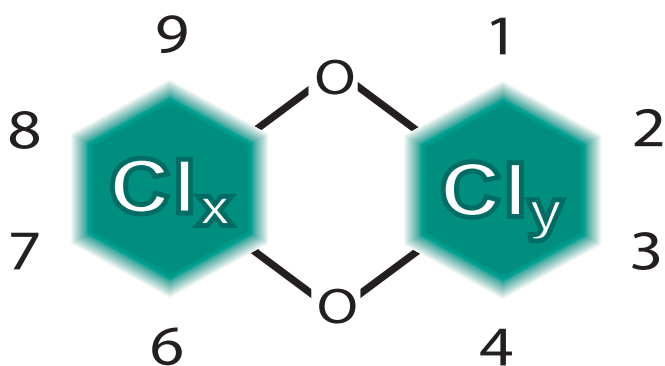




PROTECTING OUR ENVIRONMENT

PACE ANALYTICAL DIOXIN LABORATORY



WASTE CHARACTERIZATION

DRINKING WATER

WASTEWATER

FOOD/FEED PRODUCT TESTING

RCRA MONITORING

BROWNFIELDS



Working Together to Protect Our Environment and Improve Our Health

DIOXIN AND FURAN are the common names associated with polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF). This group of primarily anthropogenic chemical compounds is created as an unintended byproduct of a number of human activities including: combustion, certain types of chemical manufacture, chlorine bleaching of paper, and other industrial processes. Extensive research has concluded that exposure to dioxins and furans can result in biochemical and biological effects in animals and humans. Because these ubiquitous compounds accumulate in biological tissues, dioxins and furans have been in the environmental spotlight for more than two decades. Since 1982 Pace Analytical's laboratories have been providing dioxin/furan analysis in support of industrial compliance, federal regulatory/monitoring efforts, and the remedial activities of military and civilian engineering firms. Extensive experience with demanding projects and difficult matrices has forged a "culture of quality" that ensures precision, accuracy, and data integrity. Pace Analytical Services is a nationwide analytical services company with modern facilities and instrumentation, significant dioxin testing capacity, experienced scientists, national certifications, solid quality assurance and a commitment to meeting client needs.

DIOXIN/FURAN PROJECT EXPERIENCE

Pace Analytical's dioxin laboratories have extensive experience in all matrices and perform all EPA dioxin methodologies. A brief summary of select project experience illustrates the expertise and diversity of Pace Analytical's dioxin scientists and project management

- Drinking Water Analysis** – SDWA monitoring by 1613
- NPDES Permitting** – Waste water analysis by 613 & 8280
- Landfill Monitoring** – Leachate analysis by 8280 & 8290
- Groundwater Monitoring** – Appendix 9 analysis by 8280
- Municipal Sewage Sludge** – Land application analysis by 1613
- Pulp and Paper Effluent** – CWA compliance by 1613 TCDD/TCDF
- Food Product Testing** – Chicken, Fish, Grapes, Venison by 1613
- PCB Fire Sites** – Ash, Wipes, Air and decontamination by 8290

- Site Characterization** – Superfund Sites, SW846 by 8280 & 8290
- Site Remediation** – Rapid Screen by 8290
- Base Realignment and Closure** – USACE support, all methods
- Perimeter Air Monitoring** – Volume air sampling by TO-9
- Incinerator Stack Monitoring** – Stack sampling by method 23
- Decontamination Monitoring** – Wipes, concrete etc by SW846
- Cement Kiln Ash** – Landfill application monitoring by 8280
- Site Closure Monitoring** – Onsite monitoring wells by SW846



MAJOR INSTRUMENTATION

- (2) - HRGC/HRMS - ThermoFisher DFS
(High Resolution Mass Spectrometers)
- (1) - HRGC/HRMS - Autospec Premier
(High Resolution Mass Spectrometers)
- (2) - HRGC/HRMS - Autospec Ultima
(High Resolution Mass Spectrometers)
- (2) - HP 5972 GCMS (Low Resolution Mass Spectrometers)

LAB TESTING QUALIFICATIONS

Pace Analytical's dioxin credentials include more than 16 years of accumulated dioxin experience and a reputation for quality that is both well deserved and well documented. Objective proof of this "Culture of Quality" is available upon request in the form of...

- Quality Assurance Plan
- Standard Operating Procedures
- Method Detection Limits
- Recent PE Performance
- Precision and Accuracy Charting
- Summary of Project Experience
- Certificate of Insurance Coverage
- Client References and Referrals

SAMPLE MATRICES

- > Soil
- > Water
- > Sediment
- > Air
- > Sludge
- > Tissue
- > Wipes
- > Food/Feed

Food Sources



Animal Feed



Because dioxins are not biodegradable, they are persistent and bio-accumulate in the food chain. Dioxins have a high affinity for fatty substances and are found in fat tissue of both plants and animals.

TESTING CAPABILITIES

Dioxin and Dioxin-like Testing Capabilities

- > **Dioxin/Furans**
 - USEPA Method 1613
 - USEPA Method 8290
 - DLM 02.0
 - USEPA Method 8280
 - Method 23 and TO-9

> PCB Congeners

- USEPA Method 1668

> HRMS Pesticides

- USEPA Method 1699

> Polybrominated Diphenyl Ethers

- USEPA Method 1614

CERTIFICATIONS

- > USEPA
- > NELAC
- > Multiple States

PCB CONGENERS

Polychlorinated Biphenyls (PCBs) are a complex group of industrial chemicals whose properties were useful, in part, because of their resistance to degradation. Unfortunately, this capability has enabled PCBs to become a widespread environmental contaminant throughout the global ecosystem. PCBs are both persistent and bioaccumulative, so they are capable of migrating up the food chain — posing risks to both animals and humans.

PCB CONGENER ANALYSIS BY HRGC/MS

Of the 209 PCB Congeners, 12 of the most toxic exhibit a planar structure and are considered to be dioxin-like in their potential toxicity. These compounds are analyzed by EPA Method 1668 and have been assigned Toxic Equivalency Factors (TEFs) relative to dioxin/furan in recent regulatory initiatives. Unlike dioxin, however, PCB's toxicity is more widely dispersed throughout the family of compounds, and many of the congeners exhibit toxicity mechanisms and endpoints dissimilar to those attributed to dioxin. To establish toxicity for complex combinations of these contaminants, the EPA has developed and promulgated Method 1668A capable of determining and quantifying the presence of all 209 PCB Congeners or subsets of them. Both PCB methods utilize isotope dilution combined with HRGCMS analysis to provide the lowest possible detection limits in a wide variety of matrices. Pace Analytical has been performing method 1668 since its promulgation in early 2001 and added Method 1668A later the same year. With years of experience performing isotope dilution methods by HRGCMS for dioxin and furans, these ultra-trace analyses for PCB Congeners are a natural extension of Pace Analytical's technical capabilities.

PBDEs and PBBs

Polybrominated Diphenyl Ethers (PBDEs) and Polybrominated Biphenyls (PBBs) are part of the larger family of compounds commonly referred to as brominated flame retardants. These compounds have been used extensively for several decades to improve the flame resistance of common household products including: carpeting, seat cushions, drapery material and consumer electronics like computers and televisions. We have lived in close proximity to these chemical products for some time, and they have provided a valuable, life-saving function—protecting us from fire in our homes and workplaces. Because of their valuable properties, the use of these chemicals has increased significantly in the United States over the past several years. Unfortunately, a number of recent research studies have indicated that these PBDE and PBB compounds are persistent and bioaccumulating in the environment. Such compounds have been linked to adverse health effects that pose a potential risk to both animals and humans.

To better assess these risks, the EPA has developed and promulgated Method 1614, which is capable of determining and quantifying the presence of 49 PBDEs. Pace also includes 3 PBB compounds that are common in environmental and food supply matrices. Pace Analytical has been performing this method since early 2005 and has current experience in a range of matrices. Method 1614 is based upon the isotope dilution analytical techniques used for dioxin/furan analysis by HRGC/MS – and for the Pace Dioxin Laboratory, this is a natural extension of their dioxin experience and expertise. Pace Analytical supports the growing list of toxic, bioaccumulative compounds like PBDEs with significant instrument capacity, an experienced scientific staff, certifications to perform the work, and a proven quality assurance program.

DIOXINS/FURANS and Dioxin-like Compounds

High Resolution

METHOD	ISOMERS	NOTE	DESCRIPTION	MATRIX	RL/PQL	TAT*	Container	Preservation	Hold Times	Minimum Volume
1613	2378 - TCDD		Single Dioxin compound, drinking water	DW	5 pg/L	10 Days	2 1-L AG	Refrigerate 4° C Sodium Thiosulfate	30 Days; 7 days in NY, NJ, WI & UT	1 Liter
1613	2378 - TCDD		Single Dioxin compound, all matrices	Water	10 pg/L	15 Days	2 1-L AG	Refrigerate 4° C	30 Days Up to 1 year	1 Liter
			Soil	1.0 ng/Kg	1 4-8 oz AG		10 grams			
			Tissues	1.0 ng/Kg	Aluminum Foil		25 grams			
1613	Tetra - Octa		All 17 Dioxin/Furan compounds	Water	10-100 pg/L	15 Days	2 1-L AG	Refrigerate 4° C	30 Days Up to 1 year	1 Liter
			Soil	1-10 ng/Kg	1 4-8 oz AG		10 grams			
			Tissues	1-10 ng/Kg	Aluminum Foil		25 grams			
8290	2378 - TCDD		Single Dioxin compound, all matrices	Water	10-100 pg/L	15 Days	2 1-L AG	Refrigerate 4° C	30 Days	1 Liter
			Soil	1-10 ng/Kg	1 4-8 oz AG		10 grams			
8290	Tetra - Octa		All 17 Dioxin/Furan compounds	Water	10-100 pg/L	15 Days	2 1-L AG	Refrigerate 4° C	30 Days	1 Liter
			Soil	1-10 ng/Kg	1 4-8 oz AG		10 grams			
DLM02.0	Tetra - Octa		All 17 Dioxin/Furan compounds	Water	10-100 pg/L	15 Days	2 1-L AG	Refrigerate 4° C	10 Days	1 Liter
			Soil	1-10 ng/Kg	1 4-8 oz AG		10 grams			
RapidScreen	Tetra-Octa	3	17 Dioxins/Furans Positive/Negative Screen	Water	10-100 pg/L	15 Days	2 1-L AG	Refrigerate 4° C	30 Days	1 Liter
			Soil	1-10 ng/Kg	1 4-8 oz AG		10 grams			
RS Confirms	Tetra-Octa		Full 8290/1613B RS Confirmation	Water	10-100 pg/L	15 Days	2 1-L AG	Refrigerate 4° C	30 Days	1 Liter
			Soil	1-10 ng/Kg	1 4-8 oz AG		10 grams			
Method 23	Tetra - Octa	1	Stack testing 17 D/F compounds	AIR	0.01-0.1 ng/S	15 Days	XAD-II Trap/Filter	None	30 Days	per method
TO-9	Tetra - Octa		Ambient testing 17 D/F compounds	AIR	0.01-0.1 ng/S	15 Days	High Vol PUF	Refrigerate 4° C	30 Days	per method
1668	PCB Congeners		WHO List 12 PCB congeners	Water	500 pg/L	15 Days	2 1-L AG	Refrigerate 4° C	30 Days Up to 1 year	1 Liter
			Soil	50 ng/Kg	1 4-8 oz AG		10 grams			
			Tissues	50 ng/Kg	Aluminum Foil		25 grams			
1668A	PCB Congeners		209 PCB congeners and totals	Water	500 pg/L	20 Days	2 1-L AG	Refrigerate 4° C	30 Days Up to 1 year	1 Liter
			Soil	50-125 ng/Kg	1 4-8 oz AG		10 grams			
			Tissues	50-125 ng/Kg	Aluminum Foil		25 grams			
1613/1668	Tetra - Octa & PCBs	2	Dioxin/Furan/PCB 29 compounds	Water	See	20 Days	2 1-L AG	Refrigerate 4° C	30 Days Up to 1 year	2 Liters
			Soil	20 grams						
			Tissues	Above			Aluminum Foil			50 grams
1699	HRMS Pesticides		OC Pesticides-28 compounds	Water	0.4 ng/L	20 Days	2 1-L AG	Refrigerate 4° C	7 Days	1 Liter
1614	Mono - Deca		PBDE's 49 compounds	Water	0.5-4.0 ng/L	20 Days	2 1-L AG	Refrigerate 4° C	Up to 1 year	1 Liter
			Soil	5-900 ng/Kg	1 4-8 oz AG		10 grams			
			Tissues	5-170 ng/Kg	Aluminum Foil		25 grams			

- 1 Toluene rinse combined with impinger solution, surcharge for separate toluene rinse analysis (Method 0023A).
Sample train preparation fee \$75 per train.
- 2 Price is based upon combined extraction procedure.
- 3 Qualitative Screen based on TEQ Target Limits set by the client, 4-500 ppt TEQs
- * TAT is in business or working days.

Low Resolution

METHOD	ISOMERS	NOTE	DESCRIPTION	MATRIX	RL/PQL	TAT*	Container	Preservation	Hold Times	Minimum Volume
8280A	Tetra - Hexa	1	Dioxin/Furan Tetra thru Hexa isomers only	Water	10-50 ng/L	15 Days	2 1-L AG	Refrigerate 4° C	30 Days	1 Liter
			Soil	1.0-5.0 ug/Kg	1 4-8 oz AG		10 grams			
8280A	2378 - TCDD		Single Dioxin compound all matrices	Water	10-50 ng/L	15 Days	2 1-L AG	Refrigerate 4° C	30 Days	1 Liter
			Soil	1.0-5.0 ug/Kg	1 4-8 oz AG		10 grams			
8280A	Tetra - Octa		All 17 Dioxin/Furan compounds	Water	10-50 ng/L	15 Days	2 1-L AG	Refrigerate 4° C	30 Days	1 Liter
			Soil	1.0-5.0 ug/Kg	1 4-8 oz AG		10 grams			

- 1 Specified protocol for Appendix IX reporting criteria.

NOTES: Above prices reflect "Level II" reporting (results and QC only). A surcharge of as much as \$50 per sample may be applied for a fully validatable report format. Internal batch QC is provided with all samples. Client specific QC, if required, is billable. *Standard TAT is indicated above in working days, rush TAT may be available by prearrangement and may incur additional charges.

COMMON REPORTING UNIT CONVERSIONS

Pace Analytical routinely analyzes air, water, and soil samples to the parts per million (ppm), parts per billion (ppb), parts per trillion (ppt), and even parts per quadrillion (ppq) level. To understand the relationship of these levels, review the following:

ppm (parts per million)	mg/kg mg/L	ug/g ug/L	ng/mg ng/uL
ppb (parts per billion)	ug/kg ug/L	ng/g ng/mL	pg/mg pg/uL
ppt (parts per trillion)	ng/kg ng/L	pg/g pg/mL	fg/mg fg/uL
ppq (parts per quadrillion)	pg/kg pg/L	fg/g fg/mL	ag/mg ag/uL

Dioxin:
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