested for optimal performance in capturing and extraction of semivolatile organics.

Supelpak Adsorbents

Description	Pkg.	Cat. No.
Supelpak-2		
20/60 mesh	100 g	**20279**
20/60 mesh	1 kg	**21130-U**
Supelpak-2B		
20/60 mesh	100 g	**13670**
NEW! Supelpak-2SV		
20/60 mesh	100 g	**13673-U**
20/60 mesh	250 g	**13682-U**
20/60 mesh	1 kg	**13674-U**

Porous Polymers

- **Tenax® TA** is a porous material based on 2,6-diphenylene oxide polymer. It is used to trap volatile and semivolatile compounds with an upper temperature limit of 350 °C. It has a low affinity for water and methanol. When sampling for very volatile analytes with Tenax TA, a carbon molecular sieve typically is used as a backup.
- **Supelpak-TA** is a refined (screened) Tenax TA.
- **Tenax GR** is a composite material containing 30% graphite carbon and 70% Tenax TA. Compared to Tenax TA, it has a higher retention volume for most compounds and is twice as dense. Like Tenax TA, it has a low affinity for water or methanol and has an upper temperature limit of 350 °C.
- **Chromosorb® 106** is a styrenedivinylbenzene polymer used to trap small molecules. It has a surface area of 750 m^2/g and an upper temperature limit of 250 °C.
- **Porapak™ N** is a divinylbenzene-ethyleneglycol dimethacrylate polymer.

Porous Polymers, Bulk

Description	Pkg.	Cat. No.
Tenax TA		
60/80 mesh	10 g	**11982**
Supelpak TA		
60/80 mesh	100 g	**12168-U**
Tenax GR		
20/35 mesh	500 g	**11049-U**
Chromosorb 106		
60/80 mesh	50 g	**20225**
Porapak N		
50/80 mesh	75 cc	**20324**

General Purpose Adsorbents

Activated Coconut Charcoal

Activated coconut charcoal has been used extensively as a general purpose adsorbent due to its ability to adsorb/desorb a wide range of volatile analytes.

Description	Pkg.	Cat. No.
Activated Charcoal		
20/40 mesh	10 g	**10275**

Silica Gel

Silica gel has been used extensively as a general purpose adsorbent due to its ability to adsorb/desorb a wide range of volatile analytes, in particular, those that are polar. Care must be taken when sampling in humid environments due to its affinity for water.

Description	Pkg.	Cat. No.
Davison Silica Gel, Grade 12		
60/80 mesh	100 g	**20290-U**

Adsorbents for Air Monitoring

Adsorbent Cross Reference

Adsorbent	Supelco Equivalent or Substitute
Ambersorb 347	Carboxen 564
Anasorb CMS	Carboxen-564, Carboxen-1000, Carbosieve S-III
Anasorb CSC	Coconut charcoal
Anasorb GCB1	Carbopack B, Carbotrap B
Anasorb GCB2	Carbopack C, Carbotrap C
Anasorb 708	Chromosorb 108
Anasorb 727	XAD-4
Anasorb 747	Carboxen-564, Carboxen-1000, Carbosieve S-III

Adsorbent	Supelco Equivalent or Substitute
Carbograph 1	Carbopack B, Carbotrap B
Carbograph 2	Carbopack C, Carbotrap C
Carbosphere	Carboxen-1000
Graphpac-GC	Carbopack B, Carbotrap B,
Carbopack C	Carbotrap C
Purosieve	Carboxen-1000
Spherocarb	Carboxen-1000
Tenax GC	Tenax TA

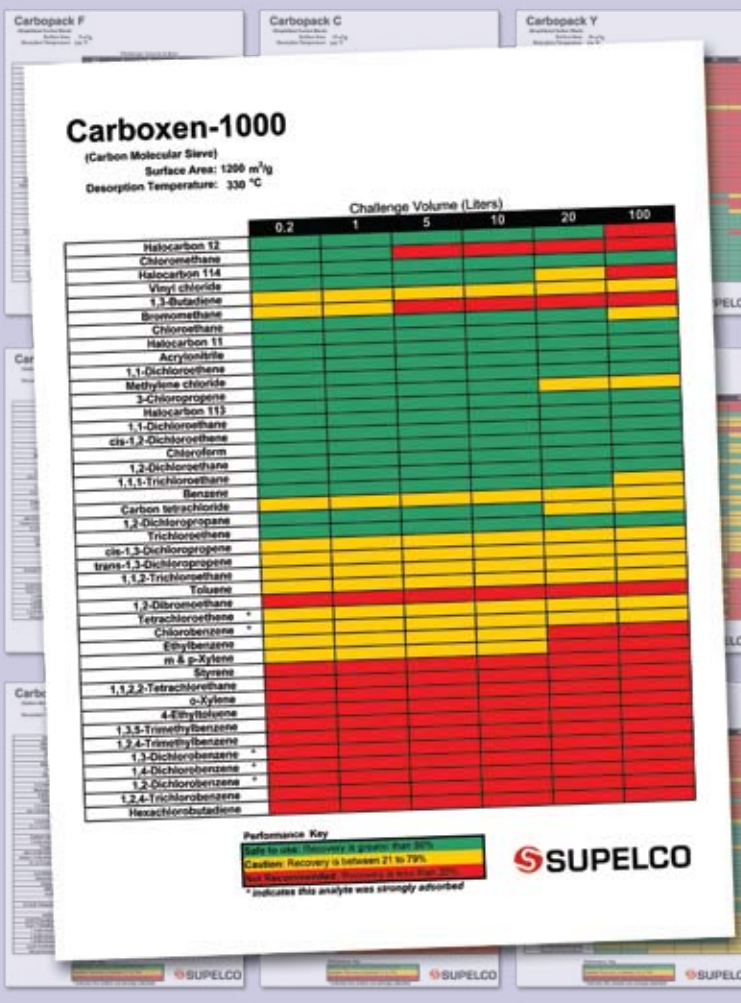
For more in-depth information:

Visit our web site, ***sigma-aldrich.com/supelco*** and view T402025 (EQF), *"A Tool for Selecting an Adsorbent for Thermal Desorption Applications,"* which includes adsorption/desorption data on 43 common air pollutants on 24 different adsorbents, and T402026 (EQG), *"Characterization of Adsorbents for Sample Preparation Process,"* which describes the past, present, and future of carbon adsorbent research at Supelco.


SUPELCO

Technical Report

A Tool for Selecting an Adsorbent for Thermal Desorption Applications


Carboxen-1000

(Carbon Molecular Sieve)

Surface Area: 1200 m^2/g

Desorption Temperature: 330 °C

Challenge Volume (Liters)

0.2 1 5 10 20 100

Halocarbon 12
Chloromethane
Halocarbon 114
Vinyl chloride
1,3-Butadiene
Bromomethane
Chloroethane
Halocarbon 11
Acrylonitrile
1,1-Dichloroethene
Methylene chloride
3-Chloropropene
Halocarbon 113
1,1-Dichloroethane
cis-1,2-Dichloroethene
Chloroform
1,2-Dichloroethane
1,1,1-Trichloroethane
Benzene
Carbon tetrachloride
1,2-Dichloropropane
Trichloroethene
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
1,1,2-Trichloroethane
Toluene
1,3-Dibromoethane
Tetrachloroethene *
Chlorobenzene *
Ethylbenzene
m & p-Xylene
Styrene
1,1,2,2-Tetrachloroethane
o-Xylene
4-Ethyltoluene
1,3,5-Trimethylbenzene
1,2,4-Trimethylbenzene
1,3-Dichlorobenzene *
1,4-Dichlorobenzene *
1,2-Dichlorobenzene *
1,2,4-Trichlorobenzene
Hexachlorobutadiene

Performance Key

Safe to use: Recovery is greater than 80%

Caution: Recovery is between 21 to 79%

Not Recommended: Recovery is less than 20%

* indicates this analyte was strongly adsorbed

SUPELCO

Carbopack F

Carbopack C

Carbopack Y

Carbopack B

Carboxen-1000

Carboxen-1001

Carboxen-1018

Carbosieve S-III

SUPELCO

Did you know..

Space, the Final Frontier.

The National Aeronautics and Space Administration (NASA) has been studying planets in our solar system for several decades. The missions attempt to obtain a breadth of knowledge by gathering data on the electromagnetic spectrum, magnetic fields, particle analyses, and atmosphere constituents of these planets. Some information may lead to determining the birth of the solar system and origins of life on Earth. To assist in these studies, Supelco designed unique carbon adsorbents for analyzing atmospheric constituents under the arduous constraints of space exploration.

The Galileo Probe, which arrived at Jupiter in 1995, employed a column packed with a Carbosieve carbon molecular sieve adsorbent, as part of a mass spectrometer experiment. This adsorbent was developed to separate and quantify the gases in Jupiter's atmosphere — methane, water, argon, neon, hydrogen sulfide, krypton, xenon, ammonia, and isotopes of helium and hydrogen. The adsorption / desorption properties of the adsorbent allowed concentration of these gases of interest, and their subsequent desorption to a mass spectrometer sensor for analysis.

NASA's project, the Cassini-Huygens Mission to Saturn, is a journey to the ringed planet that will last approximately seven years. Exploration will continue for four years. A total of 27 experiments will be performed, with the involvement of a number of international space agencies, academic institutions, and industrial partners. Supelco participated in composing the atmosphere sampling experiments. The Cassini spacecraft consists of two parts — the Saturn orbiter will collect data, communicate with Earth, and power the spacecraft; the Huygens probe will separate from the orbiter and travel to Titan, Saturn's largest moon. A gas chromatograph/mass spectrometer (GC-MS) in the Huygens probe will analyze the organic components of Titan's atmosphere. Light hydrocarbons will be concentrated using a new, porous graphitized carbon developed at Supelco specifically for this application. This carbon will trap the C2 to C8 hydrocarbon fraction — an important indicator of the presence of life.

Supelco scientists graphitized a carbon molecular sieve to optimize the analysis of light hydrocarbons and efficiently release the trapped analytes under conditions specific to a totally new GC-MS flow design. The carbon molecular sieve base withstands the vibrations of the launch and entry into Titan's atmosphere. Also onboard the Huygens probe is another carbon molecular sieve, Carboxen-1004. As the atmosphere of Titan is believed to be similar to that of ancient Earth, Supelco provided an adsorbent that will trap permanent gases. Scientists working at the University of Paris, packed a microcolumn with Carboxen-1004, for in situ GC-MS analysis.

Supelco's carbon laboratory is one of the finest in the world. In addition to developing new carbon molecular sieves and making recent developments with porous graphitized carbon, we also produce a variety of graphitized carbon blacks (GCBs).

We can prepare carbons in sub-micron particle sizes (for capillary GC applications) to 1.0 mm sizes (for sample preparation applications where pressure drop considerations are required). Some carbons are available in larger sizes. The temperature capability of our furnace reaches 3000 °C, and its capacity extends from bench- to pilot-scale. We pride ourselves on being able to tailor carbon adsorbents to specific applications. The graphitized carbon molecular sieve designed specifically for NASA is just one example. Supelco carbon adsorbents are available in bulk, packed in columns, sampling tubes, or gas purifiers. Custom requests are welcome, even if your demands are earthbound.

Active Sampling

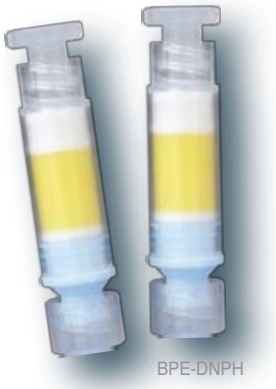
LpDNPH (Low Pressure) Products

LpDNPH cartridges are air-sampling devices designated for sampling carbonyls (e.g. formaldehyde) in ambient, indoor, and industrial atmospheres. Carbonyls are trapped on a high purity silica adsorbent coated with 2,4-dinitrophenylhydrazine (DNPH), where they are converted to hydrazone derivatives. The derivatives are eluted from the cartridge with acetonitrile and analyzed by HPLC.

LpDNPH cartridge benefits:

- High purity adsorbent for better accuracy and trace analysis.
- High sensitivity, low background.
- Low pressure drop, enables use at high sampling rates (1.5-2 L/min), or long pump performance
- New packaging, for maximum sample integrity
- Manufactured in controlled environment
- Meets EPA, OSHA, NIOSH and ASTM specifications

NEW! *BPE-DNPH* Cartridge*



This innovative product is dual-layered and designed to enable the end-user to simultaneously analyze ozone and aldehydes in their sample; or for use as an inline ozone scrubber and aldehyde analysis in one tube. It incorporates a bed of 1,2-bis(4-pyridyl) ethylene (BPE) coated silica and a bed of DNPH coated silica. This product is also not affected by high humidity. Two uses, your choice.

Description	Pkg.	Cat. No.
BPE-DNPH, 90/260 mg Rezorian	10	54269-U
BPE-DNPH, 90/260 mg Rezorian	50	54270-U

Reference: Uchiyama,S.Anal. Chem. 2008, 80, 3285-3290
**Patent Pending*

DNPH Rezorian™ Cartridge

Rezorian cartridges are made of polypropylene with polyethylene frits. The end-fittings are luer lock syringe connections that can be used to connect a pump tubing or two cartridges in a series (piggybacked) to monitor breakthrough or to increase capacity.

Description	Pkg.	Cat. No.
DNPH, 350 mg, Rezorian	10	54074-U
DNPH, 350 mg, Rezorian	50	54075-U

S10 Cartridge

The design of the S10 cartridge makes it easy to use in the field and the laboratory. Reusable adapters are available for connecting the cartridge to the sampling pump. The built-in reservoir eliminates the need to attach a syringe for sample extraction/elution.

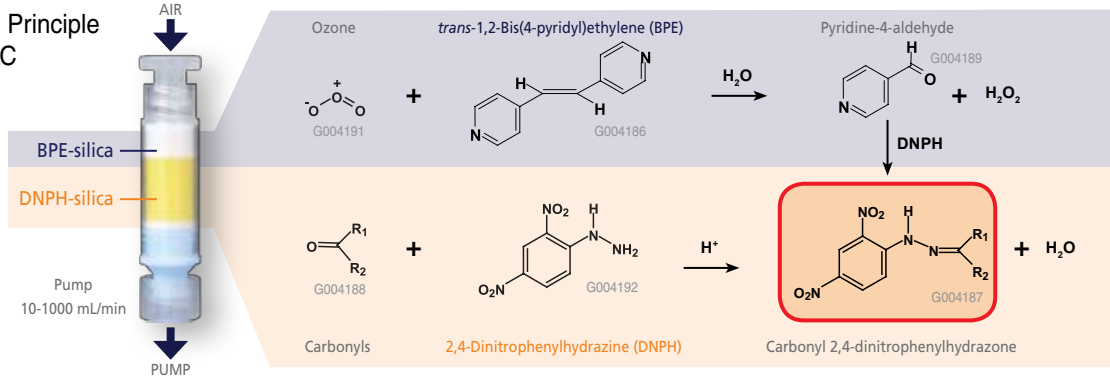
Description	Pkg.	Cat. No.
LpDNPH S10, 3 mL/350 mg	50	21014
LpDNPH S10, 3 mL/350 mg	10	21026-U
LpDNPH S10, 3 mL/350 mg (1 per nylon bag)	50	54072-U
LpDNPH S10 Starter Kit	10	21024-U
Kit includes one tube adapter and ten 1/8" male luer fittings		

S10x Cartridge

The S10x cartridge is shorter than the S10 cartridge and designed to fit automated systems.

Description	Pkg.	Cat. No.
LpDNPH S10x, 350 mg	10	505293

Reaction Principle and HPLC



S10L Cartridge

The S10L cartridge offers a reversible design and is for analysts who prefer shorter dimensions and does not need an adaptor for sampling. The cartridge is eluted by connecting to a syringe barrel (empty SPE tube) that acts as a reservoir for gravity-fed elution solvent. Meets EPA TO-11A requirements.

Description	Pkg.	Cat. No.
LpDNPH S10L, 350 mg Reversible	10	505358
LpDNPH S10L, 350 mg Reversible	50	505361-U

H Series Cartridges

The H series of LpDNPH cartridges contain higher loadings of 2,4-DNPH and/or larger bed weights compared to the S10 cartridges. This provides a higher capacity for carbonyls making the H series cartridges the preferred choice for use in high concentration environments. The H series is available in H10 (350 mg), H30 (1 g) and H300 (10 g) cartridges.

Description	Pkg.	Cat. No.
LpDNPH H10, 3 mL/350 mg	10	**505315**
LpDNPH H10, 3 mL/350 mg	50	**505320-U**
LpDNPH H30, 6 mL/1 g	10	**505323**
LpDNPH H300, 20 mL/10 g	10	**505331**

ORBO-DNPH Tube

The ORBO-DNPH tube contains 120 mg of 2,4-DNPH packed into a glass tube with break seal at both ends, each measuring 6 mm O.D. x 90 mm long.

Description	Pkg.	Cat. No.
ORBO-DNPH, 120 mg/6 mm O.D. x 90 mm L	10	**20081-U**

Ozone Scrubber

This cartridge offers a reversible design, like the S10L cartridge and contains 1.5 g of high purity potassium iodide. KI traps the ozone, which causes a negative formaldehyde interference in DNPH-coated devices. Luer endfittings enable you to connect this cartridge directly to the inlet of any DNPH cartridge with a luer tip. Testing (200 ppb ozone, 50% RH, 25C) has shown the scrubber to have an ozone capacity of 100,000 ppb/hr. The ozone scrubber is also available in the Rezorian hardware.

Description	Pkg.	Cat. No.
Ozone Scrubber, 1.5 g, Reversible	10	**505285**
Ozone Scrubber, 1.5 g, Rezorian	10	**54078-U**

LpDNPH Cartridge Specifications

Adsorbent:	Chromatographic grade, high purity silica gel coated with: DNPH: 2,4-dinitrophenylhydrazine BPE: trans-1,2-bis(4-pyridyl)ethylene
Particle Size:	150-250 µm (60/100 mesh)
DNPH Loading:	0.29% (1 mg/cartridge) 0.38% (1 mg/cartridge, BPE-DNPH) 0.86% (3 mg/cartridge, H series) 0.21% (0.25 mg/cartridge, ORBO-DNPH)
Capacity (total carbonyls):	75 µg (S10 series, BPE-DNPH) 225 µg (H10) 643 µg (H30) 6.4 mg (H300) 18.8 µg (ORBO-DNPH) 26 µg ozone capacity (BPE-DNPH)
Cartridge Length:	7.4 cm (S10) 3.8 cm (S10x) 4.0 cm (S10L) 4.0 cm (Rezorian, BPE-DNPH) 9.0 cm (ORBO-DNPH)
Background:	**SPE Style Cartridges**: <0.06 µg formaldehyde, <0.10 µg acetaldehyde, <0.30 µg acetone **ORBO-DNPH**: <0.025 µg formaldehyde, <0.035 µg acetaldehyde, <0.120 µg acetone
Pressure Drop:	<7 KPA at 1.5L/min (S10) <20 inches water at 167 mL/min (<28 inches water/<2.1 inches mercury)
Storage:	Refrigerate (4 °C), protect from light
Shelf Life:	12 months

HPLC Column Reference

For HPLC columns suitable for carbonyl-DNPH analysis, see page 12.

Adapters and Fittings

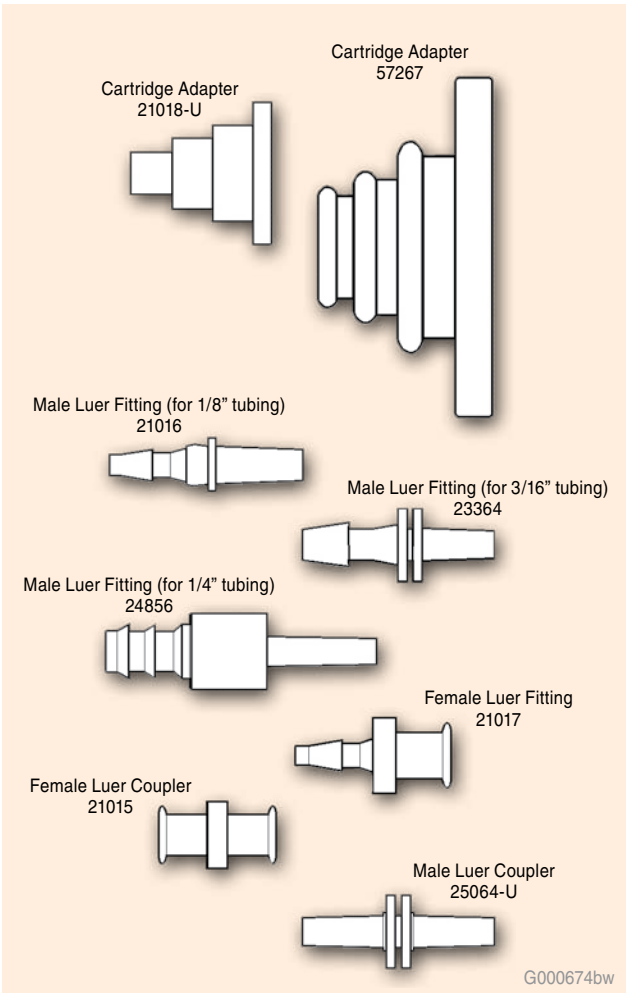
We offer a selection of reusable adapters and fittings for connecting our cartridges to a sampling pump and other devices.

E000981

Accessories

Description	Pkg.	Cat. No.
Connectors		
Cartridge Adapters for S10, H10, H30	10	**21018-U**
Cartridge Adapters for H300	6	**57267**
Male Luer Fittings for 1/8" Tubing	20	**21016**
Male Luer Fittings for 3/16" Tubing	20	**23364**
Male Luer Fittings for 1/4" Tubing	10	**24856**
Female Luer Fittings	20	**21017**
Female Luer Couplers	20	**21015**
Male Luer Couplers	20	**25064-U**
Male Luer Plugs	12	**504351**
Lapel Clips	6	**21019-U**
Syringe Barrels, 6 mL	30	**57242**
Glass Reservoirs, 5 mL	5	**20015-U**
Universal Elution Rack	1	**21043-U**
Analytical Columns Suitable for Carbonyl-DNPH Analysis		
Ascentis C18, 15 cm x 4.6 mm I.D., 3 µm	1	**581322-U**
Ascentis C18, 25 cm x 4.6 mm I.D., 5 µm	1	**581325-U**
Ascentis RP-Amide, 15 cm x 4.6 mm I.D., 3 µm	1	**565322-U**
Ascentis RP-Amide, 25 cm x 4.6 mm I.D., 5 µm	1	**565325-U**

Visit our website for detailed analysis and description.



Universal Elution Rack

Fast and convenient sample preparation without the use of a vacuum

Our versatile elution rack can be used with a variety of air monitoring tubes and receiving vessels, including our LpDNPH cartridges, for simultaneous gravity feed extraction up to 12 samples. By using the assembly plates in various combinations, you can configure the unit to accept:

P000131

- Closed cartridges (S10L)
- 1,3, or 6 mL syringe style cartridges
- 5 or 10 mL flasks
- 2 or 4 mL vials
- Test tubes up to 15 mm I.D. x 10 cm

For more in-depth information:

Aldehyde Method Applications

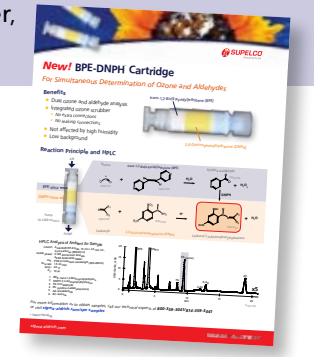
US EPA TO11A – Method for Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)

US EPA IP-6A – Determination of Formaldehyde and Other Aldehydes in Indoor Air Using a Solid Sorbent Cartridge

US EPA Technical Assistance Document – Sampling and Analysis of Ozone Precursors

ASTM D5197 – Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air Active Sampler Methodology

Visit ***sigma-aldrich.com/air_monitoring*** to request the NEW **BPE-DNPH Flyer**, T408066 (KJB)



ORBO Solvent Desorption Tubes

ORBO Solvent Desorption Tubes are packed in glass with sealed ends. ORBO Tubes are mostly dual-layered and contain one larger bed of adsorbent followed by a smaller back-up bed to capture any sample break-through. The beds contain separators typically of glass wool or foam to secure the beds in place.

G000211

ORBO No.	Matrix	Bed Wt. A/B (mg)	O.D. x Length (mm)	SKC Equivalent	Pkg.	Cat. No.
ORBO Charcoal						
ORBO 32 Large	Activated Coconut Charcoal (20/40)	400/200	8 x 100	226-09	50	**20228**
ORBO 32 Small	Activated Coconut Charcoal (20/40)	100/50	6 x 75	226-01	50	**20267-U**
ORBO 33	Activated Petroleum Charcoal (20/40)	700/390	8 x 150	226-35	50	**20259**
ORBO 34	Activated Coconut Charcoal (special)	400/200	8 x 105	-	25	**20211**
ORBO 303	Petroleum Charcoal (20/40)	100/50	6 x 75	226-38		**custom order**
ORBO 304	Charcoal (low Ni) (20/40)	120/60	6 x 80	-	50	**20041**
ORBO 306	Petroleum Charcoal (20/40)	400/200	8 x 105	-	50	**20073-U**
ORBO 351	4-tert-butyl catechol on charcoal	100/50	6 x 75	226-73	50	**20042**
ORBO 353	HBr on Petroleum Charcoal	100/50	6 x 75	226-38-03	25	**20044**
ORBO 354	Charcoal (AVL Barneby Cheney, 580-19)	100/50	6 x 75	226-67	50	**20045**
ORBO 356	4-tert-butyl catechol on charcoal	400/200	8 x 110	-	50	**20047**
Silica Gel						
ORBO 52 Small	Activated Silica Gel(20/40)	150/75	6 x 75	226-10	50	**20229**
ORBO 52 Large	Activated Silica Gel (45/60)	150/150	8 x 75	226-48	50	**20263**
ORBO 53	Activated Silica Gel (20/40) with glass fiber filter	400/200	7 x 100	226-10-03	50	**20265**
ORBO 502	Activated Silica Gel (20/45)	100/50	6 x 75	226-51	50	**20030-U**
ORBO 506	Activated Silica Gel (45/60)	300/150	8 x 75	226-10-04	50	**20032**
ORBO 507	Silica Gel (20/40)	520/260	8 x 110	226-15	50	**20870-U**
ORBO-DNPH	2,4-DNPH coated Silica Gel	120	6 x 90	-	10	**20081-U**
Florisil						
ORBO 60	Florisil Magnesium Silicate (30/45)	100/50	6 x 75	226-39	50	**20351**
ORBO Carbon						
ORBO 76 (3 bed)	TEA-Coated Molesieve with Oxidizer	400/800/400	7 x 125	226-40	25	**20826-U**
ORBO 77	H_2SO_4-Treated Carbon Bead (20/30)	500/100	8 x 150	226-29	50	**20036**
ORBO 78	Carboxen-564	400/200	6 x 100	-	25	**20355**
ORBO 90	Carboxen-564 (for group MEK)	160/80	6 x 75	226-81	25	**20358**
ORBO 91	Carbosieve S-III	130/65	6 x 75	226-121	25	**20360**
ORBO 91T (3 bed)	Carbotrap B/Carbosieve S-III x 2	100/200/100	7 x 150	-	25	**20366-U**
ORBO 92	Carboxen-564 (for group vinyl acetate)	160/80	6 x 75	226-81	25	**20362**
ORBO 100	HBr on Carbotrap (20/40)	350/175	7 x 110	-	25	**20255-U**
ORBO 101	Carbotrap (20/40)	100/50	6 x 70	-	25	**20254-U**
ORBO Porous Polymers						
ORBO 23	2-(Hydroxymethyl) piperidine on Supelpak-20 (20/40)	120/60	6 x 85	226-118	25	**20257-U**
ORBO 24	2-(Hydroxymethyl) piperidine on Supelpak-20 (20/40)	150/75	6 x 105	226-117	25	**20231**
ORBO 25	2-(Hydroxymethyl)piperidine on Supelpak-20 (20/40)	450/225	8 x 115	226-27	25	**20357**
ORBO 42 Small	Supelpak-20E (20/40)	66/33	6 x 75	-	50	**20262**
ORBO 42 Large	Supelpak-20P (20/40)	100/50	10 x 100	-	50	**20264-U**
ORBO 43	Supelpak-20U (20/40)	100/50	8 x 100	226-30-04	50	**20258**
ORBO 44	Supelpak-20E (20/40)	100/50	8 x 100	226-30-04	50	**20260-U**
ORBO 47	Supelpak-70	100/50	6 x 90	226-95	50	**20349**
ORBO 49P	Supelpak-20P (20/40) with glass fiber filter	270/140	OVS-2 Tube	226-30-16	10	**20350**
ORBO 65M	XAD-4 (w/MCE filter)	160/80	OVS-2 Tube	-	10	**20028-U**
ORBO 65P	XAD-4 (w/Glass Fiber Filter)	160/80	OVS-2 Tube	-	10	**20029-U**
ORBO 70	5% Na_2CO_3 on Chromosorb P (30/60)	355/165	8 x 100	-	50	**20256-U**
ORBO 402	Tenax TA (35/60)	100/50	8 x 100	226-35-03	50	**20832-U**
ORBO 403	Tenax TA (60/80), acetone/methanol treated	100/50	6 x 85	-	50	**20034**
ORBO 601	XAD-8 (16/50), single bed	100	6 x 75	226-30-08	50	**20048**
ORBO 605	XAD-2 (20/50)	100/50	6 x 100	-	50	**20049**
ORBO 608	XAD-2 (20/50)	150/75	8 x 110	226-30-05	50	**20050-U**
ORBO 609	XAD-2 (20/50)	400/200	8 x 110	226-30-06	50	**20051**
ORBO 613	XAD-4	80/40	6 x 75	226-93	50	**20052**
ORBO 615	XAD-7 (15/50)	100/50	6 x 75	226-94	50	**20053**
ORBO 655	XAD-7 (20/60), Phosphoric Acid Treated	80/40	6 x 75	226-98	50	**20054**
ORBO 657	XAD-7 (20/60),1-(2-pyridyl) piperazine coated)	80/40	6 x 90	-	50	**20055**
ORBO 706	Chromosorb 102 (20/40)	100/50	8 x 100	226-107	50	**20057**
ORBO 711	Chromosorb 106 (60/80)	600/300	10 x 115	226-111	50	**20059**
ORBO 1102	Poropak P (50/80)	100/50	6 x 75	226-114	50	**20062**
ORBO 1103	Poropak Q (50/80)	150/75	6 x 100	226-115	50	**20063**
ORBO Accessories						
Puller/Inserter Tool					2	**22406**
ORBO Tube Cutter					1	**20596**
Tube Cutter Replacement Blade					1	**20575**

ORBO PUF Cartridges

Polyurethane foam (PUF) cartridges exhibit a low-pressure drop across the cartridge that facilitates high volume sampling. Several US EPA and ASTM methods require a PUF adsorbent cartridge for monitoring semivolatiles in stack, ambient, indoor, and workplace atmospheres. Refer to the tables below for descriptions of our PUF cartridges. The PUF plugs for these cartridges are thoroughly cleaned and tested to ensure absence of contamination.

P000745

Specifications for Small PUF Plug (Low Volume)

	ORBO 1000 Small PUF	ORBO 1500 PUF/XAD-2/PUF
Sampling Rate:	1-5 L/min	1-5 L/min
PUF Density:	0.022 g/cm³	0.022 g/cm³
Dimensions: (O.D. x L)	22 mm x 7.6 cm	22 mm x 30 mm/ 1.5 g XAD-2/22 mm x 30 mm
Applications:	ASTM D4861 Pesticides/ PCBs	Pesticides/PCBs
	ASTM D4947 Chlordane/ Heptachlor	
	EPA IP-8 Pesticides/PCBs	
	EPA TO-10A Pesticides/PCBs	

Specifications for Large PUF Plug (High Volume)

	ORBO 2000 Large PUF	ORBO 2500 PUF/XAD-2/PUF
Sampling Rate:	20-225 L/min	20-225 L/min
PUF Density:	0.022 g/cm³	0.022 g/cm³
Dimensions: (O.D. x L)	6 cm x 7.6 cm	6 cm x 30 mm/10 g XAD-2/6 cm x 30 mm
Applications:	ASTM D6209 PAHs	Pesticides/PCBs
	EPA IP-7 PAHs	PAHs
	EPA TO-4A Pesticides/PCBs	Dioxins
	EPA TO-9A	Dioxins
	EPA TO-13	PAHs

Small PUF Cartridges

Description	Pkg.	Cat. No.
ORBO 1000 PUF Cartridge, Assembly	3	20557
ORBO 1500 PUF Cartridge PUF/ XAD-2/PUF	3	21233-U
Glass Holder for Small PUF	1	20556
Cleaned Small PUF Plug	3	20600-U

Large PUF Cartridges

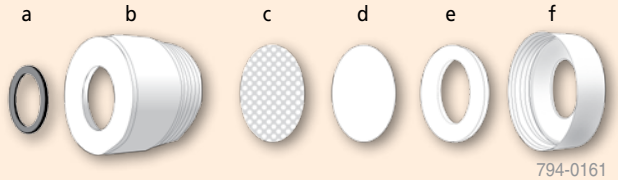
Description	Pkg.	Cat. No.
ORBO 2000 PUF Cartridge, Assembly	1	20037
ORBO 2500 PUF Cartridge, PUF/XAD-2/PUF	1	21235-U
Cleaned Large PUF Plug, 7.6 cm	1	20038
Glass Holder & Screen for Large PUF	1	20563
Stainless Steel Screen	2	21008-U

Filter Cartridge

An optional filter cartridge can be attached to the inlet of an ORBO 1000 or 1500 cartridge to trap aerosol and particulate forms of semi-volatiles. The filter cartridge contains a replaceable 32 mm diameter quartz microfiber filter with a stainless steel support screen.

Filter Cartridge Assembly includes 1 o-ring (a), 1 filter cartridge body (b), 1 stainless steel screen (c), 1 quartz filter (d), 1 filter ring (e), 1 cartridge screw cap (f), and 2 end caps.

Filter Cartridge consists of 1 o-ring (a), 1 filter cartridge body (b), 1 filter ring (e), and 1 cartridge screw cap (f).



794-0161

Note: b and c only available when purchased as the complete assembly.

Filter Cartridge

Description	Pkg.	Cat. No.
Filter Cartridge Assembly	1	21031
Filter Cartridge	1	21033
Replacement Parts		
Quartz Filter, 32 mm diameter (d)	10	21038
O-ring for Filter Cartridge (a)	2	21037
Filter Ring (e)	1	21035
Filter Cartridge End Caps	2	21041-U
Filter Cartridge Body (f)	1	21035

Filters and Cassettes

We have carefully selected these cassettes, filters and accessories to best meet your air sampling needs. These products, cited in numerous US Occupational Health and Safety Administration (OSHA) and National Institute of Occupational Safety and Health (NIOSH) methods, are universally respected for quality and reliability.

Coated Filters

ORBO 80 Coated 1,2-PP Filter is a 1-(2-pyridyl) piperazine coated glass fiber filter used for sampling diisocyanates in air (OSHA Methods 42 and 47).

Description	Pkg.	Cat. No.
ORBO 80 Coated Filter	25	20811
ORBO 80 Coated Filter w/Cassettes, unassembled	25	20812-U

Analytical Column for Isocyanate Derivative Analysis

Description	Pkg.	Cat. No.
SUPELCOSIL™ LC-CN HPLC Column		
25 cm x 4.6 mm I.D., 5 µm	1	58231

Related Chemical Standards

Isocyanate Derivative Standards – 1-(2-Pyridyl)piperazine derivatives. Each solution contains 1000 µg/mL in 1 mL dimethyl sulfoxide

Description	Cat. No.
2,6-TDI Derivative	
2,6-bis(4-(2-Pyridyl)-1-piperazinylcarbamyl) toluene	48144
2,4-TDI Derivative	
2,4-bis(4-(2-Pyridyl)-1-piperazinylcarbamyl) toluene	48145
1,6-HDI Derivative	
1,6-bis (4-(2-Pyridyl)-1-piperazinylcarbamyl) hexane	48146
4-4'-MDI Derivative	
4,4-bis (4-(2-Pyridyl)-1-piperazinylcarbamyl) diphenyl methane	48147

For more in-depth information:

Methods and Applications

OSHA Method 42 – Diisocyanates

OSHA Method 47 – Methylene Bisphenyl Isocyanate (MDI)

Application Note 31 – Monitor Airborne Diisocyanates Using ORBO 80 Coated Filters. Request T394031 at *sigma-aldrich.com/air_monitoring*

Membrane Filters and Cassettes for Air Monitoring of Fibers, Asbestos and Metals

Membrane Filter: Mixed Cellulose Ester (MCE) GN-4 Metricel®

P000662

We offer preassembled 3-piece design cassette which includes a GN-4 Metricel membrane and support pad. Banded cassettes are available for critical applications. The banded cassettes assure an air-tight seal, are leak-proof and tamper-resistant.

- 0.8 mm GN-4 Metricel (mixed cellulose esters) membrane filters have a low fiber background count.
- Accepted for air monitoring of fibers, asbestos fibers, and airborne metals such as lead (NIOSH Methods 7400 and 7402).
- Can be used to monitor respirable particulates such as silica, metal and dusts.

Description	Pkg.	Cat. No.
25 mm, pore 0.8 mm		
Three-piece unit w/GN-4 Metricel membrane and Support Pad	50	23371
Three-piece unit w/GN-4 Metricel membrane and Support Pad (banded)	50	23374
GN-4 Metricel Membrane Filter, 25 mm, plain	100	23380-U
37 mm, pore 0.8 mm		
Three-piece unit w/GN-4 Metricel membrane and Support Pad	50	23368
GN-4 Metricel Membrane Filter, 37 mm, plain	100	23381
GN-6 Metricel (0.45 mm) Membrane Filter, 37 mm, plain	100	23379

PTFE Membrane Filters

Zefluor™ Membrane Filters are suitable for monitoring acid rain, polynuclear aromatic hydrocarbons (PAHs) and particulates. Meets NIOSH specifications. Zefluor membrane filters feature a low-chemical background for highly sensitive determinations.

Zylon™ Membrane Filters are recommended for monitoring dyes, benzidine, o-tolidine, o-dianisidine (NIOSH Method 5013) and feature a low-chemical background for highly sensitive determinations.

TF-1000 (PTFE) Membrane Filters are recommended for general sampling of airborne particulate matter.

Description	Pkg.	Cat. No.
25 mm PTFE Membrane Filters		
Zefluor Membrane Filter, 25 mm, pore 0.5 mm	100	**23395**
37 mm PTFE Membrane Filters		
Zefluor Membrane Filter, 37 mm, pore 1 mm	50	**23391**
Zefluor Membrane Filter, 37 mm, pore 2 mm	50	**23390-U**
Zylon Membrane Filter, 37 mm, pore 5 mm	50	**23389**
TF-1000 Membrane Filter, 37 mm, pore 1 mm	50	**23383**

Additional Filters

Borosilicate Glass Fiber Filters are binding agent free and are recommended by the US EPA for high volume air sampling to collect atmospheric particles and aerosols.

GLA-5000 Polyvinyl chloride (PVC) Membrane filters feature low ash and moisture pick-up, light tare weight, and are gravimetrically stable. Suitable for multiple NIOSH analytical methods including silica monitoring.

Description	Pkg.	Cat. No.
Borosilicate Glass Fiber Filters		
A/E Glass Fiber Filter, 13 mm, pore 1 mm	500	**23376**
A/E Glass Fiber Filter, 25 mm, pore 1 mm	500	**23377**
A/E Glass Fiber Filter, 37 mm, pore 1 mm	500	**23378**
PVC Membrane Filters		
GLA-5000 PVC Membrane Filter, 37 mm, pore 5 mm	100	**23387**

Cassettes and Filter Accessories

Description	Pkg.	Cat. No.
Cassettes		
Empty 13 mm cassette – 2 piece, with washer	5	**23367**
Empty 25 mm cassette – 3 piece, unassembled	50	**23372**
Empty 37 mm cassette – 2 piece, unassembled	100	**23380-U**
Empty 37 mm cassette – 3 piece, unassembled (includes space ring)	100	**23370-U**
Support Pad (for 37 mm O.D Cassettes)		
Filter Support Pad, 37 mm	100	**23385**
Filter Support Pad, 37 mm	500	**23382**
Accessories		
PTFE Washer for 13 mm Cassette	1	**23388**
Sealing Band for 25 mm Cassette	100	**23365**
Sealing Band for 37 mm Cassette	100	**23366**

NEW! Mercury Emissions Sampling Tubes

Experience and Proven Track Record of Performance

P001177

Mercury Sampling Traps are designed for short-term and continuous sampling of total mercury emissions in combustion flue gas streams according to 40 CFR Part 75 Appendix K. Compared to competing technologies, our mercury sampling traps have revolutionized mercury vapor monitoring in two important ways.

- Generates accurate and precise multi-point mercury measurements
- Permits practical, economical long-term continuous mercury monitoring solutions

Supelco has a long-standing partnership (15 years) with Frontier GeoSciences (FGS), respected leaders in the mercury and trace metals characterization industry. Together our experience provides you with Mercury Sampling Traps that are proven and tested in the industry.

- Supelco and Frontier GeoSciences – 15 years of technical collaboration
- FGS/Supelco Traps – principle traps used to validate EPA Method 30B and Appendix K

And feature:

- FSTM Sorbent – Iodinated charcoal developed by Frontier GeoSciences, only available from FGS and Supelco.
- Low mercury background
- High-capacity mercury loading
- Reliability and proven track record of performance

Looking for **spiked traps, mercury analysis and RATA certification**? In the US, contact Frontier GeoSciences at 206-622-6960 or visit their website at *frontiergeosciences.com*. Frontier provides a guarantee with every spiked trap. Frontier's analytical mercury analysis method is based on compliance Method EPA 1631 Revision E (co-authored by EPA and FGS) using cold vapor atomic fluorescence spectroscopy (CVAS) detection. Frontier is NELAC accredited for sorbent trap analysis.

Did you know?

Frontier GeoSciences Inc. is an advanced research and analytical laboratory specializing in the determination and characterization of mercury and other trace metals in the environment.

EPA Method 30B (RATA) Traps (unspiked):

Monitoring: 1-2 hours
Sorbent: FSTM Iodinated Charcoal
Measurement Dimensions: 6 mm OD x 200 mm L
Sorbent Beds: 2 bed, 3 bed
Tube Ends: Glass open

Description	Pkg.	Cat. No.
Method 30B (RATA), 6 mm, 2 bed	25	2270-U
Method 30B (RATA), 6 mm, 3 bed	25	2274-U

Appendix K Traps (unspiked):

Monitoring: 1-10 days
Sorbent: FSTM Iodinated Charcoal
Measurement Dimensions: 10 mm O.D. x 240 mm L
Sorbent Beds: 2 bed, 3 bed
Tube ends: One glass open, one tapered end

Description	Pkg.	Cat. No.
Appendix K, 10 mm, 2 bed	25	2272-U
Appendix K, 10 mm, 3 bed	25	2273-U

For Indoor/Ambient Total Mercury Monitoring

Description	Pk	Cat. No.
10 mm, 300 mg/300 mg FSTM adsorbent	25	2271-U

For more in-depth information

EPA Method 30B RATA* (Draft) is a reference method for measuring total vapor phase mercury (Hg) emissions from coal-fired combustion sources using sorbent trap sampling and an extractive or thermal analytical technique. *RATA = Initial Relative Accuracy Test Audit. ***http://www.epa.gov/mercury*** (Controlling Power Plant Emissions)

40 CFR Part 75 Appendix K (formerly US EPA Method 324) is the EPA Clean Air Mercury Rule (CAMR). It was issued to reduce and cap mercury emissions from coal-fired power plants. This regulation outlines Continuous Emissions Monitoring (CEM) compliance monitoring of total vapor phase mercury using sorbent trap monitoring systems. ***http://ecfr.gpoaccess.gov*** (Title 40, Parts 72-80)

Detector Tubes and Pumps

MSA/Auer Detector Tubes

MSA/Auer Detector tubes contain treated adsorbent granules that react with specific compound(s) in the air sample causing the adsorbent to change color. A sample is collected by attaching the detector tube to a special bellows-type pump that draws a known volume of air with each stroke. After sampling, the length of the adsorbent bed that has undergone the color change is measured from a graduated scale printed on the tube, allowing direct readings of the vapor concentration – no extraction, no analysis, and no calculations are required.

Detector tubes are particularly useful in situations where quick screening is required, such as Haz-Mat Response, and for use in various industries in which specific, routine groups of compounds are monitored regularly. These MSA tubes and pumps are interchangeable with Draeger tubes and pumps.

MSA/Auer Detector Tubes

Analyte Group	Range (ppm)	Pkg.	Cat. No.
Triethylamine	5-30	10	**28184-U**
Ammonia	2-500	10	**28161-U**
Bromobenzene	5-500	10	**28162-U**
Benzene	0.5-25	10	**28163-U**
Chlorine	0.2-30	10	**28164-U**
Carbon Monoxide	5-1000	10	**28166-U**
Carbon Monoxide	10-3000	10	**28167-U**
Carbon Dioxide	0.1-7.0% (v/v)	10	**28168-U**
Carbon Dioxide	100-3000	10	**28169-U**
Formaldehyde	0.1- 55	10	**28171-U**
Hydrogen Sulfide	1-200	10	**28172-U**
Hydrogen Sulfide	100-4000	10	**28173-U**
Hydrogen Chloride	1-30	10	**28174-U**
Hexane	20-3200	10	**28175-U**
Nitrous Fumes	0.5-50	10	**28176-U**
Nitrous Fumes	50-3000	10	**28177-U**
Nitrogen Dioxide	0.5-50	10	**28178-U**
Ozone	0.05-5	10	**28179-U**
Phosphine	0.05-3	10	**28181-U**
Sulfur Dioxide	0.5-25	10	**28182-U**
1,1,2-Trichlorethane	10-170	10	**28183-U**

Toximeter II Auto Detector Tube Pump

Preset number of 100 mL pump strokes. Doubles as a sampling pump for other tubes, bags, impingers. Constant flow rate of 300 mL/min for adsorbent tubes with 8 hours of operating time. Fault recognition for low battery of obstructed flow. Rechargeable NiCd battery pack included.

E000056C

Description	Pkg.	Cat. No.
Detector Tube Pump		
Toximeter II, Automatic	1	**28188-U**
Omega Battery Charger		
110 V, units charged: 1	1	**28157-U**
240 V, units charged: 1	1	**28158-U**

Kwik Draw Deluxe Detector Tube Pump

One hand operation, simply squeeze handle to compress bellows, features a stroke counter and end-of-stroke indicator. Consistent 100 mL sample draw.

P000660

Gas-Tester II Detector Tube Pump

This pump offers both a stroke counter and end-of-stroke indicator with a unique locking system. Consistent 100 mL sample draw.

E000057

Description	Pkg.	Cat.No.
Kwik Draw Deluxe Detector Tube Pump	1	**28185-U**
Gas-Tester II Detector Tube Pump	1	**28186-U**

Thermal Desorption Tubes

For Active & Passive* Sampling

Supelco is recognized as the world leader in adsorbent technology. Our evaluation and development of air sampling adsorbents has produced the industry's most comprehensive selection of adsorbent tubes – Carbotrap tubes – offering superior performance for trapping and thermally desorbing organic compounds. Selection of the proper adsorbent(s) is critical to achieving the best results for a thermal desorption application. An ideal adsorbent tube will trap and retain compounds of interest for the entire sampling period, then allow total analyte desorption without thermal decomposition. The rate of release will be as rapid as possible, to minimize analysis time and provide the most efficient separation, especially when the analytes are desorbed directly to a chromatographic column held at ambient or above-ambient temperature. Thermal stability is also an important attribute of an ideal adsorbent. Stable adsorbents ensure the best detection limits by minimizing the possibility of breakdown products interfering with quantification in addition to a long lifetime.

Multi-Bed Adsorbent Tubes

Because no single adsorbent is capable of trapping and efficiently releasing all compounds, many Carbotrap thermal desorption tubes contain more than one adsorbent. Multiple beds of adsorbents enable you to analyze a wider range of compounds in a single sampling.

In multi-bed adsorbent tubes, the adsorbents are arranged in order of increasing adsorbent strength, from sample inlet to sample outlet. The largest molecules in the sample are trapped by the first bed of adsorbent, preventing them from coming into contact with stronger materials that could release them too slowly – or not at all. Smaller molecules are trapped by the succeeding, stronger beds. To avoid forcing analytes through an adsorbent that is too strong, desorption flow is always in the direction opposite of sample collection flow.

*Carbopack X for Passive Sampling. pg. 21.

Tube Construction

The design of a thermal desorption tube and its contents is critical to a well-performing air monitoring system. Glass tube blanks are manufactured to close tolerances, to ensure consistent lot-to-lot performance. As discussed, the adsorbents must retain the desired compounds effectively, release them quickly and completely, and be thermally stable at the temperatures required for analyte desorption. Every thermal desorption tube we make meets these criteria. After extensive thermal conditioning, we seal each tube. For convenient and reliable identification, we mark each of our glass tubes with a permanent unique number. Thermal desorption tubes are most commonly made of glass or stainless steel, with glass wool, wire gauze, or glass frits to hold the adsorbents in place. Tube lengths and outside diameters are dictated by the instrument of choice. Tubes having a large internal volume (4 mm I.D. or greater) are typically used for sampling because they hold relatively large size beds of adsorbents. In many cases, however, analytical results can be improved by transferring the analytes from the large I.D. sampling tube to a tube of smaller I.D. (1-2 mm), thus "focusing" the sample into a smaller volume. Subsequent desorption from the smaller ID tube to the chromatography column gives a higher linear velocity of desorption flow through the tube, delivering the sample to the column more rapidly and in a much narrower band.

Empty Tubes

We mark these specially cleaned glass tubes with an arrow to indicate sampling flow direction. Fill them in this direction with successively stronger adsorbents. You can fill an empty 4 mm I.D. tube with adsorbents for air sampling, or with a solid sample (soil, plastic, etc.) for a thermal extraction analysis. Use our empty 1 mm I.D. and 2 mm I.D tubes to create your own focusing tubes for better chromatography.

When you intend to trap especially sensitive compounds, use an adsorbent tube with a frit in the inlet, rather than a glass wool plug. The frit will hold the adsorbent in place without adsorbing or decomposing the analytes; glass wool plugs can adsorb or degrade sensitive compounds.

Custom-Made Thermal Desorption Tubes

We routinely manufacture thermal desorption tubes on request, for standard methods or customer-specific applications. Our in-house glass and machine shops fabricate glass and metal tubes to be compatible with commercially available desorption systems, or to unique specifications. We offer the widest range of adsorbent materials, including porous polymers (Chromosorb, Porapak, Tenax), carbon molecular sieves (Carbosieve, Carboxen), graphitized carbons (Carbopack, Carbotrap), and activated charcoals. Prices for custom prepared tubes are comparable to prices for our stock items.

For more information see the Custom Tube Order Form, page 51.

Overview on Carbotrap Thermal Desorption Tubes with Multiple Beds

Tube Name	Adsorbents	Compounds
Carbotrap 100	Carbotrap B	C-5-C12 compounds in air
Carbotrap 150	Glass beads, Carbotrap C	Large molecules in air or aqueous samples
Carbotrap 200	Glass beads, Carbotrap B, Carbosieve S-III	C2-C14 compounds in air
Carbotrap 201	Carbopack B, Carboxen-1000	Focusing semivolatile to very volatile compounds
Carbotrap 202	Carbopack B, Carbopack C	C5-C20 compounds in air
Carbotrap 217	Carbotrap B, Carboxen-1000	TO-17 compounds & other volatile compounds in air
Carbotrap 300	Carbotrap C, Carbotrap B, Carbosieve S-III	C2 and larger compounds in air
Carbotrap 301	Carbopack C, Carbopack B, Carboxen-1000	Focusing volatile and semivolatile compounds
Carbotrap 302	Carbopack C, Carbopack B, Carboxen-1001	Volatile compounds in aqueous solutions
Carbotrap 317	Carbotrap C, Carbotrap B, Carboxen-1000	TO-17 compounds and other volatile and semivolatile compounds in air
Carbotrap 349	Carbopack Y, Carbopack B, Carboxen-1003	NIOSH 2549: Volatile organic compounds in air
Carbotrap 370	Carbopack F, Carbopack C, Carbopack B	C5-C30 compounds thermally extracted from solid samples; focusing semivolatile compounds
Carbotrap 400	Carbotrap F, Carbotrap C, Carbotrap B, Carboxen-569	C2 and larger compounds in aqueous samples

For PerkinElmer Instruments

Supelco offers both Stainless Steel and Glass pre-packed sampling tubes that are fully compatible with the ATD-50 the ATD-400, and the TurboMatrix instrument. Each tube has a unique number. The tubes are available either pre-conditioned and ready for use with brass Swagelok end caps or unconditioned.

We also offer unconditioned tubes that must be conditioned as described.

- Each tube is sealed with Swagelok fittings.
- Fits: ATD-50, ATD-400 and TurboMatrix. 1/4 in. O.D. × 3.5 in. Long.
- Stainless steel 5 mm I.D., glass 4 mm I.D.

Stainless Steel

O.D. x length: 1/4 in. x 3 1/2 in., I.D.: 5 mm

Description	Pkg.	Application	Cat. No.
Preconditioned			
Carbotrap 100	10	ASTM D6196	**25052**
Carbotrap 202	10		**25058-U**
Carbotrap 300	10	EPA TO-17	**25050**
Carbotrap 349	10	NIOSH 2549	**25057-U**
Air Toxics	10	EPA TO-14	**25051**
Carbosieve S-III	10	EPA TO-2	**25053**
Tenax GR	10	Extends range of Tenax TA	**25054**
Tenax TA	10	EPA TO-1, EPA IP-1B	**25055**
Chromosorb 106	10	ASTM D6196, MDHS 72	**25056-U**

E000993

Description	Pkg.	Application	Cat. No.
NEW! Unconditioned			
Carbopack B	10	ASTM D6196	**28939-U**
Air Toxics	10	EPA TO-14	**28938-U**
Carbosieve SIII	10	EPA TO-2	**28942-U**
Carbotrap 300	10	EPA TO-17	**28937-U**
Carbotrap 349	10	NIOSH 2549, EPA IP-1B	**28949-U**
Tenax GR	10	Extends range of Tenax TA	**28946-U**
Tenax TA	10	EPA TO-1, EPA IP-1B	**28947-U**
Chromosorb 106	10	ASTM D6196, MDHS 72	**28948-U**
Empty			
SS Tube w/screens	1		**25049**
SS Tube w/screens w/PTFE analytical endcaps for TMX	10		**28014-U**
	50		**28015-U**

NEW! Supel-Inert Passive Sampling Device with Carbopack X for Thermal Desorption

E000973

Our new Carbopack X adsorbent tube was developed in collaboration with the US EPA for diffusive monitoring of **1,3-Butadiene** and 24 other VOC's. Monitoring 1,3-Butadiene is important due to the adverse health effects of this compound at trace atmospheric levels. (i.e. 0.03 µg/m³). The major sources of 1,3-Butadiene are combustion engines and tobacco smoking. In addition to 1,3-Butadiene, Carbopack X can effectively retain and release other VOC's of interest in the C4-C10 range. Suitable for vapor intrusion. Diffusion cap purchased separately. Diffusion cap w/silicone membrane recommended for sampling higher humidity environments. Decreases sampling rate by approximately 10%.*

Deactivated – Stainless Steel Tube

OD x length: 1/4 in. x 3 1/2 in., ID: 5 mm

Description	Application	Pkg.	Cat. No.
Preconditioned			
Carbopack X	1,3-Butadiene, EPA-TO-17 Compounds	10	59701-U
Passive Sampling Accessories			
Pen Clips for SS Tubes		10	28016-U
Diffusion Caps (standard)		10	28017-U
Diffusion Caps (w/silicone membrane)		10	28018-U

For more in-depth information:

T408041H – New Carbopack X Metal-Passivated Adsorbent Tube for 24-Hour Diffusive Sampling of 1,3-Butadiene and 24 Additional Volatile Organic Compounds

The US EPA website that describes the Detroit Exposure and Aerosol Research Study (DEARS): *http://www.epa.gov/dears*

Glass

E000994

O.D. x length: 1/4 in. x 3 1/2 in., I.D.: 4 mm

Description	Application	Pkg.	Cat. No.
Preconditioned			
Carbotrap 100	ASTM D6196	10	25087
Carbotrap 202		10	25093-U
Carbotrap 300	EPA TO-17	10	25085
Carbotrap 349	NIOSH 2549, EPA IP-1B	10	25092-U
Air Toxics	EPA TO-14	10	25086
Carbosieve S-III	EPA TO-2	10	25088
Tenax GR	Extends range of Tenax TA	10	25089
Tenax TA	EPA TO-1, EPA IP-1B	10	25090-U
Chromosorb 106	ASTM D6196, MDHS 72	10	25091
NEW! Unconditioned			
Air Toxics	EPA TO-14	10	28953-U
Carbosieve S-III	EPA TO-2	10	28956-U
Carbotrap 100	ASTM D6196	10	28954-U
Carbotrap 202		10	28967-U
Carbotrap 300	EPA TO-17	10	28952-U
Carbotrap 349	NIOSH 2549, EPA IP-1B	10	28966-U
Tenax GR	Extends range of Tenax TA	10	28957-U
Tenax TA	EPA TO-1, EPA IP-1B	10	28958-U
Chromosorb 106	ASTM D6196, MDHS 72	10	28965-U
Empty			
Glass Tube w/PTFE Analytical Endcaps for TMX		1	25084
Glass Tube w/PTFE Analytical Endcaps for TMX		10	28013-U
ATD-400 Accessories (See page 20)			
Washed Stainless Steel Clip for ATD-400		100	23393-U

Accessories

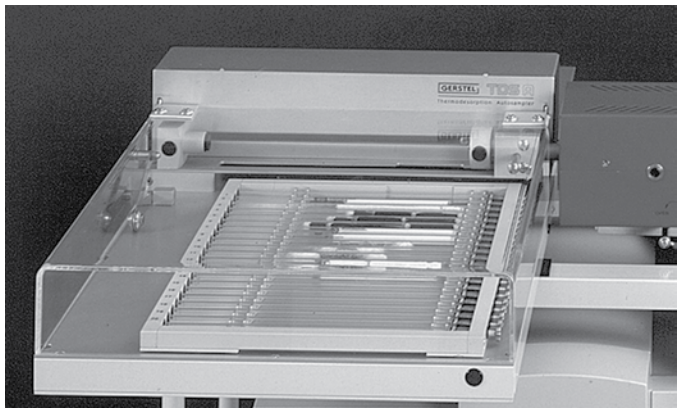
Description	Pkg.	Cat. No.
Storage Endcaps (For Glass and Stainless Steel Tubes)		
Replacement ferrules for TMX Brass Caps	20	28012-U
TurboMatrix™ Brass Caps	20	28011-U
PTFE Analytical Endcaps for TMX	20	28002-U
PTFE Analytical Endcaps for ATD-400	20	28019-U
TDS³ Storage Container		
For ATD-50, ATD-400, TurboMatrix	1	25097-U

*References

1. C.M. Linton, J.L. Brown, and W.R. Betz, Novel Coating Technology to Enhance Inertness of Stainless Steel Passive Monitoring Thermal Desorption Tubes, Pittsburgh Conference 2005 Poster T406029, Supelco, Bellefonte, PA.
2. W.A. McClenny, K.D. Oliver, H.H. Jacumin, Jr., E.H. Daughtrey, Jr., D.A. Whitaker. 2005. 24 h diffusive sampling of toxic VOCs in air onto Carbopack X solid adsorbent followed by thermal desorption/GC/MS analysis–laboratory studies. J. Environ. Monit. 7:248-256.
3. R.W. Williams, A.F. Vette, D.A. Whitaker, C.W. Croghan, P.A. Jones, H. Daughtrey, K. Oliver, H. Jacumin, D.D. Williams, C.E. Rodes, J.W. Thornburg, J.S. Herrington, and J. Zhang. The impact of passive sampling methodologies used in the DEARS. Presented at the National Environmental Monitoring Conference (NEMC), Cambridge, MA, August 20-24, 2007.

For Gerstel ThermoDesorption System

Supelco offers both stainless steel and glass pre-packed sampling tubes that are fully compatible with the Gerstel TDS and TDSA instruments. Each tube is thermally conditioned and batch tested for backpressure and background. The pre-packed tubes are sealed in our exclusive TDS³ storage containers. All of the pre-packed glass sampling tubes incorporate a glass frit at the inlet, which increases their performance, and are individually numbered. The stainless steel tubes use a stainless steel screen at both inlet and outlet to keep the adsorbent beds secure during use.



E000840

Stainless Steel

O.D. x length: 6 mm x 7 in., I.D.: 4 mm
Fits Models: TDS A & TDS 2

Description	Application	Pkg.	Cat. No.
Carbotrap 300	EPA TO-17	1	**28273-U**
Carbosieve S-III	EPA TO-2	1	**28274-U**
Tenax GR	Extends range of Tenax TA	1	**28272-U**
Tenax TA	EPA TO-1, EPA IP-1B	1	**28271-U**
Chromosorb 106	ASTM D6196, MDHS 72	1	**28275-U**
Empty SS GERSTEL Tube		1	**28276-U**
Screens for SS GERSTEL Tube		10	**28277-U**

Glass

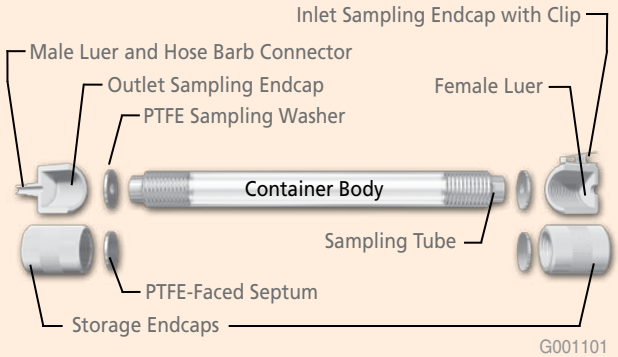
O.D. x length: 6 mm x 7 in., I.D.: 4 mm

Description	Application	Pkg.	Cat. No.
Carbotrap 300	EPA TO-17	1	**28283-U**
Carbotrap 202		1	**28313-U**
Carbotrap 217	EPA TO-17	1	**28312-U**
Carbotrap 349	NIOSH 2549, EPA IP-1B	1	**28311-U**
Carbosieve S-III	EPA TO-2	1	**28284-U**
Tenax GR	Extends range of Tenax TA	1	**28282-U**
Tenax TA	EPA TO-1, EPA IP-1B	1	**28281-U**
Chromosorb 106	ASTM D6196, MDHS 72	1	**28285-U**
Empty Fritted		1	**28286-U**
Empty non-Fritted		1	**28287-U**

Accessories

Description	Pk	Cat. No.
TDS³ Storage Container for TDS2/TDS/A	1	**25095-U**
TDS³ Storage Container for TDU (60 mm Tubes)	1	**28307-U**

TDS³ Storage Container



G001101

For additional TDS³ containers and accessories, see page 25.

For CDS/Dynatherm Instruments

Supelco offers a complete line of both pre-packed and empty tubes for the Dynatherm Thermal Desorbers. Each tube is individually numbered, thermally conditioned, and batch tested for backpressure and background. The pre-packed standard sampling tubes are sealed in our exclusive TDS³ storage containers and the fast-flow tubes are sealed with Swagelok® fittings. All of the pre-packed glass sampling tubes incorporate a glass frit at the inlet, which increases their performance. The focusing tubes are used to refocus the sample for better chromatography of the early eluting compounds.


P000679

Glass

O.D. x length: 6 mm x 4.5 in., I.D.: 4 mm
Fits models: ACEM-9300, ACEM-900 850/890 TDU, MTDU and OI Analytical Air Tube Desorber or DMP-16

Description	Application	Pkg.	Cat. No.
Glass Fritted Sampling Tubes			
Carbotrap 100	ASTM D6196	1	**20872**
Carbotrap 150		1	**20381**
Carbotrap 200		1	**20873**
Carbotrap 217	EPA TO-17	1	**20895-U**
Carbotrap 300	EPA TO-17	1	**20875**
Carbotrap 302		1	**20356**
Carbotrap 317	EPA TO-17	1	**20877**
Carbotrap 349	NIOSH 2549, EPA IP-1B	1	**20243**
Carbotrap 400		1	**20882**
Tenax TA	EPA TO-1, EPA IP-1B	1	**20896-U**
Empty Fritted		1	**20235-U**
Non-Fritted Glass Sampling Tubes			
Carbotrap 100	ASTM D6196	1	**20238**
Carbotrap 200		1	**20242**
Carbotrap 300	EPA TO-17	1	**20379**
Carbotrap 400		1	**20359**
Empty non-Fritted		1	**20380-U**

Fast Flow

These glass tubes have a 7 mm I.D. that allows faster flow rates to pass through tubes while sampling.

O.D. x length: 10 mm x 4.5 in., I.D.: 7 mm
Fits models: ACEM-9300, IACEM-980, ACEM-900 and MTDU equipped with fast-flow "FF" option
Sealed with Swageloks

Description	Application	Pkg.	Cat. No.
Carbotrap 217	EPA TO-17	1	**20724**
Carbotrap 317	EPA TO-17	1	**20881**
Tenax TA	EPA TO-1, EPA IP-1B	1	**20894**

Focusing Tubes

Fits models: 850/890 TDU

Description	Pkg.	Cat. No.
Carbotrap 200 - 2 mm x 6 mm x 4.5 in.	1	**20244**
Carbotrap 201 - 1 mm x 6 mm x 4.5 in.	1	**20361**
Carbotrap 300 - 2 mm x 6 mm x 4.5 in.	1	**20382**
Carbotrap 301 - 1 mm x 6 mm x 4.5 in. (I.D. tapers to 0.75 mm)	1	**20354**
Carbotrap 370 - 2 mm x 6 mm x 4.5 in.	1	**20373**
Empty - 2 mm x 6 mm x 4.5 in.	1	**20237**
For Model ACEM900/901FF		
Carbotrap 201 - 1 mm x 6 mm x 7.5 in.	1	**20865**

NEW!

Color-Coded Tenax TA Tube

Glass Fritted Standard Sampling Tubes

Simplify your field sampling process and reduce error in the field with our color-coded glass fritted sampling tubes. Each color can represent a different sample in the field or a different testing protocol the laboratory. All tubes contain Tenax TA.


E000986

O.D. x length: 6 mm x 4.5 in. I.D.: 4 mm
Fits models: ACEM-9300, ACEM-900 850/890 TDU, MTDU and OI Analytical Air Tube Desorber or DMP-16
Application: EPA TO-1, EPA IP-1B

Description	Pkg.	Cat. No.
White Dot	1	**11271-U**
Black Dot	1	**11272-U**
Red Dot	1	**11273-U**
Green Dot	1	**11274-U**

CDS Adsorbent Tube

O.D. x length: 6.25 mm x 3 in., I.D. 3.9 mm

Description	Application	Pkg.	Cat. No.
Carbotrap 300	EPA TO-17	1	**20372**

Stainless Steel

Length: 115 mm

Description	Application	Pkg.	Cat. No.
Tenax TA	EPA TO-1, EPA IP-1B	1	**20367-U**

Accessories

Description	Pkg.	Cat. No.
TDS³ Storage Container for Dynatherm	1	**25096-U**
Fits Standard Tubes 850/890 & ACEM 900-901FF		

VOST Stack Sampling Tubes

VOST Tubes (Volatile Organic Sampling Train) are designed to meet specifications in US EPA SW-846, Method 0030. Each tube is individually numbered, pre-conditioned, and sealed with stainless steel Swagelok fittings before stored in a glass storage container. Each lot is tested for background and backpressure.

9960072

O.D. x length: 16 mm x 5 in. (1/4 in O.D. ends)
Fits models: Dynatherm 9300 TDA

Description	Application	Pkg.	Cat. No.
VOST Stack Sampling Tube			
Tenax TA, 35/60	EPA 0031, EPA SW-846, EPA 0030	1	20074-U
Tenax TA, 35/60: Petroleum charcoal	EPA 0031, EPA SW-846, EPA 0030	1	20075-U
Empty glass VOST Tube		1	21993
VOST Storage Container		1	21998
Analytical Column			
SPB-624 Fused Silica Capillary Column, 75 m x 0.53 mm I.D., 3 µm film		1	25432

For Teledyne Tekmar Instruments

Supelco offers both glass and stainless steel tubes for Teledyne Tekmar instruments. Our prepacked tubes are thermally conditioned and tested for background levels and backpressure. The 1/4 in. O.D. tubes are sealed in our exclusive TDS^3 storage container and the 1/2 in. O.D. tubes are sealed in a glass storage container. Fits AEROTrap 6000 instrument.

9960072

Stainless Steel

These stainless steel tubes have a 5 mm I.D. that allows faster flow rates to pass through tubes while sampling.

O.D. x length: 1/4 in. x 7 in., I.D.: 5 mm
Fits models: AEROTrap 6000

Description	Application	Pkg.	Cat. No.
Carbotrap 100	ASTM D6196	1	20241
Carbotrap 300	EPA IP-1B	1	20370-U
Tenax TA	EPA TO-1, EPA IP-1B	1	20913-U
Empty SS Tekmar Tube, 5 mm I.D.		1	20920-U
O.D. x length: 1/2 in. x 7 in., I.D.: 12 mm			
Tenax TA	EPA TO-1, EPA IP-1B	1	20984
Empty SS Tekmar Tube, 12 mm I.D.		1	20924

Glass

O.D. x length: 1/2 in. x 7 in., I.D.: 10 mm

Description	Application	Pkg.	Cat. No.
Carbotrap 300	EPA IP-1B	1	20983
Empty Glass Tekmar Tube, 10 mm I.D.		1	20922
O.D. x length: 4 in x 7 in., I.D.: 4 mm			
Carbotrap 300	EPA IP-1B	1	20912-U
Empty Glass Tekmar Tube, 4 mm I.D.		1	20918

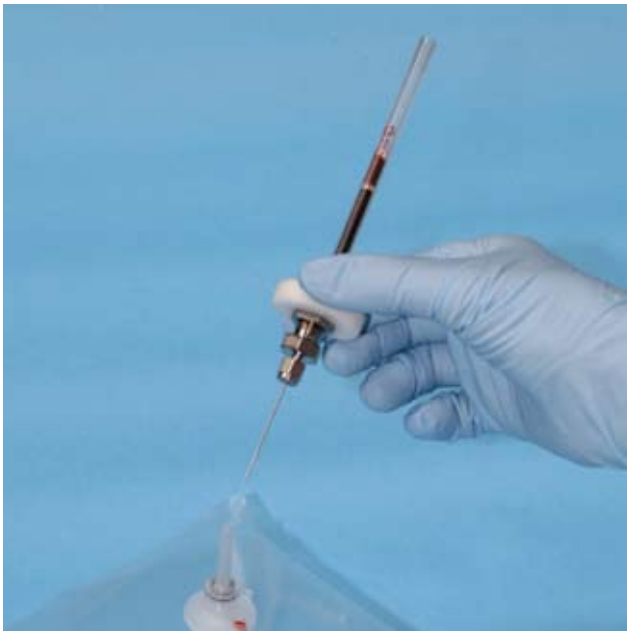
Accessories

Description	Pkg.	Cat. No.
TDS^3 Storage Container for Tekmar Tube	1	25095-U
Storage Container for 1/2 in. x 7 in. TD Tube	1	20853

Thermal Desorption Accessories

NEW!

Needle Sampling Kit for Thermal Desorption Tubes



E000991

The needle sampling kit is an accessory designed to assist users of thermal desorption tubes to attach a needle to the inlet of the tube for various sampling applications. The kit includes ferrules for thermal tubes with outside diameters of 1/4 in. or 6 mm. Choose the ferrule for the size of tube you are using.

The kit includes the following:

- Stainless steel 22s gauge needle with a bevel point
- Stainless steel fitting
- Acetal/stainless steel thumbwheel
- 1/4 in. PTFE ferrule (white)
- 1/4 in. M-2 VESPEL® ferrule (orange)
- 6 mm M-2A VESPEL graphite ferrule (black)

Description	Pkg.	Cat. No.
Needle Sampling Kit for Thermal Desorption Tubes	1	29023-U
Replacement Needles		
22s gauge 2" long with #2 bevel point●	3	20798
22s gauge 2" long with #3 blunt point	3	20862

Description	Max. Temp.	Qty.	Cat. No.
Replacement Ferrules			
0.8 mm I.D. M-2A for 22s gauge needle■	400 °C	10	22489
1/4 in. I.D. M-2 for 1/4 O.D. tubes■ (orange)	350 °C	10	22320-U
1/4 in. I.D. M-2A for 1/4 O.D. tubes (black)	400 °C	10	22481
1/4 in. I.D. PTFE for 1/4 O.D. tubes■ (white)	250 °C	10	29024-U
6 mm I.D. M-2A for 6, O.D. tubes■ (black)	400 °C	10	22393
Replacement thumbwheel	100 °C	1	28529-U

● Size and type of needle included with this kit
■ Size and type of ferrule included with this kit
For a complete description of the various needle types, see the Supelco catalog.

TDS³ Storage Container

E000992

Use our TDS³ storage sampling system to simplify the Thermal Desorption sample prep process. The TDS³ storage containers will maintain the sample integrity of both the tubes to be sampled or those which already have a sample adsorbed. The optional Sampling Caps (25069) convert the TDS³ storage container into a convenient tube holder that makes connecting the tube to the sampling pump very easy.

Description	Pkg.	Cat. No.
TDS³ Storage Container by Instrument Manufacturer/Model		
PerkinElmer, Markes Unity, and DANI Tubes	1	25097-U
Dynatherm Standard Tubes	1	25096-U
Chrompack TD Tubes	1	25098-U
GERSTEL TDS/TDS²/TDSA Tubes	1	25095-U
GERSTEL 60 mm Tubes	1	28307-U
Tekmar AEROTrap 6000 Tubes	1	25095-U
Envirochem, 810 Tubes	1	25100-U
TDS³ Storage Container Accessories		
Replacement Septa for all TDS³ containers	50	25073
Male Luer Plug	12	504351
Female Luer Cap	12	57098
Sampling caps w/washers for ½ in TDS³	10	25069
Tubing Adapter		
For use with 1/8 in. tubing to male luer	20	21016
For use with 3/16 in. tubing to male luer	20	23364
For use with 1/4 in. tubing to male luer	10	24856
Tubing Coupler		
For use with male to male luer	20	25064-U

PTFE Packed Column Ferrule

E000984

I.D. 1/4 in., configured for 1/4 O.D. column
Maximum Temperature: 250 °C

Description	Pkg.	Cat. No.
Ferrule, PTFE – 1/4 in.	10	29024-U

ATIS Adsorbent Tube Injector System

Sample Preparation Device for Thermal and Solvent Desorption Tubes

The Supelco ATIS is a sample preparation device for adsorbent tubes. The Adsorbent Tube Injector System employs the technique of flash vaporization to vaporize the sample into a continuous flow of inert gas, which carries the sample to the adsorbent tube. The sample pathway is constructed of glass and stainless steel. The calibration standard is injected by a syringe through a replaceable septum in the center of the injection glassware, which is heated.

P001253

Benefits:

- Inject calibration standards directly onto adsorbent tube to calibrate your analytical system
- Inject surrogates and system monitoring compounds onto adsorbent tubes before or after sampling
- Removes moisture from tubes prior to analysis (dry purge)
- Connect air-sampling bag to the ATIS outlet to vaporize calibration standards to assure complete vaporization
- Easy installation – plumb into a regulated source of nitrogen or helium and plug into appropriate electrical source

The ATIS will accept either 1/4 in. or 6 mm O.D. Thermal Desorption tubes. Included with this system:

- Luer/hose barb adapter to connect a variety of solvent desorption tubes
- Injection glassware
- Constant flow controller with an on/off valve - flow range: 0-100 mL/min
- Heating source - temperature range: ambient to 120 °C
- Spare parts along with all the necessary fittings and tubing

Description	Pkg.	Cat. No.
ATIS System, 110V	1	28520-U
ATIS System, 230V	1	28521-U
Replacement Luer/Hose Barb	1	28525-U
Replacement Standard Injection Glassware	1	28526-U
Replacement Thumbwheel Nut	1	28529-U

Purge and Trap/Humidifier Module for the ATIS

A separate module is available that will allow you to purge aqueous samples onto an adsorbent tube at ambient temperatures. This module can also be used to generate a dynamic humidified stream of the carrier gas for spiking calibration standards. The purge and trap module includes purge and trap glassware, and a separate flow controller that allows the user to set a separate purge (wet) flow rate independently of the dry flow rate. The purge and trap module accepts standard 22 mL threaded vials to simplify your sample prep.

P000851

Description	Pkg.	Cat. No.
ATIS Purge and Trap/Humidifier Module	1	28522-U
ATIS Replacement Purge and Trap/ Humidifier Glassware	1	28527-U
ATIS Replacement Purge and Trap Transfer Tube	1	28528-U

Thermal Extraction Glassware

Use the ATIS to thermally extract samples onto an adsorbent tube. The opening of the glassware will accept solid samples up to 1/2 in. (13 mm) in diameter and up to 3 in. long (76 mm) to be inserted into the glassware. The extraction glassware simply slides into the ATIS heating block. Two types of glass joints are available.

P000850

Description	Pkg.	Cat. No.
Extraction Glassware w/Ground Joint	1	28524-U
Extraction Glassware w/Micro Connector	1	28523-U

Supelco GC Capillary Columns

SUPELCO® Analytical

Supelco is dedicated to the development of leading-edge technology to meet the needs of our loyal customer base.

- Special purpose columns for many specific applications
- Columns for general purpose uses
- Each capillary column individually tested to ensure quality
- Guaranteed satisfactory performance
- Superior technical service before and after your purchase

For more information, visit ***sigma-aldrich.com/gc*** or contact Supelco Technical Service at ***800-359-3041*** (USA and Canada only), ***814-359-3041***, or email ***techservice@sial.com***

Column Selection by Industry

Supelco has developed the most extensive line of special purpose columns designed for industry specific applications. These columns are manufactured to deliver high resolution, great analyte response, low bleed, and long column life; allowing analysts to achieve the analytical performance they require. This easy-to-read phase selection chart is conveniently arranged to simplify the process of selecting the proper phase. Simply locate your application to identify the recommended phase.

These columns can be used with methodologies for determining indoor air quality as well as outdoor organic compounds.

	Indoor Air Quality - EPA IP-8	Indoor Air Quality - NIOSH 1003	Indoor Air Quality - NIOSH 1403	Indoor Air Quality - NIOSH 1500/1501	Indoor Air Quality - NIOSH 2530	Indoor Air Quality - NIOSH 2542	Indoor Air Quality - NIOSH 5503	Indoor Air Quality - OSHA 53	Indoor Air Quality - OSHA 56	Indoor Air Quality - OSHA 62	Indoor Air Quality - OSHA 80	Toxic Organics - TO-1/TO-2	Toxic Organics - TO-4/TO-10	Toxic Organics - TO-9	Toxic Organics - TO-13	Toxic Organics - TO-14/TO-15/TO-17	Hazardous Air Pollutants
SPB™-HAP																	■
Equity®-1			■	■		■		■	■			■				■	
SLB™-5ms	■				■		■			■			■	■	■		
VOCOL™		■															
SPB-608													■				
Equity-1701													■				
SPB-225														■			
SUPELCOWAX™ 10											■						
SP™-2331														■			

Solutions Sampling

Impingers and Bubblers

E000252

Our borosilicate glass impingers (for particles) and bubblers (for gases and vapors) are ideal for NIOSH and OSHA methods that require collection of airborne contaminants by drawing them into solution.

Standard Impinger and Bubbler

Length:	186 mm (7.3 in.)
Reservoir Length:	152 mm (6 in.)
Reservoir Capacity:	25 mL
Graduations:	5 mL
Glass Joint:	24/40 taper
Impinger:	Standard Glass Stem
Bubbler:	Fritted Glass Stem

Volume (mL)	Pkg.	Cat. No.
Standard Impinger	1	20270-U
Standard Bubbler	1	64835-U

Threaded Midget Impingers and Bubblers

E000251

Threaded midget impingers and bubblers make your sampling process more convenient. The vial can be capped after sampling, thus reducing sample handling in the field – no transferring of samples from the reservoir to a separate vial. The reservoir may be easily replaced with a standard or graduated screw-top vial.

Specifications:

	Threaded Midget Impinger	Threaded Midget Bubbler	Spill Resistant Midget Bubbler
Length (without vial):	143 mm (5 5/8 in.)	143 mm (5 5/8 in.)	143 mm (5 5/8 in.)
Vial Capacity (mL):	22	22	40
Thread (mm):	20	20	24
Graduation Mark (mL):	-	15	15
Pack Size (ea):	2	1	1
Cat. No.:	**64712-U**	**64834-U**	**64832**

Replacement Vials, screw top (cap not included)

Description	Pkg.	Cat. No.
Clear Vials		
22 mL vial, 23 mm x 85 mm, thread 24-400	100	**27173**
40 mL vial, 29 mm x 82 mm, thread 24-400	100	**27184**
40 mL vial, 28 mm x 95 mm, thread 24-400	100	**27184**
Amber Vials		
22 mL vial, 23 mm x 85 mm, thread 20-400	100	**27073-U**
40 mL vial, 29 mm x 82 mm, thread 24-400	100	**27185-U**
40 mL vial, 28 mm x 95 mm, thread 24-400	100	**27382**

Impinger Accessories


9960284

In-Line Impinger Trap

Bottom cap allows easy emptying – 15 mL capacity for absorbing solution. Can be packed with charcoal or other adsorbent (sold separately). Cap and PTFE liner included. Length 152 mm (6 in.): 20 mm threads.


9950155

Impinger Holder

Insert your impinger, bubbler, or in-line trap in this holder and attach to your lapel, shirt pocket or belt.

Description	Pkg.	Cat. No.
In-line Impinger Trap w/20 mm Thread	1	**64833**
Impinger Holder	1	**20271**

Plastic Clips/PTFE Sleeves


9130299

Plastic clips fit over the connection on our 24/40 taper ground glass joints to ensure secure connections. Use the PTFE sleeves in ground glass joints for inert, tight seals without the possibility of frozen joints. For use with standard impingers and bubblers.

Volume (mL)	Pkg.	Cat. No.
Plastic Clip for use with 24/40	1	**64764**
PTFE Sleeve for use with 24/40	1	**64761**

Passive Sampling

Overview

Passive/diffusive sampling relies on the unassisted molecular diffusion of gaseous agents (analytes) through a diffusive surface onto an adsorbent. Unlike active (pumped) sampling, passive samplers require no electricity (expensive pumps), have no moving parts, and are simple to use (no pump operation or calibration). After sampling, the adsorbed analytes are desorbed off the adsorbent by solvent or thermal desorption.

Benefits of Passive/Diffusive Sampling:

- Compact, portable, unobtrusive, and inexpensive
- Offers indication of average pollution levels over time periods of 8 hours to weeks/months
- Requires no supervision, is non-flammable, and noiseless
- Low cost allows for sampling at multiple locations (e.g., for highlighting pollution "hotspots"; or determining long term data trends in a specific geographical area)
- Amenable to personal monitoring (breathing zone), indoor air analysis, and outdoor ambient air analysis

Fick's Law:

$$\frac{dm}{dt} = D \cdot S \cdot \frac{dC}{dl}$$

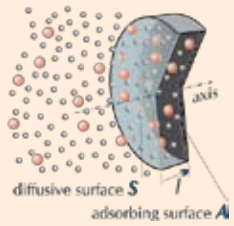
Where,
- Q = dm/dt = adsorbed mass m during time t (sampling rate)
- D = diffusion coefficient (constant for each analyte)
- S = diffusive surface
- dC/dl = concentration gradient
- K = geometric constant of the sampler

To determine C:

$$C\left[\mu g \cdot m^{-3}\right] = \frac{m[\mu g]}{Q[mL \cdot min^{-1}] \cdot t[min]} \cdot 1{,}000{,}000$$

From Fick's Law, we know that the sampling rate (Q) is a function of the diffusion coefficient of a given analyte (D) and the geometric constant of the sampler (K): Q = D x K The diffusion coefficient (D) always remains constant for a given analyte; therefore, to improve sampling rate (Q), the geometric constant (K) must be improved: K = S/l where S is diffusive surface and l is the distance between the diffusive and adsorbing surface.

Configuration of a Diffusive Gas-Sampling Device (Axial)

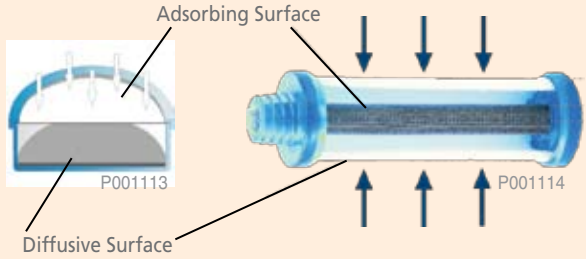


Most commercially available passive/diffusive samplers are planar or axial in shape and offer lower sampling rates and limited sampling capacity. As a result, sensitivity can suffer during short-term analysis (due to low sampling rates), or long-term sampling (analyte back diffusion to low capacity). A radial coaxial design circumvents this issue by improving the geometry, resulting in up to 10X higher sampling rates.

Example Sampling Rates for Benzene (25 °C)

Axial Sampler
7-8 mL/min.

Radial Sampler
80 mL/min.



radiello

What is Radiello?

In the mid 1990s, Dr. Vincenzo Cocheo, Director of the Fondazione Salvatore Maugeri (FSM), Padova, Italy, in collaboration with the European Commission Joint Research Center and other institutions, developed and patented a revolutionary diffusive sampling design - Radial symmetry (now a registered trademarked as radiello). It consists of a microporous cylindrical polypropylene diffusive body. Housed within the diffusive body is a removable cartridge adsorbent. Each cartridge adsorbent contains a unique adsorbent that is application specific. The radial symmetry design offers a very large diffusive surface relative to the adsorbing surface allowing for an exponential increase in uptake rate when compared to traditional passive samplers. This translates to shorter necessary sampling times that are close to the range of active sampling.

Radiello offers Higher Capacity

With active sampling, i.e. using a pump, adsorbed gaseous compounds move through the axial sampler (adsorbent tube) as a gaussian peak. This means only a part of the adsorbent bed is used for trapping the analyte, and in addition, it is forced through the tube by the sample flow. Eventually breakthrough will occur.

In the diffusive radiello samplers, the analytes are not forced through the adsorbent cartridge which results in a more complete use of the adsorbent bed and a higher capacity, providing longer possible sampling times or broader concentration ranges.
To read more about the capacity comparison between active and passive sampling, please request the radiello brochure (T406090 - IXV) or visit tghe website *sigma-aldrich.com/radiello*

How to Use Radiello Samplers

Assembly of the Radiello sampler is simple. Sampling using Radiello monitors begins with a quick assembly of the support plate.

1. Transfer adsorbent cartridge from the storage container into the appropriate diffusive body.

2a. Screw diffusive body into triangular support plate.

2b. Use vertical adapter for personal sampling.

3. Document date and time on the enclosed barcode label and insert label into sampler pocket.

Sampling has begun.

4. At the conclusion of sampling, transfer the adsorbent cartridge from the diffusive body to the original storage container, and document date, time, and temperature on the barcode label. Transfer label to the storage container and send this to the lab for analysis.

5. Desorb and analyze adsorbing cartridge.

1.

P001117

3.

P001120

2a.

P001118

4.

P001121

2b.

P001119

5.

P001122

P001123

Outdoor Shelters

Protective outdoor shelters are recommended for environmental/ambient air sampling (available as easy to assemble & use accessory, see page 35).

Desorption and Analysis

For each compound/compound group, the Fondazione Salvatore Maugeri has developed detailed desorption and analytical protocols involving analytical techniques typical of most independent, academic, industrial, and regulatory laboratories. Detailed desorption and analytical conditions are available in the Radiello manual (IYP) which can be viewed and downloaded at ***sigma-aldrich.com/radiello.***

Analytical services are available in the US and to European customers directly through the Fondazione Salvatore Maugeri. For more information, please contact the Fondazione Salvatore Maugeri IRCCS under email ***fsmpd@fsm.it*** or refer to web ***radiello.com***

Official Methods

Radiello Samplers are suitable for a variety of methods for diffusive sampling, but are explicitly listed in the following:

- **EN 14412:2004 Indoor Air Quality** – Diffusive samplers for the determination of concentrations of gases and vapors
- **EN 14662-5:2005 Ambient Air Quality** – Standard method for measurement of benzene concentrations
- **ISO/FDIS 16200-2 Workplace Air Quality** – Sampling and analysis of VOCs by solvent desorption/gas chromatography

For more in-depth information:

More official method listings can be found in the Radiello brochure T406090 (IXV), The Radiello CD (IXW) and the Radiello Manual (IYP). To request this information, visit ***sigma-aldrich.com/radiello***

Radiello Products and Accessories

Cartridge Adsorbents

Cat. No.	Matrix	Compounds	Pkg.	Radiello No.
RAD165	2,4-DNPH Coated Florisil®	Aldehydes	20	Code 165
RAD145	350 mg Carbograph 4 (35/50)	BTEX/VOC's (Thermal Desorption)	20	Code 145
RAD130	Activated charcoal (30/50)	BTEX/VOC's (CS_2 Desorption)	20	Code 130
RAD166	Microporous PE Impregnated w/ wet TEA	HF, NO_2, and SO_2	20	Code 166
RAD172	Microporous PE w/4,4'-dipyridylethylene coated silica	Ozone (O_3)	20	Code 172
RAD170	Microporous PE Coated with Zinc Acetate	Hydrogen Sulfide (H_2S)	20	Code 170
RAD168	Microporous PE Impregnated w/Phosphoric Acid	Ammonia (NH_2)	20	Code 168
RAD132	Mix of Molesieve and activated charcoal (30/50)	Anaesthetic gases and vapors	20	Code 132
RAD147	250 mg Tenax TA (20/35)	Phenolic compounds (Thermal Desorption)	20	Code 147
RAD169	Silica Gel (100-400 µm particles)	HCl	20	Code 169

Radiello Diffusive Bodies

RAD120 P001129

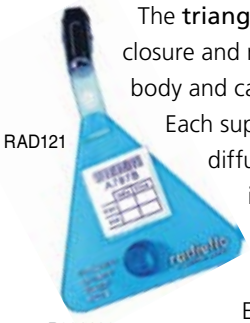
RAD120-1 P001130

RAD120-2 P001131

RAD120-3 P001132

Cat. No.	Color	Configured for	Body	Pkg.	Radiello No.
RAD120	White	General Use	Polyethylene	20	Code 120
RAD1201	Blue	Light Sensitive Compounds	Polyethylene	20	Code 120-1
RAD1202	Yellow	Reduced Sampling Rates	Polyethylene	20	Code 120-2
RAD1203	Grey	Anaesthetic Gases and Vapors	Permeative Silicone	20	Code 120-3

Radiello Key Components



RAD121 P001136

The **triangular support plate** acts as both a closure and means of suspension for the diffusive body and cartridge adsorbent during sampling. Each support plate is threaded for easy diffusive body attachment. Each plate includes a clip and transparent adhesive pocket to hold the barcode label.

RAD190 P001137

Each **Barcode Label** is self-adhesive with a unique barcode for the unmistakable identification of the cartridge adsorbent during sampling, desorption and analysis.

RAD1221 P001138

RAD122 P001139

The **Vertical Adapter** is available to position the diffusive body vertically on the triangular support plate for personal (breathing zone) sampling.

Description	Pkg.	Cat. No
Triangle Support Plate	20	RAD121
Radiello Clips	20	RAD195
Bar Code Labels	198	RAD190
Radiello Vertical Adapter		
Threaded for Standard Use	20	RAD122
Non-Threaded for Ready-to-Use Samplers	20	RAD1221

New! Radiello VOC/BTEX Starter Kits for Chemical and Thermal Desorption

Handy trial size includes everything you need to make the first steps with the Radiello passive/diffusive air samplers. Each containing one complete sampler plus an additional adsorbent cartridge. No additional parts are needed.

P001111

Each kit includes:

- 1 Diffusive body
- 1 Vertical adapter
- 1 Triangular base plate
- 2 Adsorbent cartridges and barcode label
- 1 Instruction sheet

Cat. No.	Matrix	Compounds	Pkg.	Radiello No.
RAD130S	Activated charcoal (30/50), activated	BTEX/VOC's (CS2 Desorption)	1	Code 130S
RAD145S	Carbograph 4 (35/50)	BTEX/VOC's (Thermal Desorption)	1	Code 145S

Radiello Ready-to-Use Diffusive Sampler

Radiello Cartridge Adsorbents

The Radiello ready-to-use (RTU) diffusive samplers come preassembled with the cartridge adsorbent pre-contained within the diffusive body, and sealed with a polycarbonate screw-thread cap. To avoid premature sampling, the entire unit is enclosed in an airtight polypropylene (PP) container.

They are snapped to the ready-to-use vertical adapter, pre-fixed to the triangular support plate. Once sampling is complete, the diffusive sampling unit is removed from the support plate and resealed into the PP container. The RTU diffusive samplers are ideal for workplace sampling but not recommended for low concentrations in outdoor or domestic environments.

Shelf life: 3 months


P001132


P001133

Each ready to use sampler includes:

- A sampler unit (sealed diffusive body with cartridge adsorbent)
- Glass or plastic tube for storage prior to analysis
- Ready-to-use vertical adapter
- Barcode label
- Polypropylene container

Note: Please order Triangular Support Plates separately

Cat. No.	Diffusive Body	Cartridge Adsorbent	Compounds	Pkg.	Radiello No.
RAD1231	RAD120 White	RAD130	BTEX/VOC's (CS_2 Desorption)	5	Code 123-1
RAD1232	RAD1202 Yellow	RAD145	BTEX/VOC's (Thermal Desorption)	5	Code 123-2
RAD1233	RAD1201 Blue	RAD166	HF, NO_2, and SO_2	5	Code 123-3
RAD1234	RAD1201 Blue	RAD165	Aldehydes	5	Code 123-4
RAD1235	RAD1201 Blue	RAD172	Ozone (O_3)	5	Code 123-5
RAD1236	RAD120 White	RAD170	Hydrogen Sulfide (H_2S)	5	Code 123-6
RAD1237	RAD1201 Blue	RAD168	Ammonia (NH_2)	5	Code 123-7
RAD1238	RAD120 White	RAD169	HCl	5	Code 123-8

Anesthetic Gases and Vapor Sampler (Sterile)

This kit is developed to sample nitrous oxide, isofluorane, ethrane, halothane, and sevorane in surgical theaters. Parts for one complete sampler are packed separately in one sealed and sterile bag. Pack of 10 sterile bags.


E000985

Sterile bag contains:

- 1 permeative body
- 1 support plate
- 1 vertical adapter
- 1 adsorbing cartridge

Cat. No.	Description	Pkg.
RAD125	Anesthetic Gas Sampler	10

Accessories & Replacement Parts

Radiello Outdoor Shelter

The protective outdoor shelter is designed to accommodate up to four Radiello samplers and is recommended for outdoor/ambient sampling. The shelter allows for adequate ventilation while simultaneously protecting the samplers from harsh weather conditions. It can be mounted to a variety of outdoor fixtures such as lamp-posts, traffic lights, and telephone poles of various diameters. It can be easily transported from one lab and mounted without the use of tools. Dimensions: 159 mm x 230 mm, pack of 10 and includes 20 mounting strips.

P001140

P001141

Description	Pkg.	Cat. No.
Radiello Outdoor Shelter	10	RAD196
Replacement Mounting Strips	100	RAD198

Radiello On-Field Thermometer and Temperature Reader

Uptake rates are dependent on temperature; therefore concentration values obtained during sampling will be more accurate if precise temperature values are recorded during sampling. The thermometer acts like a mini (< 1 cm^3 in size) temperature measurement station that can be mounted on the triangular support plate in conjunction with the diffusive body that is pre-attached to a vertical adapter. The thermometer offers a precision of ± 0.5 °C between –20 to 80 °C and can log up to 2048 data points allowing you to record one reading every 15 min. for 22 days, every 30 min. for 43 days and every 60 min. for 85 days. It requires no batteries and is amenable to harsh weather conditions.

P001145

Thermometer

A Temperature Reader (purchased separately) connects the thermometer to your PC (via RS232 serial port) allowing the user to program the thermometer prior to sampling and download readings after sampling. Each thermometer has a unique serial number for easy identification. A user-friendly software package is included with the reader to perform statistical and graphic analysis.

P001146

Description	Pkg.	Cat. No.
Reader	1	RAD127
Standard Use Configuration		
Thermometer plus vertical adapter (RAD122)	3	RAD126
Ready-to-Use Configuration (for RTU samplers)		
Thermometer plus RTU vertical adapter (RAD1221)	3	RAD1261

Radiello Filtration Kit

The filtration kit consists of a graduated polypropylene syringe and 13 mm diameter syringe filters with 0.45 µm porosity. It is ideal for filtering aqueous samples prior to reversed-phase HPLC and ion-chromatography.

P001149

Description	Pkg.	Cat. No.
Radiello Filtration Kit	20	RAD174

Calibration Kits

Radiello BTEX Calibration Kits

The BTEX Calibration Kit is available for CS2 Desorption and Thermal Desorption, both kits are designed for analysis of BTEX in urban environments. The kit may be used for both routine calibration and quality control. The calibration kit includes: 12 cartridge adsorbents of which three are blanks, and the remaining nine are divided into three concentration groups preloaded with BTEX to simulate 7-day exposures (100,800 minutes). Concentrations are described in the listed tables below. The values shown are indicative. Actual concentrations are certified for each lot. Cartridges are stable for at least 12 months when stored at 4 °C.

CS2 Desorption Kit

Includes: 12 RAD130 Cartridge Adsorbents
Simulated Concentrations in µg/m³
Exposure Limit: 7 days equivalent

	Group 1	Group 2	Group 3
Benzene	1	10	50
Toluene	2	20	100
Ethylbenzene	1	10	50
m-xylene	1	10	50
p-xylene	1	10	50
o-xylene	1	10	50

Description	Pkg.	Cat. No.
CS2 Desorption Kit	1 kit	RAD405

Thermal Desorption Kit

Includes: 12 RAD145 Cartridge Adsorbents
Simulated Concentrations in µg/m³
Exposure Limit: 7 days equivalent

	Group 1	Group 2	Group 3
Benzene	1	5	25
Toluene	2	10	50
Ethylbenzene	1	5	25
m-xylene	1	5	25
p-xylene	1	5	25
o-xylene	1	5	25

Description	Pkg.	Cat. No.
Thermal Desorption Kit	1 kit	RAD407

VOC Calibration Kit (Chemical Desorption) (Workplace Environment)

P001150

The VOC Calibration Kit is ideal for conducting scheduled quality control runs when analyzing workplace environments. The calibration kit includes: 12 cartridge adsorbents of which three are blanks, and the remaining nine are divided into three concentration groups preloaded with VOC's to simulate 8-hour (480 minutes) exposure. Concentrations are described in the listed table below. The values shown are indicative. Actual concentrations are certified for each lot. The composition of VOC's represents a broad range of polarity. The spiked concentrations represent 0.5, 1.0, and 2.0 times the threshold limit values (TLV) for each compound. VOC's are spiked onto the cartridges by injecting vaporized VOC standards in CS2 under nitrogen flow. Cartridges are stable for at least four months when stored at 4 °C.

Includes: 12 RAD130 Cartridge Adsorbents
Simulated Concentrations in µg/m³
Exposure Limit: 8 hours equivalent

	Group 1	Group 2	Group 3
Benzene	0.1	0.2	0.4
Toluene	19	38	76
Ethylbenzene	12	24	48
m-xylene	12	24	48
p-xylene	12	24	48
o-xylene	12	24	48
Butanol	15	30	60
2-ethyoxyethyl acetate	2.5	5	10

Description	Pkg.	Cat. No.
VOC Calibration Kit	1 kit	RAD406

Calibration Standards

Aldehyde Calibration Standard

The aldehyde calibration standard consists of nine 2,4-dinitrophenylhydrazones (2,4-DNPH) diluted in acetonitrile. Actual concentrations for each component are certified for each lot. The standard stock solution is shipped in a pierceable-septum crimped cap. Cartridges are stable for at least four months when stored at 4 °C.

50 µg/mL of each compound in acetonitrile (aldehyde equivalent)
Exception: Acrolein (10 µg/mL)

Components

Formaldehyde-2,4-DNPH
Acetaldehyde-2,4-DNPH
Acrolein-2,4-DNPH
Propanal-2,4-DNPH
Butanal-2,4-DNPH
Isopentanal-2,4-DNPH
Pentanal-2,4-DNPH
Hexanal-2,4-DNPH
Benzaldehyde-2,4-DNPH

Description	Pkg.	Cat. No.
Aldehyde Calibration Standard	10 mL	RAD302

Methylene Blue Calibration Standard for H_2S (Hydrogen Sulfide)

The hydrogen sulfide calibration standard contains a Methylene blue concentrate that, once diluted 1:50 (v/v) with water, provides the same absorbance value of hydrogen sulfide at 665 nm at a concentration of 1.145 µg/mL sulfide ions. This concentration value is the highest absorbance value within linear range of the spectrophotometer and can be used as a stock solution to prepare standards for the calibration curve. The concentrate is suitable for preparing up to 50 calibration curves and is stable for at least 1 year.

Description	Pkg.	Cat. No.
Methylene Blue Calibration Standard	100 mL	RAD171

DSD-DNPH

NEW! - *DSD-DNPH Passive Sampling Device*

High Efficiency Diffusive Sampler for Determination of Aldehydes and Ketones in Indoor Air

The DSD-DNPH diffusive sampler was introduced first in Japan and was an integral device for monitoring carbonyls in indoor air, specifically related to "sick house syndrome". Sick house syndrome results from exposure to building materials that emit VOC's such as formaldehyde. Common building materials known to emit formaldehyde are: adhesives, paints, plywood, and wallpaper.


E000962

The DSD-DNPH is comprised of a porous polyethylene tube, which acts as the diffusive membrane, to which is attached a small syringe barrel used for the elution of the analytes from the adsorbent. Because the diffusive membrane is round, it permits exposure from all sides, making it unique compared to other diffusive samplers. Silica gel coated with 2,4-dinitrophenylhydrazine (DNPH) acts as the adsorbent and moves from the diffusive end during sample collection to the syringe end for sample extraction, by inverting the device. Aldehydes and ketones diffuse through the membrane reacting with DNPH to form stable derivatives. The DNPH-derivatives are then eluted with acetonitrile and analyzed by high performance liquid chromatography (HPLC).

Simple

Versatile

Safe

Benefits:

- Specified in OSHA 1007 Method for Determination of Aldehydes
- Collection and analysis of carbonyls without transfer of the adsorbent, which minimizes the risk of contamination
- High-purity adsorbent provides collection of ppb levels of a wide range of carbonyls in a convenient, easy-to-use configuration
- Excellent uptake rates – faster, stable for wind, temperature and humidity
- Stable blank data – important LOQ
- Simple elution
- Versatile – use for indoor air, personal sampling, and ambient air

Description	Pkg.	Cat. No.
DSD-DNPH Diffusive Sampling Device	10	28221-U
Accessories		
Perforated Holder	10	28222-U
Female Luer Fitting to Tubing 5/32 in.	20	28224-U
Lapel Clip	10	21019-U
Filtration Column w/o frit 6 mL	30	57242
Plastic color-coded cap insert	100	000J004
Visiprep™-DL vacuum manifold	1	57044
Visi-1™ Sample Processor	1	57080-U
Calibration Standards		
TO-11/IP-6A Aldehyde/Ketone-DNPH Mix	1	47285-U
Formaldehyde-DNPH	1 mL	47177
Acetaldehyde-DNPH	1 mL	47340-U
Acetone-DNPH	1 mL	47341
Acrolein-DNPH	1 mL	47342
Propionaldehyde	1 mL	47181
Analytical Columns for Carbonyl DNPH Analysis		
Discovery RP Amide, 25 cm x 4.6 mm I.D., 5µm	1	505064
Ascentis C18, 15 cm x 4.6 mm I.D., 3 µm	1	581322-U
Ascentis C18, 25 cm x 4.6 mm I.D., 5 µm	1	581325-U
Ascentis RP-Amide, 15 cm x 4.6 mm I.D., 3 µm	1	565322-U
Ascentis RP-Amide, 25 cm x 4.6 mm I.D., 5 µm	1	565325-U

For more in-depth information:

OSHA 1007: Method for Determination of Aldehydes

Visit *sigma-aldrich.com/air_monitoring* to obtain the following:

T708004 DSD-DNPH Application Manual for complete sampling and analysis information.

T408065 (KIX) DSD-DNPH Flyer for summary of performance, features and benefits.

T400128 (DIC) Poster: High Efficiency Diffusive Sampler for Determination of Aldehydes and Ketones

References

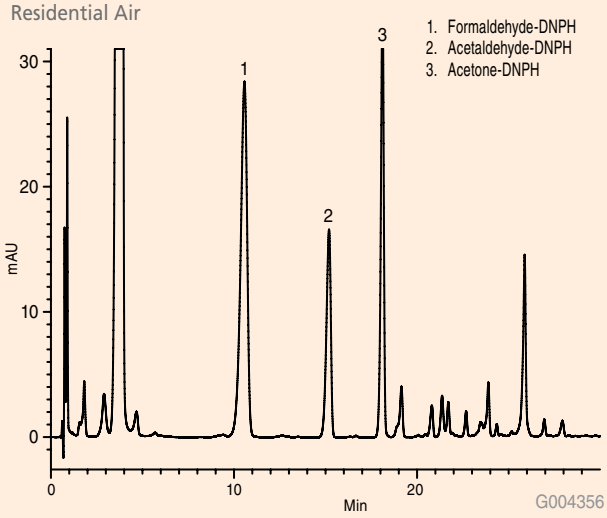
1. S. Uchiyama, S Aoyagi, ad Ando, Masanori, "Evaluation of a Diffusive Sampler for Measurement of Carbonyl Compounds in Air", Atmospheric Environment, 2004, 38, 6319-6326.
2. S. Uchiyama and S Hasegawa, "A Reactive Sensitive Diffusion Sampler for the Determination of Aldehydes and Ketones in Ambient Air", Atmospheric Environment, 1999, 33, 1999-2005.

DNPH Product Applications

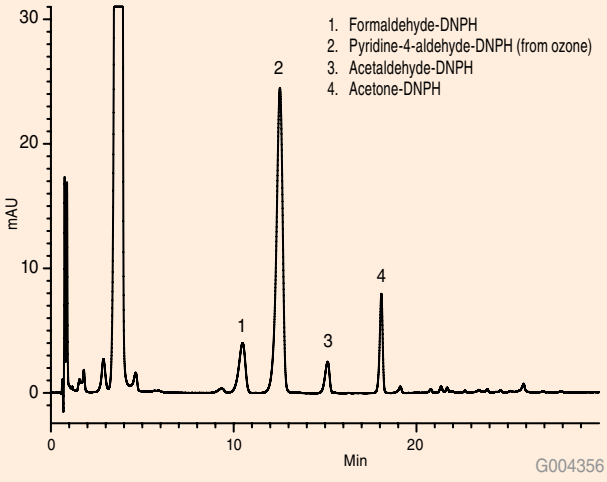
Ozone and Carbonyls: Residential and Laboratory Air

column: Ascentis C18, 15 cm x 4.6 mm I.D., 5 µm particles (581324-U)
mobile phase: 2 mM ammonium acetate in water:acetonitrile (65:35, 10 min. hold), gradient to 75% acetonitrile at 25 min. (5 min. hold)
flow rate: 1.9 mL/min.
det: UV-Vis, 360 nm
injection: 20 µL
sampling cartridge: BPE-DNPH Rezorian Cartridge (54269-U)
sampling: 90 mL/min for 24 hours
extraction: 3 mL acetonitrile/DMSO (70:30), allow to set 2 hours before HPLC injection

Residential Air



Laboratory Air



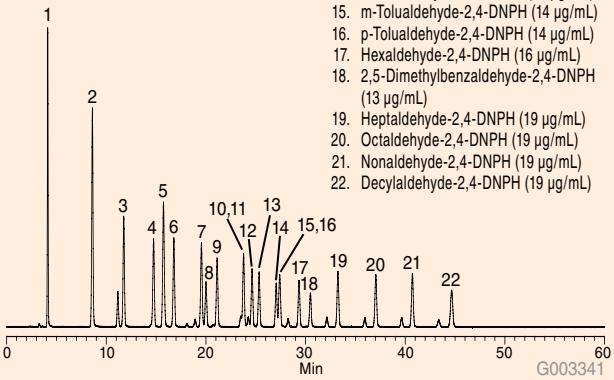
Analysis of 21 Aldehyde / Ketone DNPH Derivatives Using Ascentis RP-Amide

This application demonstrates the suitability of the Ascentis RP-Amide for the analysis of 21 aldehyde ketone derivatives.

column: Ascentis RP-Amide, 15 cm x 4.6 mm I.D., 3 µm particles (565322-U)
mobile phase A: 60:40, water:acetonitrile
mobile phase B: 25:75, water:acetonitrile
flow rate: 1.5 mL/min.
temp.: 30 °C
det.: UV at 360 nm
injection: 10 µL
sample: as listed in mobile phase
gradient:

Min	%A	%B
0	100	0
5	100	0
25	40	60
40	0	100
60	0	100

1. Dinitrophenylhydrazine (100 µg/mL)
2. Formaldehyde-2,4-DNPH (40 µg/mL)
3. Acetaldehyde-2,4-DNPH (29 µg/mL)
4. Acetone-2,4-DNPH (23 µg/mL)
5. Acrolein-2,4-DNPH (24 µg/mL)
6. Propionaldehyde-2,4-DNPH (23 µg/mL)
7. Crotonaldehyde-2,4-DNPH (20 µg/mL)
8. 2-Butanone-2,4-DNPH (10 µg/mL)
9. Butyraldehyde-2,4-DNPH (20 µg/mL)
10. Benzaldehyde-2,4-DNPH (15 µg/mL)
11. Cyclohexanone-2,4-DNPH (10 µg/mL)
12. Isovaleraldehyde-2,4-DNPH (18 µg/mL)
13. Valeraldehyde-2,4-DNPH (18 µg/mL)
14. o-Tolualdehyde-2,4-DNPH (14 µg/mL)
15. m-Tolualdehyde-2,4-DNPH (14 µg/mL)
16. p-Tolualdehyde-2,4-DNPH (14 µg/mL)
17. Hexaldehyde-2,4-DNPH (16 µg/mL)
18. 2,5-Dimethylbenzaldehyde-2,4-DNPH (13 µg/mL)
19. Heptaldehyde-2,4-DNPH (19 µg/mL)
20. Octaldehyde-2,4-DNPH (19 µg/mL)
21. Nonaldehyde-2,4-DNPH (19 µg/mL)
22. Decylaldehyde-2,4-DNPH (19 µg/mL)



Did you know?

Supelco has a wide range of Air Monitoring Application Notes available on request and on our website. Please contact Technical Service at 800-359-3041 or visit our website for more application information.

SPME

SPME for Air Sampling – Grab Sampling

SPME is another way to perform Grab sampling. It is highly sensitive, simple-to-use and easy to deploy in the field.

SPME consists of a coated fiber that can be exposed to the air. Analytes are trapped on the fiber and are later thermally desorbed in the hot injector block of a gas chromatograph.

SPME requires no solvents or complicated apparatus. It can concentrate volatile and nonvolatile compounds in both gaseous and liquid samples for analysis by GC, GC-MS, or HPLC

SPME Fiber Assortment Kits Suitable for Air Sampling

Each kit contains one each specified fiber

For use with	Needle	Cat. No.
SPME StableFlex™ Fiber Assortment Kit		
Kit Contains: 65 µm PDMS/DVB coating, 50/30 µm DVB/Carboxen/PDMS coating, 85 µm Carboxen/PDMS, and 85 µm Polyacrylate coating		
Manual Holder	24 gauge	**57550-U**
Autosampler	24 gauge	**57551-U**
Autosampler	23 gauge	**57284-U**
SPME Fiber Assortment Kit 1 for Volatile and Semi-Volatiles		
Kit Contains: 100 µm PDMS, 7 µm PDMS, and 85 µm Polyacrylate coating		
Manual Holder	24 gauge	**57306**
Autosampler	24 gauge	**57307**
Autosampler	23 gauge	**57285-U**
SPME Fiber Assortment Kit 4 for Flavors and Odors		
Kit Contains: 100 µm PDMS, 65 µm PDMS/DVB, and 75 µm Carboxen PDMS coating		
Manual Holder	24 gauge	**57324-U**
Autosampler	24 gauge	**57235-U**
Autosampler	23 gauge	**57287-U**
SPME Fiber Assortment Kit 5 for Flavors and Odors		
Kit Contains: 100 µm PDMS, 65 µm PDMS/DVB, and 85 µm Carboxen/PDMS coating and 50/30 µm DVB/Carboxen/PDMS coating		
Autosampler	23 gauge (4 each)	**57362-U**

For more in-depth information:

For more information on SPME, please visit us on our website ***sigma-aldrich.com/spme*** and request the most recent edition of the SPME CD. You can view detailed applications and informative materials and video sequences demonstrating the use of SPME.

SPME Portable Field Samplers

The portable field samplers collect organic compounds in air. In our studies, the sampler allowed us to monitor typical HPLC and GC solvents at ppb levels common in laboratory air. Three fibers are available: a polydimethylsiloxane (PDMS)/Carboxen fiber for trace levels of volatiles, a general-purpose PDMS fiber and a PDMS/DVB for semi-volatiles and larger volatile compounds.

Five slots in the needle guide/depth gauge control the depth of needle insertion into a sample container, or into the injection port during fiber desorption.

Assemblies contain 24 gauge needles. 23 gauge and other coatings available as custom (on request).

Description	Pkg.	Cat. No.
SPME Portable Field Sampler		
100 µm polydimethylsiloxane	2	**504823**
75 µm Carboxen/polydimethylsiloxane	2	**504831**
65 µm PDMS/DVB StableFlex fiber	2	**57359-U**
Thermogreen® LB-2 Septa		
Diam. 5.0 mm (3/16 in.)	50	**20638**
SPME Septum Removing Tool		
For Portable Field Sampler	1	**504858**

SPME Fiber Holder

The holder protects/guides the fiber assembly and controls exposure of the fiber during analyte adsorption and desorption. The holder is reusable indefinitely and accepts the replaceable fiber assembly. First time users must order both a holder and a fiber assembly.

Fiber holders are available for:

- Manual sampling
- Automated sampling or HPLC analysis
- CTC CombiPAL™ and Varian® 8400/8410 autosampler

Description	Pkg.	Cat. No.
SPME Fiber Holder, for use with manual sampling	1	**57330-U**
SPME Fiber Holder, for use with Autosampler or HPLC, Varian	1	**57331**
SPME Fiber Holder, for use with CTC CombiPAL, GERSTEL MPS 2 and Thermo TriPlus Autosamplers	1	**57347-U**

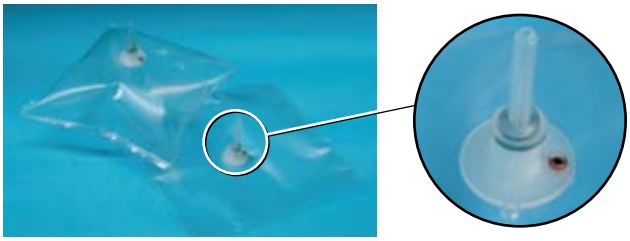
Whole Air Sampling

Overview

A whole air sample is collected when the air is drawn into some sort of containment vessel such as a Tedlar bag, stainless steel or glass canister. The method of collection is easy and the compounds of interest are recovered directly from the vessel. Recovery is a function of several factors which include, the surface area of the vessel, the chemistry and vapor pressure of the contaminants, the influence of various matrix effects, and the ability to begin with a vessel free of contamination. Supelco offers Gas Sampling Bags (Tedlar) and Glass Bulbs for whole air sampling.

Tedlar Gas Sampling Bags

Tedlar gas sampling bags are recommended in many US EPA methods including TCLP and Methods TO-3 (VOCs), TO-12 (NMOC), TO-14A (VOCs), TO-15 (VOCs), ASTM D-5504 (reduced sulfur compounds) and a variety of atmospheric gas methods.



E000995 E000996

Benefits:

- Patented 2-in-1 valve with unique push-pull device operates with one hand so you have your other hand free for other operations.
- Valve consistently achieves a positive open or closed setting.
- Unique valve and seam-sealing process ensures bags are sturdy and leak-proof under demanding sampling conditions.
- 2-mil Dupont Tedlar material for superior inertness and impermeability.
- Bags assembled in a controlled environment, eliminating contamination during manufacture.

Max Vol. (L)	W x Depth (in.)	Pkg.	Cat. No.
1	7 x 7	10	**24633**
2	9 x 9	10	**24654**
5	12 x 12	10	**24655**
10	12 x 19	10	**24634**
25	18 x 24	5	**24656**

Gas Sampling Bulbs

Glass sampling bulbs may be used as an alternative to Tedlar bags to trap and transport a gas sample. To analyze the sample, take an aliquot (through the plug-type septum). Our bulbs are oven annealed to prevent damage during transportation and on-site use.

9970169

Sampling Bulbs with Glass Stopcocks

Volume (mL)	Pkg.	Cat. No.
Glass Stopcock		
125	1	**22146-U**
250	1	**22147-U**
500	1	**22148-U**
1000	1	**22144-U**
PTFE Stopcock		
125	1	**22161**
250	1	**22162-U**
500	1	**22163-U**
1000	1	**22145-U**
Stopcock Plug	1	**64779-U**
Thermogreen LB-1 Septa for Shimadzu		
Cylindrical w/half-hole	100	**20668**

Static Dilution Bottle

- Two-liter, round-bottom flask with a threaded neck
- Accommodates a Mininert® valve

9960281

Use the static dilution bottle to prepare gaseous volatile organic standards, using a technique developed by the US EPA for air analyses. Simply inject neat compound through the valve and allow it to vaporize; then withdraw the aliquots using a gas-tight syringe. Multicomponent standards are conveniently prepared and may be stored for at least one week.

Description	Pkg.	Cat. No.
Static Dilution Bottle w/Mininert Valve	1	**21992**
Septum inserter, for use with Mininert Valves	1	**33311**
Replacement Mininert Septa, length 0.308 in. × O.D. 0.125 in.	50	**33310-U**
Mininert Valve, for use with 24/400 mm thread	12	**33304**

Air Monitoring Pumps & Accessories

Air Sampling Pumps

Escort Elf Air Sampling Pump and Accessories

An electronic laminar flow sensor in this easy-to-operate, state-of-the-art sampling pump provides constant flow control, unaffected by changes in battery voltage, temperature, sample load, or altitude. An internal secondary standard calibrates the pump continuously, requiring only monthly calibration with a primary standard. A built-in counter monitors total operating time, and reminds you when a primary calibration is required. The pump also features a low battery function with an indicator light, and blocked flow detection. LED readout alternately displays flow rate and elapsed sampling time. It may not be used with Tedlar bags. Order charger separately.

Gemini Twin Port Sampler

This pump attachment is designed for low flow industrial hygiene sampling, such as gas and vapor monitoring, using sorbent tubes. Two needle valves provide independent flow control for simultaneous collection on two tubes, but can also be used for a single tube by closing the flow to one valve. The sampler is compatible with any personal sampling pump capable of 1.5 L/min flow rate and a load of 25 in. of water. Total flow cannot exceed 500 mL/min. Each sampler comes with two tube protectors, one for small tubes (<2 in. long) and one for large tubes (<4.5 in. long), and the tubing required to connect the sampler to the sampling pump.

P000747

Description	Pk	Cat. No
Escort Elf Sampling Pump	1	28160-U
Gemini Twin Port Sampler	1	28118-U

Accessories

Description	Pkg.	Cat. No.
Omega Battery Charger		
12 Volt	1	28155-U
110 Volt, units charged: 1	1	28157-U
240 Volt, units charged: 1	1	28158-U
120 V/240 V, units charged: 5	1	28159-U

PAS-500 Micro Air Sampler

9940285

This low flow pump is lightweight (4 oz.) and compact (7 in. high), fitting easily into your shirt pocket. The adsorbent tube connects directly to the inlet of the pump. This sampler is versatile, adapts to fit both 6 mm and 8 mm tubes and the flow range is 40-200 cc/min. The low flow adapter enables you to sample at 20 cc/min.

This unit is powered by a convenient and easily replaceable 9-volt battery. The full flow regulation feature provides constant voltage to the pump, even as battery voltage drops. It is intrinsically safe – a built-in resistor limits the power current, preventing any short circuit.

Description	Pkg.	Cat. No.
PAS-500 Micro Air Sampler with Low Flow Orifice		
Includes sampler, 6 mm tube holder, screwdriver, and 9-volt battery	1	24865
Tube Holder for PAS-500 Pump		
For use with 6 mm adsorbent tube	1	24867
For use with 8 mm adsorbent tube	1	24868
For use with detector tube	1	24869
Carrying Case for PAS-500		
Single pump case	1	24871
Eight pump case	1	24872

Field Sampling Pumps for Active and Whole Air Samplers

E000129

E000018

Description	Recommended For	Pkg.	Cat. No.
Model 1060 Bag Sampler	Single 1-2 Liter Tedlar Bags	1	24622-U
Model 1062 Bag Sampler	Single 1-10 Liter Tedlar Bags	1	24623
Model 1063 Bag Sampler	Six 1 Liter Tedlar Bags	1	24647
Model 1067 Tube Sampler* (Dual Channel)	Adsorbent Tubes (ORBO & TD)	1	507113

*Includes universal charger

Accessories

Description	Pkg.	Cat. No.
Battery Charger		
For Model 1060, 110V	1	24643
For Models 1062 & 1063, 110V	1	24644
Universal Charger, 110V/240V For use with 1060,1062,1063 &1067	1	24697-U
Replacement Battery for Field Sampling Pump		
For Model 1060	1	24635
For Models 1062, 1063, & 1067	1	24636
Critical Orifice for 1063 Bag Sampler		
Flow Rate: 1 mL/min	1	24667
Flow Rate: 10 mL/min	1	24668
Filter, SS, 40 µm	1	24672

Bubble Flow Meters

P000854

Description	Pkg.	Cat. No.
Bubble Meter Kit, 500 mL	1	20414
Bubble Meter Kit, 1000 mL	1	20415
Replacement Bubble Meter, 500 mL	1	20427-U
Replacement Bubble Meter, 1000 mL	1	20428-U
Stopwatch	1	23011

P000299

Flow Calibration Devices for Air Sampling Pumps

P000853

Description	Pkg.	Cat. No.
Mini-Buck Flow Calibrator		
Model M-5*, Flow Rate 1-6000 mL/min	1	24843
Model M-30*, Flow Rate 1-30 mL/min	1	24845
Battery Charger for M-5/M-30, 110V	1	24844
Battery Charger for M-5/M-30, 220V	1	24846

*Battery charger not included with 24843 and 24845, order separately

Digital Flow Calibrator

9130186

Measures volumetric flows between 5 to 5.000 mL/min with accuracy to within ±3% of the reading. A microprocessor indicates fault and low battery conditions and automatically adjusts the meter to the air flow rate. Comes complete with a 9-volt battery, Tygon tubing, and instructions.

Description	Pkg.	Cat. No.
Humonics Flowmeter		
Model 650, Flow range: 5-5000 mL/min	1	22912

Air Monitoring Standards

ASTM Methods

American Society for Testing and Materials (ASTM) Methods

The following standards are for use with methods developed under ASTM Committee D-22, described in the Annual Book of ASTM Methods, Volume 11.03, Atmospheric Analysis, Occupational Health and Safety. The standards are quantitative formulations for use as chromatographic calibration or spiking solutions. Products include a Certificate of Analysis describing lot-specific production and analytical information. Free data packets are available for most of these products. Data packets contain data on raw materials and final production. Request the data packet when ordering the standard; the order number is the same as that for the standard, preceded by the letters DP.

ASTM D5197 Method Description: Analysis of Aldehydes in Air

Description standard type calibration	Concentration	Pkg.	Cat. No.
TO11/IP-6A Aldehyde/Ketone-DNPH Mix	15 µg/mL each component in acetonitrile (aldehyde equivalent)	1 mL	47285-U

Acetaldehyde-2,4-dinitrophenylhydrazone
Acetone-2,4-dinitrophenylhydrazone
Acrolein-2,4-dinitrophenylhydrazone
Benzaldehyde-2,4-dinitrophenylhydrazone
Butyraldehyde-2,4-dinitrophenylhydrazone
Crotonaldehyde-2,4-dinitrophenylhydrazone
2,5-Dimethylbenzaldehyde-2,4-dinitrophenylhydrazone
Formaldehyde-2,4-dinitrophenylhydrazone
Hexaldehyde-2,4-dinitrophenylhydrazone
Isovaleraldehyde-2,4-dinitrophenylhydrazone
Propionaldehyde-2,4-dinitrophenylhydrazone
o-Tolualdehyde-2,4-dinitrophenylhydrazone
m-Tolualdehyde-2,4-dinitrophenylhydrazone
p-Tolualdehyde-2,4-dinitrophenylhydrazone
Valeraldehyde-2,4-dinitrophenylhydrazone

California Air Resources Board (CARB) Methods

Analysis of Carbonyls in Ambient Air

California Air Resources Board (CARB) – The following quantitative formulations were developed to support the analysis of aldehydes in ambient air by CARB Method 1004. Analysis is of the dinitrophenylhydrazine (DNPH) derivatives by HPLC-UV. **Concentrations stated are of the equivalent carbonyl before derivatization, except where noted.** The Certificate of Analysis accompanying these products states both DNPH derivatized and non-derivatized concentrations.

Description standard type calibration	Concentration	Pkg.	Cat. No.
CARB Carbonyl-DNPH Mix 1	in acetonitrile (varied)	1 mL	47649-U

Acetaldehyde-2,4-dinitrophenylhydrazone, 1000 µg/mL
Acetone-2,4-dinitrophenylhydrazone, 500 µg/mL
Acrolein-2,4-dinitrophenylhydrazone, 500 µg/mL
Benzaldehyde-2,4-dinitrophenylhydrazone, 500 µg/mL
Butyraldehyde-2,4-dinitrophenylhydrazone, 500 µg/mL
Formaldehyde-2,4-dinitrophenylhydrazone, 1500 µg/mL
Propionaldehyde-2,4-dinitrophenylhydrazone, 500 µg/mL

CARB Method 1004 DNPH Mix 1	3 µg/mL in acetonitrile (aldehyde equivalent)	1 mL	47650-U
CARB Method 1004 DNPH Mix 2	30 µg/mL in acetonitrile (aldehyde equivalent)	1 mL	47651-U

Acetaldehyde-2,4-dinitrophenylhydrazone
Acetone-2,4-dinitrophenylhydrazone
Acrolein-2,4-dinitrophenylhydrazone
Benzaldehyde-2,4-dinitrophenylhydrazone
2-Butanone-2,4-dinitrophenylhydrazone
Butyraldehyde-2,4-dinitrophenylhydrazone
Crotonaldehyde-2,4-dinitrophenylhydrazone
Formaldehyde-2,4-dinitrophenylhydrazone
Hexaldehyde-2,4-dinitrophenylhydrazone
Methacrolein-2,4-dinitrophenylhydrazone
Propionaldehyde-2,4-dinitrophenylhydrazone
m-Tolualdehyde 2,4-dinitrophenylhydrazone
Valeraldehyde-2,4-dinitrophenylhydrazone

European Mixes

DNPH Mixes - The following dinitrophenylhydrazine (DNPH) standards were developed in response to European requests for working and calibration check standards for the ambient air analysis of carbonyl emissions from automobile exhaust. Methods for this analysis are equivalent to California Air Resources Board 1004 (Sacramento, CA, USA). Concentrations are of the equivalent carbonyl quantity before derivatization. The Certificate of Analysis accompanying each of these products states both DNPH-derivatized and non-derivatized concentrations.

Description standard type calibration	Concentration	Pkg.	Cat. No.
Carbonyl-DNPH Mix 1	20 µg/mL in acetonitrile (except where indicated; aldehyde equivalent) *Acetaldehyde-2,4-dinitrophenylhydrazone* *Acetone-2,4-dinitrophenylhydrazone* *Acrolein-2,4-dinitrophenylhydrazone* *Benzaldehyde-2,4-dinitrophenylhydrazone* *2-Butanone-2,4-dinitrophenylhydrazone* *Butyraldehyde-2,4-dinitrophenylhydrazone* *Crotonaldehyde-2,4-dinitrophenylhydrazone* *Formaldehyde-2,4-dinitrophenylhydrazone, 40 µg/mL* *Hexaldehyde-2,4-dinitrophenylhydrazone* *Methacrolein-2,4-dinitrophenylhydrazone* *Propionaldehyde-2,4-dinitrophenylhydrazone* *p-Tolualdehyde 2,4-dinitrophenylhydrazone* *Valeraldehyde-2,4-dinitrophenylhydrazone*	1 mL	**47672-U**
Carbonyl-DNPH Mix 2	2 µg/mL in acetonitrile (except where indicated; aldehyde equivalent) *Acetaldehyde-2,4-dinitrophenylhydrazone* *Acetone-2,4-dinitrophenylhydrazone* *Acrolein-2,4-dinitrophenylhydrazone* *Benzaldehyde-2,4-dinitrophenylhydrazone* *2-Butanone-2,4-dinitrophenylhydrazone* *Butyraldehyde-2,4-dinitrophenylhydrazone* *Crotonaldehyde-2,4-dinitrophenylhydrazone* *Cyclohexanone 2,4-dinitrophenylhydrazone, 5 µg/mL* *Formaldehyde-2,4-dinitrophenylhydrazone, 4 µg/mL* *Hexaldehyde-2,4-dinitrophenylhydrazone* *Methacrolein-2,4-dinitrophenylhydrazone* *Propionaldehyde-2,4-dinitrophenylhydrazone* *p-Tolualdehyde 2,4-dinitrophenylhydrazone* *Valeraldehyde-2,4-dinitrophenylhydrazone*	1 mL	**47671-U**
Cyclohexanone-2,4-DNPH solution	500 µg/mL in acetonitrile	1 mL	**47673-U**

Oximes

PFBHA (O-(2,3,4,5,6-pentafluorobenzyl)hydroxylamine) derivatives do not decompose at an elevated temperature. For this reason, PFBHA derivatives are a good alternative to 2,4-DNPH derivatives when using GC.

Material purity ≥98% by GC except where noted.

Description	Material Number	Pkg.
Acetaldehyde-O-pentafluorphenylmethyl-oxime purum	15875	10 mg
Acetone-O-pentafluorphenylmethyl-oxime purum	44114	10 mg, 50 mg
Acrolein-O-pentafluorphenylmethyl-oxime purum (≥95%)	65819	10 mg, 50 mg
Crotonaldehyde-O-pentafluorphenylmethyl-oxime purum	42094	10 mg
Formaldehyde-O-pentafluorphenylmethyl-oxime purum	41558	10 mg
Glutaraldehyde bis-O-pentafluorophenylmethyl-oxime purum	03718	10 mg
Propionaldehyde O-pentafluorophenylmethyl-oxime purum	43508	10 mg
Valeraldehyde O-pentafluorophenylmethyl-oxime purum	66156	10 mg, 50 mg

DAIH

(2-Diphenylacetyl-indan-1,3-dione-1-ethylidenehydrazone) derivatives of aldehydes and ketones.

Material purity ≥98% by GC.

Description	Material Number	Pkg.
Acetaldehyde, DAIH derivative	14423	50 mg
Acetone, DAIH derivative	02819	50 mg
Acrolein, DAIH derivative	13173	50 mg
Crotonaldehyde, DAIH derivative	55556	50 mg
Cyclohexanone, DIAH derivative	91547	50 mg
Formaldehyde, DAIH derivative	06947	50 mg
Propionaldehyde, DAIH derivative	51299	50 mg

Aldehyde & Ketone DNPH Derivatives, Neats & Solutions

These solutions of DNPH derivatives are designed as quantitative calibration mixtures where a multi-component solution is not suitable. At concentration indicated in 1 mL (actual filling 1.1-1.2 mL) acetonitrile, in amber glass ampul.

Description	Concentration	Pkg.	Cat. No.
2,5-Dimethylbenzaldehyde-2,4-DNPH		100 mg	442321-U
2-Butanone-2,4-DNPH		100 mg	442339
2-Butanone-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47344
Acetaldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47340-U
Acetaldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	5 x 1 mL	4M7340-U
Acetaldehyde-2,4-DNPH		100 mg	442434
Acetone-2,4-DNPH		50 mg	442436
Acrolein-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47342
Acrolein-2,4-DNPH		25 mg	442441
Benzaldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47343
Benzaldehyde-2,4-DNPH		100 mg	442469
Butyraldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47345-U
Butyraldehyde-2,4-DNPH		100 mg	442504
Crotonaldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47175-U
Crotonaldehyde-2,4-DNPH		100 mg	442529
Cyclohexanone DNPH solution	500 µg/mL in acetonitrile	1 mL	47673-U
Cyclohexanone DNPH		10 mg	442533
Decanal 2,4-dinitrophenylhydrazone		100 mg	33852
Formaldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47177
Formaldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	5 x 1 mL	4M7177
Formaldehyde-2,4-DNPH		100 mg	442597
Formaldehyde-2,4-DNPHydrazide solution	100 µg/mL in acetonitrile	3 x 2 mL	49208-U
Glutaraldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47564-U
Heptanal 2,4-dinitrophenylhydrazone		100 mg	33848
Hexaldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47178-U
Hexaldehyde-2,4-DNPH		100 mg	442614
Isobutyraldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47886
Isovaleraldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47179
Methacrolein-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47180-U
Methacrolein-2,4-DNPH		100 mg	442639
Nonanal 2,4-dinitrophenylhydrazone		100 mg	33851
Octanal 2,4-dinitrophenylhydrazone		100 mg	33849
o-Phthaldialdehyde-$(DNPH)_2$ solution	10 µg/mL in acetonitrile/DMSO (7:3)	1 mL	47032-U
m-Tolualdehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47183
o-Tolualdehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47182
o-Tolualdehyde-2,4-DNPH		100 mg	442722
p-Tolualdehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47184-U
p-Tolualdehyde-2,4-DNPH		100 mg	442735
Propionaldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47181
Propionaldehyde-2,4-DNPH		100 mg	442768
Valeraldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47185-U
Valeraldehyde-2,4-DNPH		100 mg	442834

Analytical Columns for Carbonyl DNPH Analysis

Discovery RP Amide, 25 cm x 4.6 mm I.D., 5 µm	1	505064
Ascentis C18, 15 cm x 4.6 mm I.D., 3 µm	1	581322-U
Ascentis C18, 25 cm x 4.6 mm I.D., 5 µm	1	581325-U
Ascentis RP-Amide, 15 cm x 4.6 mm I.D., 3 µm	1	565322-U
Ascentis RP-Amide, 25 cm x 4.6 mm I.D., 5 µm	1	565325-U

Alternative Aldehyde and Ketone Derivatives

NIOSH and OSHA Methods

NIOSH and OSHA Methods for Workplace Atmospheres

The following standards are for use with methods listed in OSHA and NIOSH manuals of methods for analysis of workplace contaminants. The standards are quantitative formulations for use as chromatographic calibration or spiking solutions. Products include a Certificate of Analysis describing lot-specific production and analytical information.

Free data packets containing data on raw materials and final production are available for most products. Request the data packet when ordering the standard; the order number is the same as that for the standard, preceded by the letters DP.

NIOSH 2541/OSHA 52: Analysis of Formaldehyde in Indoor Air

Description standard type calibration	Concentration	Pkg.	Cat. No.
Formaldehyde Oxazolidine solution	2000 µg/mL in toluene	1 mL	48414

US EPA IP Methods

Compendium of Methods for the Determination of Air

The following standards are for use with EPA document number EPA/600/4-90/010. The standards are quantitative formulations for use as chromatographic calibration or spiking solutions. Products include a Certificate of Analysis describing lot-specific production and analytical information. Free data packets are available for these products. Data packets contain data on raw materials and final production. Request the data packet when ordering the standard; the order number is the same as that for the standard, preceded by the letters DP.

IP1: Analysis of Volatile Organics (BP 80-200 °C) in Indoor Air by GC-MS

Description standard type calibration	Concentration		Pkg.	Cat. No.
EPA TO-1 Toxic Organic Mix 1A	2 mg/mL each component in methanol		1 mL	48896
Benzene	*Heptane*	*o-Xylene*		
Cumene	*1-Heptene*	*m-Xylene*		
Ethylbenzene	*Toluene*	*p-Xylene*		
EPA TO-1 Toxic Organic Mix 1B	2 mg/mL each component in methanol		1 mL	48897
Acrylonitrile	*Chlorobenzene*	*1,3-Dichloropropane*		
Allyl chloride	*Chloroform*	*Tetrachloroethylene*		
Bromobenzene	*1,2-Dibromoethane*	*1,1,1-Trichloroethane*		
Bromoform	*1,2-Dichloroethane*	*Trichloroethylene*		
Carbon tetrachloride	*1,2-Dichloropropane*			

IP6: Analysis of Aldehydes and Ketones in Indoor Air by HPLC/UV

Description standard type calibration	Concentration		Pkg.	Cat. No.
TO-11/IP-6A Aldehyde/Ketone-DNPH Mix	15 µg/mL each component in acetonitrile (aldehyde equivalent)		1 mL	47285-U
			3 × 1 mL	4M7285-U
Acetaldehyde-2,4-dinitrophenylhydrazone	*Crotonaldehyde-2,4-dinitrophenylhydrazone*	*Propionaldehyde-2,4-dinitrophenylhydrazone*		
Acetone-2,4-dinitrophenylhydrazone	*2,5-Dimethylbenzaldehyde 2,4-dinitrophenylhydrazone*	*o-Tolualdehyde 2,4-dinitrophenylhydrazone*		
Acrolein-2,4-dinitrophenylhydrazone	*Formaldehyde-2,4-dinitrophenylhydrazone*	*m-Tolualdehyde 2,4-dinitrophenylhydrazone*		
Benzaldehyde-2,4-dinitrophenylhydrazone	*Hexaldehyde-2,4-dinitrophenylhydrazone*	*p-Tolualdehyde 2,4-dinitrophenylhydrazone*		
Butyraldehyde-2,4-dinitrophenylhydrazone	*Isovaleraldehyde 2,4-dinitrophenylhydrazone*	*Valeraldehyde-2,4-dinitrophenylhydrazone*		

US EPA TO Methods

Toxic Organic Compounds in Air (TO)

TO-1: Volatile Organic Compounds

Description standard type calibration	Concentration		Pkg.	Cat. No.
EPA TO-1 Toxic Organic Mix 1A	2 mg/mL each component in methanol		1 mL	48896
Benzene	*Heptane*	*o-Xylene*		
Cumene	*1-Heptene*	*m-Xylene*		
Ethylbenzene	*Toluene*	*p-Xylene*		
EPA TO-1 Toxic Organic Mix 1B	2 mg/mL each component in methanol		1 mL	48897
Acrylonitrile	*Chlorobenzene*	*1,3-Dichloropropane*		
Allyl chloride	*Chloroform*	*Tetrachloroethylene*		
Bromobenzene	*1,2-Dibromoethane*	*1,1,1-Trichloroethane*		
Bromoform	*1,2-Dichloroethane*	*Trichloroethylene*		
Carbon tetrachloride	*1,2-Dichloropropane*			

TO-2: Volatile Organic Compounds

Description standard type calibration	Concentration		Pkg.	Cat. No.
EPA Toxic Organic Mix 2A	2 mg/mL each component in methanol		1 mL	48898
Dichloromethane	*Vinyl chloride*	*Vinylidene chloride*		

TO-5/TO-11: Aldehydes and Ketones by HPLC/UV

Description standard type calibration	Concentration		Pkg.	Cat. No.
TO11/IP-6A Aldehyde/Ketone-DNPH Mix	15 µg/mL each component in acetonitrile (aldehyde equivalent)		1 mL 3 x 1 mL	47285-U 4M7285-U
Acetaldehyde-2,4-dinitrophenylhydrazone	*Benzaldehyde-2,4-dinitrophenylhydrazone*	*2,5-Dimethylbenzaldehyde-2,4-dinitro-phenylhydrazone*		
Acetone-2,4-dinitrophenylhydrazone	*Butyraldehyde-2,4-dinitrophenylhydrazone*			
Acrolein-2,4-dinitrophenylhydrazone	*Crotonaldehyde-2,4-dinitrophenylhydrazone*	*Formaldehyde-2,4-dinitrophenylhydrazone*		

TO-11A Formaldehyde by HPLC

Description	Concentration		Pkg.	Cat. No.
TO-11A Six Component Carbonyl-DNPH Mix	15 µg/mL each component in acetonitrile		1.5 mL	48149-U
Acetaldehyde-2,4-dinitrophenylhydrazone	*Acrolein-2,4-dinitrophenylhydrazone*	*Formaldehyde-2,4-dinitrophenylhydrazone*		
Acetone-2,4-dinitrophenylhydrazone	*Crotonaldehyde-2,4-dinitrophenylhydrazone*	*Propionaldehyde-2,4-dinitrophenylhydrazone*		

TO-15/17 Volatile Organic Compounds by GC-MS

Description	Concentration	Pkg.	Cat. No.
TO-15/17 Calibration Mix (62 components)	100 ppb each in N_2	110 L	**41974-U**
	1 ppm each in N_2	110 L	**41973-U**

Acetone
Benzene
*Benzyl chloride**
Bromoform
Bromomethane
Bromodichloromethane
1,3-Butadiene
2-Butanone (MEK)
*Carbon disulfide**
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Cyclohexane
Chloromethane
Dibromochloromethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
1,4-Dioxane
*Ethanol**
Ethyl acetate
Ethylbenzene
Ethyl dibromide (1,2-dibromoethane)
4-Ethyltoluene
Freon® 11 (Trichlorofluoromethane)
Freon 12 (Dichlorodifluoromethane)
Freon 113 (1,1,2-Trichlorotrifluoroethane)
Freon 114 (1,2-Dichlorotetrafluoroethane)
Heptane
Hexachloro-1,3-butadiene
Hexane
2-Hexanone (MBK)
4-Methyl-2-pentanone (MIBK)
Methylene chloride
Methyl-tert-butylether (MTBE)
*2-Propanol**
Propylene
Styrene
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Tetrahydrofuran
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Vinyl acetate
Vinyl chloride
m-Xylene
o-Xylene
p-Xylene

Blend Tolerance and Analytical Accuracy = +/- 25% (**41974-U**)

TO-15/17 Subset 25 Component Calibration Mix	100 ppb in N_2	110 L	**41979-U**
	1 ppm in N_2	110 L	**41978-U**

Acetone
Allyl chloride
*Benzyl chloride**
Bromodichloromethane
Bromoform
1,3-Butadiene
2-Butanone (MEK)
*Carbon disulfide**
Cyclohexane
Dibromochloromethane
1,4-Dioxane
Ethyl acetate
4-Ethyltoluene
Heptane
Hexane
2-Hexanone (MBK)
4-Methyl-2-pentanone (MIBK)
Methyl-tert-butylether (MTBE)
*2-Propanol**
Propylene
Tetrahydrofuran
trans-1,2-Dichloroethene
2,2,4-Trimethylpentane
Vinyl acetate
Vinyl bromide

*** Blend Tolerance and Analytical Accuracy = +/- 25% (41979-U)**

TO-15 SUBSET A (12 Components)	1 ppm in N_2	110 L	**41983-U**

Acetonitrile
Acrylonitrile
Allyl chloride
*Benzyl chloride**
1,3-Butadiene
Ethyl bromide
Hexane
Methyl ethyl ketone
Methyl-isobutyl-ketone
2,2,4-Trimethylpentane
Vinyl acetate
Vinyl bromide

*** Blend Tolerance and Analytical Accuracy = +/- 25%**

Ozone Precursor / PAMS Method

Description	Concentration	Pkg.	Cat. No.
Ozone Precursor / PAMS Mix (57 components)	100 ppb each in N_2	110 L	41975-U
	1 ppm each in N_2	110 L	41976-U
	EPA Conc. ppbC in N_2	110 L	41977-U

Acetylene
Benzene
n-Butane
1-Butene
cis-2-Butene
trans-2-Butene
Cyclohexane
Cyclopentane
n-Decane
m-Diethylbenzene
p-Diethylbenzene
2,2-Dimethylbutane
2,3-Dimethylbutane
2,3-Dimethylpentane
2,4-Dimethylpentane
n-Dodecane
Ethane
Ethylbenzene
Ethylene
m-Ethyltoluene
o-Ethyltoluene
p-Ethyltoluene
n-Heptane
n-Hexane
1-Hexene
Isobutane
Isopentane
Isoprene
Isopropylbenzene
Methylcyclohexane
Methylcyclopentane
2-Methylheptane
3-Methylheptane
2-Methylhexane
3-Methylhexane
2-Methylpentane
3-Methylpentane
n-Nonane
n-Octane
n-Pentane
1-Pentene
cis-2-Pentene
trans-2-Pentene
Propane
n-Propylbenzene
Propylene
Styrene
Toluene
1,2,3-Trimethylbenzene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
2,2,4-Trimethylpentane
2,3,4-Trimethylpentane
n-Undecane
m/p-Xylene (combined)
o-Xylene

Alternative VOC Methods

Description	Concentration	Pkg.	Cat. No.
Massachusetts APH Mix (26 components)	EPA Concentrations, in N_2	110 L	41982-U

	ppmv		ppmv		ppmv
Benzene	*0.5*	*n-Heptane*	*0.25*	*Toluene*	*2*
1,3-Butadiene	*1*	*n-Hexane*	*0.5*	*Toluene-d_8 (IS)*	*0.5*
Butylcyclohexane	*1*	*Isopentane*	*0.5*	*1,2,3-Trimethylbenzene*	*1*
Cyclohexane	*0.5*	*Isopropylbenzene*	*0.25*	*1,3,5-Trimethylbenzene*	*0.5*
n-Decane	*0.25*	*p-Isopropyltoluene*	*1*	*n-Undecane*	*0.25*
2,3-Dimethylheptane	*0.25*	*1-Methyl-3-ethylbenzene*	*1*	*m- & p-Xylene (50% each)*	*2*
2,3-Dimethylpentane	*1*	*Methyl tert-butyl ether (MTBE)*	*1*	*o-Xylene*	*0.5*
n-Dodecane	*0.25*	*n-Nonane*	*0.25*		
Ethylbenzene	*1*	*n-Octane*	*0.5*		

Japanese Air Monitoring Methods

Description	Concentration	Pkg.	Cat. No.
Japanese 50-Component Indoor Air Standard	100 µg/mL in methanol:water (95:5)	1 x 1 mL	49148-U
	100 µg/mL in methanol:water (95:5)	3 x 1 mL	4M9148-U
	1000 µg/mL in methanol:water (97:3)	1 x 1 mL	49149-U

Acetone
1-Butanol
Chloroform
Dibromochloromethane
Dichloromethane
Dodecane
Ethylbenzene
4-Ethyltoluene
Hexane
Nonane
Pentadecane
1-Propanol
Tetrachloroethylene
Toluene
1,2,3-Trimethylbenzene
2,2,4-Trimethylpentane (isooctane)
o-Xylene
Benzene
2-Butanone
Decanal
1,4-Dichlorobenzene
1,2-Dichloropropane
Ethanol
2-Ethyltoluene
Heptane
(R)-(+)-Limonene
1-Nonanol
(1S)-(-)-alpha-Pinene
2-Propanol
Tetradecane
Trichloroethylene
1,2,4-Trimethylbenzene
Undecane
p-Xylene
Bromodichloromethane
Butyl acetate
Decane
1,2-Dichloroethane
2,4-Dimethylpentane
Ethyl acetate
3-Ethyltoluene
Hexadecane
4-Methyl-2-pentanone
Octane
(-)-beta-Pinene
Styrene
1,2,4,5-Tetramethylbenzene
Tridecane
1,3,5-Trimethylbenzene (mesitylene)
m-Xylene

Japan Calibration Mix (9 components)	1 ppm in N_2	110 L	41981-U

1,2-Dichloroethane
1,3-Butadiene
Acrylonitrile
Benzene
Chloroform
Dichloromethane
Tetrachloroethylene
Trichloroethylene
Vinyl chloride
Balance Gas - Nitrogen

How to Order Custom-Made Sampling Tubes

To order custom-made air sampling tubes, simply complete this form, then fax or mail us a copy, or call us and provide the information. U.S.: Phone 800-247-6628 or 814-359-3441; Fax 800-447-3044 or 814-359-3044. All other countries, contact your local Sigma-Aldrich office.

Name: _____

Address: _____

Phone/Fax: _____ email: _____

May we contact you by email? ❍ Yes ❍ No

❍ Solvent Desorption Tubes or ❍ Thermal Desorption Tubes ❍ Repeat Order? (Previous MR#)

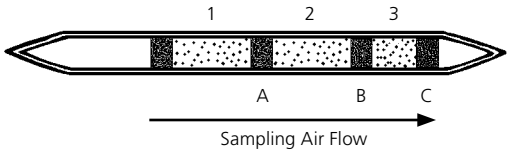
Quote Number: _____

Number of Tubes: _____

Application _____

Tube Specifications

Solvent Desorption Tubes



❍ 6 mm O.D. glass _____

❍ 7 mm O.D. glass _____

❍ 8 mm O.D. glass _____

❍ 10 mm O.D. glass _____

❍ Other O.D.: _____

Length: _____

_____

Retaining Plugs:

Silanized glass wool	❍ A	❍ B	❍ C
Glass wool	❍ A	❍ B	❍ C
Foam	❍ A	❍ B	❍ C

❍ Stainless steel clip

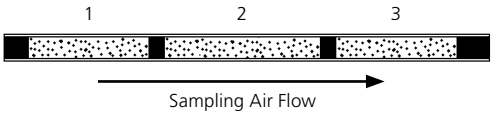
Adsorbent(s) and Bed Weight(s):[1]

1. _____

2. _____

3. _____

Thermal Desorption Tubes



❍ Glass

❍ Stainless steel

Dimensions:

O.D.: _____ I.D.: _____

Length: _____

Length: _____

Length of heated zone of instrument: _____

Retaining Plugs:

❍ Fritted (in glass tubes only)
❍ Glass wool
❍ Screens (in stainless steel tubes only)
❍ Stainless steel clip (in glass tubes only)

TDU Instrument*: Model No.: _____

❍ CDS Analytical	❍ Chrompak	❍ Dynatherm
❍ Entech	❍ Envirochem	❍ GERSTEL
❍ Markes International	❍ OI Analytical	❍ PerkinElmer
❍ Teledyne-Tekmar		

*If your instrument is not listed, please contact Technical Service.

Adsorbent(s) and Bed Weight(s) or Length(s):[1]

1. _____

2. _____

3. _____

Comments/Special Request:

_____

_____

_____

[1] Up to three beds available.

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SUPELCO

Air Methods Guide

2nd edition

T411091D

ISO 9001 REGISTERED

SUPELCO

Supelco Air Methods Guide

The Supelco Air Methods Guide is a resource of sampling and analytical methods for more than 1000 compounds in air. Air monitoring of many matrices – workplace, indoor, ambient, and source – are integrated into this one easy-to-read reference.

The guide lists:

- compound (alphabetically)
- method reference
- sample volume and flow rate
- sampling media description and Supelco catalog number
- analytical technique

Note that a compound of interest may be listed by more than one chemical name and/or category classification (e.g., VOCs).

The guide also features:

- NIOSH, OSHA, EPA, and ASTM validated methods
- cross reference to SKC part numbers
- latest updates through May 1999

Please note:
This guide is for general information only. It is not intended to replace careful review of applicable agency methods, equipment operating instructions, or national or regional legal regulations.

Key to Abbreviations

Sampling Devices

Abbrev.	Description
1-2PP	1-(2-pyridyl)piperazine
2-HMP	2-(hydroxymethyl)piperadine
c/w	coated with
DMBA	3,4-dimethoxybenzylamine
DNPH	2,4-dinitrophenylhydrazine
DOP	di-n-octyl phthalate
MCE	mixed cellulose ester
NBDC	7-chloro-4-nitrobenzo-2-oxa-1,3-diazole
NITC	1-naphthylisothiocyanate
NPMPA	N-[(4-nitrophenyl)methyl]propylamine
OVS	OSHA versatile sampler
PVC	polyvinyl chloride
t/w	treated with
TBC	4-tert-butylcatechol
TEA	triethanolamine

Other

Abbrev.	Description
NA	not available

Trademarks

Anasorb – SKC, Inc.
Cellosolve – Union Carbide Corp.
Chromosorb – Celite Corp.
Florisil – U.S. Silica Co.
Freon – E.I. duPont de Nemours & Co., Inc.
Gas Chrom – Applied Science Laboratories, Inc.
Hopcalite – Mine Safety Appliances Company.
Porapak – Waters Associates, Inc.
Tedlar – E.I. du Pont de Nemours & Co., Inc.
Teflon – E.I. du Pont de Nemours & Co., Inc.
Tenax – Enka Research Institute Arnhem
XAD – Rohm and Haas Co.
Carbosieve, Carbotrap, Carboxen, ORBO, Supelpak – Sigma-Aldrich Co.

Analytical Techniques

Abbrev.	Description
AACV	atomic adsorption cold vapor
AAFAG	atomic adsorption flame arsine generation
AAGF	atomic adsorption graphite furnace
AAS	atomic adsorption spectrophotometry
AAS-HGA	flame atomic adsorption spectrophotometry - heated graphite furnace atomizer
ASV	anodic stripping voltametry
DPP	differential pulse polarography
EGA-TOA	evolved gas analysis - thermal optical sensor
ELISA	enzyme linked immunosorbent assay
FAAS	flame atomic adsorption spectrophotometry
GC-AED	gas chromatography - atomic emission detector
GC-ECD	gas chromatography - electron capture detector
GC-ECN	gas chromatography - electrolytic conductivity detector
GC-ELCD	gas chromatography - electrochemical detector
GC-FID	gas chromatography - flame ionization detector
GC-FPD	gas chromatography - flame photometric detector
GC-MS	gas chromatography - mass spectrometry
GC-NPD	gas chromatography - nitrogen/phosphorus detector
GC-PID	gas chromatography - photoionization detector
GC-SCLD	gas chromatography - sulfur chemiluminescence detector
GC-TCD	gas chromatography - thermal conductivity detector
GC-TEA	gas chromatography - thermal energy analyzer
HPLC-AAGF	high performance liquid chromatography - atomic adsorption graphite furnace
HPLC-FL	high performance liquid chromatography - fluorescence
HPLC-TEA/UV	high performance liquid chromatography - thermal energy analyzer/ultraviolet
HPLC-UV	high performance liquid chromatography - ultraviolet
HPLC-UV/ELCD	high performance liquid chromatography - ultraviolet/electrochemical detector
HPLC-UV/FL	high performance liquid chromatography - ultraviolet/fluorescence
HPLC-VIS	high performance liquid chromatography - visible absorption spectrophotometry
IC	ion chromatography
IC-AAS	ion chromatography - atomic absorption spectrophotometry
IC-CD	ion chromatography - conductivity detector
IC-ELCD	ion chromatography - electrochemical detector
IC-PCR	ion chromatography - post-column reactor
IC-PED	ion chromatography - pulsed electrochemical detector
IC-UV	ion chromatography - ultraviolet
ICP-AES	inductively coupled plasma/atomic emission spectroscopy
IR	infrared spectrophotometry
ISE	ion-specific electrode
NDIR	nondispersive infrared spectrophotometry
PCD	post-column derivatization
PCM	phase contrast microscopy
PES	plasma emission spectrometry
PLM	polarized light microscopy
TD-GC/MS	thermal desorption - gas chromatography - mass spectrometry
TD-IR	thermally desorbed infrared spectrophotometry
TEM	transmission electron microscopy
UV	ultraviolet
VIS	visible absorption spectrophotometry
XPD	x-ray powder diffraction
XRD	x-ray diffraction
XRF	x-ray fluorescence
XRF/XRD	x-ray fluorescence/x-ray diffraction

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Acenaphthene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Acenaphthene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Acenaphthylene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Acenaphthylene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Acetaldehyde	NIOSH 2538	1-12	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-25	20357	226-27	GC-FID
Acetaldehyde	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2 HMP	ORBO-23	20257-U	226-118	GC-FID
Acetaldehyde	NIOSH 3507	6-60	0.1-0.5	fritted bubbler	-----	64835-U	225-36-2	HPLC-UV
Acetaldehyde	OSHA 68	3	0.05	XAD-2 c/w 2-HMP	ORBO-25	20357	226-27	GC-NPD
Acetic Acid	NIOSH 1603	20-300	0.01-0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Acetic Acid	US Army	10-25		Chromosorb P c/w Na2CO3	ORBO-70	20256-U	NA	GC-FID
Acetic Anhydride	NIOSH 3506	25-100	0.2-1	fritted bubbler	-----	64835-U	225-36-2	VIS
Acetic Anhydride	OSHA 102	7.5	0.05-0.5	glass fiber filter c/w DMBA & DOP	894	custom	225-9010	GC-NPD
Acetic Anhydride	OSHA 82	0.75	0.05	glass fiber filter c/w 1-2PP	821	custom	225-9009	GC-NPD
Acetone	NIOSH 1300	0.50-3	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Acetone	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Acetone	OSHA 69	3	0.05	Carbosieve S-III (Anasorb CMS)	ORBO-91	20360	226-121	GC-FID
Acetone Cyanohydrin	NIOSH 2506	0.30-12	0.2	Porapak QS	ORBO-1101	20061	226-59-09	GC-NPD
Acetonitrile	NIOSH 1606	1-25	0.01-0.2	coconut charcoal	ORBO-32L	20228	226-09	GC-FID
Acetylene Dichloride	NIOSH 1003	0.2-5	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Acetylene Tetrabromide	NIOSH 2003	50-100	0.2-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Acetylene Tetrachloride	NIOSH 1019	3-30	0.01-0.2	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
Acid Mist	OSHA ID 165SG	96	0.20	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Acids, Inorganic	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Acridine	OSHA 58	960	2	glass fiber filter	-----	23378	225-7	HPLC-UV
Acrolein	NIOSH 2501	1.50-48	0.01-0.1	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-NPD
Acrolein	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Acrolein	OSHA 52	48	0.1	XAD-2 c/w 2-HMP	ORBO-24	20231	226-117	GC-NPD
Acrylamide	OSHA 21	120	1	silica gel glass fiber filter	ORBO-52S ----	20229 23376	226-10 225-16	GC-NPD
Acrylic Acid	OSHA 28	24	0.1	XAD-8	ORBO-601	20048	226-30-08	HPLC-UV
Acrylic acid	OSHA 312	24	0.1	(2) XAD-8	ORBO-601	20048	226-30-08	HPLC-UV
Acrylonitrile	NIOSH 1604	3.50-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Acrylonitrile	OSHA 37	20	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-NPD
Aerobic Bacteria by GC-FAME	NIOSH 0801	50-300	28.30	Andersen Impactor				GC-FID
Air Exchange Rate	EPA IP-4A			perfluorocarbon tracer				GC-ECD
Air Exchange Rate	EPA IP-4B			tracer gas				GC-ECD
Alachlor	NIOSH 5603	70-1750	1	SPE disk				ELISA
Aldehydes	EPA 0011			DNPH absorbing solution				HPLC-UV
Aldehydes (screening)	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Aldehydes/Ketones	EPA 0100		1	silica gel c/w DNPH	LpDNPH S10	21026-U	226-119	HPLC-UV
Aldehydes/Ketones	EPA IP-6A		0.5-1.2	silica gel c/w DNPH	LpDNPH S10	21026-U	226-119	HPLC-UV
Aldehydes/Ketones	EPA IP-6B			continuous colorimetric analyzer				colorimetric
Aldehydes/Ketones	EPA IP-6C			diffusive sampler	-----	NA		HPLC-UV
Aldehydes/Ketones	EPA TO-11A	280	0.1-2	silica gel c/w DNPH ozone scrubber	LpDNPH S10 -----	21026-U 505285	226-119 NA	HPLC-UV
Aldehydes/Ketones	EPA TO-5	<80	0.1-1	DNPH absorbing solution				HPLC-UV
Aldicarb (Temik)	OSHA 74	480	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	GC-NPD
Aldrin	NIOSH 5502	18-240	0.2-1	glass fiber filter fritted bubbler	----- -----	23378 64835-U	225-7 225-36-2	GC-ECD
Alkaline Dusts	NIOSH 7401	70-1000	1-4	PTFE filter	-----	23383	225-1710	titration
Allyl Alcohol	NIOSH 1402	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Allyl Chloride	NIOSH 1000	16-100	0.01-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Allyl Chloride	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Allyl Glycidyl Ether	NIOSH 2545	1.5-8	0.01-0.2	Tenax	ORBO-402	20832-U	226-35-03	GC-FID
Allyl Trichloride	NIOSH 1003	2-60	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Alumina	NIOSH 0500	7-133	1-2	PVC filter	-----	23387	225-8-01	gravimetric
Aluminum	NIOSH 7300	5-100	1-4	MCE filter	-----	23381	225-5	ICP-AES
Aluminum, Al compounds (as Al)	NIOSH 7013	10-400	1-3	MCE filter	-----	23381	225-5	FAAS
Amines, Aliphatic	NIOSH 2010	3-30	0.01-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Amines, Aliphatic	Supelco			Carbotrap	ORBO-100	20255-U	NA	GC-NPD
Amines, Aromatic	NIOSH 2002	30-150	0.2-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Aminobenzene	NIOSH 2002	30-150	0.2-1	silica gel	ORBO-52S	20229	226-10	GC-FID
4-Aminodiphenyl (4-Aminobiphenyl)	NIOSH 4/269	0.2		silica gel glass fiber filter	ORBO-502 -----	20030-U 23376	226-51 225-16	GC-FID
4-Aminodiphenyl (4-Aminobiphenyl)	OSHA 93	100	1.0	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
Aminoethanol Compounds II	NIOSH 3509	5-300	0.5-1	impinger	-----	20270-U	225-36-1	IC
2-Aminoethanol (Ethanolamine)	NIOSH 2007	4-24	0.01-0.2	silica gel	ORBO-506	20032	226-10-04	GC-FID
2-Aminoethanol (Ethanolamine)	NIOSH 3509	5-300	0.5-1	impinger	-----	20270-U	225-36-1	IC
p-Aminophenylarsonic Acid	NIOSH 5022	50-1000	1-3	PTFE filter	-----	23383	225-1710	IC-AAS
2-Aminopyridine	NIOSH 4/S158	12	0.01-0.2	Tenax	ORBO-405	custom	226-35	GC-FID
2-Aminotoluene	NIOSH 2002	10-150	0.02-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Ammonia	NIOSH 6015	0.1-96	0.1-0.2	silica gel c/w H2SO4	ORBO-555	custom	226-10-06	VIS
Ammonia	NIOSH 6016	0.1-96	0.1-0.5	silica gel c/w H2SO4	ORBO-555	custom	226-10-06	IC-CD
Ammonia	OSHA ID 188	7.50-24	0.1-0.5	Purosieve c/w H2SO4	ORBO-77	20036	226-29	IC
Ammonium Sulfamate	NIOSH 5/S348	90	1.5-2	MCE filter	-----	23381	225-5	IC-CD
Amyl Acetate	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
n-Amyl Acetate	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Amyl Acetate	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
sec-Amyl Acetate	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
sec-Amyl Acetate	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Aniline	NIOSH 2002	5-30	0.02-0.2	silica gel	ORBO-52S	20229	226-10	GC-FID
Aniline	NIOSH 2017	5-50	0.2	silica gel + glass fiber filter c/w H2SO4	ORBO-507 822	20870-U 20065	226-15 225-9004	GC-FID
Anisidine	NIOSH 2514	24-320	0.5-1	XAD-2	ORBO-608	20050-U	226-30-05	HPLC-UV
Anthracene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Anthracene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Anthracene	OSHA 58	960	2	glass fiber filter	-----	23378	225-7	HPLC-UV
Antimony	NIOSH 1/173	180	1.5	MCE filter	-----	23381	225-5	AAS
Antimony	NIOSH 1/189		1.5-2	MCE filter	-----	23381	225-5	ASV
Antimony	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Antimony, Sb Compounds (as Sb)	NIOSH 2/S2		1.5	MCE filter	-----	23381	225-5	AAS
Antimony, Sb Compounds (as Sb)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Antimony, Sb Compounds (as Sb)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Antimony Particulates	NIOSH 4/261	45	1.5	MCE filter	-----	23381	225-5	AAGF
ANTU (Alphanaphthyl thiourea)	NIOSH 5/S276	480	1.5-2	PTFE filter	-----	23383	225-1710	HPLC-UV
Aqua Fortis	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
p-Arsanilic acid	NIOSH 5022	50-1000	1-3	PTFE filter	-----	23383	225-1710	IC-AAS
Arsenic	NIOSH 7300	5-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Arsenic, As Compounds (as As)	NIOSH 7900	30-1000	1-3	MCE filter	-----	23381	225-5	AAFAG
Arsenic, Organo	NIOSH 5022	50-1000	1-3	PTFE filter	-----	23383	225-1710	IC-AAS

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Arsenic, Particulate & Volatiles	OSHA ID 105	480-960	2	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	AAGF
Arsenic Trioxide (as As)	NIOSH 7901	30-1000	1-3	MCE filter w/ support pad c/w Na2CO3	824	20067	NA	AAGF
Arsine	NIOSH 6001	0.1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	AAGF
Arsine	OSHA ID 105	120-240	0.5	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	AAGF
Asbestos	NIOSH 9000			bulk		-----		XRD
Asbestos	NIOSH 9002			bulk		-----		PLM
Asbestos	OSHA ID 191			bulk		-----		PLM
Asbestos Fibers	NIOSH 7400	400-	0.5-16	MCE filter	-----	23380-U	225-19	PCM
Asbestos Fibers	NIOSH 7402	400-	0.5-16	MCE filter	-----	23380-U	225-19	TEM
Asbestos in Air	OSHA ID 160	25-1200	0.5-2.5	MCE filter	-----	23380-U	225-19	PCM
Aspartame	NIOSH 5031	70-1200	1-3	PTFE filter	-----	23383	225-1710	HPLC-UV
Asphalt Fumes (Petroleum)	OSHA 58	960	2	glass fiber filter	-----	23378	225-7	HPLC-UV
Azelaic Acid	NIOSH 5019	200-1000	1-3	PVC filter	-----	23387	225-8-01	GC-FID
Azinphos, Methyl	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Barium	NIOSH 1/173	180	1.5	MCE filter	-----	23381	225-5	AAS
Barium (soluble compounds)	NIOSH 7056	50-2000	1-4	MCE filter	-----	23381	225-5	AAS
Barium (soluble compounds)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Benz(a)anthracene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Benz(a)anthracene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Benzaldehyde	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Benzene	NIOSH 1500	2-30	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Benzene	NIOSH 1501	5-30	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Benzene	NIOSH 2549	1-6	0.01-0.5	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Benzene	NIOSH 3700	<80% vol	0.02-5	5L sampling bag	-----	24655	232-05	GC-PID
Benzene	OSHA 12	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Benzene-Soluble Fraction & Total Particulate (Asphalt Fume)	NIOSH 5042	28-400	1-4	PTFE filter	-----	23390-U	225-17-07	gravimetric
Benzene-Soluble Particulate Matter	ASTM D4600	960	2	glass fiber filter	-----	23378	225-7	gravimetric
Benzidine	NIOSH 5509	20-100	0.2	glass fiber filter	-----	23376	225-16	HPLC-UV
Benzidine	OSHA 65	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
Benzidine Dyes	NIOSH 5013	150-500	1-3	PTFE filter	-----	23389	225-17	HPLC-UV
Benzin (petroleum ether)	NIOSH 1550	1.3-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Benzo(a)pyrene (BAP)	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Benzo(a)pyrene (BAP)	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Benzo(a)pyrene (BAP)	OSHA 58	960	2	glass fiber filter	-----	23378	225-7	HPLC-UV
Benzo(b)fluoranthene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Benzo(b)fluoranthene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Benzo(e)pyrene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Benzo(e)pyrene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Benzo(ghi)perylene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Benzo(ghi)perylene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Benzo(k)fluoranthene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Benzo(k)fluoranthene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Benzothiazole in Asphalt Fume	NIOSH 2550	480-960	1-2	XAD-2 PTFE filter	ORBO-42L -----	20264-U 23390-U	NA 225-17-07	GC-SCLD
Benzoyl Peroxide	NIOSH 5009	40-400	1-3	MCE filter	-----	23381	225-5	HPLC-UV
Benzyl Chloride	NIOSH 1003	6-50	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Benzyl Chloride	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Beryllium	NIOSH 7300	1250-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Beryllium	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Beryllium, Be Compounds (as Be)	NIOSH 7102	25-1000	1-4	MCE filter	-----	23381	225-5	AAGF
BHT (Butylated Hydroxytoluene)	NIOSH 1/226	10	0.2	silica gel	ORBO-504	20031	NA	GC-FID
Bioaerosol Sampling	NIOSH 0800			Andersen cascade impactor Andersen N-6 sampler				
Biphenyl (Diphenyl)	NIOSH 2530	15-30	0.01-0.5	Tenax	ORBO-404	custom	226-35-01	GC-FID
bis-Chloromethyl Ether	NIOSH 1/213	5	0.08	Chromosorb 101	ORBO-703	custom	226-102	GC-MS
bis-Chloromethyl Ether	OSHA 10	50	0.5	fritted bubbler	-----	64835-U	225-36-2	GC-ECD
Bismuth	NIOSH 1/173	180	1.5	MCE filter	-----	23381	225-5	AAS
Bisphenol A (BPA)	NIOSH 6/333	288	1.6	glass fiber filter	-----	23378	225-7	HPLC-UV
Boroethane (Diborane)	NIOSH 6006	60-260	0.5-1	charcoal c/w oxidizer PTFE filter	ORBO-352 -----	20043 special order	226-151	PES
Boron Carbide	NIOSH 7506	100-1000	1.7 or 2.2	PVC filter	-----	23387	225-8-01	XPD
Boron Oxide	NIOSH 0500	25-133	1.5-2	PVC filter	-----	23387	225-8-01	gravimetric
BPA (Bisphenol A)	NIOSH 6/333	288	1.6	glass fiber filter	-----	23378	225-7	HPLC-UV
Bromine	NIOSH 6011	8-360	0.3-1	PTFE filter + silver membrane	885	custom	225-9006	IC-CD
Bromine	OSHA ID 108	7.5-30	0.5	fritted bubbler	-----	64835-U	225-36-2	IC
Bromoethane (Ethyl Bromide)	NIOSH 1011	0.5-4	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Bromoform	NIOSH 1003	4-70	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Bromoform	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Bromotrifluoromethane	NIOSH 1017	0.1-1	0.01-0.05	(2) coconut charcoal	ORBO-32S + ORBO-32L	20267-U 20228	226-01 226-09	GC-FID
Bromoxynil	NIOSH 5010	2-400	1-3	PTFE filter	-----	23390-U	225-17-07	HPLC-UV
Bromoxynil Octanoate	NIOSH 5010	90-400	1-3	PTFE filter	-----	23390-U	225-17-07	HPLC-UV
1,3-Butadiene	NIOSH 1024	5-25	0.01-0.5	coconut charcoal	ORBO-32L	20228	226-09	GC-FID
1,3-Butadiene	OSHA 56	3	0.05	charcoal c/w TBC	ORBO-351	20042	226-73	GC-FID
1-Butanethiol (n-Butyl Mercaptan)	NIOSH 2525	1-4	0.01-0.05	Chromosorb 104	-----	NA	226-109	GC-FPD
2-Butanone (MEK)	NIOSH 2500	.25-12	0.01-0.2	Carboxen 564	ORBO-90	20358	226-81 226-121	GC-FID
2-Butanone (MEK)	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
2-Butanone (MEK)	OSHA 84	3	0.05	Carbosieve S-III	ORBO-91	20360	226-121	GC-FID
2-Butoxyethanol (Butyl Cellosolve)	NIOSH 1403	2-10	0.01-0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Butoxyethanol	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
2-Butoxyethanol	OSHA 83	48	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Butoxyethyl Acetate (Butyl Cellosolve Acetate)	OSHA 83	48	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Butyl Acetate	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Butyl Acetate	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Butyl Acetate, sec- & tert-	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Butyl Acetate	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
sec-Butyl Acetate	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
tert-Butyl Acetate	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Butyl Alcohol	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Butyl Alcohol	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Butyl Alcohol, n- & sec-	NIOSH 1401	2-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
sec-Butyl Alcohol	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
tert-Butyl Alcohol	NIOSH 1400	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
tert-Butyl Alcohol	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Butylamine	NIOSH 2012	2-100	0.01-1	silica gel c/w H2SO4	ORBO-554	20033	226-53	GC-FID
Butyl Cellosolve - see 2-Butoxyethanol								
Butyl Cellosolve Acetate - see 2-Butoxyethyl Acetate								
n-Butyl Glycidyl Ether	NIOSH 1616	15-30	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Butyl Glycidyl Ether	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Butyl Mercaptan	NIOSH 2525	1-4	0.01-0.05	Chromosorb 104	-----	NA	226-109	GC-FPD
n-Butyl Mercaptan	NIOSH 2542	10-150	0.01-0.2	glass fiber filter c/w mercuric acetate	826	20068	225-9007	GC-FPD
p-tert-Butyltoluene	NIOSH 1501	1-29	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
p-tert-Butyltoluene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Butylated Hydroxytoluene (BHT)	NIOSH 1/226	10	0.2	silica gel	ORBO-504	20031	NA	GC-FID
1,3-Butylene Glycol	NIOSH 5523	5-60	0.5-2	XAD-7/glass fiber filter (OVS)	ORBO-47P	custom	226-57	GC-FID
Butyraldehyde	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2 HMP	ORBO-23	20257-U	226-118	GC-FID
Cadmium	NIOSH 7300	13-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Cadmium	OSHA ID 189	960	2.0	MCE filter	-----	23381	225-5	AAS or AAS-HGA
Cadmium, Cd Compounds (as Cd)	NIOSH 7048	25-1500	1-3	MCE filter	-----	23381	225-5	AAS
Cadmium Dust (as Cd)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Cadmium Dust (as Cd)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Cadmium Fume (as Cd)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Cadmium Fume (as Cd)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Calcium	NIOSH 7300	5-200	1-4	MCE filter	-----	23381	225-5	ICP-AES
Calcium & compounds	NIOSH 7020	20-400	1-3	MCE filter	-----	23381	225-5	AAS
Camphor	NIOSH 1301	1-25	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Camphor	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Capsaicin	NIOSH 5041	5-1000	1-3	glass fiber filter	-----	23376	225-16	HPLC-FL
Carbaryl (Sevin)	NIOSH 5006	20-400	1-3	glass fiber filter	-----	23378	225-7	VIS
Carbaryl (Sevin)	OSHA 63	60	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	HPLC-UV
Carbitol	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Carbon, Elemental (Diesel Particulate)	NIOSH 5040	142-19,000	2-4	quartz fiber filter (37mm)	-----	special order	225-1809	EGA-TOA
Carbon Black	NIOSH 5000	30-570	1-2	PVC filter	-----	23387	225-8-01	gravimetric
Carbon Black	OSHA ID 196	480-960	2	PVC filter	-----	23387	225-8-01	gravimetric
Carbon Dioxide	EPA IP-3A			nondispersive infrared				NDIR
Carbon Dioxide	EPA IP-3B			continuous gas filter correlation				CFC Spectometry
Carbon Dioxide	EPA IP-3C			electrochemical CO monitor				Electrochemical Oxidation
Carbon Dioxide	NIOSH 6603	80% vol	0.02-1	5L sampling bag	-----	24655	232-05	GC-TCD
Carbon Dioxide	OSHA ID 172	2-5	0.01-0.05	5L sampling bag	-----	24655	232-05	GC-TCD
Carbon Disulfide	NIOSH 1600	2-25	0.01-0.2	coconut charcoal in-line trap	ORBO-32S -----	20267-U custom	226-01 -----	GC-FPD
Carbon Monoxide	EPA IP-3A			nondispersive infrared				NDIR
Carbon Monoxide	EPA IP-3B			continuous gas filter correlation				CFC Spectometry
Carbon Monoxide	EPA IP-3C			electrochemical CO monitor				Electrochemical Oxidation
Carbon Monoxide	NIOSH 6604			portable instrument				sensor
Carbon Monoxide	OSHA ID 209			direct reading instrument				
Carbon Monoxide	OSHA ID 210	2-5	0.01-0.05	5L sampling bag	-----	24655	232-05	GC-TCD
Carbon Tetrachloride	NIOSH 1003	3-150	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Carbon Tetrachloride	OSHA 7	15	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Carbonyls - see Aldehydes/Ketones								
delta-3-Carene	NIOSH 1552	2-30	0.01-0.02	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Chlordane	ASTM D4947	250	1-5	polyurethane foam (PUF)	ORBO-1000	20557	226-92	GC-ECD
Chlordane	NIOSH 5510	10-200	0.5-1	XAD-2 MCE filter stainless steel screen	ORBO-44 ----- -----	20260-U 23381 custom	226-30-04 225-5	GC-ECD
Chlordane	OSHA 67	480	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	GC-ECD
Chlorides	EPA 0050			filter + absorbing solutions				IC
Chlorides	EPA 0051	120	2	filter + absorbing solutions				IC
Chlorinated Camphene (Toxaphene)	NIOSH 5039	2-30	0.2-1	MCE filter	-----	23381	225-5	GC-ECD
Chlorinated Diphenyl Ether	NIOSH 5025	8-200	0.5-1.5	MCE filter	-----	23381	225-5	GC-ECD
Chlorinated Terphenyl (60% chlorine)	NIOSH 5014	100-1500	1-3	glass fiber filter	-----	23378	225-7	GC-ECD
Chlorine	NIOSH 6011	2-90	0.3-1	PTFE filter + silver membrane	885	custom	225-9006	IC-CD
Chlorine	OSHA ID 101	15-240	1	fritted bubbler	-----	64835-U	225-36-2	ISE
Chlorine Dioxide	OSHA ID 202	7.50-120	0.5	fritted bubbler	-----	64835-U	225-36-2	IC
Chloroacetaldehyde	NIOSH 2015	3-16	0.05-0.2	silica gel	ORBO-507	20870-U	226-15	GC-ECD
Chloroacetaldehyde	OSHA 76	7.5	0.5	silica gel	ORBO-507	20870-U	226-15	GC-ECD
Chloroacetic Acid	NIOSH 2008	1-100	0.05-0.2	silica gel	ORBO-505	custom	226-47-01	IC
α-Chloroacetophenone	NIOSH 5/291	12	0.01-0.2	Tenax	ORBO-405	custom	226-35	GC-FID
Chlorobenzene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Chlorobenzene (Monochlorobenzene)	NIOSH 1003	1.50-40	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
o-Chlorobenzylidene Malonitrile	NIOSH 5/304	90	1.5	Tenax PTFE stainless steel screen	ORBO-408 ----- -----	custom 23383 custom	226-35-07 225-1710	HPLC-UV
Chlorobromomethane	NIOSH 1003	0.5-8	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Chlorodifluoromethane	NIOSH 1018	1-4	0.01-0.05	(2) coconut charcoal	ORBO-32S + ORBO-32L	20267-U 20228	226-01 226-09	GC-FID
Chlorodiphenyl (42% & 54% Cl)	NIOSH 5503	1-50	0.05-0.2	glass fiber filter florisil	----- ORBO-60	23376 20351	225-16 226-39	GC-ECD
Chloroethane (Ethyl Chloride)	NIOSH 2519	0.3-3	0.02-0.05	(2) coconut charcoal	ORBO-32L	20228	226-09	GC-FID
2-Chloroethanol	NIOSH 2513	2-35	0.01-0.2	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
Chloroform (Trichloromethane)	NIOSH 1003	1-50	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Chloroform (Trichloromethane)	OSHA 5	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Chloromethyl Methyl Ether	NIOSH 1/220		1.5	fritted bubbler	-----	64835-U	225-36-2	GC-ECD
Chloromethyl Methyl Ether	OSHA 10	50	0.5	fritted bubbler	-----	64835-U	225-36-2	GC-ECD
4-Chloronitrobenzene	NIOSH 2005	1-150	0.01-1	silica gel	ORBO-52S	20229	226-10	GC-FID
1-Chloro-1-nitropropane	NIOSH 5/S211	12	0.04-0.2	Chromosorb 108	ORBO-710	20058	226-113	GC-FID
p-Chlorophenol	NIOSH 2014	1.5-40	0.05-0.2	silica gel	ORBO-52S	20229	226-10	HPLC-UV
Chloroprene	NIOSH 1002	1.5-8	0.01-0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Chloroprene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
beta-Chloroprene	OSHA 112	6	0.05	Chromosorb 106	ORBO-711	20059	226-111	GC-ECD
Chlorpyrifos (Dursban)	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Chlorpyrifos (Dursban)	OSHA 62	480	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	GC-FPD
Chromic Acid	NIOSH 7600	8-400	1-4	PVC filter	-----	23387	225-8-01	VIS
Chromic Acid	NIOSH 7604	100-1000	1-4	PVC filter	-----	23387	225-8-01	IC-CD
Chromic Acid, Chromates (as CrO3)	OSHA ID 103	30-960	2	PVC filter	-----	23387	225-8-01	DPP

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Chromium	NIOSH 7300	5-1000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Chromium, Cr Compounds (as Cr)	NIOSH 7024	10-1000	1-3	MCE filter	-----	23381	225-5	AAS
Chromium (metal & insoluble compounds)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Chromium (metal & insoluble compounds)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Chromium Acetate (listed as II & III compounds)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Chromium Carbonate (listed as II & III compounds)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Chromium, Hexavalent	EPA 0061			KOH absorbing solution				IC/PCR
Chromium, Hexavalent	NIOSH 7600	8-400	1-4	PVC filter	-----	23387	225-8-01	VIS
Chromium, Hexavalent	NIOSH 7604	100-1000	1-4	PVC filter	-----	23387	225-8-01	IC-CD
Chromium, Hexavalent	NIOSH 9101			chromate test kit				
Chromium, Hexavalent	OSHA ID 215	960	2	PVC filter	-----	23387	225-8-01	IC-UV, PCD
Chromium Phosphate (listed as II & III compounds)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Chromium, Soluble Salts (IC/OUS) (listed as II & III compounds)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Chrysene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Chrysene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Chrysene	OSHA 58	960	2	glass fiber filter	-----	23378	225-7	HPLC-UV
Chrysotile Fibers	NIOSH 7400	400- varies	0.5-16	MCE filter	-----	23380-U	225-19	PCM
Coal Tar Naphtha	NIOSH 1550	1.3-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Coal Tar Pitch Volatiles	OSHA 58	960	2	glass fiber filter	-----	23378	225-7	HPLC-UV
Cobalt	NIOSH 7300	25-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Cobalt	OSHA ID 213	30-480	2	MCE filter	-----	23381	225-5	ICP-AES
Cobalt, Co Compounds (as Co)	NIOSH 7027	30-1500	1-3	MCE filter	-----	23381	225-5	AAS
Cobalt, Metal, Dust & Fume	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Cobalt, Metal, Dust & Fume	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Coke Oven Emissions	OSHA 58	960	2	glass fiber filter	-----	23378	225-7	HPLC-UV
Copper	NIOSH 7300	5-1000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Copper, Dust & Fume	NIOSH 7029	50-1500	1-3	MCE filter	-----	23381	225-5	AAS
Copper, Dusts & Mists	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Copper, Dusts & Mists	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Copper Fume	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Copper Fume	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Crag Herbicide (total dust)	NIOSH 5/S356	90	1-1.5	MCE filter	-----	23381	225-5	VIS
Cresol	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Cresol	OSHA 32	24	0.1	XAD-7 (Supelpak 70)	ORBO-47	20349	226-95	HPLC-UV
Cresol, all isomers	NIOSH 2546	1-24	0.01-0.1	XAD-7 (Supelpak 70)	ORBO-47	20349	226-95	GC-FID
Cresols (Methylphenols)	EPA TO-8	<80	0.1-1	NaOH absorbing solution				HPLC UV/ELCD/Fl
Cristobalite	OSHA ID 142	816	1.7	PVC filter 10mm nylon cyclone	----- -----	23387 NA	225-8-01	XRD
Crocidolite Fibers	NIOSH 7400	400-	0.5-16	MCE filter	-----	23380-U	225-19	PCM
Crotonaldehyde	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Crotonaldehyde	NIOSH 3516	1-49	0.1-0.2	fritted bubbler	-----	64835-U	225-36-2	DPP
Crotonaldehyde	OSHA 81	6	0.1	glass fiber filter c/w DNPH	827	20069	225-9003	HPLC-UV

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Cryofluorane	NIOSH 1018	1-4	0.01-0.05	(2) coconut charcoal	ORBO-32S + ORBO-32L	20267-U 20228	226-01 226-09	GC-FID
Cryolite	NIOSH 7902	12-800	1-2	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	ISE
Cumene	NIOSH 1501	1-30	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Cumene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Cyanide (as CN)	OSHA ID 120	90-120	1	MCE filter impinger	----- -----	23381 20270-U	225-5 225-36-1	ISE
Cyanides	NIOSH 6010	2-90	0.05-0.2	soda lime	ORBO-1006	custom	226-28	VIS
Cyanides, Aerosol & Gas	NIOSH 7904	10-180	0.5-1	MCE filter fritted bubbler	----- -----	23381 64835-U	225-5 225-36-2	ISE
Cyanuric Acid	NIOSH 5030	10-1000	1-3	PVC filter	-----	23387	225-8-01	HPLC-UV
Cyclohexane	NIOSH 1500	2.50-5	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Cyclohexane	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Cyclohexanol	NIOSH 1402	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Cyclohexanol	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Cyclohexanone	NIOSH 1300	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Cyclohexanone	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Cyclohexanone	OSHA 1	10	0.05-0.2	Chromosorb 106	ORBO-704	custom	226-110	GC-FID
Cyclohexene	NIOSH 1500	5-7	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Cyclohexene	OSHA 7	5	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,3-Cyclopentadiene	NIOSH 2523	1-5	0.01-0.05	Chromosorb 104 c/w maleic anhydride	-----	NA	NA	GC-FID
2,4-D	NIOSH 5001	15-200	1-3	glass fiber filter	-----	23378	225-7	HPLC-UV
DDT	NIOSH 3/S274	90	1.5	glass fiber filter	-----	23378	225-7	GC-ELCD
n-Decane	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Demeton	NIOSH 5514	30-500	0.2-1	XAD-2 MCE filter stainless steel screen	ORBO-608 ----- -----	20050-U 23381 custom	226-30-05 225-5	GC-FPD
Desflurane	OSHA 106	3	0.05	Carbosieve S-III (Anasorb 747)	ORBO-91	20360	226-81A	GC-FID
Di-(2-ethylhexyl) phthalate	NIOSH 5020	10-200	1-3	MCE filter	-----	23381	225-5	GC-FID
Di-(2-ethylhexyl) phthalate	OSHA 104	240	1	Tenax/glass fiber filter (OVS)	ORBO-410P	custom	226-56	GC-FID
Diacetone Alcohol	NIOSH 1402	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Diacetone Alcohol	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
o-Dianisidine	NIOSH 5013	150-500	1-3	PTFE filter	-----	23389	225-17	HPLC-UV
o-Dianisidine	OSHA 71	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
Diatomaceous Earth	NIOSH 7501	50-400	1-3	PVC filter	-----	23387	225-8-01	XRD
Diazinon	NIOSH 5600	12-240	0.2-1.0	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Diazinon	OSHA 62	480	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	GC-FPD
Diazomethane	NIOSH 2515	6-30	0.2	XAD-2 c/w octanoic acid	ORBO-651	custom	226-23	GC-FID
Dibenz(a,h)anthracene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Dibenz(a,h)anthracene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Diborane	NIOSH 6006	60-260	0.5-1	charcoal c/w oxidizer PTFE filter	ORBO-352 -----	20043 special order	226-151	PES
Dibromodifluoromethane	NIOSH 1012	2.5-10	0.01-0.2	(2) coconut charcoal	ORBO-32S or ORBO-301	20267-U or 20039	226-01 NA	GC-FID
1,2-Dibromoethane (Ethylene Dibromide)	NIOSH 1008	0.1-25	0.02-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-ECD
1,2-Dibromoethane	OSHA 2	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-ECD
2-Dibutylaminoethanol	NIOSH 2007	4-24	0.01-0.2	silica gel	ORBO-506	20032	226-10-04	GC-FID
Dibutyl Phosphate	NIOSH 5017	50-250	1-3	PTFE filter	-----	23383	225-1710	GC-FPD
Dibutyl Phthalate	NIOSH 5020	6-200	1-3	MCE filter	-----	23381	225-5	GC-FID
Dibutyl Phthalate	OSHA 104	240	1	Tenax/glass fiber filter (OVS)	ORBO-410P	custom	226-56	GC-FID
Dibutyltin bis (Isooctyl Mercaptoacetate)	NIOSH 5504	50-500	1-1.5	XAD-2 glass fiber filter	ORBO-614 -----	custom 23378	226-30 225-7	HPLC-AAGF

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
o-Dichlorobenzene	NIOSH 1003	1-60	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
o-Dichlorobenzene	OSHA 7	3	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
o,p-Dichlorobenzene	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
p-Dichlorobenzene	NIOSH 1003	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
p-Dichlorobenzene	OSHA 7	3	0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
3,3'-Dichlorobenzidine	NIOSH 5509	20-100	0.2	glass fiber filter	-----	23376	225-16	HPLC-UV
3,3'-Dichlorobenzidine	OSHA 65	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
Dichlorodifluoromethane (F-12)	NIOSH 1018	1-4	0.01-0.05	(2) coconut charcoal	ORBO-32S + ORBO-32L	20267-U 20228	226-01 226-09	GC-FID
1,1-Dichloroethane	NIOSH 1003	0.5-15	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1-Dichloroethane	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,2-Dichloroethane – see Ethylene dichloride								
1,1-Dichloroethene – see Vinylidene Chloride								
1,2-Dichloroethylene	NIOSH 1003	0.2-5	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,2-Dichloroethylene	OSHA 7	3	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Dichloroethyl Ether	NIOSH 1004	2-15	0.01-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Dichloroethyl Ether	OSHA 7	15	1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1-Dichloro-1-fluoroethane (Freon 141b)	OSHA 113	1	0.05	(2) Carbosieve S-III (Anasorb CMS)	ORBO-91	20360	226-121	GC-FID
Dichlorofluoromethane	NIOSH 2516	0.25-3	0.01-0.05	(2) coconut charcoal	ORBO-32L	20228	226-09	GC-FID
Dichloromethane (Methylene Chloride)	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Dichloromethane	OSHA 80	3	0.05	Carbosieve S-III	ORBO-91	20360	226-121	GC-FID
Dichloromethane	NIOSH 1005	0.5-2.5	0.01-0.2	(2) coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1-Dichloro-1-nitroethane	NIOSH 1601	1.5-15	0.01-1	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
1,1-Dichloro-1-nitroethane	OSHA 7	15	1	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
1,2-Dichloropropane	NIOSH 1013	0.10-3.50	0.01-0.2	petroleum charcoal	ORBO-303	20040-U	226-38	GC-ECN
1,2-Dichlorotetra-fluoroethane	NIOSH 1018	1-4	0.01-0.05	(2) coconut charcoal	ORBO-32S + ORBO-32L	20267-U 20228	226-01 226-09	GC-FID
Dichlorvos	NIOSH 5/295	120	0.5-1	XAD-2	ORBO-603	custom	226-30-03	GC-FPD
Dichlorvos	OSHA 62	480	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	GC-FPD
Dicrotophos	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Dieldrin	NIOSH 3/S283	180	1.5	glass fiber filter	-----	23378	225-7	GC-ELCD
Diesel Exhaust	NIOSH 5040	106-4300	1-4	quartz fiber filter (37mm)	-----	special order	225-1809	EGA-TOA
Diethanolamine	NIOSH 3509	5-300	0.5-1	impinger	-----	20270-U	225-36-1	IC
Diethylamine	NIOSH 2010	3-30	0.01-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Diethylamine	OSHA 41	10	0.2	XAD-7 c/w 10% NBDC	ORBO-653	custom	226-96	HPLC-VIS
2-Diethylaminoethanol	NIOSH 2007	4-24	0.01-0.2	silica gel	ORBO-506	20032	226-10-04	GC-FID
Diethyl Carbamoyl Chloride	NIOSH 6/317	12	0.2	Porapak P	ORBO-1102	20062	226-114	GC-FID
Diethyl Ether	NIOSH 1610	0.25-3	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Diethyl Phthalate	OSHA 104	240	1	Tenax/glass fiber filter (OVS)	ORBO-410P	custom	226-56	GC-FID
Diethylene Dioxide - see Dioxane								
Diethylene Gycol	NIOSH 5523	5-60	0.5-2	XAD-7/glass fiber filter (OVS)	ORBO-47P	custom	226-57	GC-FID
Diethylene Glycol Ether	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Diethylenetriamine (DETA)	NIOSH 2540	1-20	0.01-0.1	XAD-2 c/w 10% NITC	ORBO-654	custom	226-30-18	HPLC-UV
Diethylenetriamine (DETA)	OSHA 60	10	0.1	XAD-2 c/w 10% NITC	ORBO-654	custom	226-30-18	HPLC-UV
Difluorodibromomethane	NIOSH 1012	2.5-10	0.01-0.2	(2) coconut charcoal	ORBO-32S or ORBO-301	20267-U or 20039	226-01 NA	GC-FID

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Difluorodibromomethane	OSHA 7	10	0.2	(2) coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Difluorodichloromethane	NIOSH 1018	1-4	0.01-0.05	(2) coconut charcoal	ORBO-32S + ORBO-32L	20267-U 20228	226-01 226-09	GC-FID
Diglycidyl Ether of Bisphenyl A (DGEBA)	NIOSH 6/333	288	1.6	glass fiber filter	-----	23378	225-7	HPLC-UV
Dihydrocapsaicin	NIOSH 5041	7-1000	1-3	glass fiber filter	-----	23376	225-16	HPLC-FL
Diisobutyl Ketone	NIOSH 1300	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Diisobutyl Ketone	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Dimethoxymethane (Methylal)	NIOSH 1611	1-3	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Dimethylacetamide	NIOSH 2004	15-80	0.01-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Dimethylamine	NIOSH 2010	3-30	0.01-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Dimethylamine	OSHA 34	10	0.2	XAD-7 c/w 10% NBDC	ORBO-653	custom	226-96	HPLC-VIS
N,N-Dimethylaniline	NIOSH 2002	3-30	0.02-1	silica gel	ORBO-52S	20229	226-10	GC-FID
N,N-Dimethylaniline	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Dimethylarsinic Acid	NIOSH 5022	50-1000	1-3	PTFE filter	-----	23383	225-1710	IC-AAS
Dimethylformamide	NIOSH 2004	15-80	0.01-1	silica gel	ORBO-52S	20229	226-10	GC-FID
N,N-Dimethylformamide	OSHA 66	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-NPD
1,1-Dimethylhydrazine	NIOSH 3515	2-100	0.2-1	fritted bubbler	-----	64835-U	225-36-2	VIS
Dimethyl Phthalate	OSHA 104	240	1	Tenax/glass fiber filter (OVS)	ORBO-410P	custom	226-56	GC-FID
Dimethyl Sulfate	NIOSH 2524	0.25-12	0.01-0.2	Porapak P	ORBO-1102	20062	226-114	GC-ECD
Dimethyl Sulfate	NIOSH 5/301	12	0.05	Porapak P	ORBO-1102	20062	226-114	GC-ECN
N,N-Dimethyl-p-toluidine	NIOSH 2002	20-100	0.02-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Dinitrobenzene (all isomers)	NIOSH 4/S214	90	1.5	MCE filter fritted bubbler	----- -----	23381 64835-U	225-5 225-36-2	HPLC-UV
Dinitro-o-cresol	NIOSH 5/S166	180	1.5	MCE filter stainless steel screen fritted bubbler	----- ----- -----	23381 custom 64835-U	225-5 225-36-2	HPLC-UV
2,4-Dinitrotoluene	OSHA 44	60	1	Tenax/glass fiber filter	ORBO-79	custom	NA	GC-TEA
Di-n-octyl Phthalate	OSHA 104	240	1	Tenax/glass fiber filter (OVS)	ORBO-410P	custom	226-56	GC-FID
Dioxane (Diethylene Dioxide)	NIOSH 1602	0.5-15	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Dioxane (Diethylene Dioxide)	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Dioxins	EPA TO-9A	325,000	225	quartz fiber filter polyurethane foam (PUF)	----- ORBO-2000	custom 20037	226-131	GC-MS
Dioxins	EPA 0023A			glass fiber filter XAD-2	----- Supelpak 2	custom 20279	NA	GC-MS
Diphenyl (Biphenyl)	NIOSH 2530	15-30	0.01-0.5	Tenax	ORBO-404	custom	226-35-01	GC-FID
Diphenylamine	OSHA 78	100	1	(2) glass fiber filter c/w H_2SO_4	822	20065	225-9004	HPLC-UV
Dipropylene Glycol Methyl Ether	NIOSH 2/S69	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Dipropylene Glycol Methyl Ether	OSHA 101	10	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Dipropylene Glycol Methyl Ether	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Disul	NIOSH 5/S356	90	1-1.5	MCE filter	-----	23381	225-5	VIS
Disulfoton	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
2,6-Di-t-butyl-p-cresol (DBPC)	NIOSH 1/226	10	0.2	silica gel	ORBO-504	20031	NA	GC-FID
Divinylbenzene	OSHA 89	12	0.05	charcoal c/w TBC	ORBO-356	20047	NA	GC-FID
Dursban	OSHA 62	480	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	GC-FPD
Dust, Respirable Nuisance	NIOSH 0600	75-1000	1.7	PVC filter	-----	23387	225-8-01	gravimetric
Dust, Total Nuisance	NIOSH 0500	7-133	1-2	PVC filter	-----	23387	225-8-01	gravimetric
Dyes, Benzidine	NIOSH 5013	150-500	1-3	PTFE filter	-----	23389	225-17	HPLC-UV

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Dyes, o-Dianisidine	NIOSH 5013	150-500	1-3	PTFE filter	-----	23389	225-17	HPLC-UV
Dyes, o-Toluidine	NIOSH 5013	150-500	1-3	PTFE filter	-----	23389	225-17	HPLC-UV
EDA – see Ethylenediamine								
Elements	NIOSH 7300	varies	1-4	MCE filter	-----	23381	225-5	ICP-AES
Endrin	NIOSH 5519	12-400	0.5-1	Chromosorb 102 MCE filter	ORBO-706 ------	20057 23381	226-107 225-5	GC-ECD
Enflurane (Ethrane)	OSHA 103	12	0.05	Carbosieve S-III (Anasorb 747)	ORBO-91	20360	226-81A	GC-FID
Epichlorohydrin	NIOSH 1010	2-30	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Epichlorohydrin	OSHA 7	20	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
EPN – see o-Ethyl-o-(p-nitro-phenyl) phenylphosphorothioate								
Ethanol	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Ethanol (Ethyl Alcohol)	NIOSH 1400	0.1-1	0.01-0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethanol (Ethyl Alcohol)	OSHA 100	12	0.05	Carbosieve S-III (Anasorb 747)	ORBO-91	20360	226-82	GC-FID
Ethanol (Ethyl Alcohol)	OSHA 7	1	0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethanolamine - see 2-Aminoethanol								
3-Ethenylpyridine	ASTM D5075	90	<1.5	XAD-4	ORBO-613	20052	226-93	GC-NPD
Ethion	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Ethoprop	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
2-Ethoxyethanol (Cellosolve)	NIOSH 1403	1-6	0.01-0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Ethoxyethanol (Cellosolve)	OSHA 79	15-48	0.1-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Ethoxyethyl Acetate (Cellosolve Acetate)	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Ethoxyethyl Acetate	OSHA 79	15-48	0.1-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Ethoxyethyl Acetate	OSHA 7	10	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethrane (Enflurane)	OSHA 103	12	0.05	Carbosieve S-III (Anasorb 747)	ORBO-91	20360	226-81A	GC-FID
Ethyl Acetate	NIOSH 1457	0.1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Acetate	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Ethyl Acetate	OSHA 7	5	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Acrylate	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Acrylate	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Acrylate	OSHA 92	12	0.05	charcoal c/w TBC	ORBO-356	20047	NA	GC-FID
Ethylamine	NIOSH 3/S144	30	0.2	silica gel	ORBO-52S	20229	226-10	GC-FID
Ethylamine	OSHA 36	10	0.2	XAD-7 c/w 10% NBDC	ORBO-653	custom	226-96	HPLC-VIS
Ethyl Amyl Ketone (5-Methyl-3-heptanone)	NIOSH 1301	1-25	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethylbenzene	NIOSH 1501	1-24	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethylbenzene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Bromide	NIOSH 1011	0.5-4	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Bromide	OSHA 7	5	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Butyl Ketone (3-Heptanone)	NIOSH 1301	1-25	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Butyl Ketone (3-Heptanone)	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Chloride	NIOSH 2519	0.3-3	0.02-0.05	(2) coconut charcoal	ORBO-32L	20228	226-09	GC-FID
Ethyl-2-cyanoacrylate	OSHA 55	12	0.1	XAD-7 t/w H3PO4	ORBO-655	20054	226-98	HPLC-UV
Ethyl Ether	NIOSH 1610	0.25-3	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Ether	OSHA 7	3	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Formate	NIOSH 1452	0.3-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethyl Formate	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Ethyl Mercaptan	NIOSH 2542	10-150	0.1-0.2	glass fiber filter c/w mercuric acetate	826	20068	225-9007	GC-FPD
Ethyl Silicate	NIOSH 3/S264	9	0.05	XAD-2	ORBO-605	20049	NA	GC-FID
Ethylene Chlorohydrin	NIOSH 2513	2-35	0.01-0.2	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
Ethylene Chlorohydrin	OSHA 7	20	0.2	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
Ethylenediamine (EDA)	NIOSH 2540	1-20	0.01-0.1	XAD-2 c/w 10% NITC	ORBO-654	custom	226-30-18	HPLC-UV
Ethylenediamine (EDA)	OSHA 60	10	0.1	XAD-2 c/w 10% NITC	ORBO-654	custom	226-30-18	HPLC-UV
Ethylene Dibromide – see 1,2-Dibromoethane								
Ethylene Dichloride (1,2-Dichlorethane)	NIOSH 1003	1-50	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethylene Dichloride (1,2-Dichlorethane)	OSHA 3	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-ECD
Ethylene Glycol	NIOSH 5523	5-60	0.5-2	XAD-7/glass fiber filter (OVS)	ORBO-47P	custom	226-57	GC-FID
Ethylene Glycol Dinitrate	NIOSH 2507	3-100	0.2-1	Tenax	ORBO-402	20832-U	226-35-03	GC-ECD
Ethylene Glycol Dinitrate	OSHA 43	15	1	Tenax	ORBO-402	20832-U	226-35-03	HPLC-TEA/UV
Ethylene Oxide	ASTM D4413	3-20	0.01-0.2	coconut charcoal	ORBO-32J	custom	226-16	GC-FID
Ethylene Oxide	ASTM D5578	1-10	0.02-0.1	Carboxen-564 c/w HBr	ORBO-78	20355	NA	GC-ECD
Ethylene Oxide	NIOSH 1614	1-24	0.05-0.15	petroleum charcoal c/w HBr	ORBO-353	20044	226-38-03	GC-ECD
Ethylene Oxide	NIOSH 3702	<80% vol	>0.02	5L sampling bag	-----	24655	232-05	GC-PID
Ethylene Oxide	OSHA 49		0.0493	3M #3551 diffusive sampler	-----	20253-U		GC-ECD
Ethylene Oxide	OSHA 50	24	0.1	petroleum charcoal c/w HBr	ORBO-353	20044	226-38-03	GC-ECD
Ethylene Oxide (Qazi-Ketcham)	AIHAJ 11/77	4.8-9.6	0.2	petroleum charcoal	ORBO-33	20259	226-36	GC-FID
Ethylene Thiourea	NIOSH 5011	200-800	1-3	MCE filter	-----	23381	225-5	VIS
Ethylene Thiourea	OSHA 95	480	2	(2) glass fiber filter	-----	23376	225-16	HPLC-UV
Ethylenimine	NIOSH 3514	1-48	0.2	fritted bubbler	-----	64835-U	225-36-2	HPLC-UV
N-Ethylmorpholine	NIOSH 3/S146	10	0.2	silica gel	ORBO-52S	20229	226-10	GC-FID
o-Ethyl-o-(p-nitro-phenyl)-phenylphos phorothioate (EPN)	NIOSH 5012	15-700	1-2	glass fiber filter	-----	23378	225-7	GC-FPD
Ethyl sec-Amyl Ketone (5-Methyl-3-heptanone)	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ethylvinylbenzene	OSHA 89	12	0.05	charcoal c/w TBC	ORBO-356	20047	NA	GC-FID
Fenamiphos	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Ferrovanadium Dust	NIOSH 1/173	180	1.5	MCE filter	-----	23381	225-5	AAS
Ferrovanadium Dust	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Ferrovanadium Dust	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Fluoranthene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Fluoranthene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Fluorene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Fluorene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Fluoride (F- & HF)	OSHA ID 110	22.5-90	1.5	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	ISE
Fluoride Particles	OSHA ID 110	22.5-90	1.5	MCE filter	-----	23381	225-5	ISE
Fluorides	ASTM D4765	varies	2	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	ISE
Fluorides, Aerosol & Gas	NIOSH 7906	1-120	1-2	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	IC-CD
Fluorides, Aerosol & Gas	NIOSH 7902	12-800	1-2	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	ISE
Fluorotrichloromethane	NIOSH 1006	0.3-7	0.01-0.05	coconut charcoal	ORBO-32L	20228	226-09	GC-FID
Fonofos	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Formaldehyde	ASTM D5197	see method	0.5-1.5	silica gel c/w DNPH	LpDNPH S10	21026-U	226-119	HPLC-UV

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Formaldehyde	EPA 0100		1	silica gel c/w DNPH	LpDNPH S10	21026-U	226-119	HPLC-UV
Formaldehyde	NIOSH 2016	1-15	0.1-1.5	silica gel c/w DNPH	LpDNPH S10	21026-U	226-119	HPLC-UV
Formaldehyde	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Formaldehyde	NIOSH 2541	1-36	0.01-0.1	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Formaldehyde	NIOSH 3500	1-100	0.2-1	PTFE filter (2) impingers	----- -----	23383 20270-U	225-1710 225-36-1	VIS
Formaldehyde	OSHA 52	3-24	0.1-0.2	XAD-2 c/w 2-HMP	ORBO-24	20231	226-117	GC-NPD
Formaldehyde	OSHA ID 102	30-160	0.5-1	MCE filter fritted bubbler	----- -----	23381 64835-U	225-5 225-36-2	DPP
Formaldehyde	OSHA ID 205		0.0614	3M #3721 diffusive sampler	-----	NA		colorimetric
Formaldehyde (on dust)	NIOSH 5700	240-1050	2	PVC filter inhalable sampler	----- -----	special order		HPLC-UV
Formic Acid	NIOSH 2011	1-24	0.05-0.2	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Formic Acid	US Army	10-25		Chromosorb P c/w Na2CO3	ORBO-70	20256-U	NA	GC-FID
Furfural	NIOSH 2529	1-12	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Furfural	NIOSH 2539	5	0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Furfural	OSHA 72	180	1	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
Furfuryl Alcohol	NIOSH 2505	3-25	0.01-0.05	Porapak Q	ORBO-1103	20063	226-115	GC-FID
Gallium	NIOSH 1/177	100	1.5-2	MCE filter	-----	23381	225-5	ASV
Glass, Fibrous	NIOSH 7400	400-	0.5-16	MCE filter	-----	23380-U	225-19	PCM
Glutaraldehyde	NIOSH 2532	1-30	0.05-0.5	silica gel c/w DNPH	LpDNPH H10	505315	226-119	HPLC-UV
Glutaraldehyde	OSHA 64	15	1	glass fiber filter c/w DNPH	827	20069	225-9003	HPLC-UV
Glycerin Mist	NIOSH 0500	7-133	1-2	PVC filter	-----	23387	225-8-01	gravimetric
Glycidol (2,3-Epoxy-1-propanol)	NIOSH 1608	5-100	0.01-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Glycidol (2,3-Epoxy-1-propanol)	OSHA 7	50	1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Glycols	NIOSH 5523	5-60	0.5-2	XAD-7/glass fiber filter (OVS)	ORBO-47P	custom	226-57	GC-FID
Hafnium	NIOSH 5/S194	90	1.5-2	MCE filter	-----	23381	225-5	PES
Halothane	OSHA 103	12	0.05	Carbosieve S-III (Anasorb 747)	ORBO-91	20360	226-81A	GC-FID
Heptachlor	ASTM D4947	250	1-5	polyurethane foam (PUF)	ORBO-1000	20557	226-92	GC-ECD
Heptachlor	NIOSH 5/S287	60	0.01-1	Chromosorb 102	ORBO-706	20057	226-107	GC-ECD
Heptanal	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
n-Heptane	NIOSH 1500	4	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Heptane	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
n-Heptane	OSHA 7	5	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
3-Heptanone	NIOSH 1301	1-25	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
3-Heptanone	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Herbicides, Chlorinated and Organonitrogen (Hand Wash)	NIOSH 9200			polyethylene bag				GC-ECD
Herbicides, Chlorinated and Organonitrogen (Patch)	NIOSH 9201			PUF pads				GC-ECD
Herbicides, Chlorinated, Organonitrogen, and Acid	NIOSH 5602	12-480	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-ECD
Hexachlorobutadiene	NIOSH 2543	1-100	0.05-0.2	XAD-2	ORBO-608	20050-U	226-30-05	GC-ECD
Hexachloro-1,3-cyclopentadiene	NIOSH 2518	0.25-90	0.01-0.2	(2) Porapak T	ORBO-1105	custom	226-116	GC-ECD
Hexachloroethane	NIOSH 1003	3-70	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Hexachloroethane	OSHA 7	30	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Hexachloronaphthalene	NIOSH 2/S100	30	1	MCE filter	-----	23381	225-5	GC-ECD
1,6-Hexamethylene Diisocyanate (HDI)	OSHA 42	15	1	glass fiber filter c/w 1-2PP	ORBO-80	20811	225-9002	HPLC-UV
1,6-Hexamethylene-diisocyanate (HDI)	NIOSH 5521	5-500	1	impinger	-----	20270-U	225-36-1	HPLC-UV ELCD
Hexamethylene Diisocyanate	NIOSH 5522	15-360	1-2	impinger	-----	20270-U	225-36-1	HPLC-FL
Hexamethylenetetramine (HMTA)	NIOSH 4/263	15	1.5	MCE filter fritted bubbler	----- -----	23381 64835-U	225-5 225-36-2	VIS

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Hexanal	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Hexanal	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
n-Hexane	NIOSH 1500	4	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Hexane	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
n-Hexane	OSHA 7	5	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Hexanone (MBK)	NIOSH 1300	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Hexanone (MBK)	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Hexavalent Chromium - see Chromium								
Hexone (MIBK)	NIOSH 1300	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Hexone (MIBK)	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Hexone (MIBK)	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
sec-Hexyl Acetate	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Hydrazine	NIOSH 3503	7-100	0.2-1	fritted bubbler	-----	64835-U	225-36-2	VIS
Hydrazine	OSHA 108	240	1	(2) glass fiber filters c/w H2SO4	840	custom	NA	HPLC-UV
Hydrazoic Acid	OSHA ID 211	>5	1.0	silica gel c/w NaOH PVC filter	ORBO-560 -----	custom 23387	226-55 225-8-01	IC-UV
Hydrazoic Acid	US Army	10-25		Chromosorb P c/w Na2CO3	ORBO-70	20256-U	NA	VIS
Hydrobromic Acid	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Hydrocarbons, General	Supelco			Carbotrap	ORBO-100	20255-U	NA	GC-FID
Hydrocyanic Acid	NIOSH 6010	2-90	0.05-0.2	soda lime	ORBO-1006	custom	226-28	VIS
Hydrocyanic Acid	NIOSH 7904	7-100	0.5-1	MCE filter fritted bubbler	----- -----	23381 64835-U	225-5 225-36-2	ISE
Hydrocyanic Acid	OSHA ID 120	90-120	1	MCE filter impinger	----- -----	23381 20270-U	225-5 225-36-1	ISE
Hydrofluoric Acid	NIOSH 7902	12-800	1-2	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	ISE
Hydrofluoric Acid	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Hydrogen Bromide	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Hydrogen Bromide	OSHA ID 165SG	96	0.20	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Hydrogen Chloride	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Hydrogen Chloride	OSHA ID 174	7.5	0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Hydrogen Cyanide	NIOSH 6010	2-90	0.05-0.2	soda lime	ORBO-1006	custom	226-28	VIS
Hydrogen Cyanide	NIOSH 7904	7-100	0.5-1	MCE filter fritted bubbler	----- -----	23381 64835-U	225-5 225-36-2	ISE
Hydrogen Cyanide	OSHA ID 120	90-120	1	MCE filter impinger	----- -----	23381 20270-U	225-5 225-36-1	ISE
Hydrogen Fluoride	NIOSH 7906	1-800	1-2	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	IC
Hydrogen Fluoride – see Hydrofluoric Acid								
Hydrogen Sulfide	NIOSH 6013	1.2-40	0.1-1.5	coconut charcoal	ORBO-34	20211	NA	IC-CD
Hydrogen Sulfide	OSHA ID 141	2-6	0.1-0.2	MCE filter c/w AgNO3	828	20070-U	225-9008	DPP
Hydroquinone	NIOSH 5004	30-180	1-4	MCE filter	-----	23381	225-5	HPLC-UV
Indeno(1,2,3-cd)pyrene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Indeno(1,2,3-cd)pyrene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Indium	NIOSH 1/173	180	1.5	MCE filter	-----	23381	225-5	AAS
Indium	NIOSH 1/190	100	1.5-2	MCE filter	-----	23381	225-5	ASV
Iodine	NIOSH 6005	15-225	0.5-1	charcoal c/w KOH	ORBO-354	20045	226-27	IC
Iodine	OSHA ID 212	2.5-7.5	0.5	beaded carbon c/w KOH	ORBO-1010W	custom	226-80	IC-PED
Iron	NIOSH 7300	5-100	1-4	MCE filter	-----	23381	225-5	ICP-AES
Iron	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Iron Oxide Fume	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Iron Oxide Fume	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Isoamyl Acetate	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isoamyl Acetate	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isoamyl Alcohol	NIOSH 1402	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isobutyl Acetate	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isobutyl Acetate	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isobutyl Alcohol	NIOSH 1401	2-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Isobutyl Alcohol	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isobutyraldehyde	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Isocyanates	NIOSH 5521	5-500	1	impinger	-----	20270-U	225-36-1	HPLC-UV ELCD
Isocyanates	NIOSH 5522	15-360	1-2	impinger	-----	20270-U	225-36-1	HPLC-FL
Isocyanates – see HDI, MDI, TDI								
Isoflurane	OSHA 103	12	0.05	Carbosieve S-III (Anasorb 747)	ORBO-91	20360	226-81A	GC-FID
Isophorone	NIOSH 2508	2-25	0.01-1	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
Isophorone	OSHA 7	10	0.2	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
Isopropyl Acetate	NIOSH 1454	0.1-9	0.02-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isopropyl Acetate	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isopropyl Alcohol	NIOSH 1400	0.2-3	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isopropyl Alcohol	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Isopropyl Alcohol	OSHA 7	3	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isopropylamine	NIOSH 3/S147	100	1	fritted bubbler	-----	64835-U	225-36-2	GC-FID
N-Isopropylaniline	OSHA 78	100	1	(2) glass fiber filter c/w H_2SO_4	822	20065	225-9004	HPLC-UV
Isopropyl Ether	NIOSH 1618	0.1-3	0.01-0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isopropyl Ether	OSHA 7	3	0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isopropyl Glycidyl Ether (IGE)	NIOSH 1620	1-30	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isopropyl Glycidyl Ether (IGE)	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Isovaleraldehyde	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Kepone	NIOSH 5508	50-600	0.5-1	MCE filter impinger	----- -----	23381 20270-U	225-5 225-36-1	GC-ECD
Kerosene	NIOSH 1550	1.3-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Ketene	NIOSH 2/S92	50	1	fritted bubbler	-----	64835-U	225-36-2	colorimetric
Ketones	EPA 0011			DNPH absorbing solution				HPLC-UV
Ketones – see Aldehydes								
Lead	NIOSH 7082	200-1500	1-4	MCE filter	-----	23381	225-5	AAS
Lead	NIOSH 7105	1-1500	1-4	MCE filter	-----	23381	225-5	AAGF
Lead	NIOSH 7300	1250-	1-4	MCE filter	-----	23381	225-5	ICP-AES
Lead	NIOSH 7700	10-240	2	MCE filter	-----	23381	225-5	Spot
Lead	NIOSH 7701	20-1500	1-4	MCE filter	-----	23381	225-5	ASV
Lead	NIOSH 9100			wipes	-----			AAS, ICP
Lead by Field Portable XRF	NIOSH 7702	570-1900	1-4	MCE filter	-----	23381	225-5	XRF
Lead, Inorganic Fumes & Dusts (as Pb)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Lead, Inorganic Fumes & Dusts (as Pb)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Lead Sulfide	NIOSH 7505	600-1000	1.7 or 2.2	PVC filter	-----	23387	225-8-01	XPD
Limonene	NIOSH 1552	2-30	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Limonene	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Lindane (γ-BHC)	NIOSH 5502	18-240	0.2-1	glass fiber filter impinger	----- -----	23378 64835-U	225-7 225-36-2	GC-ECD
Lithium	NIOSH 7300	100-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Lithium Hydroxide	NIOSH 7401	70-1000	1-4	PTFE filter	-----	23383	225-1710	titration
Magnesium	NIOSH 7300	5-67	1-4	MCE filter	-----	23381	225-5	ICP-AES
Magnesium	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Magnesium Oxide Fume	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Malathion	NIOSH 5012	15-130	1-2	glass fiber filter	-----	23378	225-7	GC-FPD
Malathion	NIOSH 5600	12-60	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Malathion	OSHA 62	60	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	GC-FPD
Maleic Anhydride	NIOSH 3512	40-500	0.2-1.5	fritted bubbler	-----	64835-U	225-36-2	HPLC-UV
Maleic Anhydride	OSHA 86	60	0.5	(2) glass fiber filter c/w DMBA	834	20072	NA	HPLC-UV
Maneb	OSHA 107	500	2	MCE filter	-----	23380-U	225-19	HPLC-UV
Manganese	NIOSH 7300	5-200	1-4	MCE filter	-----	23381	225-5	ICP-AES

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Manganese, Mn Compounds (as Mn)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Manganese, Mn Compounds (as Mn)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Manganese Oxide	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Manganese Oxide	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
MBK – see 2-Hexanone								
MDI – see Methylene Bisphenyl Isocyanate and Isocyanates								
Mercaptans	NIOSH 2542	10-150	0.1-0.2	glass fiber filter c/w mercuric acetate	826	20068	225-9007	GC-FPD
Mercury	NIOSH 6009	2-100	0.15-0.25	Hopcalite	ORBO-1002	20863	226-17-1A	AAS
Mercury, Organic	NIOSH 6/S342	3-12	0.01-0.2	Carbosieve B	ORBO-910	custom	NA	AAS
Mercury, Particulate	OSHA ID 145	10	2	MCE filter	-----	23381	225-5	AACV
Mercury, Vapor	OSHA ID 140	3-100	0.2	Hopcalite	ORBO-1002	20863	226-17-1A	AACV
Mesityl Oxide	NIOSH 1301	1-25	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Mesityl Oxide	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Metal Particulates	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Metal Particulates	OSHA ID 125G	30-480	2	MCE filter	-----	23381	225-5	ICP-AES
Metal/Metalloid Particulates	OSHA ID 206	480	2	MCE filter	-----	23381	225-5	ICP-AES
Metals	ASTM D4185	varies	2	MCE filter	-----	23381	225-5	AAS
Metals	EPA 0060			filter + absorbing solutions				ICP-AES
Metals	NIOSH 7300	varies-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Methacrylic Acid	OSHA 312	24	0.1	(2) XAD-8	ORBO-601	20048	226-30-08	HPLC-UV
Methamidophos	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Methanol	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Methanol (Methyl Alcohol)	NIOSH 2000	1-5	0.02-0.2	silica gel	ORBO-502	20030-U	226-51	GC-FID
Methanol (Methyl Alcohol)	OSHA 91	3-5	0.05	Carbosieve S-III (Anasorb 747)	ORBO-91	20360	226-82	GC-FID
Methoxychlor	NIOSH 4/S371	100	1.5	glass fiber filter	-----	23378	225-7	GC-ELCD
2- Methoxyethanol (Methyl Cellosolve)	NIOSH 1403	6-50	0.01-0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Methoxyethanol	OSHA 79	15-48	0.1-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Methoxyethyl Acetate (Methyl Cellosolve Acetate)	NIOSH 1451	0.2-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Methoxyethyl Acetate	OSHA 79	15-48	0.1-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1-Methoxy-2-propanol (1M2P)	OSHA 99	10	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Methoxy-1-propanol (2M1P)	OSHA 99	10	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1-Methoxy-2-propyl Acetate (1M2PA)	OSHA 99	10	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Methoxy-1-propyl Acetate (2M1PA)	OSHA 99	10	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Acetate	NIOSH 1458	0.2-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Acetate	OSHA 7	5	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Acetylene	NIOSH 5/S84	3-4	0.01-0.05	5L sampling bag	-----	24655	232-05	GC-FID
Methyl Acetylene Propadiene Mix	OSHA 7	2	0.05	(2) coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Acetylene Propadiene Mix (MAPP)	NIOSH 6/S85	3-4	0.01-0.05	5L sampling bag	-----	24655	232-05	GC-FPD

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Methyl Acrylate	NIOSH 1459	1-5	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Acrylate	OSHA 7	5	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Acrylate	OSHA 92	12	0.05	charcoal c/w TBC	ORBO-356	20047	NA	GC-FID
Methyl Amine	NIOSH 4/277		0.2	silica gel	ORBO-508	custom	226-14	GC-FID
Methyl Amine	NIOSH 6/S148	24	0.02-0.2	silica gel	ORBO-508	custom	226-14	IC-ELCD
Methyl Amine	OSHA 40	10	0.2	XAD-7 c/w 10% NBDC	ORBO-653	custom	226-96	HPLC-VIS
4-Methylamino-azobenzene	NIOSH 4/284	72	0.2	Gas Chrom P glass fiber filter	ORBO-1001 -----	custom 23376	226-52 225-16	GC-FID
Methyl(n-amyl)ketone	NIOSH 1301	1-25	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Bromide	NIOSH 2520	1-5	0.01-0.1	Na2SO4 drying tube (2) petroleum charcoal	ORBO-971 ORBO-310	custom custom	226-44-02 226-38-02	GC-AED
Methyl-n-butyl Ketone – see 2-Hexanone								
Methyl Chloride	NIOSH 1001	0.40-3	0.01-0.1	(2) coconut charcoal	ORBO-32S ORBO-32L	20267-U 20228	226-01 226-09	GC-FID
Methyl Chloroform	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Methyl Chloroform – see 1,1,1-Trichloroethane								
Methyl-2-cyanoacrylate	OSHA 55	12	0.1	XAD-7 t/w H3PO4	ORBO-655	20054	226-98	HPLC-UV
Methyl Cyclohexane	NIOSH 1500	4	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Cyclohexane	OSHA 7	5	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Ethyl Ketone	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Methyl Ethyl Ketone (MEK) – see 2-Butanone								
Methyl Ethyl Ketone Peroxide	NIOSH 3508	52-520	0.5-2	impinger	-----	20270-U	225-36-1	VIS
Methyl Ethyl Ketone Peroxide	OSHA 77	15	1	XAD-4	ORBO-613	20052	226-93	HPLC-UV PCD
Methyl Formate	NIOSH 5/S291	3	0.01-0.05	Carbosieve G	ORBO-901	custom	NA	GC-FID
5-Methyl-3-heptanone	NIOSH 1301	1-25	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
5-Methyl-3-heptanone	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Iodide	NIOSH 1014	15-50	0.01-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Isoamyl Acetate	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Isobutyl Carbinol	NIOSH 1402	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Isobutyl Carbinol	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl Isobutyl Ketone (MIBK) – see Hexone								
Methyl Isocyanate	OSHA 54	15	0.05	XAD-7 c/w H2SO4 & 1-2PP	ORBO-657	20055	NA	HPLC-UV
Methyl Mercaptan	NIOSH 2542	10-150	0.1-0.2	glass fiber filter c/w mercuric acetate	826	20068	225-9007	GC-FPD
Methyl Mercaptan	OSHA 26	20	0.2	glass fiber filter c/w mercuric acetate	826	20068	225-9007	GC-FPD
Methyl Methacrylate	NIOSH 2537	1-8	0.01-0.05	XAD-2	ORBO-609	20051	226-30-06	GC-FID
Methyl Methacrylate	OSHA 94	3	0.05	charcoal c/w TBC	ORBO-356	20047	NA	GC-FID
Methyl Parathion	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Methyl Phenol	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
N-Methyl-2-pyrrolidinone	NIOSH 1302	0.5-125	0.05-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-NPD/FID
α-Methyl Styrene	NIOSH 1501	1-30	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
α-Methyl Styrene	OSHA 7	3	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methyl tert-Butyl Ether (MTBE)	NIOSH 1615	2-96	0.1-0.2	(2) coconut charcoal	ORBO-32L	20228	226-09	GC-FID
N-Methyl-N-2,4,6-tetranitrobenzamine	NIOSH 3/S225	1	1.5	MCE filter	-----	23381	225-5	VIS
Methylal	NIOSH 1611	1-3	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methylal	OSHA 7	2	0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methylarsonic Acid	NIOSH 5022	50-1000	1-3	PTFE filter	-----	23383	225-1710	IC-AAS
Methylcyclohexanol	NIOSH 1404	1-15	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Methylcyclohexanone	NIOSH 2521	1-6	0.01-0.05	Porapak Q	ORBO-1103	20063	226-115	GC-FID

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
4,4'-Methylene Bis(2-chloroaniline) (MOCA)	NIOSH 1/236	3-480	0.2-1	silica gel glass fiber filter	ORBO-501 -----	custom 23376	226-63 225-16	HPLC-UV
4,4'-Methylene Bis(2-chloroaniline)	OSHA 71	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
Methylene Bisphenyl Isocyanate (MDI)	NIOSH 5521	5-500	1	impinger	-----	20270-U	225-36-1	HPLC-UV ELCD
Methylene Bisphenyl Isocyanate (MDI)	OSHA 47	15	1	glass fiber filter c/w 1-2PP	ORBO-80	20811	225-9002	HPLC-UV
Methylene Chloride	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Methylene Chloride	OSHA 59	10	0.05	coconut charcoal (3-section, 350mg)	ORBO-32TB	custom	226-09-02	GC-FID
Methylene Chloride – see Dichloromethane								
4,4'-Methylene Dianiline (MDA)	NIOSH 5029	10-1000	1-2	filter gasket glass fiber filter c/w H2SO4	----- 822	NA 20065	225-9004	HPLC-UV ELCD
4,4'-Methylene Dianiline (MDA)	OSHA 57	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
Mevinphos (Phosdrin)	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Mineral Spirits	NIOSH 1550	1.3-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Mineral Spirits	OSHA 48	3	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
MOCA - see 4,4'-Methylene Bis(2-chloroaniline)								
Molybdenum	NIOSH 7300	5-67	1-4	MCE filter	-----	23381	225-5	ICP-AES
Molybdenum Insolubles (as Mo)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Molybdenum Insolubles (as Mo)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Molybdenum Solubles (as Mo)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Monochloroacetic Acid	NIOSH 2008	1-100	0.05-0.2	silica gel	ORBO-505	custom	226-47-01	IC
Monochlorobenzene	NIOSH 1003	1.5-40	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Monochlorobenzene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Monocrotophos	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Monomethylaniline	NIOSH 3511	11-100	0.2-1	fritted bubbler	-----	64835-U	225-36-2	GC-FID
Monomethylhydrazine	NIOSH 3510	3-20	0.5-1.5	fritted bubbler	-----	64835-U	225-36-2	VIS
Morpholine	NIOSH 3/S150	20	0.2	silica gel	ORBO-52S	20229	226-10	GC-FID
Mycobacterium Tuberculosis Airborne	NIOSH 0900		>4	PTFE filter	-----	23391	225-1705	Polymerase Chain Reaction
Naphtha	OSHA 48	3	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Naphtha (Coal Tar)	NIOSH 1550	1.3-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Naphthalene	NIOSH 1501	100-200	0.01-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Naphthalene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Naphthalene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Naphthalene	OSHA 35	10	0.2	Chromosorb 106	ORBO-704	custom	226-110	GC-FID
α-Naphthalthiourea	NIOSH 5/S276	480	1.5-2	PTFE filter	-----	23383	225-1710	HPLC-UV
α-Naphthylamine (1-Naphthylamine)	NIOSH 5518	30-100	0.2-0.8	silica gel glass fiber filter	ORBO-502 -----	20030-U 23376	226-51 225-16	GC-FID
α-Naphthylamine (1-Naphthylamine)	OSHA 93	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
β-Naphthylamine (2-Naphthylamine)	NIOSH 5518	30-100	0.2-0.8	silica gel glass fiber filter	ORBO-502 -----	20030-U 23376	226-51 225-16	GC-FID
β-Naphthylamine (2-Naphthylamine)	OSHA 93	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
Nickel	NIOSH 7300	25-1000	1-4	MCE filter	-----	23381	225-5	ICP-AES

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Nickel Carbonyl	NIOSH 6007	7-80	0.05-0.2	low Ni charcoal MCE filter	ORBO-304 -----	20041 23381	NA 225-5	AAGF
Nickel, Insoluble Compounds (as Ni)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Nickel, Insoluble Compounds (as Ni)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Nickel, Metal & Soluble Compounds (as Ni)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Nickel, Metal & Soluble Compounds (as Ni)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Nicotine	ASTM D5075	90	<1.5	XAD-4	ORBO-613	20052	226-93	GC-NPD
Nicotine	EPA IP-2A		1	XAD-4	ORBO-613	20052	226-93	GC-NPD
Nicotine	EPA IP-2B		1.7-3	2 Teflon coated glass fiber filters, 1 t/w sodium	-----	custom		GC-NPD
Nicotine	NIOSH 2544	60-400	1	XAD-2	ORBO-43	20258	226-30-04	GC-NPD
Nicotine	NIOSH 2551	0.5-600	0.1-1	XAD-4	ORBO-613	20052	226-93	GC-NPD
Nicotine	NIOSH 3/S293	100	1	XAD-2	ORBO-605	20049	NA	GC-FID
Nitric Acid	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Nitric Acid	OSHA ID 127	120	1	fritted bubbler	-----	64835-U	225-36-2	IC
Nitric Acid	OSHA ID 165SG	96	0.20	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Nitric Oxide	NIOSH 6014	1.5-6	0.025	molecular sieve c/w TEA + oxidizer	ORBO-904 ORBO-905	custom custom	226-40	VIS
Nitric Oxide	OSHA ID 190	6	0.025	(2) molecular sieve c/w TEA + (1) oxidizer tube	ORBO-906 ORBO-905	custom custom	226-40-02 NA	IC-CD
p-Nitroaniline	NIOSH 5033	16-350	1-3	MCE filter	-----	23381	225-5	HPLC-UV
Nitrobenzene	NIOSH 2005	10-150	0.01-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Nitrobenzene	NIOSH 2017	5-50	0.2	silica gel + glass fiber filter c/w H2SO4	ORBO-507 822	20870-U 20065	226-15 225-9004	GC-FID
4-Nitrobiphenyl	NIOSH 4/273	48	0.2	silica gel glass fiber filter	ORBO-502 -----	20030-U 23376	226-51 225-16	GC-FID
p-Nitrochlorobenzene	NIOSH 2005	1-150	0.01-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Nitroethane	NIOSH 2526	1.5-3	0.01-0.05	XAD-2	ORBO-610	custom	226-30-02	GC-FID
Nitrogen Dioxide	EPA IP-5A			continuous luminox monitor				
Nitrogen Dioxide	EPA IP-5B			Palmes diffusion tube	-----	NA		VIS
Nitrogen Dioxide	EPA IP-5C			diffusive sampler	-----	NA		IC
Nitrogen Dioxide	NIOSH 6014	1.5-6	0.025-0.2	molecular sieve c/w TEA + oxidizer	ORBO-904 ORBO-905	custom custom	226-40	VIS
Nitrogen Dioxide	NIOSH 6700	0.25-8hr		Palmes diffusion tube	-----	NA		VIS
Nitrogen Dioxide	OSHA ID 182	3	0.2	(2) molecular sieve c/w TEA + (1) oxidizer tube	ORBO-906 ORBO-905	custom custom	226-40-02 NA	IC
Nitrogen Dioxide	OSHA ID 190	6	0.025	(2) molecular sieve c/w TEA + (1) oxidizer tube	ORBO-906 ORBO-905	custom custom	226-40-02 NA	IC-CD
Nitroglycerin	NIOSH 2507	3-100	0.2-1	Tenax	ORBO-402	20832-U	226-35-03	GC-ECD
Nitroglycerin	OSHA 43	15	1	Tenax	ORBO-402	20832-U	226-35-03	HPLC-TEA/UV
Nitromethane	NIOSH 2527	1.2-3	0.01-0.05	Chromosorb 106	ORBO-711	20059	226-111	GC-FPD
1-Nitropropane	OSHA 46	4	0.1	XAD-4	ORBO-613	20052	226-93	GC-FID
2-Nitropropane	NIOSH 2528	0.1-2	0.01-0.05	Chromosorb 106	ORBO-704	custom	226-110	GC-FID
2-Nitropropane	OSHA 46	4	0.1	XAD-4	ORBO-613	20052	226-93	GC-FID
Nitrosamines	NIOSH 2522	15-1000	0.2-2	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosodiamylamine (NDAMA)	OSHA 38	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosodibutylamine	NIOSH 2522	15-1000	0.2-2	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosodi-n-butylamine	OSHA 27	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosodiethanolamine	OSHA 31	480	2	glass fiber filter	-----	23378	225-7	GC-TEA
N-Nitrosodiethylamine	NIOSH 2522	15-1000	0.2-2	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosodiethylamine	OSHA 27	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosodi-isopropylamine (NDIPA)	OSHA 38	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosodimethylamine	EPA TO-7	<300	0.1-2	Thermosorb/N	-----	NA	NA	GC-MS
N-Nitrosodimethylamine	NIOSH 2522	15-1000	0.2-2	Thermosorb/N	-----	NA	NA	GC-TEA

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
N-Nitrosodimethylamine	OSHA 27	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosodiphenylamine	OSHA 23	250	1	fritted bubbler	-----	64835-U	225-36-2	HPLC-UV
N-Nitrosodi-n-propylamine	OSHA 27	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosodipropylamine	NIOSH 2522	15-1000	0.2-2	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosoethyl-n-butylamine (NEBA)	OSHA 38	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosomethyl-n-butylamine (NMBA)	OSHA 38	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosomethyl-ethylamine (NMEA)	OSHA 38	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosomorpholine	NIOSH 2522	15-1000	0.2-2	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosomorpholine	OSHA 27	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosopiperidine	NIOSH 2522	15-1000	0.2-2	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosopiperidine	OSHA 27	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitroso-n-propyl-n-butylamine (NPBA)	OSHA 38	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosopyrrolidine	NIOSH 2522	15-1000	0.2-2	Thermosorb/N	-----	NA	NA	GC-TEA
N-Nitrosopyrrolidine	OSHA 27	75	1	Thermosorb/N	-----	NA	NA	GC-TEA
Nitrotoluene	NIOSH 2005	1-30	0.01-0.02	silica gel	ORBO-52S	20229	226-10	GC-FID
Nitrous Oxide	NIOSH 6600	80% vol		5L sampling bag	-----	24655	232-05	IR
Nitrous Oxide	OSHA ID 166			Landauer diffusive sampler				TD-IR
Non-Methane Organic Compounds	EPA TO-12			glass bead trap canister		custom NA	 NA	FID
Octachloronaphthalene	NIOSH 2/S97	30	1.30	MCE filter	-----	23381	225-5	GC-ECD
Octamethylcyclo-tetrasiloxane	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Octane	OSHA 7	5	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Octane	NIOSH 1500	4	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Octane	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
1-Octanethiol	NIOSH 2510	1-15	0.01-0.2	Tenax	ORBO-403	20034	NA	GC-FPD
Oil Mist, Mineral	NIOSH 5026	20-500	1-3	MCE filter or glass fiber filter or PVC filter or PTFE filter	----- ----- ----- -----	23381 23378 23387 23390-U	225-5 225-7 225-8-01 225-17-07	IR
Oil of Vitriol (Sulfuric Acid)	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Organic Vapors	ASTM D3686	see method	0.001-0.2	coconut charcoal	ORBO-32S ORBO-32L	20267-U 20228	226-01 226-09	GC-FID
Organics	EPA 0040	20	0.5	Tedlar bag	-----	24656	231-15	GC-MS
Organotin Compounds (as Sn)	NIOSH 5504	50-500	1-1.5	XAD-2 glass fiber filter	ORBO-614 -----	custom 23378	226-30 225-7	HPLC-AAGF
Oxygen	NIOSH 6601	1		portable O2 monitor				sensor
Ozone	NIOSH 1/153	variable	1-2	impinger	-----	20270-U	225-36-1	colorimetric
Ozone	NIOSH 1/154	45	1	impinger	-----	20270-U	225-36-1	colorimetric
Ozone	NIOSH 2/S8		1	impinger	-----	20270-U	225-36-1	colorimetric
Ozone	OSHA ID 214	22.5-90	0.25-1.5	(2) glass fiber filter c/w $NaNO_2$, K_2CO_3, glycerol	850	custom	NA	IC-UV
PAHs – see Polynuclear Aromatic Hydrocarbons								
Palladium	NIOSH 1/173	180	1.5	MCE filter	-----	23381	225-5	AAS
Paraquat	NIOSH 5003	40-1000	1-4	PTFE filter	-----	23383	225-1710	HPLC-UV
Parathion	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Parathion	OSHA 62	480	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	GC-FPD
Particulate Matter, Respirable	EPA IP-10A			size specific impaction				gravimetric
Particulate Matter, Respirable	EPA IP-10B			continuous particulate monitor				gravimetric
Particulates	NIOSH 0600	20-400	1.7 or 2.2	PVC filter cyclone	----- -----	23387 NA	225-8-01	gravimetric

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
PCBs – Aroclor 1242 (42% Cl)	NIOSH 5503	1-50	0.05-0.2	glass fiber filter Florisil	----- ORBO-60	23376 20351	225-16 226-39	GC-ECD
PCBs – Aroclor 1254 (54% Cl)	NIOSH 5503	1-50	0.05-0.2	glass fiber filter Florisil	----- ORBO-60	23376 20351	225-16 226-39	GC-ECD
Pentachlorobenzene	NIOSH 5517	3-12	0.01-0.2	XAD-2 PTFE filter	ORBO-44 -----	20260-U special order	226-30-04	GC-ECD
Pentachloroethane	NIOSH 2517	1-10	0.01-0.2	Porapak R	ORBO-1104	20064	226-59-04	GC-ECD
Pentachloronaphthalene	NIOSH 2/S96	250	1.3	glass fiber filter fritted bubbler	----- -----	23378 64835-U	225-7 225-36-2	GC-ECD
Pentachlorophenol	NIOSH 5512	48-480	0.5-1	MCE filter stainless steel screen fritted bubbler	----- ----- -----	23381 custom 64835-U	225-5 225-36-2	HPLC-UV
Pentachlorophenol	OSHA 39	48	0.2	XAD-7 XAD-7/glass fiber filter (set of 3)	ORBO-602	custom	226-97	HPLC-UV
Pentamidine Isethionate	NIOSH 5032	50-1500	1-2	PVC filter	-----	23387	225-8-01	HPLC-FL
Pentane	OSHA 7	2	0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Pentane	NIOSH 1500	2	0.01-0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Pentane	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
2-Pentanone	NIOSH 1300	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2-Pentanone	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Perchloroethylene	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Perchloroethylene in exhaled breath and air	NIOSH 3704		0.02-5	1L sampling bag	-----	24633	232-01	portable GC-PID
Perchloroethylene – see also Tetrachloroethylene								
Pesticides	ASTM D4861	240-7200	1-5	polyurethane foam (PUF)	ORBO-1000	20557	226-92	GC-ECD
Pesticides	US Air Force		0.6-1	XAD-2	ORBO-42S	20262	NA	GC-ECD or HPLC-UV
Pesticides, Organochlorine	EPA IP-8		1-5	polyurethane foam (PUF) glass fiber filter cartridge	ORBO-1000 -----	20557 21031	226-126	GC-ECD
Pesticides, Organonitrogen	NIOSH 5601	<480	0.1-1	XAD-2/glass fiber filter XAD-2/quartz filter (OVS)	ORBO-49P or ORBO-49Q	20350 custom	226-30-16 226-58	HPLC-UV
Pesticides, Organophosphorus	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Pesticides/PCBs	EPA TO-10A		1-5	polyurethane foam (PUF) quartz filter cartridge	ORBO-1000 -----	20557 21031	226-126	GC/ECD/NPD/FPD/MS
Pesticides/PCBs	EPA TO-4A	320,000	225	polyurethane foam (PUF)	ORBO-2000	20037	226-131	GC/ECD/NPD/FPD/MS
Petroleum Distillates (Naphtha)	NIOSH 1550	1.3-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Petroleum Distillates (Naphtha)	OSHA 48	3	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Petroleum Ether (Benzin)	NIOSH 1550	1.3-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Phenanthrene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Phenanthrene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Phenanthrene	OSHA 58	960	2	glass fiber filter	-----	23378	225-7	HPLC-UV
Phenol	EPA TO-8	<80	0.1-1	NaOH absorbing solution				HPLC UV/ELCD/Fl
Phenol	NIOSH 2546	1-24	0.01-0.1	XAD-7 (Supelpak 70)	ORBO-47	20349	226-95	GC-FID
Phenol	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Phenol	OSHA 32	24	0.1	XAD-7 (Supelpak 70)	ORBO-47	20349	226-95	HPLC-UV
Phenyl Ether	NIOSH 1617	1-50	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Phenyl Ether	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Phenyl Ether – Biphenyl Mixture	NIOSH 2013	1-40	0.01-0.2	silica gel	ORBO-52S	20229	226-10	GC-FID
Phenyl Glycidyl Ether	NIOSH 1619	80-150	0.01-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Phenyl Glycidyl Ether	OSHA 7	50	0.1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Phenylhydrazine	NIOSH 3518	25-120	0.2-1	fritted bubbler	-----	64835-U	225-36-2	VIS
N-Phenyl-1-naphthylamine	OSHA 96	240	1	glass fiber filter c/w ascorbic acid	893	custom	NA	HPLC-FI
N-Phenyl-2-naphthylamine	OSHA 96	240	1	glass fiber filter c/w ascorbic acid	893	custom	NA	HPLC-FI
o-, m-, p-Phenylenediamine	OSHA 87	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	HPLC-UV
Phorate	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Phosdrin (Mevinphos)	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Phosgene	EPA TO-6	<50	<1	aniline in toluene absorbing solution				HPLC-UV
Phosgene	NIOSH 1/219	25-50	1	impinger	-----	20270-U	225-36-1	colorimetric
Phosgene	OSHA 61	240	1	XAD-2 c/w 2-HMP	ORBO-24	20231	226-117	GC-NPD
Phosphine	NIOSH 6002	1-16	0.01-0.2	silica gel c/w mercuric cyanide	ORBO-553	NA	NA	VIS
Phosphine	OSHA ID 180	36	0.05-0.15	carbon c/w KOH	ORBO-1004	20035	226-31	IC
Phosphoric Acid	OSHA ID 111	960	2	MCE filter	-----	23381	225-5	IC
Phosphoric acid	OSHA ID 165SG	96	0.20	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
m-Phosphoric Acid	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
o-Phosphoric Acid	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Phosphorus	NIOSH 7300	50-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Phosphorus	NIOSH 7905	5-100	0.01-0.2	Tenax	ORBO-402	20832-U	226-35-03	GC-FPD
Phosphorus Pentachloride	NIOSH 5/S257	48	0.2	PVC filter fritted bubbler	----- -----	custom 64835-U	225-36-2	colorimetric
Phosphorus Trichloride	NIOSH 6402	11-100	0.05-0.2	fritted bubbler	-----	64835-U	225-36-2	VIS
Phthalic Anhydride	NIOSH 3/S179	100	1.5	MCE filter	-----	23381	225-5	HPLC-UV
Phthalic Anhydride	OSHA 90	75	1	(2) glass fiber filter c/w DMBA	835	custom	NA	HPLC-UV
Picric Acid	NIOSH 4/S228	180	1.5	MCE filter	-----	23381	225-5	HPLC-UV
Pinene	NIOSH 1552	2-30	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Pinene	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Platinum	NIOSH 7300	13-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Polychlorinated Dibenzofurans	EPA 23			XAD-2	Supelpak 2	20279	NA	GC-MS
Polychlorinated Dibenzo-p-dioxins – see Dioxins	EPA 23			XAD-2	Supelpak 2	20279	NA	GC-MS
Polychlorobenzenes	NIOSH 5517	3-12	0.01-0.2	XAD-2 PTFE filter	ORBO-44 -----	20260-U special order	226-30-04	GC-ECD
Polychlorobiphenyls (also see PCBs)	ASTM D4861	240-7200	1-5	polyurethane foam (PUF)	ORBO-1000	20557	226-92	GC-ECD
Polycyclic Aromatic Compounds, Total (PACs)	NIOSH 5800	5-1000	1-2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	Flow injection, FI
Polymethylsiloxane Mist	NIOSH 1/227	408	1.7	MCE filter	-----	23381	225-5	AAS
Polynuclear Aromatic Hydrocarbons (PAHs)	EPA IP-7	30,000	20	polyurethane foam (PUF)	ORBO-2000	20037	226-131	GC-FID HPLC-UV
Polynuclear Aromatic Hydrocarbons	EPA TO-13A	<320,000	225	polyurethane foam (PUF) or XAD-2	ORBO-2000 Supelpak 2	20037 or 20279	226-131	GC-MS
Polynuclear Aromatic Hydrocarbons	ASTM D6209	<350,000	225	polyurethane foam (PUF) or XAD-2	ORBO-2000 Supelpak 2	20037 or 20279	226-131	GC-MS
Polynuclear Aromatic Cmpds by HPLC	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 or ORBO-42L -----	20258 20264-U 23390-U	226-30-04 NA 225-17-07	HPLC-UV/FI
Polynuclear Aromatic Hydrocarbons	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Polynuclear Aromatic Hydrocarbons, Selected	OSHA 58	960	2	glass fiber filter	-----	23378	225-7	HPLC-UV

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Portland Cement (Total Dust)	OSHA ID 207	240	1	PVC filter	-----	23387	225-8-01	gravimetric, XRF
Potassium	NIOSH 1/173	180	1.5	MCE filter	-----	23381	225-5	AAS
Potassium, K	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Potassium Hydroxide	NIOSH 7401	70-1000	1-4	PTFE filter	-----	23383	225-1710	titration
Propargyl Alcohol	OSHA 97	6	0.05	petroleum charcoal c/w HBr	ORBO-353	20044	226-38-03	GC-ECD
Propionaldehyde	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
n-Propyl Acetate	NIOSH 1450	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Propyl Acetate	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Propyl Alcohol	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Propyl Alcohol	NIOSH 1401	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Propyl Nitrate	NIOSH 3/S227	70	1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
n-Propyl Nitrate	OSHA 7	50	0.1	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
Propylene Dichloride	NIOSH 1013	0.1-3.5	0.01-0.2	petroleum charcoal	ORBO-303	20040-U	226-38	GC-ECN
Propylene Dichloride	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Propylene Glycol	NIOSH 5523	5-60	0.5-2	XAD-7/glass fiber filter (OVS)	ORBO-47P	custom	226-57	GC-FID
Propylene Glycol Momomethyl Ethers/Acetates - see Methoxypropanols, Methoxypropyl Acetates								
Propylene Oxide	NIOSH 1612	0.5-5	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Propylene Oxide	OSHA 88	5	0.1	Carbosieve S-III (Anasorb 747)	ORBO-91	20360	226-81A	GC-FID
Prussic Acid	NIOSH 7904	7-100	0.5-1	MCE filter fritted bubbler	----- -----	23381 64835-U	225-5 225-36-2	ISE
Prussic Acid	OSHA ID 120	90-1280	1	MCE filter impinger	----- -----	23381 20270-U	225-5 225-36-1	ISE
Prussic Acid (Hydrogen Cyanide)	NIOSH 6010	2-90	0.05-0.2	soda lime	ORBO-1006	custom	226-28	VIS
Pyrene	NIOSH 5506	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	HPLC-UV/Fl
Pyrene	NIOSH 5515	200-1000	2	XAD-2 PTFE filter	ORBO-43 -----	20258 23390-U	226-30-04 225-17-07	GC-FID
Pyrene	OSHA 58	960	2	glass fiber filter	-----	23378	225-7	HPLC-UV
Pyrethrum	NIOSH 5008	20-400	1-4	glass fiber filter	-----	23378	225-7	HPLC-UV
Pyrethrum	OSHA 70	60	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	GC-ECD
Pyridine	NIOSH 1613	18-150	0.01-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Pyridine	OSHA 7	50	1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Qualitative X-ray Fluorescence Analysis of Workplace Substances	OSHA ID 204	960	2	MCE filter PVC filter	----- -----	23381 23387	225-5 225-8-01	XRF
Quartz	OSHA ID 142	816	1.7	PVC filter 10mm nylon cyclone	----- -----	23387 NA	225-8-01	XRD
Quartz, Respirable, in Coal Dust	NIOSH 7603	300-1000	1.7 or 2.2	PVC filter	-----	23387	225-8-01	IR
Quicklime (Calcium)	NIOSH 7020	20-400	1-3	MCE filter	-----	23381	225-5	AAS
Quinone	NIOSH 4/S181	24	0.01-0.2	XAD-2	ORBO-605	20049	NA	HPLC-UV
Reactive Acidic and Basic Gases and Particulate Matter	EPA IP-9			annular denuder system				IC
Resorcinol	NIOSH 5701	5-160	0.2-1	XAD-7/glass fiber filter (OVS)	ORBO-47P	custom	226-57	GC-FID
Rhodium, Metal, Fumes & Dust	NIOSH 3/S188	720	1.5	MCE filter	-----	23381	225-5	AAS
Rhodium, Soluble Salts	NIOSH 3/S189	370	1.5	MCE filter	-----	23381	225-5	AAGF
Ribavirin	NIOSH 5027	5-1000	1-4	glass fiber filter	-----	23378	225-7	HPLC-UV
Ronnel	NIOSH 5600	12-60	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Rotenone	NIOSH 5007	8-400	1-4	PTFE filter	-----	23383	225-1710	HPLC-UV
Rubidium	NIOSH 1/173	180	1.5	MCE filter	-----	23381	225-5	AAS

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Selenium	NIOSH 7300	5-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Selenium	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Semivolatiles	EPA 0010			glass fiber filter XAD-2	----- Supelpak 2	custom 20279	NA	GC-MS
Semivolatiles (SASS)	EPA 0020			glass fiber filter XAD-2	----- Supelpak 2	custom 20279	NA	GC-MS
Sevin	NIOSH 5006	20-400	1-3	glass fiber filter	-----	23378	225-7	VIS
Sevin	OSHA 63	60	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	HPLC-UV
Silica, Amorphous	NIOSH 7501	50-400	1.7 or 2.2	PVC filter	-----	23387	225-8-01	XPD
Silica, Crystalline	NIOSH 7601	400-800	1.7 or 2.2	MCE filter or PVC filter + 10mm nylon cyclone	----- ----- -----	23381 23387 NA	225-5 225-8-01	VIS
Silica, Crystalline	NIOSH 7602	400-800	1.7 or 2.2	MCE filter or PVC filter + 10mm nylon cyclone	----- ----- -----	23381 23387 NA	225-5 225-8-01	IR
Silica, Crystalline, Respirable	NIOSH 7500	400-1000	1.7 or 2.2	PVC filter	-----	23387	225-8-01	XPD
Silica (Quartz, Respirable) also see Quartz	OSHA ID 142	816	1.7	PVC filter	-----	23387	225-8-01	XRD
Silica, Quartz, in Coal Dust	NIOSH 7603	300-1000	1.7 or 2.2	PVC filter	-----	23387	225-8-01	IR
Silicon	NIOSH 1/173	180	1.5	MCE filter	-----	23381	225-5	AAS
Silver	NIOSH 7300	250-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Silver (as Ag)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Sodium Azide	OSHA ID 211	>5	1.0	silica gel c/w NaOH PVC filter	ORBO-560 -----	custom 23387	226-55 225-8-01	IC-UV
Sodium Dichloroisocyanurate Dihyrate	NIOSH 5/314	400	1.7	PVC filter	-----	23387	225-8-01	titration
Sodium Fluoride	NIOSH 7902	12-800	1-2	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	ISE
Sodium Fluoroacetate	NIOSH 5/S301	480	1.5-2	Nucleopore cellulosic membrane	-----	special order		IC-ELCD
Sodium Hexafluoroaluminate	NIOSH 7902	12-800	1-2	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	ISE
Sodium Hexafluoroaluminate	NIOSH 7906	120-800	1-2	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	IC
Sodium Hydroxide	NIOSH 7401	70-1000	1-4	PTFE filter	-----	23383	225-1710	titration
Sodium Hydroxide	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Sodium Polyacrylate	NIOSH 5035	50-1500	1-3	PVC filter	-----	23387	225-8-01	ICP-AES or AAS
Solder Metals	OSHA ID 206	480	2	MCE filter	-----	23381	225-5	ICP-AES
Stibine	NIOSH 6008	4-50	0.01-0.2	silica gel c/w mercuric chloride	ORBO-551	custom	226-10-02	VIS
Stoddard Solvent	NIOSH 1550	1.3-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Stoddard Solvent	OSHA 48	3	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Strychnine	NIOSH 5016	70-1000	1-3	glass fiber filter	-----	23378	225-7	HPLC-UV
Styrene (Phenylethylene)	OSHA 9	10-15	0.2-1.0	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Styrene	NIOSH 1501	1-14	0.01-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Styrene	OSHA 89	12	0.05	charcoal c/w TBC	ORBO-356	20047	NA	GC-FID
Styrene Oxide	NIOSH 5/303	13	0.01-0.2	Tenax	ORBO-406	custom	226-35-06	GC-FID
Sulfur Dioxide	NIOSH 6004	4-200	0.5-1.5	MCE filter + support pad c/w Na2CO3	845	custom	225-9005 225-9001	IC
Sulfur Dioxide	OSHA ID 104	15-60	1	MCE filter fritted bubbler	----- -----	23381 64835-U	225-5 225-36-2	IC
Sulfur Dioxide	OSHA ID 200	1.5-12	0.1	carbon c/w KOH	ORBO-1010	custom	226-80	IC
Sulfur Hexafluoride	NIOSH 5/S244	3-4	0.01-0.05	5L sampling bag	-----	24655	232-05	GC-TCD
Sulfur Hexafluoride	NIOSH 6602	80% vol	0.01-0.05	5L sampling bag	-----	24655	232-05	GC-ECD
Sulfuric Acid	NIOSH 7903	3-100	0.2-0.5	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Sulfuric Acid	OSHA ID 113	480	2	MCE filter	-----	23381	225-5	IC
Sulfuric Acid	OSHA ID 165SG	96	0.20	silica gel/glass fiber filter	ORBO-53	20265	226-10-03	IC
Sulfuric Acid Mist	ASTM D4856	40	1	MCE filter	-----	23381	225-5	IC

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Sulfuryl Fluoride	NIOSH 6012	1.3-10	0.05-0.1	coconut charcoal	ORBO-32J	custom	226-16	IC
Sulprofos	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Super Absorbent Polymers	NIOSH 5035	50-1500	1-3	PVC filter	-----	23387	225-8-01	ICP-AES or AAS
2,4,5-T	NIOSH 5001	15-200	1-3	glass fiber filter	-----	23378	225-7	HPLC-UV
Talc, Respirable	NIOSH 355 2nd ed. update	200	1.7	PVC filter 10mm nylon cyclone	----- -----	23387 NA	225-8-01	XRD
Tellurium	NIOSH 7300	25-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Tellurium	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Tellurium Hexafluoride	NIOSH 3/S187	400	1	coconut charcoal	ORBO-32S	20267-U	226-01	AAS
Temik	OSHA 74	480	1	XAD-2/glass fiber filter (OVS)	ORBO-49P	20350	226-30-16	GC-NPD
Terbufos	NIOSH 5600	12-240	0.2-1	XAD-2/quartz filter (OVS)	ORBO-49Q	custom	226-58	GC-FPD
Terpenes	NIOSH 1552	2-30	0.01-2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
o-Terphenyl	NIOSH 5021	2-30	1-3	PTFE filter	-----	23390-U	225-17-07	GC-FID
1,1,2,2-Tetra-bromoethane	NIOSH 2003	50-100	0.2-1	silica gel	ORBO-52S	20229	226-10	GC-FID
Tetrabutyltin	NIOSH 5504	50-500	1-1.5	XAD-2 glass fiber filter	ORBO-614 -----	custom 23378	226-30 225-7	HPLC-AAGF
1,2,4,5-Tetrachlorobenzene	NIOSH 5517	3-12	0.01-0.2	XAD-2 PTFE filter	ORBO-44 -----	20260-U special order	226-30-04	GC-ECD
1,1,1,2-Tetrachloro-2,2-difluoroethane	NIOSH 1016	0.5-2	0.01-0.035	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1,1,2-Tetrachloro-2,2-difluoroethane	OSHA 7	2	0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1,2,2-Tetrachloro-1,2-difluoroethane	NIOSH 1016	0.5-2	0.01-0.035	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1,2,2-Tetrachloro-1,2-difluoroethane	OSHA 7	2	0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1,2,2-Tetrachloroethane	NIOSH 1019	3-30	0.01-0.2	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
1,1,2,2-Tetrachloroethane	OSHA 7	10	0.2	petroleum charcoal	ORBO-303	20040-U	226-38	GC-FID
Tetrachloroethylene (Perchloroethylene)	NIOSH 1003	0.2-40	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Tetrachloroethylene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Tetrachloronaphthalene	NIOSH 2/S130	100	1.3	glass fiber filter fritted bubbler	----- -----	23378 64835-U	225-7 225-36-2	GC-FID
2,3,4,6-Tetrachlorophenol	OSHA 45	48	0.2	XAD-7 XAD-7/glass fiber filter (set of 3)	ORBO-602	custom	226-97	HPLC-UV
Tetraethyl Lead	NIOSH 2533	30-200	0.01-1	XAD-2	ORBO-605	20049	NA	GC-PID
Tetraethyl Pyrophosphate	NIOSH 2504	20-48	0.01-0.2	(2) Chromosorb 102	ORBO-707	custom	226-105	GC-FPD
Tetraethyltin	OSHA 110	3-48	0.2	XAD-7 (Supelpak 70)	ORBO-47	20349	226-95	GC-FID
Tetraethylene Glycol	NIOSH 5523	5-60	0.5-2	XAD-7/glass fiber filter (OVS)	ORBO-47P	custom	226-57	GC-FID
Tetrahydrofuran	NIOSH 1609	1-9	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Tetrahydrofuran	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Tetramethyl Lead (as Pb)	NIOSH 2534	15-100	0.01-0.2	XAD-2	ORBO-609	20051	226-30-06	GC-PID
Tetramethylper-oxidicarbonicdiamide (Thiram)	NIOSH 5005	10-400	1-4	PTFE filter	-----	23383	225-1710	HPLC-UV
Tetramethyl Succinonitrile	NIOSH 3/S155	50	1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Tetramethyl Succinonitrile	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Tetramethyl Thiourea	NIOSH 3505	50-250	0.2-1	impinger	-----	20270-U	225-36-1	VIS

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Tetranitromethane	NIOSH 3/S224	250	1	impinger	-----	20270-U	225-36-1	GC-FID
Tetranitromethane	NIOSH 3513	20-250	0.5-1	impinger	-----	20270-U	225-36-1	GC-FID
Tetryl (2,4,6-trinitrophenyl-methylnatramine)	NIOSH 3/S225	100	1.5	MCE filter	-----	23381	225-5	VIS
Thallium	NIOSH 7300	25-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Thallium (as Tl)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Thiophene	NIOSH 1/255	70	1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FPD
Thiram	NIOSH 5005	10-400	1-4	PTFE filter	-----	23383	225-1710	HPLC-UV
Tin (as Sn), Tin Oxide	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Tin (Organic Compounds)	NIOSH 5504	50-500	1-1.5	XAD-2 glass fiber filter	ORBO-614 -----	custom 23378	226-30 225-7	HPLC-AAGF
Titanium	NIOSH 7300	5-100	1-4	MCE filter	-----	23381	225-5	ICP-AES
Titanium Diboride	NIOSH 6/323	500	1.7	PVC filter	-----	23387	225-8-01	XRD
Titanium Dioxide	NIOSH 3/S385	100	1.5	MCE filter	-----	23381	225-5	AAS
o-Tolidine	NIOSH 5013	150-500	1-3	PTFE filter	-----	23389	225-17	HPLC-UV
o-Tolidine	OSHA 71	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
Toluene	NIOSH 1500	2-8	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Toluene	NIOSH 1501	1-8	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Toluene	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Toluene	NIOSH 4000	15m-8h		3M #3500 diffusive sampler	-----	20249-U		GC-FID
Toluene	OSHA 111	12	0.05	coconut charcoal or Carbosieve SIII (Anasorb 747) or 3M #3520 diffusive sampler	ORBO-32S ORBO-91 -----	20267-U 20360 207121	226-01 226-81A 575-002	GC-FID
Toluene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
2,4-Toluenediamine	NIOSH 5516	30-500	1	impinger	-----	20270-U	225-36-1	HPLC-UV
2,4-Toluenediamine	OSHA 65	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
2,6-Toluenediamine	NIOSH 5516	30-500	1	impinger	-----	20270-U	225-36-1	HPLC-UV
2,6-Toluenediamine	OSHA 65	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
2,4-Toluene Diisocyanate (TDI)	ASTM D5836	15	1	glass fiber filter c/w 1-2PP	ORBO-80	20811	225-9002	HPLC-UV
2,4-Toluene Diisocyanate (TDI)	OSHA 42	15	1	glass fiber filter c/w 1-2PP	ORBO-80	20811	225-9002	HPLC-UV
Toluene-2,4-diisocyanate	NIOSH 5522	15-380	1-2	impinger	-----	20270-U	225-36-1	HPLC-FL
Toluene-2,4-diisocyanate (TDI)	NIOSH 2535	2-170	0.2-1	glass wool c/w NPMPA	ORBO-1007	custom	special order	HPLC-UV
Toluene-2,4-diisocyanate (TDI)	NIOSH 5521	5-500	1	impinger	-----	20270-U	225-36-1	HPLC-UV ELCD
2,6-Toluene Diisocyanate (TDI)	ASTM D5836	15	1	glass fiber filter c/w 1-2PP	ORBO-80	20811	225-9002	HPLC-UV
2,6-Toluene Diisocyanate (TDI)	OSHA 42	15	1	glass fiber filter c/w 1-2PP	ORBO-80	20811	225-9002	HPLC-UV
Toluene-2,6-diisocyanate	NIOSH 5521	5-500	1	impinger	-----	20270-U	225-36-1	HPLC-UV ELCD
Toluene-2,6-diisocyanate	NIOSH 5522	15-380	1-2	impinger	-----	20270-U	225-36-1	HPLC-FL
p-Toluenesulfonic Acid	NIOSH 5043	10-1000	1-3	glass fiber filter	-----	23376	225-16	HPLC-UV
m-Toluidine	OSHA 73	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
o-Toluidine	NIOSH 2002	10-150	0.02-1	silica gel	ORBO-52S	20229	226-10	GC-FID
o-Toluidine	NIOSH 2017	5-50	0.2	silica gel + glass fiber filter c/w H2SO4	ORBO-507 822	20870-U 20065	226-15 225-9004	GC-FID
o-Toluidine	OSHA 73	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
p-Toluidine	OSHA 73	100	1	glass fiber filter c/w H2SO4	822	20065	225-9004	GC-ECD
Tremolite Fibers	NIOSH 7400	400-	0.5-16	MCE filter	-----	23380-U	225-19	PCM
Tribromomethane	NIOSH 1003	4-70	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Tributyl Phosphate	NIOSH 5034	2-100	1-3	MCE filter	-----	23381	225-5	GC-FPD
Tributyltin Chloride	NIOSH 5504	50-500	1-1.5	XAD-2 glass fiber filter	ORBO-614 -----	custom 23378	226-30 225-7	HPLC-AAGF
1,2,4-Trichlorobenzene	NIOSH 5517	3-12	0.01-0.2	XAD-2 PTFE filter	ORBO-44 -----	20260-U special order	226-30-04	GC-ECD
1,1,1-Trichloroethane	NIOSH 1003	0.1-8	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
1,1,1-Trichloroethane	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
1,1,1-Trichloroethane	OSHA 14	3	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1,2-Trichloroethane	NIOSH 1003	2-60	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1,2-Trichloroethane	OSHA 11	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Trichloroethylene	NIOSH 1022	1-30	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Trichloroethylene	NIOSH 3701	<80% vol	0.02-0.05	5L sampling bag	-----	24655	232-05	GC-PID
Trichloroethylene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Trichlorofluoromethane	NIOSH 1006	0.3-7	0.01-0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Trichloroisocyanuric Acid	NIOSH 5/314	400	1.7	PVC filter	-----	23387	225-8-01	titration
Trichloronaphthalene	NIOSH 2/S128	100	1.3	glass fiber filter fritted bubbler	----- -----	23378 64835-U	225-7 225-36-2	GC-FID
1,2,3-Trichloropropane	NIOSH 1003	0.6-60	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,2,3-Trichloropropane	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon113)	NIOSH 1020	0.1-3	0.01-0.05	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon113)	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	OSHA 113	1	0.05	(2) Carbosieve S-III (Anasorb CMS)	ORBO-91	20360	226-121	GC-FID
Tricyclohexyltin Hydroxide	NIOSH 5504	50-500	1-1.5	XAD-2 glass fiber filter	ORBO-614 -----	custom 23378	226-30 225-7	HPLC-AAGF
Triethanolamine	NIOSH 3509	5-300	0.5-1	impinger	-----	20270-U	225-36-1	IC
Triethylamine	NIOSH 3/S152	100	1	fritted bubbler	-----	64835-U	225-36-2	GC-FID
Triethylene Glycol	NIOSH 5523	5-60	0.5-2	XAD-7/glass fiber filter (OVS)	ORBO-47P	custom	226-57	GC-FID
Triethylenetetramine (TETA)	NIOSH 2540	1-20	0.01-0.1	XAD-2 c/w 10% NITC	ORBO-654	custom	226-30-18	HPLC-UV
Triethylenetetramine (TETA)	OSHA 60	10	0.1	XAD-2 c/w 10% NITC	ORBO-654	custom	226-30-18	HPLC-UV
Trifluorobromomethane	NIOSH 1017	0.1-1	0.01-0.05	(2) coconut charcoal	ORBO-32S + ORBO-32L	20267-U 20228	226-01 226-09	GC-FID
Trimellitic Anhydride	NIOSH 5036	400-1000	1.5-2	37mm PVC-copolymer filter 0.8um	-----	special order		GC-FID
Trimellitic Anhydride	OSHA 98	480	2	glass fiber filter c/w DMBA & DOP	894	custom	225-9010	HPLC-UV
2,4,7-Trinitrofluoren-9-one	NIOSH 5018	100-500	1-3	PTFE filter	-----	special order	225-17-04	HPLC-UV
2,4,6-Trinitrotoluene (TNT)	OSHA 44	60	1	Tenax/glass fiber filter	ORBO-79	custom	NA	GC-TEA
Triorthocresyl Phosphate	NIOSH 5037	2-100	1-3	MCE filter	-----	23381	225-5	GC-FPD
Triphenyl Phosphate	NIOSH 5038	10-400	1-3	MCE filter	-----	23381	225-5	GC-FPD
Tungsten	OSHA ID 213	30-480	2	MCE filter	-----	23381	225-5	ICP-AES
Tungsten, Insoluble	NIOSH 7074	200-1000	1-4	MCE filter	-----	23381	225-5	AAS
Tungsten, Soluble	NIOSH 7074	200-1000	1-4	MCE filter	-----	23381	225-5	AAS
Turpentine	NIOSH 1551	1-10	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Turpentine	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
V M & P Naphtha	NIOSH 1550	1.30-20	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Valeraldehyde	NIOSH 2536	0.5-10	0.01-0.04	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Valeraldehyde	NIOSH 2539	5	0.01-0.05	XAD-2 c/w 2-HMP	ORBO-23	20257-U	226-118	GC-FID
Valeraldehyde	OSHA 85	3	0.05	glass fiber filter c/w DNPH	827	20069	225-9003	HPLC-UV
Vanadic Anhydride	NIOSH 7504	200-1000	1.7 or 2.2	PVC filter	-----	23387	225-8-01	XPD
Vanadic Oxide	NIOSH 7504	200-1000	1.7 or 2.2	PVC filter	-----	23387	225-8-01	XPD
Vanadium	NIOSH 7300	5-2000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Vanadium (V205) Dust (as V)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Vanadium (V205) Fume (as V)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Vanadium Oxides	NIOSH 7504	200-1000	1.7 or 2.2	PVC filter	-----	23387	225-8-01	XPD
Vanadium Pentoxide	OSHA ID 185	816	1.7	PVC filter	-----	23387	225-8-01	XRF/XRD
Vinyl Acetate	NIOSH 1453	0.085-24	0.1-0.2	Carboxen 564	ORBO-92	20362	NA	GC-FID
Vinyl Acetate	OSHA 51	24	0.1	Carboxen 564	ORBO-92	20362	NA	GC-FID
Vinyl Benzene (Styrene)	NIOSH 1501	1-14	0.01-1	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Vinyl Bromide	NIOSH 1009	2-10	0.01-0.2	coconut charcoal	ORBO-32L	20228	226-09	GC-FID
Vinyl Bromide	OSHA 8	5	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Vinyl Chloride	ASTM D4766	25	0.05-0.1	coconut charcoal	ORBO-32J	custom	226-16	GC-FID
Vinyl Chloride	NIOSH 1007	0.7-5	0.05	(2) coconut charcoal	ORBO-301	20039	NA	GC-FID
Vinyl Chloride	OSHA 75	3	0.05	Carbosieve S-III	ORBO-91	20360	226-121	GC-FID
Vinyl Toluene	NIOSH 1501	24	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Vinyl Toluene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Vinylidene Chloride (1,1-Dichloroethene)	NIOSH 1015	2.5-7	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Vinylidene Chloride	OSHA 19	3	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
Volatile Organic Compounds (VOST)	EPA 0030	20	1	Tenax + Tenax/charcoal	VOST 100 + VOST 200	20074-U 20075-U	226-134 226-135	GC-MS
Volatile Organic Compounds (VOST)	EPA 0031	20	1	(2) Tenax + (1) Carbosieve S-III (Anasorb 747)	VOST 100 + VOST 150	20074-U custom	226-134 226-133	GC-MS
Volatile Organic Compounds (VOCs)	EPA IP-1A			canister	-----	NA	NA	GC-MS
Volatile Organic Compounds (VOCs)	EPA IP-1B	17-23	0.02-0.06	3-bed thermal desorption tube	Carbotrap 300	20379		TD-GC/MS
Volatile Organic Compounds (VOCs)	EPA TO-1	varies		3-bed thermal desorption tube	Carbotrap 300	20379		GC-MS
Volatile Organic Compounds (VOCs)	EPA TO-2	20-100	0.020-0.5	3-bed thermal desorption tube	Carbotrap 300	20379		GC-MS
Volatile Organic Compounds (VOCs)	EPA TO-3	0.1-1	0.01-0.1	3-bed thermal desorption tube	Carbotrap 300	20379		GC/ECD/FID
Volatile Organic Compounds (VOCs)	EPA TO-14			canister	-----	NA	NA	GC-MS or NPD/FID/ECD/ PID
Volatile Organic Compounds (VOCs)	EPA TO-15		0.0035-0.007	canister focusing trap	----- Purge Trap H	NA 20321	NA NA	GC-MS
Volatile Organic Compounds (VOCs)	EPA TO-16			FTIR and other remote sensing instruments				FTIR
Volatile Organic Compounds (VOCs)	EPA TO-17	1 & 4	0.01-0.2	multi-bed thermal desorption tube	Carbotrap 217 Carbotrap 317 Air Toxics Air Toxics Carbotrap 300 Carbotrap 300	20895-U 20877 25086 25051 25085 25050		TD-GC/MS
Volatile Organic Compounds (VOCs)	ASTM D6196	<10	<0.2	multi-bed thermal desorption tube	Carbotrap 217 Carbotrap 317 Air Toxics Air Toxics Carbotrap 300 Carbotrap 300	20895-U 20877 25086 25051 25085 25050		TD-GC/MS
Volatile Organic Compounds (VOCs)	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243		TD-GC/MS
Warfarin	NIOSH 5002	200-1000	1-4	PTFE filter	-----	23383	225-1710	HPLC-UV
Welding Fumes	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES

Compound	Method	Volume Liters	Rate Liters/Min	Medium and/or Sample Collection Device	Supelco Model No.	Supelco Cat. No.	SKC Equiv	Analytical Technique
Xylene	NIOSH 2549	1-6	0.01-0.05	3-bed thermal desorption tube	Carbotrap 349	20243	NA	TD-GC/MS
Xylene	OSHA 7	10	0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
m-Xylene	NIOSH 1501	2-23	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
o-Xylene	NIOSH 1501	2-23	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
p-Xylene	NIOSH 1501	2-23	0.01-0.2	coconut charcoal	ORBO-32S	20267-U	226-01	GC-FID
m-Xylene-α,α'-diamine	OSHA 105	15	1	glass fiber filter c/w H2SO4	822	20065	225-9004	HPLC-UV
p-Xylene-α,α'-diamine	OSHA 105	15	1	glass fiber filter c/w H2SO4	822	20065	225-9004	HPLC-UV
2,4-Xylidine	NIOSH 2002	3-20	0.02-0.2	silica gel	ORBO-52S	20229	226-10	GC-FID
Yttrium	NIOSH 7300	5-1000	1-4	MCE filter	-----	23381	225-5	ICP-AES
Zinc, Zinc Compounds (as Zn)	NIOSH 7030	2-400	1-3	MCE filter	-----	23381	225-5	AAS
Zinc, Zinc Compounds (as Zn)	NIOSH 7300	5-200	1-4	MCE filter	-----	23381	225-5	ICP-AES
Zinc, Zinc Compounds (as Zn)	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Zinc, Zinc Compounds (as Zn)	OSHA ID 125G	480	2	MCE filter	-----	23381	225-5	ICP-AES
Zinc Chloride Fume	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Zinc Oxide	NIOSH 7502	10-400	1-3	PVC filter	-----	special order		XPD
Zinc Oxide	OSHA ID 143	30-960	2	PVC filter	-----	23387	225-8-01	XRD
Zineb	OSHA 107	500	2	MCE filter	-----	23380-U	225-19	HPLC-UV
Zirconium	NIOSH 7300	5-200	1-4	MCE filter	-----	23381	225-5	ICP-AES
Zirconium	OSHA ID 121	480-960	2	MCE filter	-----	23381	225-5	AAS
Zirconium Oxides	NIOSH 4/250	90	1.7	PVC filter	-----	23387	225-8-01	XRD

If you have questions concerning this guide, please contact our Technical Service specialists. For additional method information, visit the agency websites listed below.

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Agency Websites

NIOSH www.cdc.gov/niosh/homepage.html

OSHA www.osha.gov

EPA www.epa.gov

ASTM www.astm.org