Anthropogenic Chemicals in the Source and Finished Water from Three Mississippi Communities that Use Surface Water as Their Drinking-Water Supply

Claire E. Rose, U.S. Geological Survey
Richard H. Coupe, U.S. Geological Survey
C.M. Smith, Mississippi Department of Environmental Quality

The U.S. Geological Survey, in cooperation with the Mississippi Department of Environmental Quality, began a sampling program in the fall of 2007 to analyze water samples for a suite of wastewater indicator compounds and pesticides for the three drinking-water facilities in Mississippi that use surface water from the Pearl, Tombigbee, and Tennessee Rivers as their source water. Three samples, from both source water and finished water, were collected from each facility in October 2007, and January and May 2008. Few wastewater indicator chemicals were detected in source water; however, low concentrations of some commonly used herbicides were detected in the source and finished water from all three facilities. None of these compounds were detected in finished water at or above established drinking-water standards. Modern society depends upon chemicals to prevent and combat disease, cleanse and soften skin, smell better, reduce wrinkles, influence moods, and control weeds and insects for safety and aesthetic reasons. These compounds, which can be found in any drug or hardware store, enter the environment through runoff from agricultural fields, urban lawns, highway rights of way, parks and recreational areas, domestic sewage, and other sources. Some of these compounds have been shown to be stable in the environment, and also have been shown to survive the conventional drinking-water treatment process and be detected in the finished drinking-water supply. Little is known about the abundance and persistence of these compounds in surface waters of Mississippi; hence, there is little information on what effect further development in basins upstream of source-water intakes will have on downstream communities that rely on surface water as their source for drinking water.

Key words: Nonpoint Source Pollution; Source Water; Surface Water; Water Quality; Water Supply

Introduction

Human impact upon a watershed is inevitable and unavoidable, and the results of these impacts are reflected in the quality of the water that drains the watershed. Modern society depends upon chemicals to prevent and combat disease, cleanse and soften skin, create perfumes, reduce wrinkles, influence moods, and control weeds and insects for safety and aesthetic reasons. These compounds, which can be found in any drug or hardware store, enter the environment through runoff from agricultural fields, urban lawns, highway rights-of-way, parks and recreational areas, domestic sewage, and other sources. Some of these compounds have been shown to be stable in the environment, and also have been shown to survive the conventional drinking-water treatment process and be detected in the finished drinking-water supply. Little is known about the abundance or persistence of these compounds in surface waters of Mississippi; hence, there is little information on what effect further development in basins upstream of source-water intakes will have on downstream communities which rely on surface water as their source for drinking water.

Pesticides are used extensively throughout the United States to improve crop yields, protect the health and safety of citizens, and increase the aesthetic value of parks, golf courses, ponds, and other recreational areas. However, the extensive use of these pesticides has led to the degradation of surface- and ground-water quality in many areas, and in some cases, poses a direct threat to human or aquatic health (Barbash and Resek, 1996; Larson et al., 1997). Pharmaceuticals and endocrine disrupting compounds are subclasses of organic contaminants that have been detected in waste and surface waters throughout the world (Kolpin et al., 2002; Glassmeyer et al., 2005; Boyd et al., 2003; and Ternes et al., 1999). Their occurrence in surface water is most often a result of municipal wastewater discharge, as many of these compounds are not completely removed during treatment (Ternes et al., 1999).

More than 130 million people in the United States receive their drinking water from surface-water sources (Hutson et al., 2004). Surface waters are vulnerable to pesticide contamination because they receive runoff directly from agricultural fields, urban areas, golf courses, rights-of-way, reforested areas, and other areas that typically receive pesticide applications. Pesticides have also been shown to be carried in the atmosphere and to be deposited by wet or dry deposition far from their point of application (Majewski and Capel, 1995). Wastewater treatment plants often discharge into receiving streams that are upstream from intakes for public-water sources. Some pesticides and other compounds found in wastewater effluent have been shown to survive the treatment process (Coupe and Blomquist, 2004). Scientists and water managers are concerned about the level of risk that may be associated with the presence of these compounds in drinking water (Fono and McDonald., 2008; Donald et al., 2007; Winchester et al., 2009; and Schreinemachers, 2003), as many drinking-water treatment plants use source water impacted by wastewater and/or agricultural runoff.

This paper presents the results of a study to determine the occurrence of pesticides and wastewater indicator compounds in the source and finished water of three public water systems in Mississippi that use surface water as their source of drinking water. This study began in October 2007 and was conducted by the U.S. Geological Survey (USGS) in cooperation with the Mississippi Department of Environmental Quality (MDEQ). Samples were collected in October 2007, January 2008, and May 2008.

Background

The State of Mississippi is rich in water resources, and currently (2009) only three public water systems (PWS) (table 1) use surface water as their source for drinking water. Each of the PWS uses one or more of several basic treatment types: disinfection, coagulation and clarification, filtration, and adsorption (table 2). The method of disinfection varies among PWS, as well as where disinfection occurs in the treatment process. The method of filtration, as well as the type of adsorption, also varies among PWS in this study, and some of these processes vary seasonally dependent upon the quality of the source water.

The quality of the source water used for drinking water is dependent upon basin activities. The Short-Coleman PWS takes its source water from Pickwick Lake, which is a part of the Tennessee River (figure 1). Although the Tennessee River basin is quite rural, and land use is mostly forested (pasture is second to forested), there are major cities in the drainage basin of the Tennessee River which potentially contribute wastewater to the Tennessee River.

The source of water for the City of Jackson is the Ross Barnett Reservoir, which is a water supply and recreational reservoir on the Pearl River in central Mississippi. The drainage area of the Ross Barnett Reservoir is approximately 3,000 square miles, and land use is mostly forest (silvilculture) and some agriculture. There are a number of small communities within the drainage area that potentially contribute wastewater to the Pearl River.

The Northeast Mississippi Water Association (NEMWA) uses the Tombigbee River as its source water. The Tombigbee River basin is rural, and the primary land use is forest. However, when the Tombigbee River falls below a certain stage, the U.S. Army Corps of Engineers diverts water from the Tennessee-Tombigbee Waterway, allowing some water from the Tennessee River into the Tombigbee River. Subsequently, the source water for NEMWA can be quite varied, due to the lockage, as can Short-Coleman PWS' source, due to the varied land use within the basin. Because of this interbasin transfer, the true drainage basins are indeterminate for the purposes of this paper.

Methods

The U.S. Geological Survey, in cooperation with the Mississippi Department of Environmental Quality, began a sampling program in fall 2007 to analyze water samples for a suite of wastewater indicator compounds and pesticides for the three drinking-water facilities in Mississippi that use surface water from the Tennessee, Pearl, and Tombigbee Rivers as their source water. Three samples, from both source and finished water, were collected at each facility in October 2007, and January and May 2008.

Sample collection

Water samples were collected from a tap on the intake line or, if the tap was not available, from the reservoir or river near the intake line; consecutively, samples were collected from a tap after the treatment process and before entering the distribution system. Because samples were collected consecutively, the intake sample may not represent the sample collected after the treatment process due to the time of travel through the treatment plant. However, due to the relatively short flow-through period at the plants, and the size of rivers and/or reservoirs which would tend to prevent rapid changes in source-water quality under normal conditions, it is expected that any difference would be slight. For the purpose of this paper, it is assumed that the samples are paired samples, and therefore, the difference in concentration represents the effect of the treatment processes.

Water analysis

Water samples for the analysis of wastewater indicator compounds were collected in baked amber glass bottles. For finished water samples, a preservative (ascorbic acid and tris-(hydroxymethyl) aminomethane)) was used to quench the free chlorine in the sample and prevent further degradation. The water samples for pesticide analysis were filtered on-site by using an aluminum filter plate with a combusted (baked at 400°C for at least 2 hours) 0.7-micrometer nominal pore size glass fiber filter (Advantec GFF) into 1-L combusted amber bottles. The samples were packed in ice and shipped to the USGS National Water Quality Laboratory in Denver, Colorado, for extraction and analysis. Liquid-liquid extraction was used to isolate the wastewater compounds from the whole water samples, followed by gas chromatography/mass spectrometry (GC/MS). Solid phase extraction (SPE) was used to extract the pesticides from the filtered water samples followed by analysis of the samples by GC/MS. As a quality-assurance measure, additional samples were spiked with surrogate compounds before extraction to measure the extraction efficiency. Pesticides and other related compounds were analyzed by GC/MS as described by Zaugg et al. (1995). Wastewater compounds were analyzed as described by Zaugg et al. (2006). A total of 139 compounds were analyzed using the two methods in this study.

Results and Discussion

Of the 139 compounds analyzed for, 120 compounds were not detected in both the source and the finished paired water samples; of the 120 compounds, few were detected in either source or finished water (table 3). Most of the 120 compounds were not detected in any sample. Nineteen compounds were detected in both the source and finished water for at least one sample at one of the PWS's during the study (table 4). None of these concentrations exceeded USEPA Maximum Contaminate Levels. Most of the detected compounds were pesticides or pesticide degradates.

The compounds fall into four broad categories: A.) Compounds detected at all sites and in most sampling events; B.) Compounds routinely detected at just one site; C.) Compounds detected, but not systemically across sampling events or sites; and D.) Compounds that were not detected in any samples. Each category is explained in more detail below:

A. The five compounds that were detected at all sites and in almost all samples were; atrazine, 2-chloro-4-isopropylamino-6-amino-s-triazine (CIAT, a degradate of atrazine), metolachlor, simazine and tebuthiuron. These are all herbicides that are ubiquitous in the environment and frequently used in agricultural and/or urban settings.
B. Fluridone and hexazinone were detected in every sample from the Ross Barnett Reservoir and in the finished water from the City of Jackson. An invasive aquatic plant, hydrilla, has been found in the Ross Barnett Reservoir and fluridone has been used annually for several years as part of the control process (Wersal et al., 2009). Fluridone is applied directly into the reservoir, generally in the spring; hence, the much higher concentrations in May as opposed to October or January. Hexazinone is an herbicide used in forestry, and much of the Ross Barnett Reservoir drainage basin is used for silvilculture.
C. The other 12 detected compounds have no discernable pattern of occurrence and are only observed occasionally and usually at only one site.
D. No information other than these compounds were not detected above the reporting limits can be gleaned from these data.

Conclusions

The U.S. Geological Survey, in cooperation with the Mississippi Department of Environmental Quality, began a sampling program in fall 2007 to analyze water samples for a suite of wastewater indicator compounds and pesticides for the three drinking-water facilities in Mississippi that use surface water from the Pearl, Tombigbee, and Tennessee Rivers as their source water. Three samples, from both source and finished water, were collected in October 2007, and January and May 2008. Few wastewater indicator chemicals were detected in source water; however, low concentrations of some commonly used herbicides were detected in the source and finished water from all three facilities. None of these compounds were detected in finished water at or above established drinking-water standards.

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Table 1. Community water systems in Mississippi that use surface water as their source water, sampled 2007-2008.

Water Treatment Plant	Predominant Land Use	Areas Served	Population Served	Source Water
Short-Coleman Water Association	Agriculture/ silvilculture	A small area of rural northeastern Mississippi	1,483	Pickwick Lake/ Tennessee River
O.B. Curtis Water Treatment Plant	Agriculture/ silvilculture	City of Jackson	230,125	Ross Barnett Reservoir/Pearl River
Northeast Mississippi Regional Water Supply	Agriculture/ silvilculture	City of Tupelo/ Itawamba/Lee County	58,000	Tombigbee River/ Tenn- Tom Waterway/ Tennessee River

Table 2. Order of water treatment stages and chemicals used during treatment at the community water systems in this study.

Water Treatment Plant	Order of Water Treatment Stages and Chemicals Used
Short-Coleman Water Association	1. raw water intake, 2. dual pump, 3. storage, 4. dual influent mixing, 5. dual filter (soda ash, aluminum, polymer, chlorine), 6. effluent pumping (chlorine), 7. ground storage, 8. high service pump station, 9. distribution
O.B. Curtis Water Treatment Plant Conventional Process (October 2007 and January 2008 samples)	1. raw water intake, 2. potassium permanganate, 3. dual 1 mm raw screens, 4. 4 raw water pumps (potassium permanganate, ammonia feed, lime feed), 5. dual pre-oxidation basins (chlorine feed), 6. dual rapid mix (aluminum chloral hydrate, anionic polymer feed, lime feed, powdered activated carbon), 7. three tri-stage flocculators, 8. three sedimentation basins (residuals handling facility, chlorine dioxide), 9. Six dual media filters (filter backwash, ultraviolet light), 10. 5 million gallon clearwell (fluoride feed, lime feed, chlorine, ammonia feed), 11. high service pump station, 12. distribution
O.B. Curtis Water Treatment Plant Ultrafiltration (May 2008 samples only, due to new filtration system in operation)	Ultrafiltration followed by chlorine disinfection.
Northeast Mississippi Regional Water Supply	1. raw water intake: add potassium permanganate if necessary, 2. meter pit: add aluminum before flash mixer, 3. flash mix: add lime when necessary and cationic polymer, 4. clarification: chlorine feed after clarification but before filtration, 5. filtration 6. common weir: post chlorination, fluorination, phosphate and pH adjustment, 7. 1.5 million gallon clearwell, 8. 3.0 million gallon clearwell: pH adjustment with caustic, 9. pump house: ammonia feed

Table 3. Compounds analyzed for but not detected in both the raw and finished water from three public water supply facilities in Mississippi.

Compound	Possible Compound Use or Source	Reporting Limit ug/L
1,4-Dichlorobenzene	moth repellent, fumigant, deodorant	0.2
1-Methylnaphthalene	2-5% of gasoline, diesel fuel, or crude oil	0.2
1-Naphthol	insecticide and insecticide degradate	0.04
2,6-Diethylaniline	herbicide and herbicide degradate	0.006
2,6-Dimethylnaphthalene	present in diesel/kerosene (trace in gasoline)	0.2
2-Chloro-2,6-diethylacetanilide	herbicide and herbicide degradate	0.01
2-Ethyl-6-methylaniline	herbicide and herbicide degradate	0.01
2-Methylnaphthalene	2-5% of gasoline, diesel fuel, or crude oil	0.2
3,5-Dichloroaniline	herbicide and herbicide degradate	0.008
3-beta-Coprostanol	carnivore fecal indicator	2, 0.8
3-Methyl-1(H)-indole	fragrance, stench in feces and coal tar	0.2
3-tert-Butyl-4-hydroxy anisole (BHA)	antioxidant, general preservative	0.2
4-Chloro-2-methylphenol	herbicide and herbicide degradate	0.005
4-Cumylphenol	nonionic detergent or metabolite	0.2
4-n-Octylphenol	nonionic detergent or metabolite	0.2
4-Nonylphenol diethoxylate (NP2EO)	nonionic detergent or metabolite	3
4-Nonylphenol monoethoxylate (NP1EO)	nonionic detergent or metabolite	2
4-tert-Octylphenol diethoxylate (OP2EO)	nonionic detergent or metabolite	0.32
4-tert-Octylphenol monoethoxylate (OP1EO)	nonionic detergent or metabolite	1
4-tert-Octylphenol	nonionic detergent or metabolite	0.2
5-Methyl-1H-benzotriazole	antioxidant in antifreeze and deicers	2, 3
Acetochlor	herbicide	0.006
Acetophenone	fragrance in detergents and tobacco, flavor in beverages	0.2, 0.3
Acetyl hexamethyl tetrahydronaphthalene (AHTN)	musk fragrance, persistent; widespread in ground water, concern for bioaccumulation and toxicity	0.2
Alachlor	herbicide	0.006
alpha-Endosulfan	insecticide	0.006
Anthracene	component of tar, diesel, or crude oil	0.2
Anthraquinone	manufacture of dye/textiles, seed treatment, bird repellent	0.2
Azinphos-methyl-oxon	degradate	0.04
Azinphos-methyl	insecticide	0.12
2,2`,4,4`-Tetrabromodiphenyl ether (BDE 47)	widely used brominated flame retardant	0.2
Benfluralin	herbicide	0.004, 0.006, 0.010

Table 3. Compounds analyzed for but not detected in both the raw and finished water from three public water supply facilities in Mississippi (continued)

Compound	Possible Compound Use or Source	Reporting Limit ug/L
Benzo[a]pyrene	regulated PAH, used in cancer research	0.2
Benzophenone	fixative for perfumes and soaps	0.2
beta-Stigmastanol	herbivore fecal indicator (digestion of sitosterol)	0.2, 0.8
Bisphenol A	manufacture of polycarbonate resins, antioxi-dant	0.4
Bromacil	herbicide	0.2, 0.3
Caffeine	beverages, diuretic, very mobile/biodegradable	0.2
Camphor	flavor, odorant, ointments	0.2
Carbazole	insecticide, manufacture of dyes, explosives, and lubricants	0.2
Tris(2-chloroethyl)phosphate	plasticizer, flame retardant	0.2
Chlorpyrifos oxon	insecticide and insecticide degradates	0.06
Chlorpyrifos	insecticide	0.005, 0.007
cis-Permethrin	insecticide and insecticide degradates	0.01
Cotinine	metabolite of nicotine	0.8
Cyanazine	herbicide	0.02
Cyfluthrin	used in pesticide products	0.016
lambda-Cyhalothrin	insecticide	0.004, 0.007
Cypermethrin	insecticide	0.014
Dacthal (DCPA)	herbicide	0.003
Diazinon	insecticide, > 40% nonagricultural usage, ants, flies	0.2
Dichlorvos	insecticide, pet collars, naled or trichlofon deg-radates	0.01
Dicrotophos	insecticide	0.08
Dieldrin	insecticide	0.009
Diethyl phthalate	plasticizer for polymers and resins	0.2
Dimethoate	insecticide	0.006
Disulfoton sulfone	degradate	0.01
Disulfoton	insecticide	0.04
d-Limonene	fungicide, antimicrobial, antiviral, fragrance in aerosols	0.2
Endosulfan sulfate	degradate	0.022
EPTC (Eptam)	herbicide	0.002
Ethion monoxon	degradate	0.02
Ethion	pesticide	0.006
Ethoprophos	insecticide	0.012

Table 3. Compounds analyzed for but not detected in both the raw and finished water from three public water supply facilities in Mississippi (continued)

Compound	Possible Compound Use or Source	Reporting Limit ug/L
Fenamiphos sulfone	degradate	0.053
Fenamiphos sulfoxide	degradate	0.04, 0.20
Fenamiphos	insecticide	0.03
Fipronil	insecticide	0.02
Fipronil sulfide	degradate	0.013
Fipronil sulfone	degradate	0.024
Fluoranthene	component of coal tar and asphalt (only traces in gasoline or diesel fuel),	0.2
Fonofos	insecticide	0.01
Hexahydrohexamethylcyclopentabenzopy-ran (HHCB)	musk fragrance, persistent,	0.2
Indole	pesticide inert ingredient; fragrance in coffee	0.2
Iprodione	fungicide	0.01
Isoborneol	fragrance in perfumery, in disinfectants	0.2
Isofenphos	insecticide	0.006
Isophorone	solvent for lacquer, plastic, oil,	0.2
Isopropylbenzene	manufactures phenol/acetone, fuels and paint thinner	0.2
Isoquinoline	flavors and fragrances	0.2, 0.4
Malaoxon	degradate	0.020, 0.040
Malathion	insecticide	0.016
Menthol	cigarettes, cough drops, liniment, mouthwash	0.2
Metalaxyl	fungicide	0.007
Methidathion	insecticide	0.004
Methyl salicylate	liniment, food, beverage, UV-absorbing lotion	0.2
Metribuzin	herbicide	0.012
Molinate	herbicide	0.003, 0.019, 0.021, 0.024, 0.026, 0.028
Myclobutanil	fungicide	0.01
Naphthalene	manufactures of moth repellents, toilet deodor-ants, dyes, resins, tanning leather agents, car-baryl	0.2
Oxyfluorfen	herbicide	0.006
para-Nonylphenol	personal care and domestic product use	2
Paraoxon-methyl	degradate	0.01

Table 3. Compounds analyzed for but not detected in both the raw and finished water from three public water supply facilities in Mississippi (continued)

Compound	Possible Compound Use or Source	Reporting Limit ug/L
Parathion-methyl	insecticide	0.008
Pendimethalin	herbicide	0.012
Pentachlorophenol	wood preservative, termite control	0.8, 2
Phenanthrene	manufacture of explosives, component of tar, diesel fuel, or crude oil	0.2
Phenol	disinfectant, manufacture of several products, leachate	0.2
Phorate oxon	degradate	0.03
Phorate	insecticide	0.04
Phosmet oxon	degradate	0.05
Phosmet	insecticide	0.008
Prometryn	herbicide	0.006
Propyzamide	herbicide	0.004, 0.005
Propanil	herbicide	0.006
Propargite	insecticide	0.04
Pyrene	component of coal tar and asphalt	0.2
Tefluthrin	pesticide	0.003
Terbufos oxon sulfone	degradate	0.04
Terbufos	insecticide	0.02
Terbuthylazine	herbicide	0.01
Tetrachloroethylene	solvent, degreaser, veterinary anthelmintic	0.4
Thiobencarb	herbicide	0.01
Tribufos	used in pesticide products	0.035
Tributyl phosphate	used as a solvent in inks, synthetic resins, gums, adhesives	0.2
Triclosan	found in soaps, deodorants, toothpastes, shaving creams, mouth washes, and cleaning supplies	0.2
Triethyl citrate	used as a food additive, found in medicines, as a plasticizer, and in cosmetics.	0.2
Triphenyl phosphate	manufacturing additives	0.2
Tris(2-butoxyethyl)phosphate	flame retardant	0.2
Tris(dichlorisopropyl)phosphate	manufacturing additives	0.2

Table 4. Compounds analyzed for and detected at least once at or above the reporting limit in both the source and finished water from three public supply facilities in Mississippi; October 2007, January and May 2008.
[<, less than; --, no data; E, estimated; M, presence verified but not quantified. Detections are in italics.]

		Tombigbee River/ Northeast Mississippi Regional Water Supply		Ross Barnett Reservoir/ City of Jackson		Pickwick Lake/ Short-Coleman Water Association	
Compound	**Month of Sample**	**raw ug/L**	**finished ug/L**	**raw ug/L**	**finished ug/L**	**raw ug/L**	**finished ug/L**
3,4-Dichloroaniline (degradate)	Oct-07	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
	Jan-08	<0.006	<0.006	<0.006	<0.006	--	--
	May-08	<0.006	<0.006	*E 0.004*	*E 0.006*	<0.006	<0.006
3, 4-Dichlorophenyl isocyanate (Degradate of diuron, a noncrop herbicide)	October	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	January	<2.0	<2.0	<2.0	<2.0	--	--
	May	*E 0.41*	*E 0.17*	*E 0.66*	*E 0.60*	*E 0.24*	<2.0
Atrazine (selective triazine herbicide)	October	*0.027*	*0.027*	*0.069*	*0.066*	*0.015*	*0.016*
	January	*0.014*	*0.013*	*0.044*	*0.041*	--	--
	May	*0.303*	*0.295*	*0.119*	*0.114*	*0.11*	*0.085*
Carbaryl (insecticide)	October	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060
	January	<0.060	<0.060	<0.060	<0.060	--	--
	May	*E 0.012*	*E 0.013*	<0.060	<0.060	<0.060	<0.060
Carbofuran (insecticide)	October	<0.020	<0.020	<0.020	<0.020	*E 0.009*	*E 0.016*
	January	<0.020	<0.020	<0.020	<0.020	--	--
	May	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
2-Chloro-4-isopropylamino-6-amino-s-triazine (CIAT) (degradate of atrazine)	October	*E 0.008*	*E 0.009*	*E 0.012*	*E 0.011*	*E 0.006*	*E 0.005*
	January	*E 0.007*	*E 0.009*	*E 0.010*	*E 0.012*	--	--
	May	*E 0.020*	*E 0.025*	*E 0.012*	*E 0.013*	*E 0.019*	*E 0.015*
cis-Propiconazole (fungicide)	October	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
	January	<0.006	<0.006	<0.006	<0.006	--	--
	May	*E 0.004*	*E 0.043*	<0.006	<0.006	<0.006	<0.006
Desulfinylfipronil (degradate)	October	<.012	<.012	<.012	<.012	<.012	<.012
	January	<.012	<.012	*E .004*	<.012	--	--
	May	<.012	*E.007*	*E .003*	*E .003*	*E.007*	<.012
N,N-diethyl-meta-toluamide (DEET) (mosquito repellent)	October	<0.2	*M*	*M*	*M*	*M*	*M*
	January	<0.2	<0.2	*M*	<0.2	--	--
	May	<0.2	<0.2	*0.2*	<0.2	<0.2	<0.2

Table 4. Compounds analyzed for and detected at least once at or above the reporting limit in both the source and finished water from three public supply facilities in Mississippi; October 2007, January and May 2008.
[<, less than; --, no data; E, estimated; M, presence verified but not quantified. Detections are in italics.] (continued).

		Tombigbee River/ Northeast Mississippi Regional Water Supply		Ross Barnett Reservoir/ City of Jackson		Pickwick Lake/ Short-Coleman Water Association	
Compound	**Month of Sample**	**raw ug/L**	**finished ug/L**	**raw ug/L**	**finished ug/L**	**raw ug/L**	**finished ug/L**
Fluridone (aquatic herbicide)	October	<0.026	<0.026	*0.034*	*0.037*	<0.026	<0.026
	January	<0.026	<0.026	*E 0.024*	*0.029*	--	--
	May	<0.026	<0.026	*0.26*	*0.226*	<0.026	E 0.003
Hexazinone (herbicide)	October	<0.008	<0.008	*E 0.011*	*E 0.011*	<0.008	<0.008
	January	<0.008	<0.008	*0.011*	*E 0.012*	--	--
	May	<0.008	<0.008	*0.051*	*0.052*	<0.008	<0.008
Metolachlor (herbicide)	October	<0.010	<0.010	*0.01*	*0.01*	<0.010	<0.010
	January	*E 0.010*	< 0.010	*E 0.009*	*0.01*	--	--
	May	*0.046*	*0.053*	*0.079*	*0.073*	*0.013*	*0.013*
p-Cresol (wood preservative)	October	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	January	<0.2	<0.2	<0.2	<0.2	--	--
	May	<0.2	*M*	*M*	*M*	<0.2	<0.2
Prometon (herbicide)	October	<.04	<.01	<.01	<.01	<.01	<.01
	January	<.01	<.01	<.01	<.01	--	--
	May	<.01	*E .01*	<.01	<.01	*E .01*	*E .01*
Simazine (herbicide)	October	*0.014*	*0.013*	*0.009*	*0.009*	*0.011*	*0.012*
	January	*0.01*	*0.009*	*0.018*	*0.015*	--	--
	May	*0.015*	*0.017*	*0.013*	*0.014*	*0.024*	*0.022*
Tebuthiuron (herbicide)	October	*0.02*	<0.02	<0.02	<0.02	*E 0.01*	*0.02*
	January	*0.02*	*0.03*	*E 0.01*	*0.02*	--	--
	May	*0.04*	*0.05*	*E 0.01*	*E 0.01*	*0.04*	*0.04*
trans-Propiconazole (fungicide)		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
		E .01	*E .01*	<0.02	<0.02	<0.02	<0.02
Trifluralin (herbicide)	October	<0.006	<0.006	*0.017*	*0.027*	<0.006	<0.006
	January	<0.007	<0.006	<0.006	<0.006	--	--
	May	<0.009	<0.009	*E 0.003*	<0.009	<0.009	<0.009

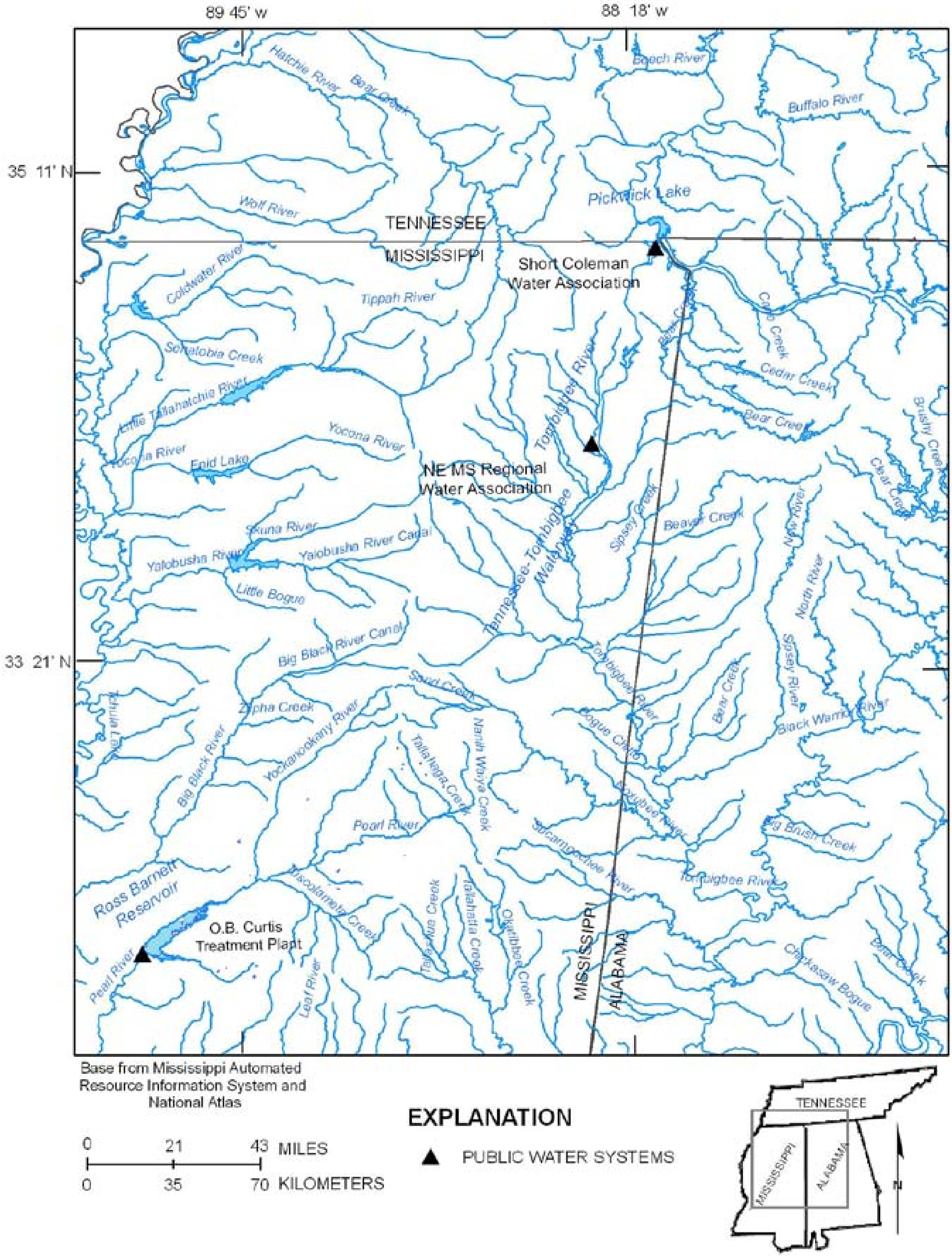

Figure 1. Location of three public water systems in northeastern Mississippi.