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Determination of Polychlorinated Biphenyls, Selected Persistent Organochlorine Pesticides, and Polybrominated Flame Retardants in Fillets of Fishes from the 2007 Missouri Department of Conservation Monitoring Program

Open-File Report 2009–1053

U.S. Department of the Interior
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Conversion Factors and Datums

SI to Inch/Pound

Multiply	By	To obtain
	Volume	
milliliter (mL)	0.03382	ounce, fluid (fl. oz)
	Mass	
gram (g)	0.03527	ounce, avoirdupois (oz)
nanogram (ng)	1×10^{-9}	grams
nanogram (ng)	3.527×10^{-11}	ounce, avoirdupois (oz)
	Concentration	
nanogram per gram (ng/g)	=	part per billion (ppb; 10^9)
nanogram per milliliter (ng/mL)	=	part per billion (ppb; 10^9)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8\times°C)+32$$

Concentrations of chemical constituents in solid materials (fish fillets) are given in nanogram per gram (ng/g). Concentrations of chemical constituents in liquid solutions (calibration standards) are given in nanogram per milliliter (ng/mL).

Determination of Polychlorinated Biphenyls, Selected Persistent Organochlorine Pesticides, and Polybrominated Flame Retardants in Fillets of Fishes from the 2007 Missouri Department of Conservation Monitoring Programs

By Robert W. Gale[1], Carl E. Orazio[1], and Michael J. McKee[2]

Abstract

This report presents the results of a study to determine polychlorinated biphenyl, organochlorine pesticide, and polybrominated diphenylether flame retardant concentrations in selected fishes from lakes and streams across Missouri. Fillets were collected from each fish sample and after homogenization, compositing, and preparation, analyte concentrations were determined with dual column capillary gas chromatography-electron-capture detection. Total concentrations of polychlorinated biphenyls in samples ranged from background levels of about 50 to 300 nanograms per gram. In samples with elevated contaminant concentrations, chlordanes, DDT-related chemicals, and dieldrin constituted the primary classes of pesticides present, and ranged from 5 to 75 nanograms per gram. Total concentrations of polybrominated diphenyl ethers in samples ranged from background levels of 5 to 86 nanograms per gram. Channel catfish from the upper and lower Blue River and lake sturgeon from the Mississippi River at Saverton exhibited different polybrominated diphenyl ethers ratios. Concentrations of polychlorinated biphenyls, chlordanes, DDT-related compounds, and polybrominated diphenyl ethers all were greatest in samples of channel catfish from the upper and lower Blue River, and in samples of lake sturgeon from the Mississippi River at Saverton.

Introduction

The Missouri Department of Conservation (MDC) began a long-term state-wide fish monitoring program in 1984 (Bataille, 2003; May and others, 2007; Gale and others, 2008). The program is designed to characterize contaminant concentrations at 20 to 30 lakes and streams throughout Missouri by annually collecting predator and bottom-feeding species samples. The sites that are monitored each year vary based on data needs, budgets, and personnel resources. Emphasis is on human health and, therefore, incorporates fish fillets, composite samples, and sample replication at each site to assess any potential fish consumption risks. In 2007, 26 samples from 7 sites were selected for sampling as part of the MDC General Contaminant Monitoring Program. The following predator and bottom-feeding species were selected based on the need for organic contaminant information and the potentially greater risk for human consumption: largemouth bass (*Micropterus salmoides*), channel catfish (*Ictalurus punctatus*), lake sturgeon (*Acipenser fulvescens*), and common carp (*Cyprinus carpio*). The MDC has requested the collaborative assistance of the U.S. Geological Survey (USGS) for this monitoring program because of its experience with aquatic biota monitoring projects and expertise in the preparation and analysis of fish for trace-level organic contaminants.

Sample History

A shipment of 26 fish fillet composites was received by the USGS on November 19, 2007. Upon receipt, the shipment was assigned USGS batch number 1428 and sample identification numbers 41267–41292. All samples were logged into the data base and assigned data-base numbers. The identification numbers, MDC field identification, location descriptions, and sample percent lipids for each sample are listed in table 1, at the back of this report.

Fish were collected from eight Missouri sites: Mississippi River at Saverton, Pool 22, Montrose Lake, the upper and lower Blue River, LaBelle Lake, Mozingo Lake, and Locust Creek near Pershing State Park. All samples had been stored wrapped in aluminum foil in sealed polyethylene bags at -20 degrees Celsius (°C) since collection at the

[1]U.S. Geological Survey.

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MDC's Resource Science Center in Columbia, Missouri, and were delivered to the USGS by MDC personnel. Requested analyses included total polychlorinated biphenyls (PCBs) and PCBs expressed as commercial Aroclor® mixtures historically reported in MDC monitoring programs, selected persistent organochlorine pesticides (OCPs), and selected polybrominated diphenyl ethers (PBDEs).

Methods

Compositing and Homogenization

Most samples were divided into three five-fish skinned fillet composites per site. Fish fillets were prepared by MDC personnel, frozen, and transported to the USGS in individually labeled bags. In some cases where fish were large, individual fillets were analyzed. Samples were stored frozen at -16 ºC before composite homogenization. Fillets were ground and homogenized to prepare samples, then the samples were stored in their original sample collection bags at -16 ºC before analysis. Sample location information was obtained from the individually labeled bags.

Preparation

The procedure used to analyze the fish for PCBs, OCPs and PBDEs has been previously reported (Hinck and others, 2006). Briefly, 5-gram (g) portions of fish fillet composite samples were removed for analysis, dehydrated by addition of anhydrous Na_2SO_4, and spiked with procedural internal standards. Each sample was fortified with 40 nanograms (ng) of the following procedural internal standard constituents: 2,4,5-trichlorobiphenyl (PCB-029), 2,2',4,4',6,6'-hexachlorobiphenyl (PCB-155), 2,2',3,4,4',5,6,6'-octachlorobiphenyl (PCB-204), and deuterated *p,p'*-DDD (*p,p'*-DDD-d_8) to monitor method recoveries.

As a trichlorobiphenyl, PCB-029 is representative of the more volatile PCBs with one to three chlorine substitutions ($Cl_1 – Cl_3$); the PCB-155, a hexachlorobiphenyl, of mid-volatility-range PCB congeners with four to six chlorine substitutions ($Cl_4 – Cl_6$); and PCB-204, an octachlorobiphenyl, of PCBs with seven to ten chlorine substitutions ($Cl_7 – Cl_{10}$). The PCB procedural internal standards also were used to monitor recovery of the five less-polar pesticides collected in the first silica-gel fraction (SG-1). The latter procedural internal standard, *p,p*'-DDD-d_8, was used to monitor the recovery of more polar pesticides and PBDEs collected in the second silica-gel fraction (SG-2). The procedural internal standard compounds provide recovery information for each fraction of each sample and were used to monitor analyte concentrations.

The Na_2SO_4-dried fish tissue samples were column extracted with dichloromethane, concentrated to 10 milliliters (mL), and aliquants (2 percent of the extract) removed for lipid analysis determined as total non-volatile residues. Aliquants of the extracts (1-g equivalent) were removed for PCB analyses. These aliquants were treated by secondary reactive cleanup for removal of biogenic materials and analyzed by dual-column gas chromatography with electron-capture detection (GC-ECD).

Additional 1.00-g equivalent aliquants of the extracts were removed for OCP/PBDE analyses. Sequentially, low-performance size exclusion chromatography (LP-SEC) and high-performance size exclusion chromatography (HP-SEC) were used to separate the analytes from residual higher molecular weight compounds in the lipophilic extracts. Additional biogenic interferences (such as cholesterols) were removed by fractionation using basic alumina open-column chromatography. Next, the extracts were fractionated using layered octadecyl silica/activated silica-gel open-column chromatography. The analytes were eluted with mobile phases containing increasing solvent polarities: SG-1, hexane eluent, collecting about 90 percent of the total PCBs (by mass) and six of the targeted OCPs; and SG-2, hexane/methyl t-butyl ether (55:45 volume/volume) eluent, collecting the residual 10 percent of the total PCBs (the less chlorinated congeners), the 23 remaining OCPs, and the PBDEs. The fractions were concentrated to 1.00 mL for a final concentration of 1 g-equivalents per milliliter.

An operational quality-control (QC) system of checks was used to control and assess the measurement quality. This system of checks was managed by a quality-assurance system that ensures that defined standards of quality are being met at stated levels of confidence. The accuracy and precision of environmental methods were assessed by utilizing appropriate checks for sample preparation and instrumental analysis. The appropriate QC sample types were selected based on the applicability to the objectives of this study, and were incorporated into the analysis plans, including procedural blanks, replicated fish fillet samples, fish tissue matrix blanks, analyte-fortified fish tissue matrix blanks, and positive control reference material (Saginaw Bay carp).

Instrumental internal standards (IIS) were added to each reactively cleaned-up fraction and final silica-gel fraction, with the final volume of each fraction adjusted to 1.0 mL. Individual congeners of PCBs, individual congeners of PBDEs, and organochlorine pesticides were measured in sample fractions by GC-ECD. Potential peaks for analytes were matched and identified on one or both gas chromatography (GC) capillary columns with individual standards. Up to nine levels of calibration for each analyte were used to quantify the targeted congeners. The calibration curves covered a concentration range of 0.01–0.03 to 200 nanograms per milliliter (ng/mL).

Method reporting limits (MRLs) for total PCBs were set at the average total amounts measured in the procedural blanks run with each set based on the lowest calibration standard run in the calibration curve [equivalent to 0.1 nanogram per gram (ng/g) per congener]. The MRLs were set at 0.1 ng/g for the OCPs and 1 ng/g for PBDEs based on procedural background amounts and the analysis of low-level calibration standards.

Quality Control

Recoveries of the procedural internal standards indicative of the first silica-gel fraction OCP and PCB analytes (PCB-029, -155, and -204) were within QC guidelines of 50 to 125 percent. All samples were between 83 and 114 percent, with the exception of the procedural blank sample USGS 021308, which incurred preparative losses and recoveries of 60 to 72 percent for surrogates in the first silica-gel fraction, PCB-029, -155, and -204. Recoveries of total PCBs from the fortified negative control matrix (whole bluegill) were 89 percent. The recovery of total PCBs from the positive control Saginaw Bay carp matrix was 128 percent of the historical average (table 2, at the back of this report). The precision of replicate analyses (n=3) of sample USGS 41290 (MDC 2007-81-230-1) for total PCBs was undetermined because concentrations of selected PCB congeners were less than the method reporting limits (table 3, at the back of this report). Concentrations of total PCBs in the replicate sample were less than 10 ng/g when corrected for the procedural blank background PCB concentration. The procedural blank analysis indicated slightly more than normal laboratory background levels of total PCBs, of 57 total ng per sample. The long term MRL for total PCBs at USGS is 21 ng/g. The correlation coefficients of the individual PCB congener calibration curves were greater than 0.98, with nearly all correlation coefficients greater than 0.98.

The recoveries of the procedural internal standard indicative of the second silica-gel fraction OCP analytes (*p,p'*-DDD-d_8) were within QC guidelines (50 to 125 percent) with recoveries in most samples between 64 to 101 percent, again, with the exception of the procedural blank sample USGS 021308 which incurred preparative losses and recovery of 26 percent for the surrogate for the SG-2 fraction, *p,p'*-DDD-d_8. Recoveries of OCPs from the fortified negative control matrix (whole bluegill) ranged from 58 to 127 percent, though for most analytes recoveries were more precise, averaging about 99 percent (table 3). The recovery of OCPs from the positive control Saginaw Bay carp matrix ranged from 61 to 170 percent of the historical average for those pesticides with concentrations significantly above the reporting limits, averaging about 109 percent (table 3). The precision of replicate analyses (n=3) of sample USGS 41290 (MDC 2007-81-230-1) for OCPs are presented in the table 3. Only 10 OCPs were quantified at levels greater than the MRL (0.1 ng/g) in the replicate, and 7 of these OCPs were less than 1 ng/g and had large relative standard deviations (RSDs) (11 to 35 percent). The remaining OCPs concentrations ranged from 1 to 2 ng/g and had smaller RSDs (6 to 10 percent). Lower values for correlation coefficients were related to slight on-column degradation of active contaminants (endrin, *p,p'*-DDT, and methoxychlor) and the precision of methoxychlor was less than most other OCPs as a result of PBDE and PCB interferences. The procedural blank analyses indicated negligible background levels of OCPs. The long term MRL for OCPs at USGS is less than 1 ng/g.

The procedural blank analysis indicated normal laboratory background levels of individual PBDEs ranging from less than 0.1 to 3.6 ng/g (PBDE-047), which were considered when evaluating the lower PBDE concentration samples (table 4, at the back of this report). Recoveries of individual PBDEs from the fortified negative control matrix (whole bluegill) ranged from 80 to 125 percent, with the exception of PBDE-183, which was degraded on-column. The recovery of PBDEs from the positive control Saginaw Bay carp matrix was about 200 percent of the limited historical average (table 4). The precision of replicate analyses (n=3) of sample USGS 41290 (MDC 2007-81-230-1) for PBDEs was undetermined because concentrations of selected PBDE congeners were less than the MRLs (table 4). Concentrations of total PBDEs in the replicate sample were less than 10 ng/g when corrected for the procedural blank background PBDE concentration. The correlation coefficients of the individual PBDE congener calibration curves were greater than 0.95.

Results and Discussion

Twenty-six fish fillet composite samples of predator and bottom-feeding fish were selected based on the need for organic contaminant information and the potentially greater risk for human consumption. Samples were collected from eight Missouri sites: Mississippi River at Saverton, Pool 22, Montrose Lake, the upper and lower Blue River, LaBelle Lake, Mozingo Lake, and Locust Creek near Pershing State Park. Samples of individual or composited fish fillets are designated by USGS ID and MDC field ID in table 1. The composite samples were prepared and analyzed for PCBs, OCPs, and PBDEs by the USGS. The results are presented below. All sample values, except procedural blanks, were adjusted for recoveries of procedural internal standards (surrogates) and corrected for procedural blank background values (tables 2–4). Procedural blank values were adjusted for surrogate recoveries only (not corrected for procedural blank background values).

Lipids

Lipids in the samples ranged from less than 0.1 to 12 percent (table 1). Largemouth bass and common carp were lowest (0.33 to 0.62 percent lipid), lake sturgeon were moderate in lipids (1.8 to 2.9 percent lipid), and channel catfish generally were the highest (less than 0.1 to 12 percent lipid). No noticeable trend in percent lipids in composited fillets was apparent between the 5 sites for the 22 channel catfish samples. The small numbers of each species and the lack of representative samples of each species at each site make any definite statements about lipid content of these samples difficult. The recoveries of procedural internal standards indicated complete extraction, indicating that extraction efficiencies for lipids (as total dichloromethane-extractable organophilic residues) also were excellent.

Total PCBs

Polychlorinated biphenyl results for previous MDC monitoring programs were expressed as concentrations of Aroclors® 1242, 1248, 1254, and 1260; therefore, the PCB congener results from this study were expressed as estimates of Aroclors® for compatibility (table 2). Response factors for three to four selected PCB congeners per Aroclor® were used to determine the fractional contribution of each congener to each Aroclor®: Aroclor® 1242—PCB-018, -019, -028, and -031; Aroclor® 1248—PCB-066, -070, and -074; Aroclor® 1254—PCB-101, -110, and -118; and Aroclor® 1260—PCB-153, -170, and -180.

Total concentrations of PCBs in samples ranged from background levels of about 60 ng/g to 300 ng/g (table 2). Concentrations of PCBs were greatest in channel catfish samples from the lower Blue River (110 to 300 ng/g) and in lake sturgeon from the Mississippi River-Saverton (Pool 22) (78 to 140 ng/g). Expressed as Aroclors®, PCBs consisted of a mixture of all four Aroclors® 1242, 1248, 1254, and 1260, in channel catfish samples from the lower Blue River, mean ratio from all samples was 23:25:14:38 percent of each Aroclor®, respectively. Samples of channel catfish from the upper Blue River were low in PCBs (27 to 33 ng/g), expressed as Aroclor® 1260. Expressed as Aroclors®, PCBs primarily consisted of Aroclors® 1248, 1254, and 1260 in lake sturgeon samples from the Mississippi River, generally in the ratio of 13:25:62 percent of each Aroclor®, respectively. Negligible contributions (less than 10 percent) were estimated from Aroclor® 1242. All other samples had concentrations of total PCBs that were less than the MRL of 10 ng/g.

Organochlorine Pesticides

Several OCPs were detected in most samples and were present at 10- to 50-fold greater levels in channel catfish samples from the lower Blue River (table 3). These OCPs also were detected in channel catfish samples from the upper Blue River and lake sturgeon from the Mississippi River at Saverton, but at concentrations 2- to 5-fold less than levels from the lower Blue River (table 3). Chlordanes (*cis/trans*-nonachlor, *cis/trans*-chlordane, heptachlor epoxide, and oxychlordane), DDT-related chemicals (*p,p'*-DDE, and *p,p'*-DDD), and dieldrin constituted the primary classes of pesticides detected at elevated concentrations in these samples, ranging from 5 to 75 ng/g. The greatest values of these pesticides were detected for a channel catfish composite from the lower Blue River USGS 41270 (MDC 2007-12-230-1); other OCP concentrations in samples generally were low. Hexachlorocyclohexanes (BHCs: α-BHC, β-BHC, γ-BHC 'Lindane', δ-BHC), heptachlor, endosulfans (I, II, sulfate), endrin, aldrin, pentachlorobenzene, hexachlorobenzene, dacthal, heptachlor, and *o,p'*-DDD, *o,p'*-DDE, *o,p'*-DDT, *p,p'*-DDT, mirex, and methoxychlor were not present in any sample at concentrations greater than 5 ng/g.

Selected PBDEs

Total concentrations of PBDEs in samples ranged from background levels of about 5 to 86 ng/g, the greatest value present in a channel catfish composite sample from the lower Blue River (table 4). Concentrations of total PBDEs generally were low, but correlated well with concentrations of total PCBs in the fish fillet composites for those sites and samples with detectable concentrations. Concentrations of PBDEs, like those of total PCBs, were greatest in samples from channel catfish from the lower Blue River and were 3- to 6-fold less in channel catfish samples from the upper Blue River. Concentrations of PBDEs in lake sturgeon samples from the Mississippi River at Saverton were several-fold less than channel catfish concentrations from the lower Blue River even though total PCBs concentrations were similar in samples from both sites. Of the target PBDE congeners, PBDE-047 contributed from 50 to 80 percent and PBDE-099 contributed from 18 to 40 percent of the total PBDE concentration, respectively. Together, these two congeners accounted for 67 to 100 percent of the total PBDEs in all samples. The next most significant contribution was from PBDE-100 (less than 1 to about 16 percent). Smaller contributions to overall PBDEs were made by PBDE-028, with no other congeners contributing to any sample. Distinct profiles of PBDEs were observed for the Blue River channel catfish samples and for the Mississippi River lake sturgeon samples. Channel catfish from the upper and lower Blue River exhibited consistent ratios for PBDE-047:-100:-099 of about 60:10:30. Lake sturgeon from the Mississippi River at Saverton exhibited consistent ratios for PBDE-028:-047:-100 of about 15:75:15. It is not know whether or not the different ratios of PBDE congeners reflect differences between species (uptake and metabolism), sites (exposure), or both.

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Tables 1–4

Table 1. Sample description and percent lipid values in Missouri Department of Conservation 2007 fish fillets.

[USGS, U.S. Geological Survey; ID, identification; <, less than; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation]

USGS ID number	Field ID	Fish common name	Sample type	Location	Lipid (percent)
41267	2007-544-230-1	Channel catfish	Fillet	Upper Blue River	1.6
41268	2007-544-230-2	Channel catfish	Fillet	Upper Blue River	1.6
41269	2007-544-230-3	Channel catfish	Fillet	Upper Blue River	0.9
41270	2007-012-230-1	Channel catfish	Fillet	Lower Blue River	5.9
41271	2007-012-230-2	Channel catfish	Fillet	Lower Blue River	2.0
41272	2007-012-230-3	Channel catfish	Fillet	Lower Blue River	2.2
41273	2007-006-406-1	Largemouth bass	Fillet	Watkins Mill State Park Lake	0.3
41274	2007-006-230-1	Channel catfish	Fillet	Watkins Mill State Park Lake	1.5
41275	2007-040-406-1	Largemouth bass	Fillet	Montrose Lake	0.6
41276	2007-040-070-1	Carp	Fillet	Montrose Lake	0.5
41277	2007-315-010-1	Lake sturgeon	Fillet	Mississippi River-Saverton Pool 22	2.9
41278	2007-315-010-2	Lake sturgeon	Fillet	Mississippi River-Saverton Pool 22	2.8
41279	2007-315-010-3	Lake sturgeon	Fillet	Mississippi River-Saverton Pool 22	1.8
41280	2007-222-230-1	Channel catfish	Fillet	LaBelle Lake	< 0.1
41281	2007-222-230-2	Channel catfish	Fillet	LaBelle Lake	0.3
41282	2007-222-230-3	Channel catfish	Fillet	LaBelle Lake	2.7
41283	2007-222-230-4	Channel catfish	Fillet	LaBelle Lake	0.9
41284	2007-222-230-5	Channel catfish	Fillet	LaBelle Lake	4.3
41285	2007-651-230-1	Channel catfish	Fillet	Mozingo Lake	1.4
41286	2007-651-230-2	Channel catfish	Fillet	Mozingo Lake	1.8
41287	2007-651-230-3	Channel catfish	Fillet	Mozingo Lake	3.1
41288	2007-651-230-4	Channel catfish	Fillet	Mozingo Lake	12
41289	2007-651-230-5	Channel catfish	Fillet	Mozingo Lake	6.7
41290-1	2007-081-230-1	Channel catfish	Fillet	Locust Creek near Pershing State Park	3.2
41290-2	2007-081-230-1	Channel catfish	Fillet	Locust Creek near Pershing State Park	3.4
41290-3	2007-081-230-1	Channel catfish	Fillet	Locust Creek near Pershing State Park	3.5
	Average:				3.4
	SD:				.15
	RSD:				5
41291	2007-081-230-2	Channel catfish	Fillet	Locust Creek near Pershing State Park	1.9
41292	2007-081-230-3	Channel catfish	Fillet	Locust Creek near Pershing State Park	2.3
PB-0213086	Procedural blank				< 0.1
MB-021408	Matrix blank	Control bluegill 654C	Whole		1.2
MS-OC-021308	Matrix spike - OCs	Control bluegill 654C	Whole		1.0
MS-PCB/PBDE-021308	Matrix spike - PCBs/PBDEs	Control bluegill 654C	Whole		1.0
PC-021408	Positive control	Saginaw carp 6806	Whole		16
Baseline PC data:	Positive control	Saginaw carp 6806	Whole	Percent lipid range (1994 – 2008)	12 – 16

Table 2. Total polychlorinated biphenyl and estimated Aroclor® concentrations and Aroclor® percentages in Missouri Department of Conservation 2007 fish fillets.

[USGS, U.S. Geological Survey; ID, identification; PCB, polychlorinated biphenyl; ng/g, nanogram per gram; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID number	Field ID	Measured[1] total PCBs (ng/g)	Aroclor 1242[2]		Aroclor 1248[3]		Aroclor 1254[4]		Aroclor 1260[5]		Estimated total Aroclor®	
			(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)[6]
41267	2007-544-230-1	37	< 10	--	11	21	< 10	--	33	64	52	139
41268	2007-544-230-2	11	< 10	--	< 10	--	< 10	--	33	100	33	298
41269	2007-544-230-3	< 10	< 10	--	< 10	--	< 10	--	27	100	27	--
41270	2007-012-230-1	300	95	28	82	24	49	14	110	32	340	113
41271	2007-012-230-2	110	31	20	37	24	19	13	65	43	150	138
41272	2007-012-230-3	150	43	22	49	26	26	14	73	38	190	128
41273	2007-006-406-1	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41274	2007-006-230-1	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41275	2007-040-406-1	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41276	2007-040-070-1	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41277	2007-315-010-1	96	< 10	--	18	13	35	26	82	60	140	142
41278	2007-315-010-2	78	< 10	--	14	13	25	23	68	63	110	139
41279	2007-315-010-3	140	< 10	--	21	12	44	25	110	62	180	126
41280	2007-222-230-1	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41281	2007-222-230-2	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41282	2007-222-230-3	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41283	2007-222-230-4	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41284	2007-222-230-5	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41285	2007-651-230-1	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41286	2007-651-230-2	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41287	2007-651-230-3	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41288	2007-651-230-4	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41289	2007-651-230-5	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41290-1	2007-081-230-1	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41290-2	2007-081-230-1	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41290-3	2007-081-230-1	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
	Average:	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
	SD:	--	--	--	--	--	--	--	--	--	--	--
	RSD:	--	--	--	--	--	--	--	--	--	--	--

Table 2. Total polychlorinated biphenyl and estimated Aroclor® concentrations and Aroclor® percentages in Missouri Department of Conservation 2007 fish fillets.—Continued

[USGS, U.S. Geological Survey; ID, identification; PCB, polychlorinated biphenyl; ng/g, nanogram per gram; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID number	Field ID	Measured[1] total PCBs (ng/g)	Aroclor 1242[2]		Aroclor 1248[3]		Aroclor 1254[4]		Aroclor 1260[5]		Estimated total Aroclor®	
			(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)[6]
41291	2007-081-230-2	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
41292	2007-081-230-3	< 10	< 10	--	< 10	--	< 10	--	< 10	--	< 10	--
PB-0213086	Procedural blank[7]	57	2.7	--	2.4	--	7.6	--	4.3	--	16	28
MB-021408	Matrix blank	16	< 10	--	< 10	--	< 10	--	< 10	--	12	77
MS-PCB/PBDE-021308	Matrix spike - PCBs/ PBDEs	890	230	19	260	22	280	23	440	36	1,200	136
PC-021408	Positive control Saginaw carp 6806	8,300	780	6	4,400	35	4,500	36	2,900	23	13,000	152
Baseline PC data:	Positive control Saginaw carp 6806	6,500	530	8	2,400	38	2,400	38	1,100	17	6,400	98
Commercial PCB mixtures used as Reference Materials												
Aroclor® 1242	(n=2)	850	620	62	330	33	51	5	< 10	--	1,000	118
Aroclor® 1248	(n=2)	920	340	29	600	52	170	15	36	3	1,200	126
Aroclor® 1254	(n=2)	890	12	1	150	13	600	52	390	34	1,200	129
Aroclor® 1260	(n=2)	890	< 10	--	< 10	--	150	12	1,100	85	1,300	145

[1] Summation of individual congeners.

[2] Congeners summed for Aroclor ® 1242 estimation (PCB-018, -019, -028, -031).

[3] Congeners summed for Aroclor ® 1248 estimation (PCB-066, -070, -074).

[4] Congeners summed for Aroclor ® 1254 estimation (PCB-101, -110, -118).

[5] Congeners summed for Aroclor ® 1260 estimation (PCB-153, -170, -180).

[6] Total Aroclor ® (sum of Aroclors ® 1242, 1248, 1254, 1260) compared to the sum of individual congeners and reported as a percentage.

[7] Procedural blank values are reported as total amounts (not concentrations), are adjusted for surrogate recovery, and are not corrected for background values.

Table 3. Organochlorine pesticide concentrations in Missouri Department of Conservation 2007 fish fillets.

[USGS, U.S. Geological Survey; ID, identification; ng/g, nanogram per gram; BHC, benzene hexachloride; HCH, hexachlorocyclohexane; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID number	Field ID	Pentachloro-benzene (ng/g)	Hexachloro-benzene (ng/g)	Pentachloro-anisole (ng/g)	alpha-BHC (α-HCH) (ng/g)	beta-BHC (β-HCH) (ng/g)	Lindane (γ-HCH) (ng/g)	delta-BHC (δ-HCH) (ng/g)	Heptachlor (ng/g)
41267	2007-544-230-1	< 0.1	0.2	2.0	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41268	2007-544-230-2	< 0.1	0.2	2.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41269	2007-544-230-3	< 0.1	< 0.1	1.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41270	2007-012-230-1	0.3	1.5	3.8	< 0.1	< 0.1	< 0.1	< 0.1	2.1
41271	2007-012-230-2	0.1	0.5	1.7	< 0.1	< 0.1	< 0.1	< 0.1	0.9
41272	2007-012-230-3	0.1	0.6	1.9	< 0.1	< 0.1	< 0.1	< 0.1	1.2
41273	2007-006-406-1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41274	2007-006-230-1	< 0.1	< 0.1	0.6	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41275	2007-040-406-1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41276	2007-040-070-1	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41277	2007-315-010-1	< 0.1	0.2	0.6	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41278	2007-315-010-2	< 0.1	0.3	0.8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41279	2007-315-010-3	< 0.1	< 0.1	0.7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41280	2007-222-230-1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
41281	2007-222-230-2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
41282	2007-222-230-3	< 0.1	< 0.1	0.4	< 0.1	< 0.1	0.4	< 0.1	< 0.1
41283	2007-222-230-4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
41284	2007-222-230-5	< 0.1	0.1	0.4	< 0.1	< 0.1	0.2	< 0.1	< 0.1
41285	2007-651-230-1	< 0.1	< 0.1	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1
41286	2007-651-230-2	< 0.1	0.1	0.2	< 0.1	< 0.1	0.3	< 0.1	< 0.1
41287	2007-651-230-3	< 0.1	< 0.1	0.5	< 0.1	< 0.1	0.5	< 0.1	< 0.1
41288	2007-651-230-4	< 0.1	0.3	0.8	< 0.1	< 0.1	0.4	< 0.1	< 0.1
41289	2007-651-230-5	< 0.1	0.3	0.9	< 0.1	< 0.1	0.5	< 0.1	< 0.1

Table 3. Organochlorine pesticide concentrations in Missouri Department of Conservation 2007 fish fillets.—Continued

[USGS, U.S. Geological Survey; ID, identification; ng/g, nanogram per gram; BHC, benzene hexachloride; HCH, hexachlorocyclohexane; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID number	Field ID	Pentachloro-benzene (ng/g)	Hexachloro-benzene (ng/g)	Pentachloro-anisole (ng/g)	alpha-BHC (α-HCH) (ng/g)	beta-BHC (β-HCH) (ng/g)	Lindane (γ-HCH) (ng/g)	delta-BHC (δ-HCH) (ng/g)	Heptachlor (ng/g)
41290-1	2007-081-230-1	< 0.1	0.1	0.8	< 0.1	< 0.1	0.4	< 0.1	< 0.1
41290-2	2007-081-230-1	< 0.1	0.2	0.8	< 0.1	< 0.1	0.4	< 0.1	< 0.1
41290-3	2007-081-230-1	< 0.1	< 0.1	0.4	< 0.1	< 0.1	0.5	< 0.1	< 0.1
	Average:	< 0.1	0.1	0.7	< 0.1	< 0.1	0.4	< 0.1	< 0.1
	SD:	--	--	0.2	--	--	0.06	--	--
	RSD:	--	--	35	--	--	13	--	--
41291	2007-081-230-2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
41292	2007-081-230-3	< 0.1	< 0.1	0.6	< 0.1	< 0.1	0.2	< 0.1	< 0.1
PB-0213086	Procedural blank[7]	< 0.1	0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
MB-021408	Matrix blank	< 0.1	0.3	0.2	0.2	< 0.1	0.3	< 0.1	< 0.1
MS-OCP-021408	Matrix spike - OCPs	36	39	50	43	40	43	40	28
PC-021408	Positive control Saginaw carp 6806	6.4	15	2.0	4.0	< 0.1	2.4	< 0.1	< 0.1
Baseline PC data:	Positive control Saginaw carp 6806	--	10	3.3	5.1	2.9	3	1	< 0.1

Table 3. Organochlorine pesticide concentrations in Missouri Department of Conservation 2007 fish fillets.—Continued

[USGS, U.S. Geological Survey; ID, identification; ng/g, nanogram per gram; BHC, benzene hexachloride; HCH, hexachlorocyclohexane; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID number	Field ID	Heptachlor epoxide (ng/g)	Aldrin (ng/g)	Dacthal (ng/g)	Oxychlordane (ng/g)	*cis*-Chlordane (ng/g)	*trans*-Chlordane (ng/g)	*cis*-Nonachlor (ng/g)	*trans*-Nonachlor (ng/g)
41267	2007-544-230-1	0.6	< 0.1	< 0.1	1.1	4.8	2.9	2.4	6.8
41268	2007-544-230-2	0.6	< 0.1	< 0.1	0.9	3.0	2.0	1.4	4.4
41269	2007-544-230-3	0.3	< 0.1	< 0.1	0.5	2.1	1.2	1.0	3.4
41270	2007-012-230-1	15	< 0.1	0.2	5.0	55	40	9.0	32
41271	2007-012-230-2	6.6	< 0.1	< 0.1	2.4	24	17	3.9	14
41272	2007-012-230-3	8.9	< 0.1	< 0.1	3.2	35	24	5.7	20
41273	2007-006-406-1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41274	2007-006-230-1	< 0.1	< 0.1	< 0.1	0.1	0.3	0.1	0.5	0.8
41275	2007-040-406-1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	0.2	0.2
41276	2007-040-070-1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1
41277	2007-315-010-1	1.1	< 0.1	< 0.1	1.0	3.0	2.1	2.1	5.5
41278	2007-315-010-2	1.1	< 0.1	< 0.1	0.9	4.3	2.5	2.2	6.7
41279	2007-315-010-3	0.6	< 0.1	< 0.1	1.1	3.0	2.4	2.7	7.3
41280	2007-222-230-1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	0.2	0.2
41281	2007-222-230-2	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	0.1	0.1
41282	2007-222-230-3	0.2	< 0.1	< 0.1	0.4	1.2	1.2	1.2	2.1
41283	2007-222-230-4	< 0.1	< 0.1	< 0.1	0.2	0.8	0.5	0.9	1.4
41284	2007-222-230-5	0.4	< 0.1	0.1	0.7	1.5	1.4	1.5	2.2
41285	2007-651-230-1	< 0.1	< 0.1	< 0.1	0.2	0.4	0.2	0.4	0.9
41286	2007-651-230-2	0.2	< 0.1	< 0.1	0.3	1.0	0.4	0.7	1.6
41287	2007-651-230-3	0.3	< 0.1	0.1	0.4	0.9	0.4	0.8	2.1
41288	2007-651-230-4	0.9	< 0.1	< 0.1	0.5	0.9	0.7	0.6	1.5
41289	2007-651-230-5	0.7	< 0.1	0.4	0.4	1.2	0.8	0.6	1.5

Table 3. Organochlorine pesticide concentrations in Missouri Department of Conservation 2007 fish fillets.—Continued

[USGS, U.S. Geological Survey; ID, identification; ng/g, nanogram per gram; BHC, benzene hexachloride; HCH, hexachlorocyclohexane; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID number	Field ID	Heptachlor epoxide (ng/g)	Aldrin (ng/g)	Dacthal (ng/g)	Oxychlordane (ng/g)	*cis*-Chlordane (ng/g)	*trans*-Chlordane (ng/g)	*cis*-Nonachlor (ng/g)	*trans*-Nonachlor (ng/g)
41290-1	2007-081-230-1	0.5	< 0.1	< 0.1	0.3	0.6	0.3	0.3	1.0
41290-2	2007-081-230-1	0.6	< 0.1	< 0.1	0.3	0.5	0.2	0.3	0.9
41290-3	2007-081-230-1	0.5	< 0.1	< 0.1	0.3	0.5	0.3	0.3	1.0
	Average:	0.5	< 0.1	< 0.1	0.3	0.5	0.2	0.3	1.0
	SD:	0.06	--	--	--	0.06	0.06	--	0.06
	RSD:	11	--	--	--	11	22	--	6.0
41291	2007-081-230-2	0.2	< 0.1	< 0.1	0.2	0.3	0.1	0.2	0.7
41292	2007-081-230-3	0.7	< 0.1	< 0.1	0.4	0.4	0.3	0.3	1.0
PB-0213086	Procedural blank[7]	0.1	< 0.1	0.3	< 0.1	0.1	0.1	< 0.1	0.1
MB-021408	Matrix blank	0.4	< 0.1	0.5	0.9	0.4	< 0.1	1.1	3.5
MS-OCP-021408	Matrix spike - OCPs	47	37	56	48	49	48	42	52
PC-021408	Positive control Saginaw carp 6806	4.1	< 0.1	3.9	3.5	26	12	12	28
Baseline PC data:	Positive control Saginaw carp 6806	4	< 0.1	4.4	4	21	10	10	21

Table 3. Organochlorine pesticide concentrations in Missouri Department of Conservation 2007 fish fillets.—Continued

[USGS, U.S. Geological Survey; ID, identification; ng/g, nanogram per gram; BHC, benzene hexachloride; HCH, hexachlorocyclohexane; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID Number	Field ID	*o,p'*-DDE (ng/g)	*o,p'*-DDD (ng/g)	*o,p'*-DDT (ng/g)	*p,p'*-DDE (ng/g)	*p,p'*-DDD (ng/g)	*p,p'*-DDT (ng/g)	Endosulfan I (ng/g)	Endosulfan II (ng/g)	Endosulfan sulfate (ng/g)
41267	2007-544-230-1	0.5	< 0.1	0.2	8.2	2.4	< 0.1	< 0.1	< 0.1	< 0.1
41268	2007-544-230-2	< 0.1	< 0.1	< 0.1	5.5	0.7	< 0.1	< 0.1	< 0.1	< 0.1
41269	2007-544-230-3	0.2	< 0.1	< 0.1	3.5	0.4	< 0.1	< 0.1	< 0.1	< 0.1
41270	2007-012-230-1	0.3	5.2	< 0.1	43	24	2.4	< 0.1	< 0.1	< 0.1
41271	2007-012-230-2	< 0.1	2.2	< 0.1	17	11	0.4	< 0.1	< 0.1	< 0.1
41272	2007-012-230-3	0.1	3.1	< 0.1	24	14	0.4	< 0.1	< 0.1	< 0.1
41273	2007-006-406-1	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41274	2007-006-230-1	0.4	< 0.1	< 0.1	3.2	0.2	< 0.1	< 0.1	< 0.1	< 0.1
41275	2007-040-406-1	< 0.1	< 0.1	< 0.1	0.7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41276	2007-040-070-1	< 0.1	< 0.1	< 0.1	0.5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
41277	2007-315-010-1	0.2	0.6	< 0.1	12	1.8	< 0.1	< 0.1	< 0.1	< 0.1
41278	2007-315-010-2	0.3	0.6	< 0.1	13	1.5	< 0.1	< 0.1	< 0.1	< 0.1
41279	2007-315-010-3	0.5	< 0.1	< 0.1	17	2.3	< 0.1	< 0.1	< 0.1	< 0.1
41280	2007-222-230-1	< 0.1	< 0.1	< 0.1	0.7	0.2	< 0.1	< 0.1	< 0.1	< 0.1
41281	2007-222-230-2	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
41282	2007-222-230-3	< 0.1	< 0.1	< 0.1	2.2	0.3	< 0.1	< 0.1	< 0.1	< 0.1
41283	2007-222-230-4	< 0.1	< 0.1	< 0.1	2.7	0.3	< 0.1	< 0.1	< 0.1	< 0.1
41284	2007-222-230-5	< 0.1	< 0.1	< 0.1	2.9	0.3	< 0.1	< 0.1	< 0.1	< 0.1
41285	2007-651-230-1	< 0.1	< 0.1	< 0.1	2.2	0.2	< 0.1	< 0.1	< 0.1	< 0.1
41286	2007-651-230-2	< 0.1	< 0.1	< 0.1	3.0	0.4	< 0.1	< 0.1	< 0.1	< 0.1
41287	2007-651-230-3	< 0.1	0.2	< 0.1	4.8	0.6	< 0.1	< 0.1	< 0.1	< 0.1
41288	2007-651-230-4	< 0.1	0.3	< 0.1	2.6	0.5	< 0.1	< 0.1	< 0.1	< 0.1
41289	2007-651-230-5	< 0.1	< 0.1	< 0.1	2.6	0.4	< 0.1	< 0.1	< 0.1	0.2

Table 3. Organochlorine pesticide concentrations in Missouri Department of Conservation 2007 fish fillets.—Continued

[USGS, U.S. Geological Survey; ID, identification; ng/g, nanogram per gram; BHC, benzene hexachloride; HCH, hexachlorocyclohexane; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID Number	Field ID	*o,p'*-DDE (ng/g)	*o,p'*-DDD (ng/g)	*o,p'*-DDT (ng/g)	*p,p'*-DDE (ng/g)	*p,p'*-DDD (ng/g)	*p,p'*-DDT (ng/g)	Endosulfan I (ng/g)	Endosulfan II (ng/g)	Endosulfan sulfate (ng/g)
41290-1	2007-081-230-1	< 0.1	0.4	< 0.1	1.8	0.3	< 0.1	0.1	< 0.1	< 0.1
41290-2	2007-081-230-1	< 0.1	0.5	< 0.1	2.0	0.2	< 0.1	< 0.1	< 0.1	0.1
41290-3	2007-081-230-1	< 0.1	< 0.1	< 0.1	2.1	0.3	< 0.1	< 0.1	< 0.1	0.1
	Average:	< 0.1	0.3	< 0.1	1.9	0.3	< 0.1	< 0.1	< 0.1	< 0.1
	SD:	--	0.24	--	0.15	0.06	--	--	--	--
	RSD:	--	75	--	7.8	22	--	--	--	--
41291	2007-081-230-2	< 0.1	0.2	< 0.1	0.9	0.2	< 0.1	< 0.1	< 0.1	< 0.1
41292	2007-081-230-3	< 0.1	< 0.1	< 0.1	1.9	0.3	< 0.1	< 0.1	< 0.1	< 0.1
PB-0213086	Procedural blank[7]	0.1	< 0.1	< 0.1	0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
MB-021408	Matrix blank	< 0.1	< 0.1	< 0.1	4.0	0.4	< 0.1	< 0.1	< 0.1	< 0.1
MS-OCP-021408	Matrix spike - OCPs	46	46	33	57	36	27	46	39	39
PC-021408	Positive control Saginaw carp 6806	6.9	57	0.9	590	260	0.9	3.1	< 0.1	< 0.1
Baseline PC data:	Positive control Saginaw carp 6806	9.1	48	0.21	350	240	4.6	12	1.4	7.4

Table 3. Organochlorine pesticide concentrations in Missouri Department of Conservation 2007 fish fillets.—Continued

[USGS, U.S. Geological Survey; ID, identification; ng/g, nanogram per gram; BHC, benzene hexachloride; HCH, hexachlorocyclohexane; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID Number	Field ID	Dieldrin (ng/g)	Mirex (ng/g)	Methoxychlor (ng/g)	Total BHCs[1] (ng/g)	Total endrin[2] (ng/g)	Total DDT Series[3] (ng/g)	Total chlordanes[4] (ng/g)	Total isodrins[5] (ng/g)	Total endosulfans[6] (ng/g)
41267	2007-544-230-1	2.0	< 0.1	< 0.1	< 1	< 1	11	19	2.0	< 1
41268	2007-544-230-2	2.1	< 0.1	< 0.1	< 1	< 1	6.2	12	2.1	< 1
41269	2007-544-230-3	1.3	< 0.1	< 0.1	< 1	< 1	4.1	8.5	1.3	< 1
41270	2007-012-230-1	75	< 0.1	< 0.1	< 1	< 1	75	160	75	< 1
41271	2007-012-230-2	28	< 0.1	< 0.1	< 1	< 1	31	69	28	< 1
41272	2007-012-230-3	44	< 0.1	< 0.1	< 1	< 1	42	98	44	< 1
41273	2007-006-406-1	< 0.1	< 0.1	< 0.1	< 1	< 1	< 1	< 1	< 1	< 1
41274	2007-006-230-1	0.3	< 0.1	< 0.1	< 1	< 1	3.8	1.8	< 1	< 1
41275	2007-040-406-1	< 0.1	< 0.1	< 0.1	< 1	< 1	< 1	< 1	< 1	< 1
41276	2007-040-070-1	< 0.1	< 0.1	< 0.1	< 1	< 1	< 1	< 1	< 1	< 1
41277	2007-315-010-1	4.5	< 0.1	< 0.1	< 1	< 1	15	15	4.5	< 1
41278	2007-315-010-2	4.1	0.1	< 0.1	< 1	< 1	15	18	4.1	< 1
41279	2007-315-010-3	2.7	0.1	< 0.1	< 1	< 1	20	17	2.7	< 1
41280	2007-222-230-1	< 0.1	< 0.1	< 0.1	< 1	< 1	< 1	< 1	< 1	< 1
41281	2007-222-230-2	< 0.1	< 0.1	< 0.1	< 1	< 1	< 1	< 1	< 1	< 1
41282	2007-222-230-3	0.6	< 0.1	< 0.1	< 1	< 1	2.5	6.3	< 1	< 1
41283	2007-222-230-4	< 0.1	< 0.1	< 0.1	< 1	< 1	3.0	3.8	< 1	< 1
41284	2007-222-230-5	0.9	< 0.1	< 0.1	< 1	< 1	3.2	7.7	1.2	< 1
41285	2007-651-230-1	0.9	< 0.1	< 0.1	< 1	< 1	2.4	2.1	1.1	< 1
41286	2007-651-230-2	2.2	< 0.1	< 0.1	< 1	< 1	3.4	4.2	2.5	< 1
41287	2007-651-230-3	2.7	< 0.1	< 0.1	< 1	< 1	5.6	4.9	2.9	< 1
41288	2007-651-230-4	7.8	< 0.1	< 0.1	< 1	< 1	3.4	5.1	8.1	< 1
41289	2007-651-230-5	6.8	< 0.1	< 0.1	< 1	< 1	3.0	5.2	7.1	< 1

Table 3. Organochlorine pesticide concentrations in Missouri Department of Conservation 2007 fish fillets.—Continued

[USGS, U.S. Geological Survey; ID, identification; ng/g, nanogram per gram; BHC, benzene hexachloride; HCH, hexachlorocyclohexane; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID Number	Field ID	Dieldrin (ng/g)	Mirex (ng/g)	Methoxychlor (ng/g)	Total BHCs[1] (ng/g)	Total endrin[2] (ng/g)	Total DDT Series[3] (ng/g)	Total chlordanes[4] (ng/g)	Total isodrins[5] (ng/g)	Total endosulfans[6] (ng/g)
41290-1	2007-081-230-1	1.4	< 0.1	< 0.1	< 1	< 1	2.5	3.0	1.6	< 1
41290-2	2007-081-230-1	1.6	< 0.1	< 0.1	< 1	< 1	2.7	2.8	1.9	< 1
41290-3	2007-081-230-1	1.7	< 0.1	< 0.1	< 1	< 1	2.4	2.9	2.0	< 1
	Average:	1.6	< 0.1	< 0.1	< 1	< 1	2.5	2.9	1.8	< 1
	SD:	0.15	--	--	--	--	0.15	0.1	0.21	--
	RSD:	9.8	--	--	--	--	6	3.4	11	--
41291	2007-081-230-2	0.8	< 0.1	< 0.1	< 1	< 1	1.3	1.7	1.1	< 1
41292	2007-081-230-3	1.9	< 0.1	< 0.1	< 1	< 1	2.2	3.1	2.2	< 1
PB-0213086	Procedural blank[7]	0.6	< 0.1	< 0.1	< 1	< 1	< 1	< 1	< 1	< 1
MB-021408	Matrix blank	4.5	< 0.1	< 0.1	< 1	< 1	4.4	6.3	4.7	< 1
MS-OCP-021408	Matrix spike - OCPs	51	45	21	170	34	250	340	120	120
PC-021408	Positive control Saginaw carp 6806	18	3.6	< 0.1	6.4	3.4	920	86	21	3.1
Baseline PC data:	Positive control Saginaw carp 6806	16	1.9	27	12	2.8	650	97	19	21

[1] Summation of α-HCH, β-HCH, γ-HCH, δ-HCH.

[2] Summation of endrin, endrin aldehyde, endrin ketone.

[3] Summation of *o,p'*-DDD, *o,p'*-DDE, *o,p'*-DDT, *p,p'*-DDD, *p,p'*-DDE, *p,p'*-DDT.

[4] Summation of *cis*-chlordane, *trans*-chlordane, *cis*-nonachlor, *trans*-nonachlor, oxychlordane, heptachlor, heptachlor epoxide, methoxychlor.

[5] Summation of aldrin, dieldrin, total endrin.

[6] Summation of endosulfan I, endosulfan II, endosulfan sulfate.

[7] Procedural blank values are reported as total amounts (not concentrations), are adjusted for surrogate recovery, and are not corrected for background values.

Table 4. Polybrominated diphenyl ethers concentrations and percentages in Missouri Department of Conservation 2007 fish fillets.

[USGS, U.S. Geological Survey; ID, identification; PBDE, polybrominated diphenyl ether; ng/g, nanogram per gram; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID number	Field ID	PBDE-028		PBDE-047		PBDE-066		PBDE-100		PBDE-099	
		(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)
41267	2007-544-230-1	< 1	--	21	61	< 1	--	3.7	11	9.9	29
41268	2007-544-230-2	< 1	--	12	69	< 1	--	1.3	7	4.1	24
41269	2007-544-230-3	< 1	--	10	74	< 1	--	1.2	9	2.4	18
41270	2007-012-230-1	< 1	--	44	51	< 1	--	8.6	10	33	39
41271	2007-012-230-2	< 1	--	13	53	< 1	--	2.5	10	9.1	37
41272	2007-012-230-3	< 1	--	15	49	< 1	--	3.8	12	12	39
41273	2007-006-406-1	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41274	2007-006-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41275	2007-040-406-1	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41276	2007-040-070-1	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41277	2007-315-010-1	< 1		5.8	84	< 1	--	1.1	16	< 1	--
41278	2007-315-010-2	2	12	11	74	< 1	--	2.1	14	< 1	--
41279	2007-315-010-3	1.9	17	7.3	67	< 1	--	1.7	16	< 1	--
41280	2007-222-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41281	2007-222-230-2	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41282	2007-222-230-3	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41283	2007-222-230-4	< 1	--	< 1	--	< 1	--	< 1	--	1.5	100
41284	2007-222-230-5	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41285	2007-651-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41286	2007-651-230-2	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41287	2007-651-230-3	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41288	2007-651-230-4	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41289	2007-651-230-5	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41290-1	2007-081-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41290-2	2007-081-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41290-3	2007-081-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
	Average:	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
	SD:	--	--	--	--	--	--	--	--	--	--
	RSD:	--	--	--	--	--	--	--	--	--	--
41291	2007-081-230-2	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
41292	2007-081-230-3	< 1	--	< 1	--	< 1	--	< 1	--	< 1	--
PB-0213086	Procedural blank[2]	0.2	--	3.6	--	0.2	--	0.2	--	1.2	--
MB-021408	Matrix blank	< 1	--	< 1	--	< 1	--	< 1	--	1.8	100
MS-PCB/PBDE-021308	Matrix spike - PCBs/PBDEs	25	15	21	12	24	14	23	14	24	14
PC-021408	Positive control Saginaw carp 6806	< 1	--	1.7	41	< 1	--	1.3	32	1.1	27
Baseline PC data:	Positive control Saginaw carp 6806	--	--	5.1	53	--	--	0.8	8	2.5	26

Table 4. Polybrominated diphenyl ethers concentrations and percentages in Missouri Department of Conservation 2007 fish fillets.—Continued

[USGS, U.S. Geological Survey; ID, identification; PBDE, polybrominated diphenyl ether; ng/g, nanogram per gram; <, less than the reporting limit; --, not reported; Average, average of replicate analyses; SD, standard deviation; RSD, percent relative standard deviation; All values are adjusted for surrogate recoveries and procedural blank sample background values]

USGS ID number	Field ID	PBDE-085		PBDE-154		PBDE-153		PBDE-183[1]		Total PBDE
		(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)	(percent)	(ng/g)
41267	2007-544-230-1	< 1	--	< 1	--	< 1	--	< 1	--	35
41268	2007-544-230-2	< 1	--	< 1	--	< 1	--	< 1	--	17
41269	2007-544-230-3	< 1	--	< 1	--	< 1	--	< 1	--	14
41270	2007-012-230-1	< 1	--	< 1	--	< 1	--	< 1	--	86
41271	2007-012-230-2	< 1	--	< 1	--	< 1	--	< 1	--	25
41272	2007-012-230-3	< 1	--	< 1	--	< 1	--	< 1	--	31
41273	2007-006-406-1	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41274	2007-006-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41275	2007-040-406-1	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41276	2007-040-070-1	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41277	2007-315-010-1	< 1	--	< 1	--	< 1	--	< 1	--	7
41278	2007-315-010-2	< 1	--	< 1	--	< 1	--	< 1	--	15
41279	2007-315-010-3	< 1	--	< 1	--	< 1	--	< 1	--	11
41280	2007-222-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41281	2007-222-230-2	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41282	2007-222-230-3	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41283	2007-222-230-4	< 1	--	< 1	--	< 1	--	< 1	--	2
41284	2007-222-230-5	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41285	2007-651-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41286	2007-651-230-2	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41287	2007-651-230-3	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41288	2007-651-230-4	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41289	2007-651-230-5	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41290-1	2007-081-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41290-2	2007-081-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41290-3	2007-081-230-1	< 1	--	< 1	--	< 1	--	< 1	--	< 10
	Average:	< 1	--	< 1	--	< 1	--	< 1	--	< 10
	SD:	--	--	--	--	--	--	--	--	--
	RSD:	--	--	--	--	--	--	--	--	--
41291	2007-081-230-2	< 1	--	< 1	--	< 1	--	< 1	--	< 10
41292	2007-081-230-3	< 1	--	< 1	--	< 1	--	< 1	--	< 10
PB-0213086	Procedural blank[2]	< 1	--	< 1	--	< 1	--	< 1	--	5
MB-021408	Matrix blank	< 1	--	< 1	--	< 1	--	< 1	--	< 10
MS-PCB/PBDE-021308	Matrix spike - PCBs/PBDEs	19	11	18	11	16	9	< 1	--	170
PC-021408	Positive control Saginaw carp 6806	< 1	--	< 1	--	< 1	--	< 1	--	< 10
Baseline PC data:	Positive control Saginaw carp 6806	--	--	--	--	--	--	--	--	10

[1] PBDE-183 not recovered, degradation via gas chromatography column activity.

[2] Procedural blank values are reported as total amounts (not concentrations), are adjusted for surrogate recovery, and are not corrected for background values.

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