# Optimizing the Analysis of Semi-volatiles by EPA Method 8270

David Steiniger<sup>1</sup>, Tommaso Albertini<sup>2</sup> and Richard Law<sup>3</sup>; <sup>1</sup>Thermo Fisher Scientific, Austin, TX; <sup>2</sup>Thermo Fisher Scientific, Milan, Italy; <sup>3</sup>Thermo Fisher Scientific, Runcorn, UK.

# **ABSTRACT**

The results of this study show how the Thermo Scientific ISQ™ Series Single Quadrupole GC-MS system can meet United States Environmental Protection Agency (U.S. EPA) 8270D Method requirements. Thanks to the extended dynamic range detection system, the method range was 0.2–200ppm using the same column. The new Thermo Scientific™ Instant Connect Helium Saver Module was assessed in this study to show that significant financial costs savings can be realized throughout the lifetime of the GC-MS instrument without compromising the instrument's performance.

# **INTRODUCTION**

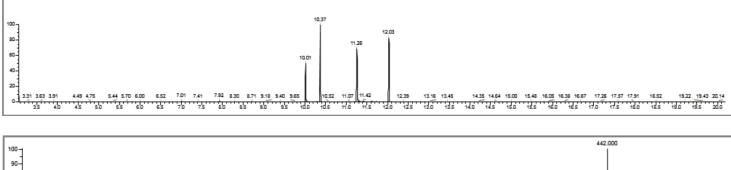
The U.S. EPA released the first Semi-Volatile Organic Compounds (SVOC) method by Gas Chromatography/Mass Spectrometry (Method 8270) at the end of 1980, which is a common method used in almost all environmental labs looking to analyze semi-volatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water. Since then, single quadrupole mass spectrometers have become much more sensitive and the source fragmentation has changed. Many original assumptions<sup>2</sup> about the origin and nature of the ion species have proven to be wrong or require correction, while the new generations of the mass spectrometers have proven to provide more response in the high-mass region,<sup>3</sup> resulting in adjustment of the tuning criteria to be met.<sup>4</sup> To adjust to these changes, the EPA has changed the ion abundance criteria for the passing of DFTPP in EPA Method 8270D.

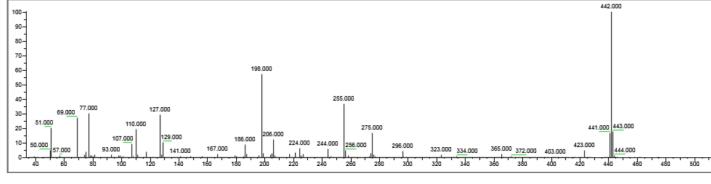
## **METHODS**

#### **Tuning for DFTPP**

The ISQ system was tuned with a built-in EPA 8270D specifically designed tune (DFTPP Tune). This assures fulfillment of all method requirements in terms of ion abundance criteria. A tune verification DFTPP solution was injected to verify that the ISQ system met the tuning requirements shown in Figure 1. The Thermo Scientific™ TraceFinder™ Environmental and Food Safety (EFS) software and Thermo Scientific™ Dionex™ Chromeleon Data System (CDS) software, with the Environmental Reporting package, automatically reports tune evaluation performance with Pass/Fail indicator (Table 1).

#### Figure 1. Chromatogram and Spectra of Tune Mix.





# Table 1. Result Report for DFTPP.

Eval Mass	Ion Abundance Criteria	% Relative Abundance	Pass/Fail	
51	Greater than or equal to 10% AND less than or equal to 80% of Base Peak	20.7	Pass	
68	Less than 2% of m/z 69	0.7	Pass	
70	Less than 2% of m/z 69	0.5	Pass	
127	Greater than or equal to 10% AND less than or equal to 80% of Base Peak	29.4	Pass	
197	Less than 2% of m/z 198	0.1	Pass	
198	Greater than 50% AND less than or equal to 100% of Base Peak	57.5	Pass	
199	Greater than or equal to 5% AND less than or equal to 9% of m/z 198	5.9	Pass	
275	Greater than or equal to 10% AND less than or equal to 60% of Base Peak	17.2	Pass	
365	Greater than 1% of m/z 198	4.6	Pass	
441	Greater than 0% AND less than 24% of m/z 442	17.4	Pass	
442	Greater than 50% AND less than or equal to 100% of Base Peak	100	Pass	
443	Greater than or equal to 15% AND less than or equal to 24% of m/z 442	18.1	Pass	

# Sample Preparation

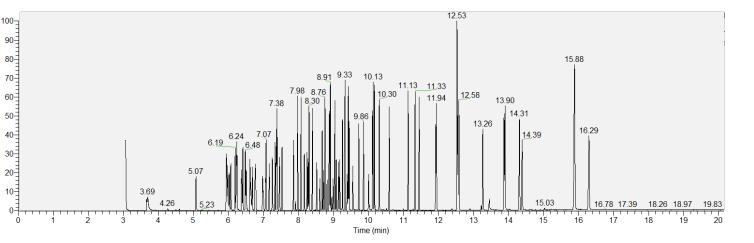
Standards (Restek 8270 MegaMix Cat. No. 31850, AccuStandard Internal Standard Cat. No. Z-014J, AccuStandard Surrogate Cat No. M-8270-SS) were prepared in methylene chloride and the internal standards were spiked at a concentration of 5 ppm for both the splitless and split methods. Spiking the range of 0.2 to 200 ppm with the same concentration of internal standards eliminated the necessity of preparing two different sets of calibration standards. Table 2 contains the calibration levels of both methods.

A volume of 1 µL of the calibration standards was injected for all methods. Figure 2 shows the chromatogram of the 5 ppm calibration standard acquired in splitless mode.

# **Table 2. Calibration Standards for Split and Splitless Methods.**

	Split Conc, ppm
0.2	2.0
0.5	5.0
1.0	10.0
2.0	20.0
5.0	35.0
10.0	50.0
20.0	100.0
35.0	200.0
50.0	
	0.5 1.0 2.0 5.0 10.0 20.0 35.0

## Figure 2. Chromatogram of 5 ppm Standard.



## **RESULTS**

#### Calibration (Splitless Method 0.2ppm-50ppm)

The average relative response factors of the 76 targeted compounds and six surrogates were calculated by analyzing the nine calibration standards from 0.2 ppm to 50 ppm in methylene chloride. Six compounds had Response Factors %RSD >20% and required an alternative curve fit. The %RSDs of those compounds calibrated using average response factors and r<sup>2</sup> values for the six alternative fit compounds are shown in Table 3.

#### Table 3. Relative Response Factor %RSDs for the 76 targeted compounds and internal standards, as well as r<sup>2</sup>, for linear fit calibrations (splitless method 0.2ppm-50ppm).

Compound	%RSD	Compound	%RSD	r <sup>2</sup>	Compound	%RSD	r <sup>2</sup>
N-Nitrosodimethylamine		1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	5.36		4,6-Dinitro-2-methylphenol		0.9945
Pyridine	10.23	Phenol, 4-chloro-3-methyl-	4.14		diphenylamine	9.61	
2-fluorophenol(surrogate)	5.57	Naphthalene, 2-methyl	7.54		Azobenzene	7.06	
Phenol-d6(surrogate)	4.99	Naphthalene, 1-methyl-	7		2,4,6-tribromophenol (surrogate)		0.9963
Aniline	6.39	Hexachlorocyclopentadiene	9.8		4-bromophenylphenylether	4.3	
Phenol	7.3	Phenol, 2,4,5-trichloro-	8.21		hexachlorobenzene	8.18	
Bis(2-chloroethyl) ether		Phenol, 2,4,6-trichloro-	5.9		Phenol, pentachloro-		0.996
Phenol, 2-chloro-	6.19	2-fluorobiphenyl,(surrogate)	4.99		Phenanthrene	10.88	
Benzene, 1,3-dichloro-	6.29	Naphthalene, 2-chloro-	7.24		phenanthrene-D10-	3.54	
1,4-Dichlorobenzene-D4	4.9	2-Nitroaniline	10.43		Anthracene	11.38	
Benzene, 1,4-dichloro-	7.57	1,4-Dinitrobenzene	16.05		Carbazole	9.69	
Benzyl alcohol	7.33	Dimethyl phthalate	5.66		Di-n-butyl phthalate	8.1	
Benzene, 1,2-dichloro-	7.43	Benzene, 1,3-dinitro-	13.75		Fluoranthene	10.94	
Phenol, 2-methyl-	6.27	2,6-dinitrotoluene	6.11		Pyrene	10.68	
Bis(2-chloroisopropyl)ether	6.31	acenaphthylene	8.24		p-Terphenyl-d14(surrogate)	6.76	
Phenol, 3&4-methyl-	6.52	1,2-Dinitrobenzene	14.85		Benzyl butyl phthalate	8.69	
N-Nitroso-di-n-propylamine	6.63	3-Nitroaniline	8.09		Bis(2-ethylhexyl)adipate	6.08	
Ethane, hexachloro-	5.8	Acenaphthene-d10	5.78		Benz[a]anthracene	9.68	
Nitrobenzene-D5(surrogate)	5.9	Acenaphthene	7.57		Chrysene	9.38	
Benzene, nitro-	3.2	2,4-dinitrophenol		0.9867	Chrysene-D12	4.02	
isophorone	3.9	Phenol, 4-nitro-	18.15		bis(2-ethylhexyl)phthalate	7.42	
Phenol, 2-nitro-	13.14	dibenzofuran	6.78		di-n-octylphthalate	6.3	
Phenol, 2,4-dimethyl-	4.52	2,4-dinitrotoluene	12.32		Benzo(b]fluoranthene	6.7	
Bis(2-chloroethoxy)methane	5.17	Phenol, 2,3,5,6-tetrachloro-		0.9957	Benzo[(k]fluoranthene	8.48	
Phenol, 2,4-dichloro-	4.76	Phenol, 2,3,4,6-tetrachloro-		0.9965	benzo(a)pyrene	6.11	
Benzene, 1,2,4-trichloro-	6.17	Diethyl Phthalate	5.6		Perylene-D12	5.73	
Naphthalene	8.26	4-chlorophenylphenylether	6.5		Indeno[1,2,3-cd]pyrene	6.36	
Naphthalene-D8	5.02	fluorene	7.31		dibenzo[a,h]anthracene	6.39	
p-Chloroaniline	4.95	4-nitroaniline	7.88		Benzo[ghi]perylene	7.75	

## Calibration (Split Method 2 ppm-200 ppm)

The average response factors of the 76 targeted compounds and six surrogates were calculated by analyzing eight calibration standards with concentrations ranging from 2 ppm to 200 ppm prepared in methylene chloride. Seven compounds had Response Factors %RSD >20% and required an alternate curve fit. The %RSDs of those compounds calibrated using average response factors and r<sup>2</sup> values for the seven alternative fit compounds are shown in Table 4.

### Table 4. Relative Response Factor %RSDs for the 76 targeted compounds and internal standards, as well as r<sup>2</sup>, for alternative fit calibrations (split method 2 ppm=200 ppm)

Compound	%RSD	Compound	%RSD	r <sup>2</sup>	Compound	%RSD	r <sup>2</sup>
N-Nitrosodimethylamine	6.31	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	5.54		4,6-Dinitro-2-methylphenol		0.9963
Pyridine	10.8	Phenol, 4-chloro-3-methyl-	8.26		diphenylamine	8.13	
2-fluorophenol(surrogate)	4.3	Naphthalene, 2-methyl	6.97		Azobenzene	9.24	
Phenol-d6(surrogate)	4.19	Naphthalene, 1-methyl-	7.35		2,4,6-tribromophenol (surrogate)	13.23	0.9963
Aniline	4.89	Hexachlorocyclopentadiene		0.9991	4-bromophenylphenylether	6.37	
Phenol	5.48	Phenol, 2,4,5-trichloro-	10.39		hexachlorobenzene	5.72	
Bis(2-chloroethyl) ether	4.45	Phenol, 2,4,6-trichloro-	7.92		Phenol, pentachloro-		0.9961
Phenol, 2-chloro-	4.94	2-fluorobiphenyl,(surrogate)	6.45		Phenanthrene	6.32	
Benzene, 1,3-dichloro-	5.03	Naphthalene, 2-chloro-	8.16		phenanthrene-D10-	6.95	
1,4-Dichlorobenzene-D4	6.01	2-Nitroaniline	17.03		Anthracene	7.23	
Benzene, 1,4-dichloro-	5.09	1,4-Dinitrobenzene		0.998	0.998 Carbazole		
Benzyl alcohol	9.21	Dimethyl phthalate	8.3		Di-n-butyl phthalate		
Benzene, 1,2-dichloro-	4.76	Benzene, 1,3-dinitro-		0.9976	Fluoranthene	7.64	
Phenol, 2-methyl-	6.77	2,6-dinitrotoluene	11.55		Pyrene		
Bis(2-chloroisopropyl)ether	4.85	acenaphthylene	6.59		p-Terphenyl-d14(surrogate)	6.38	
Phenol, 3&4-methyl-	5.92	1,2-Dinitrobenzene	15.11		Benzyl butyl phthalate	6.97	
N-Nitroso-di-n-propylamine	6.23	3-Nitroaniline	14.42		Bis(2-ethylhexyl)adipate	6.16	
Ethane, hexachloro-	4.85	Acenaphthene-d10	7.23		Benz[a]anthracene	7.43	
Nitrobenzene-D5(surrogate)	10.59	Acenaphthene	7.98		Chrysene	6.17	
Benzene, nitro-	10.24	2,4-dinitrophenol		0.9984	Chrysene-D12	10.49	
Isophorone	5.18	Phenol, 4-nitro-		0.9982	bis(2-ethylhexyl)phthalate	4.95	
Phenol, 2-nitro-	19.2	dibenzofuran	8.91		di-n-octylphthalate	8.7	
Phenol, 2,4-dimethyl-	4.92	2,4-dinitrotoluene	18.65		Benzo(b]fluoranthene	7.06	
Bis(2-chloroethoxy)methane	8.67	Phenol, 2,3,5,6-tetrachloro-	17.58	0.9957	Benzo[(k]fluoranthene	6.26	
Phenol, 2,4-dichloro-	5.68	Phenol, 2,3,4,6-tetrachloro-	12.33	0.9965	benzo(a)pyrene	6.81	
Benzene, 1,2,4-trichloro-	5.74	Diethyl Phthalate	7.83		Perylene-D12	14.99	
Naphthalene	5.74	4-chlorophenylphenylether	7.93		Indeno[1,2,3-cd]pyrene	6.15	
Naphthalene-D8	6.53	fluorene	9.13		dibenzo[a,h]anthracene	6.91	
p-Chloroaniline	6.02	4-nitroaniline	13.3		Benzo[ghi]perylene	7.06	

#### Thermo Scientific™ Instant Connect Helium Saver Module

Method 8270D was also tested with the Instant Connect Helium Saver Module (P/N 19070013). Depending on the experimental conditions, the Helium Saver module allows up to 14 years of GC and GC-MS operation from a single helium cylinder. The inlet is supplied with two different gases; Nitrogen is used for the septum purge and split flows with only Helium supplying the analytical column. Because of this innovative and patented solution, Helium consumption is dramatically reduced.

After time for equilibration, the GC-MS tuning mixture was injected and passed the criteria for EPA Method 8270D. Standards for a calibration curve (0.2–50 ppm and 2–200 ppm) were injected, and the data processed. Table 5 shows the results for splitless method and Table 6 shows the results for split method. In both configurations (SSL and Helium Saver) and for both methods (Split and Splitless), less than 10% of compounds required an alternative curve fit. All the others had RSD% less than 20% with linear fit.

## Table 5. Calibration results using the Helium Saver in splitless mode.

Compound	%RSD	Compound	%RSD	r <sup>2</sup>	Compound	%RSD	r²
N-Nitrosodimethylamine	6.62	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	4.82		4,6-Dinitro-2-methylphenol		0.9693
Pyridine	10.56	Phenol, 4-chloro-3-methyl-	8.96		diphenylamine	6.12	
2-fluorophenol(surrogate)	6.37	Naphthalene, 2-methyl	5.95		Azobenzene	6.01	
Phenol-d6(surrogate)	4.82	Naphthalene, 1-methyl-	6.54		2,4,6-tribromophenol (surrogate)	16.16	0.9963
Aniline	13.52	Hexachlorocyclopentadiene		0.9959	4-bromophenylphenylether	8.54	
Phenol	5.41	Phenol, 2,4,5-trichloro-	13.52		hexachlorobenzene	5.49	
Bis(2-chloroethyl) ether	17.24	Phenol, 2,4,6-trichloro-	9.81		Phenol, pentachloro-		0.9971
Phenol, 2-chloro-	6.34	2-fluorobiphenyl,(surrogate)	6		Phenanthrene	7.12	
Benzene, 1,3-dichloro-	5.8	Naphthalene, 2-chloro-	5.66		phenanthrene-D10-	2.95	
1,4-Dichlorobenzene-D4	2.53	2-Nitroaniline	17.31		Anthracene	12.18	
Benzene, 1,4-dichloro-	5.17	1,4-Dinitrobenzene		0.9962	Carbazole	6.86	
Benzyl alcohol	18.38	Dimethyl phthalate	5.88		Di-n-butyl phthalate	6.59	
Benzene, 1,2-dichloro-	5.36	Benzene, 1,3-dinitro-	17.9	0.9976	Fluoranthene	8.46	
Phenol, 2-methyl-	6.17	2,6-dinitrotoluene	11.8		Pyrene	7.82	
Bis(2-chloroisopropyl)ether	4.53	acenaphthylene	7.34		p-Terphenyl-d14(surrogate)	7.49	
Phenol, 3&4-methyl-	7.17	1,2-Dinitrobenzene	16.57		Benzyl butyl phthalate	5.81	
N-Nitroso-di-n-propylamine	7.58	3-Nitroaniline	19.06		Bis(2-ethylhexyl)adipate	9.11	
Ethane, hexachloro-	6.39	Acenaphthene-d10	3.99		Benz[a]anthracene	5.79	
Nitrobenzene-D5(surrogate)	8.67	Acenaphthene	4.68		Chrysene	6.9	
Benzene, nitro-	8.86	2,4-dinitrophenol		0.9938	Chrysene-D12	4.59	
isophorone	5.52	Phenol, 4-nitro-		0.995	bis(2-ethylhexyl)phthalate	7.06	
Phenol, 2-nitro-	17.07	dibenzofuran	6.21		di-n-octylphthalate	7.84	
Phenol, 2,4-dimethyl-	8.44	2,4-dinitrotoluene		0.9942	Benzo(b]fluoranthene	8.98	
Bis(2-chloroethoxy)methane	8.87	Phenol, 2,3,5,6-tetrachloro-		0.9962	Benzo[(k]fluoranthene	11.28	
Phenol, 2,4-dichloro-	8.56	Phenol, 2,3,4,6-tetrachloro-	14.62	0.9965	benzo(a)pyrene	7.47	
Benzene, 1,2,4-trichloro-	5.36	Diethyl Phthalate	5.69		Perylene-D12	5.38	
Naphthalene	5.91	4-chlorophenylphenylether	5.32		Indeno[1,2,3-cd]pyrene	8.02	
Naphthalene-D8	2.41	fluorene	9.43		dibenzo[a,h]anthracene	5.99	
p-Chloroaniline	5.82	4-nitroaniline	19.69		Benzo[ghi]perylene	7.43	

## Table 6. Calibration results using the Helium Saver in split mode.

Compound	%RSD	Compound	%RSD	r²	Compound	%RSD	r <sup>2</sup>
N-Nitrosodimethylamine	6.62	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	7.15		4,6-Dinitro-2-methylphenol		0.9967
Pyridine	13.09	Phenol, 4-chloro-3-methyl-	7.32		diphenylamine	7.24	
2-fluorophenol(surrogate)	6.02	Naphthalene, 2-methyl	5.92		Azobenzene	7.28	
Phenol-d6(surrogate)	5.71	Naphthalene, 1-methyl-	6.15		2,4,6-tribromophenol (surrogate)	14.93	0.9963
Aniline	6.13	Hexachlorocyclopentadiene		0.9985	4-bromophenylphenylether	7.06	
Phenol	6.52	Phenol, 2,4,5-trichloro-	12.06		hexachlorobenzene	7.82	
Bis(2-chloroethyl) ether	5.69	Phenol, 2,4,6-trichloro-	12.35		Phenol, pentachloro-		0.9991
Phenol, 2-chloro-	7.17	2-fluorobiphenyl,(surrogate)	7.3		Phenanthrene	8.55	
Benzene, 1,3-dichloro-	7.28	Naphthalene, 2-chloro-	7.68		phenanthrene-D10-	3.85	
1,4-Dichlorobenzene-D4	3.26	2-Nitroaniline	17.72		Anthracene	6.87	
Benzene, 1,4-dichloro-	8.13	1,4-Dinitrobenzene	19.53		Carbazole	8.99	
Benzyl alcohol	14.15	Dimethyl phthalate	7.46		Di-n-butyl phthalate	7.05	
Benzene, 1,2-dichloro-	6.95	Benzene, 1,3-dinitro-	18.89		Fluoranthene	7.25	
Phenol, 2-methyl-	6.68	2,6-dinitrotoluene	13.59		Pyrene	6.05	
Bis(2-chloroisopropyl)ether	6.28	acenaphthylene	7.25		p-Terphenyl-d14(surrogate)	6.25	
Phenol, 3&4-methyl-	6.42	1,2-Dinitrobenzene	17.76		Benzyl butyl phthalate	5.92	
N-Nitroso-di-n-propylamine	7.31	3-Nitroaniline	18.05		Bis(2-ethylhexyl)adipate	6.32	
Ethane, hexachloro-	9.32	Acenaphthene-d10	4.15		Benz[a]anthracene	7.37	
Nitrobenzene-D5(surrogate)	10.02	Acenaphthene	7.36		Chrysene	6.9	
Benzene, nitro-	11.59	2,4-dinitrophenol		0.9965	Chrysene-D12	4.81	
isophorone	6.7	Phenol, 4-nitro-		0.9978	bis(2-ethylhexyl)phthalate	6.27	
Phenol, 2-nitro-	14.78	dibenzofuran	6.9		di-n-octylphthalate	6.56	
Phenol, 2,4-dimethyl-	5.9	2,4-dinitrotoluene	18.32		Benzo(b]fluoranthene	6.55	
Bis(2-chloroethoxy)methane	5.64	Phenol, 2,3,5,6-tetrachloro-		0.9957	Benzo[(k]fluoranthene	9.18	
Phenol, 2,4-dichloro-	5.96	Phenol, 2,3,4,6-tetrachloro-	17.05		benzo(a)pyrene	7.4	
Benzene, 1,2,4-trichloro-	6.67	Diethyl Phthalate	6.09		Perylene-D12	8.17	
Naphthalene	4.81	4-chlorophenylphenylether	8.11		Indeno[1,2,3-cd]pyrene	8.23	
Naphthalene-D8		fluorene	8.51		dibenzo[a,h]anthracene	7.15	
p-Chloroaniline	5.55	4-nitroaniline	19.17		Benzo[ghi]perylene	6.5	

#### **Minimum Response Factors**

EPA Method 8270D requires a minimum relative response factor (RRF) for any point of the calibration curve for several compounds in the targeted list. Table 7 presents those minimum relative response factor requirements and the minimum RRF across all curves performed on the ISQ single-quadrupole GC-MS system.

#### Table 7. EPA Method 8270D minimum relative response factors and those produced by the Thermo Scientific ISQ Single Quadrupole system.

		Splitless	Helium Saver	Split (10:1)	Helium Saver	
Compound	EPA 8270D Minimum Response	Thermo <b>Minimum</b>	Thermo <b>Minimum</b>	Thermo <b>Minimum</b>	Thermo <b>Minimum</b>	
Phenol	0.8	1.990	2.895	2.603	2.767	
Bis(2-chloroethyl) ether	0.7	1.499	2.225	1.929	2.134	
Phenol, 2-chloro-	0.8	1.516	1.884	1.882	1.869	
Phenol, 2-methyl-	0.7	1.412	1.802	1.719	1.771	
Phenol, 3&4-methyl-	0.6	1.495	1.933	1.767	1.897	
N-Nitroso-di-n-propylamine	0.5	1.110	1.886	1.254	1.579	
Ethane, hexachloro-	0.3	0.530	0.439	0.716	0.690	
Benzene, nitro-	0.2	0.316	0.469	0.404	0.471	
Isophorone	0.4	0.708	0.989	0.869	0.995	
Phenol, 2-nitro-	0.1	0.160	0.170	0.152	0.157	
Phenol, 2,4-dimethyl-	0.2	0.389	0.453	0.430	0.465	
Bis(2-chloroethoxy)methane	0.3	0.432	0.589	0.530	0.586	
Phenol, 2,4-dichloro-	0.2	0.282	0.269	0.313	0.288	
Naphthalene	0.7	1.085	1.247	1.176	1.260	
p-Chloroaniline	0.01	0.464	0.493	0.497	0.546	
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	0.01	0.112	0.118	0.175	0.116	
Phenol, 4-chloro-3-methyl-	0.2	0.342	0.394	0.382	0.418	
Naphthalene, 2-methyl	0.4	0.785	0.730	0.726	0.724	
Hexachlorocyclopentadiene	0.05	0.236	0.128	0.213	0.044	
Phenol, 2,4,6-trichloro-	0.2	0.345	0.322	0.372	0.298	
Phenol, 2,4,5-trichloro-	0.2	0.324	0.286	0.368	0.300	
Naphthalene, 2-chloro-	0.8	1.232	1.388	1.314	1.349	
2-Nitroaniline	0.01	0.335	0.406	0.339	0.455	
Dimethyl phthalate	0.01	1.361	1.511	1.442	1.482	
2,6-dinitrotoluene	0.2	0.229	0.259	0.258	0.242	
Acenaphthylene	0.9	1.899	2.216	2.063	2.165	
3-Nitroaniline	0.01	0.298	0.336	0.428	0.541	
2,4-dinitrophenol	0.01	0.055	0.042	0.045	0.025	
Acenaphthene	0.9	1.312	1.574	1.383	1.417	
2,4-dinitrotoluene	0.2	0.304	0.327	0.316	0.330	
Dibenzofuran	0.8	1.840	1.907	1.811	1.863	
Phenol, 4-nitro-	0.01	0.167	0.042	0.124	0.055	
Diethyl Phthalate	0.01	1.335	1.676	1.508	1.518	
4-chlorophenylphenylether	0.4	0.740	0.609	0.692	0.621	
4-nitroaniline	0.01	0.306	0.360	0.315	0.296	
Fluorene	0.9	1.434	1.647	1.471	1.470	
4,6-Dinitro-2-methylphenol	0.01	0.079	0.057	0.063	0.047	
Diphenylamine	0.01	0.683	0.897	0.750	0.799	
4-bromophenylphenylether	0.1	0.477	0.332	0.241	0.206	
Hexachlorobenzene	0.1	0.324	0.256	0.283	0.267	
Phenol, pentachloro-	0.05	0.131	0.077	0.064	0.049	
Phenanthrene	0.7	1.125	1.335	1.289	1.275	
Anthracene	0.7	1.270	1.138	1.272	1.347	
Carbazole	0.01	1.070	1.407	1.006	1.156	
Di-n-butyl phthalate	0.01	1.314	1.856	1.517	1.626	
Fluoranthene	0.6	1.263	1.123	1.268	1.234	
Pyrene	0.6	1.072	1.326	1.296	1.487	
Benzyl butyl phthalate	0.01	0.496	0.906	0.677	0.847	
Bis(2-ethylhexyl)phthalate	0.01	0.741	1.225	0.941	1.144	
Chrysene	0.7	1.025	1.110	1.164	1.102	
Benz[a]anthracene	0.8	1.068	1.228	1.171	1.124	
Di-n-octylphthalate	0.01	1.465	2.673	2.084	2.413	
Benzo[b]fluoranthene	0.7	1.364	1.417	1.592	1.432	
Benzo[k]fluoranthene	0.7	1.292	1.185	1.586	1.396	
Benzo[a]pyrene	0.7	1.353	1.420	1.500	1.414	
Indeno[1,2,3-cd]pyrene	0.5	1.600	1.794	1.727	1.866	
Dibenzo[a,h]anthracene	0.4	1.393	1.645	1.472	1.617	
Benzo[g,h,i]perylene	0.5	1.302	1.560	1.406	1.636	
	0.0	1.002	1.000	1.100	1.000	

# CONCLUSIONS

■ The Thermo Scientific ISQ Series Single Quadrupole GC-MS systems are the perfect solution to perform the EPA 8270D Method. Thanks to the extended dynamic range detection system, the ISQ system allows you to cover a 0.2–200 ppm range with the same column and liner.

■ 76 compounds were reported and each fulfilled the EPA 8270D requirements in terms of minimum response factors and linearity.

■ Thermo Scientific™ Dionex™ Chromeleon Data System (CDS) software, with the Environmental Reporting package, offers unparallel flexibility, scalability, and compliance. The Thermo Scientific™ TraceFinder™ EFS software is tailored to support compliance with EPA 8270D Method requirements offering a full complement of standard reports including DFTPP Tune Check report, Breakdown report, Internal Standard Summary report, Tentatively Identified Compounds report, various quality control reports for check standards, laboratory control samples, matrix spikes, surrogate recoveries, and more.

• The Thermo Scientific Instant Connect Helium Saver Module is a unique tool that can be used to reduce the cost per analysis, without compromising the results. The Helium Saver Module makes the laboratories more efficient and environmentally friendly, saving 90% of Helium during each run.

The ISQ system also incorporates a new source design that lets your system stay cleaner, longer.

■ When the instrument finally requires cleaning, the new source design can be fully removed—including all of the lenses and the repeller—through the front vacuum interlock, without venting the system. This allows you to clean the source, swap it, or change ionization type, and be ready to run samples within minutes, not hours or days.

## REFERENCES

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