Chlorinated Hydrocarbon Pesticides in Major U.S. River Basins

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MODERN PESTICIDES are an important example of the many newly developed synthetic organic chemicals which have helped man so substantially in his continuous struggle for the improvement of his environment.

As would be the case in the widespread use of any toxic substance, a thorough understanding of the hazards as well as the benefits associated with use of pesticides in the environment is necessary (*1*). Currently, there is no evidence that the levels of chlorinated hydrocarbon pesticides in surface waters present an acute toxicity hazard to man. Little is known, however, about the effects of long-term, low-level environmental contamination. Other living forms, particularly fish, are more sensitive to pesticides at very low concentrations (*2*). Moreover, the concept of biological magnification (*3–5*) underscores the need to be aware of less-than-lethal concentrations of pesticides in water.

Pesticides, like many other persistent materials such as certain radioactive wastes from nuclear installations and surfactants, can be expected to pollute the surface waters draining the various river basins. The results of a previous study of surface water (*6*) indicated the presence in 1962 of DDT and dieldrin at 12 stations located on 10 rivers throughout the country. This study was based on analyses of the carbon chloroform extracts obtained by using carbon adsorption methods which have been a part of the Public Health Service water pollution surveillance activities since 1958.

Extensive surveillance for chlorinated hydrocarbon pesticides as well as other synthetic organic pollutants has been underway by the Public Health Service for several years. Until analytical methods suitable for small water samples were developed, most sampling and analytical work was routinely performed by the carbon adsorption method. When analytical procedures capable of measuring pesticides in the parts-per-trillion range on grab samples were developed, it was considered desirable to conduct a special synoptic survey to provide current qualitative and quantitative information on pesticide pollution in the various U.S. river systems. September was selected for this study, because during this month low streamflow conditions generally prevail. This analytical effort, which is summarized in the following section, was deliberately kept to a minimum in order to demonstrate the effectiveness of these procedures for rapid and repetitive surveillance work.

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Collection of Samples

Synoptic sampling was arranged by soliciting voluntary cooperators from an existing system of sampling stations in each river basin. These stations are manned through the coordinated efforts of Federal, State, local, and private agencies. Two 1-quart grab samples were requested for September 23, 1964, from each of the 96 sampling points shown in the maps. Samples were collected in glass jars fitted with screw-type caps lined with Teflon.

Analytical Procedures

All samples were subjected to liquid-liquid extraction (*7*), thin layer chromatography (*8*), and microcoulometric titration gas chromatography specific for halogenated compounds (*9*). Details of the methods used to detect dieldrin, endrin, DDT, DDD, DDE, aldrin, heptachlor, heptachlor epoxide, and benzene hexachloride (BHC) have been compiled (*10*). In this compilation, an aluminum column 3 feet long by ¼-inch OD, packed with 5 percent Dow 11 silicone grease on 60–80 mesh non-acid-washed Chromosorb W, was suggested for gas chromatographic use. During the survey reported here, however, good results were obtained with a column 4 feet long, packed with 5 percent Dow-Corning 200 silicone oil on 60–80 mesh Chromosorb P.

Two microcoulometric titration systems were used. One, a more recently developed Dohrman model C–200, was capable of greater sensitivity than the older model C–100. Thus, in this study, the minimum detectable concentration for dieldrin, endrin, DDT, DDE, aldrin, and heptachlor ranged from 0.002 to 0.010 μg per l. while the comparable limits for DDD, heptachlor epoxide, and benzene hexachloride were 0.075, 0.075, and 0.025 μg per l., respectively. Other scheduled analytical commitments precluded the use of the more sensitive electron capture gas chromatography, through which sensitivities of 0.001 μg. per l. are attainable. Data are reported as presumptive in instances where the results of chromatography were highly indicative but did not meet all requirements for positive identification.

Results

The analytical results of the synoptic survey are listed in table 1. Figures 1–6 show the occurrence of those substances most frequently found. Of the pesticides for which the analytical sensitivities were less, DDD was detected only in the Shenandoah River at Berryville, Va.; presumptive evidence of BHC was found only in the Delaware River at Martins Creek, Pa., and the Mississippi River at West Memphis, Ark. No indication of heptachlor epoxide was found at any station.

Discussion

The scope of the analytical methods, as previously noted, was limited to nine compounds. Although the total number of chlorinated hydrocarbon pesticides is quite large and continually growing, these nine constitute a major portion of present U.S. pesticide applications.

The most recent breakdown of production and sales data is that of Johnson and associates (*11*), who reported consumption in 1962 of 70×10^6 pounds per year DDT, 3.5×10^6 pounds per year BHC, and 110×10^6 pounds per year of other cyclic chlorinated hydrocarbons. The latter figure includes toxaphene (15 to 25×10^6 pounds per year); aldrin (9 to 12×10^6 pounds per year); dieldrin, endrin, and chlordane (5 to 10×10^6 pounds per year); and heptachlor, methoxychlor, and DDD, reported as TDE ("most likely under" 5×10^6 pounds per year). By assuming intermediate values for those compounds for which ranges are given, it is possible to estimate the relative importance of the pesticides which are currently identified (*10*). It is accordingly computed that the nine chlorinated hydrocarbon pesticides (dieldrin, endrin, DDT, DDE, DDD, aldrin, heptachlor, heptachlor epoxide, and BHC) constitute more than 60 percent of the total U.S. consumption of chlorinated hydrocarbon compounds, cited by Johnson, used as insecticides, miticides, nematocides, and rodenticides. Comparison with 1962–63 and 1963–64 data from the U.S. Department of Agriculture (*12*, *13*), which are given in less detail, indicates that the 60 percent figure is still reasonably valid.

The presence of chlorinated hydrocarbons in streams depends on the amount applied, the fraction carried to the stream in runoff, and the stability in the stream environment. Evaluation of the data is complicated because aldrin decomposes to form its epoxide, dieldrin (*14*, *15*). Similarly, heptachlor forms heptachlor epoxide. Technical DDT is known to contain congeners which include DDE. Even so, the results of the September 1964 synoptic survey are generally consistent with the production figures for DDT. DDT consumption is about a third of the total; DDT, its congeners, or its metabolites were found at 49 of the 96 stations.

Comparison of occurrences of chlorinated hydrocarbon pesticides among the various river basins is more meaningful. Figure 7 shows the frequency of occurrence, in 12 basin areas, of the six pesticides which were determined at a sensitivity level of 0.002–0.010 μg per l. Both positive and presumptive data are included in the chart. Data from basins with less than four stations were combined with data from contiguous and hydrologically similar basins.

Figure 7 reveals the widespread occurrence of dieldrin which, together with its precursor, aldrin (*14*, *15*), is reported (*11*) as being consumed in only about one-fifth the amount cited for DDT, but which clearly dominated the chlorinated hydrocarbon pesticides found in the synoptic sampling of surface waters from all river basins.

Endrin was relatively prominent in the Southwest-Lower Mississippi, Upper Mississippi, Ohio, and Missouri Basins.

DDT was found more frequently in the western States, which have extensive irrigation works. The apparent freedom from other chlorinated hydrocarbon pesticides in western States with extensive irrigated agriculture is caused in part by the limitations of the particular analytical procedures followed for this survey. For example, toxaphene is beyond the present scope of the procedure used although it is one of the most heavily used pesticides in California (personal communication, D. G. Crosby, chairman, Agricultural Toxicology and Residue Research Laboratory, University of California at Davis, 1964).

The presumptive presence of heptachlor and the apparent absence of heptachlor epoxide are most probably associated with the lesser sensitivity for the latter compound.

A detailed evaluation of specific concentrations is beyond the scope of this report. However, we should like to point out the river basins and stations at which the higher levels were found. Table 2 lists, in order of decreasing concentrations, the 10 stations which showed the highest concentrations of each of the four dominant pesticides. Individual stations frequently showed higher concentrations of more than one pesticide. Also, higher levels of chlorinated hydrocarbon pesticides were generally found in the North Atlantic, Lower Mississippi, and California Basins.

The results of this synoptic survey can be compared with those previously obtained from carbon adsorption method (CAM) samples. Data from two typical stations are shown in figure 8. This is a reproduction of output listings from the Public Health Service "STORET" system, which provides for storage and retrieval, by stream system or other geographic criteria, of pesticide and other water quality data from field investigations on water pollution control (*16*). The latest entry for each of the stations is that from the synoptic survey. Earlier CAM samples were taken during the periods indicated.

In general, both the occurrences and concentrations obtained during the September 1964 synoptic survey are in accord with earlier CAM results. Thus, the grab sample results in the nanogram-per-liter range are supported by the previous data obtained with the larger carbon adsorption samples (*10*), which contained the identified substances in at least microgram quantities. For example, the September 1964 occurrence of 0.025 μg./l. DDT at Brownsville is credible in terms of previous experience. On a broader scale, the ubiquitous nature of dieldrin is evident from both the synoptic survey and previous data.

There were a few surprises, however. The relatively high levels found along the eastern seaboard have been noted above (table 2). In contrast, only presumptive, and accordingly not quantifiable, evidence of endrin and dieldrin was found in the Mississippi River at New Orleans, where relatively high concentrations were observed during low-flow months of the preceding 3 years. Altogether 11 of the 96 stations experienced significant variation from previously reported concentration ranges. Of these, nine stations showed increases and two showed decreases.

More far-reaching significance derives from identification of pesticides in CAM extracts which have been stored for several years. A

Table 1. Synoptic survey of chlorinated hydrocarbon pesticides, U.S. river basins, September 1964

Location [1]	Concentration in micrograms per liter								
	Dieldrin	Endrin	DDT	DDE	DDD	Aldrin	Heptachlor	Heptachlor epoxide	BHC
Northeast Basin									
Connecticut River:									
Enfield Dam, Conn. (82)	ND	ND	ND	ND	ND	ND	ND	ND	ND
below Northfield, Mass. (11)	>.022	.025	P	P	ND	ND	ND	ND	ND
Wilder, Vt. (103)	.003	ND	ND	ND	ND	ND	ND	ND	ND
Hudson River: below Poughkeepsie, N.Y. (18)	.008	ND	ND	.004	ND	P	ND	ND	ND
Lake Erie: Buffalo, N.Y. (14)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Merrimack River: above Lowell, Mass. (19)	>.071	ND	ND	ND	ND	ND	ND	ND	ND
St. Lawrence River: Massena, N.Y. (63)	.003	P	ND	P	ND	ND	ND	ND	ND
North Atlantic Basin									
Delaware River:									
Trenton, N.J. (100)	.009	ND	ND	ND	ND	ND	ND	ND	ND
Martins Creek, Pa. (61)	ND	ND	ND	.008	ND	ND	P	ND	P
Potomac River:									
Washington, D.C. (130)	ND	ND	ND	ND	ND	ND	P	ND	ND
Great Falls, Md. (40)	>.040	>.094	P	P	ND	ND	ND	ND	ND
Schuylkill River: Philadelphia, Pa. (74)	>.032	ND	ND	ND	ND	ND	ND	ND	ND
Shenandoah River: Berryville, Va. (87)	.005	.009	.026	.002	.083	ND	ND	ND	ND
Susquehanna River:									
Conowingo, Md. (75)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sayre, Pa. (76)	.003	P	P	ND	ND	ND	ND	ND	ND
Southeast Basin									
Apalachicola River: Chattahoochee, Fla. (57)	.016	ND	.027	ND	ND	ND	ND	ND	ND
Chattahoochee River: Lanett, Ala. (120)	ND	ND	.007	ND	ND	ND	ND	ND	ND
Escambia River: Century, Fla. (62)	P	P	ND	ND	ND	ND	P	ND	ND
Roanoke River: John H. Kerr Reservoir and Dam, Va. (91)	P	ND	ND	ND	ND	ND	P	ND	ND
Savannah River:									
Port Wentworth, Ga. (47)	.020	ND	.020	.004	ND	ND	ND	ND	ND
North Augusta, S.C. (48)	>.118	ND	ND	P	ND	ND	P	ND	ND
Tombigbee River: below Columbus, Miss. (95)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tennessee River Basin									
Clinch River: above Kingston, Tenn. (106)	.014	.015	P	ND	ND	ND	P	ND	ND
Tennessee River:									
Bridgeport, Ala. (77)	.006	.005	P	P	ND	ND	ND	ND	ND
Lenoir City, Tenn. (107)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ohio River Basin									
Allegheny River: Pittsburgh, Pa. (79)	P	P	ND	ND	ND	ND	ND	ND	ND
Kanawha River: Winfield Dam, W. Va. (68)	ND	ND	.017	P	ND	ND	ND	ND	ND
Monongahela River: Pittsburgh, Pa. (83)	ND	ND	.018	.004	ND	ND	ND	ND	ND
Ohio River:									
Cairo, Ill. (35)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Evansville, Ind. (36)	.015	P	ND	ND	ND	ND	ND	ND	ND
Cincinnati, Ohio (37)	.013	ND	ND	ND	ND	ND	ND	ND	ND
above Addison, Ohio (117)	A	A	ND	ND	ND	ND	ND	ND	ND
Wabash River: New Harmony, Ind. (105)	.004	ND	P	ND	ND	ND	ND	ND	ND
Lake Erie Basin									
Maumee River: Toledo, Ohio (127)	ND	ND	.087	.015	ND	P	P	ND	ND

Table 1. Synoptic survey of chlorinated hydrocarbon pesticides, U.S. river basins, September 1964—Continued

Location [1]	Concentration in micrograms per liter								
	Dieldrin	Endrin	DDT	DDE	DDD	Aldrin	Hepta-chlor	Hepta-chlor epoxide	BHC
Upper Mississippi River Basin									
Illinois River: Peoria, Ill. (67)	.003	ND	ND	ND	ND	ND	ND	ND	ND
Mississippi River:									
Cape Girardeau, Mo. (23)	.008	ND	ND	ND	ND	ND	ND	ND	ND
East St. Louis, Ill. (24)	P	P	ND	ND	ND	ND	ND	ND	ND
Burlington, Iowa (25)	.004	.004	P	P	ND	ND	ND	ND	ND
Dubuque, Iowa (26)	ND	ND	ND	ND	ND	P	ND	ND	ND
Lock and Dam 3 below St. Paul, Minn. (27)	.008	.006	P	.011	ND	ND	ND	ND	ND
Rainy River: Baudette, Minn. (96)	.008	.011	P	P	ND	ND	ND	ND	ND
Red River (North): Grand Forks, N. Dak. (69)	.004	.023	.072	.004	ND	ND	P	ND	ND
Western Great Lakes Basin									
Detroit River: Detroit, Mich. (15)	ND	ND	ND	ND	ND	P	ND	ND	ND
St. Clair River: Port Huron, Mich. (64)	ND	ND	ND	P	ND	ND	P	ND	ND
Lake Michigan: Milwaukee, Wis. (65)	.007	.006	P	ND	ND	ND	ND	ND	ND
Lake Superior: Duluth, Minn. (16)	P	ND	P	P	ND	ND	ND	ND	ND
Missouri River Basin									
Big Horn River: Hardin, Mont. (104)	.012	.026	ND	P	ND	ND	ND	ND	ND
Kansas River: DeSoto, Kans. (128)	.004	.005	ND	ND	ND	ND	ND	ND	ND
Missouri River:									
St. Louis, Mo. (28)	.012	.009	ND	ND	ND	ND	ND	ND	ND
Kansas City, Kans. (29)	ND	ND	ND	ND	ND	P	P	ND	ND
Omaha, Nebr. (31)	P	ND	ND	ND	ND	ND	ND	ND	ND
Yankton, S. Dak. (32)	.009	ND	.024	.004	ND	ND	ND	ND	ND
Bismarck, N. Dak. (33)	.005	.004	.014	.003	ND	ND	ND	ND	ND
North Platte River: above Henry, Nebr. (94)	.006	ND	ND	ND	ND	ND	ND	ND	ND
Platte River: above Plattsmouth, Nebr. (86)	.023	ND	.019	.004	ND	ND	ND	ND	ND
South Platte River; Julesburg, Colo. (92):									
South Channel	.016	.014	ND	ND	ND	ND	ND	ND	ND
North Channel	P	P	ND	.018	ND	ND	P	ND	ND
Yellowstone River: near Sidney, Mont. (55)	.008	.021	ND	ND	ND	ND	ND	ND	ND
Southwest-Lower Mississippi River Basin									
Arkansas River:									
Little Rock, Ark. (131)	.004	.008	P	P	ND	ND	ND	ND	ND
near Ponca City, Okla. (1)	.008	.014	ND	ND	ND	ND	P	ND	ND
Coolidge, Kans. (2)	P	ND	ND	ND	ND	ND	ND	ND	ND
Mississippi River:									
New Orleans, La. (20)	P	P	ND	ND	ND	ND	P	ND	ND
New Roads, La. (133)	.016	.023	P	P	ND	ND	ND	ND	ND
Vicksburg, Miss. (21)	.017	.025	.041	P	ND	ND	ND	ND	ND
Delta, La. (54)	P	P	ND	ND	ND	ND	ND	ND	ND
West Memphis, Ark. (22)	P	P	ND	.007	ND	ND	P	ND	P
Red River (South):									
Alexandria, La. (42)	.007	.013	.031	ND	ND	ND	ND	ND	ND
Denison, Tex. (44)	.003	.007	ND	ND	ND	ND	ND	ND	ND
Atchafalaya River: Morgan City, La. (132)	.009	.018	.047	.003	ND	ND	ND	ND	ND
Verdigris River: Nowata, Okla. (109)	.005	.013	ND	ND	ND	ND	ND	ND	ND

Table 1. Synoptic survey of chlorinated hydrocarbon pesticides, U.S. river basins, September 1964—Continued

Location [1]	Concentration in micrograms per liter								
	Dieldrin	Endrin	DDT	DDE	DDD	Aldrin	Hepta-chlor	Hepta-chlor epoxide	BHC
Colorado River Basin									
Colorado River:									
Yuma, Ariz. (3)	P	P	.021	.004	ND	ND	ND	ND	ND
above Parker Dam, Ariz.-Calif. (4)	P	P	ND	ND	ND	ND	ND	ND	ND
near Boulder City, Nev. (5)	.002	ND	ND	ND	ND	P	P	ND	ND
Page, Ariz. (60)	.006	.012	ND	ND	ND	.085	ND	ND	ND
Loma, Colo. (6)	.008	ND	P	ND	ND	ND	ND	ND	ND
Green River: Dutch John, Utah (121)	ND	ND	P	P	ND	ND	ND	ND	ND
San Juan River: Shiprock, N. Mex. (93)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Western Gulf Basin									
Rio Grande:									
Brownsville, Tex. (71)	.005	ND	.025	P	ND	P	ND	ND	ND
Laredo, Tex. (45)	.009	.003	ND	ND	ND	ND	ND	ND	ND
El Paso, Tex. (46)	.032	.067	ND	ND	ND	ND	ND	ND	ND
below Alamosa, Colo. (72)	.007	ND	P	P	ND	ND	ND	ND	ND
Sabine River: near Ruliff, Tex. (73)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pacific Northwest Basin									
Clearwater River: Lewiston, Idaho (97)	ND	ND	.012	ND	ND	ND	ND	ND	ND
Columbia River:									
Clatskanie, Oreg. (7)	.015	.019	.034	.005	ND	ND	ND	ND	ND
McNary Dam, Oreg. (81)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pasco, Wash. (9)	.002	P	P	P	ND	ND	ND	ND	ND
Pend Oreille River: Albeni Falls Dam, Idaho (113)	P	P	P	ND	ND	ND	ND	ND	ND
Snake River:									
Ice Harbor Dam, Wash. (115)	.003	ND	ND	ND	ND	P	ND	ND	ND
Wawawai, Wash. (49)	P	ND	.014	P	ND	ND	ND	ND	ND
Payette, Idaho (102)	ND	ND	P	.005	ND	ND	ND	ND	ND
Spokane River: Post Falls Dam, Idaho (114)	.007	ND	ND	ND	ND	ND	P	ND	ND
Willamette River: Portland, Oreg. (124)	.011	.017	.029	ND	ND	ND	ND	ND	ND
California Basin									
Klamath River: near Keno, Oreg. (78)	P	ND	.016	ND	ND	ND	ND	ND	ND
Sacramento River: Greens Landing, Calif. (116)	.004	P	P	ND	ND	ND	ND	ND	ND
San Joaquin River: near Vernalis, Calif. (122)	ND	ND	.066	.005	ND	ND	ND	ND	ND
Great Basin									
Bear River: above Preston, Idaho (125)	.006	.009	.034	.011	ND	P	ND	ND	ND
Truckee River: Farad, Calif.-Nev. border (88)	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1] Numbers in parentheses are those assigned to the sampling stations by the Public Health Service Water Pollution Surveillance System.

NOTES: A—indicates laboratory accident. ND—indicates none detected. For this study, minimum detectable concentrations of dieldrin, endrin, DDT, DDE, aldrin, and heptachlor ranged from 0.002 to 0.010 μg./l. Comparable values for DDD, heptachlor epoxide, and BHC were 0.075, 0.075, and 0.025 μg./l., respectively. P—indicates presumptive.

All but the following samples were collected Sept. 23, 1964: Dutch John, Utah (Green River) Sept. 18; Preston, Idaho (Bear River) Sept. 22; Vernalis, Calif. (San Joaquin River) Sept. 22; Detroit, Mich. (Detroit River) Sept. 25; Chattahoochee, Fla. (Apalachicola River) Sept. 24; Nowata, Okla. (Verdigris River) Sept. 24; Parker Dam, Calif. (Colorado River) Sept. 29; and Brownsville, Tex. (Rio Grande) Sept. 21.

Figure 1. Occurrence of dieldrin in major river basins, September 1964

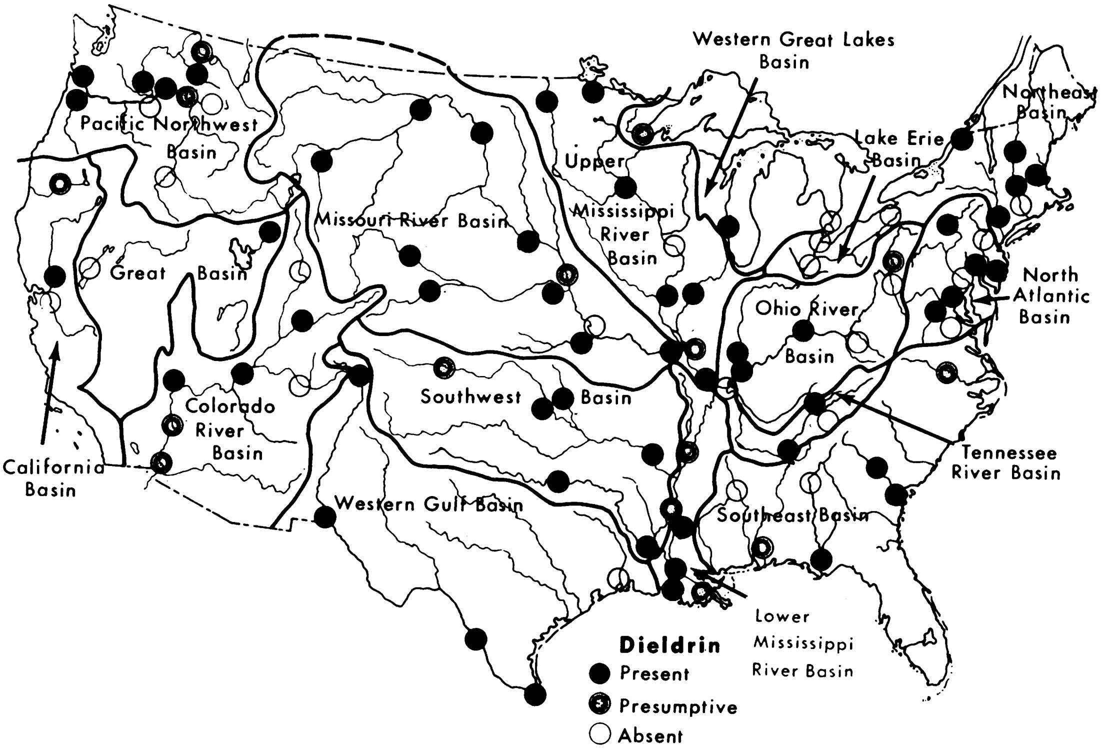


Figure 2. Occurence of endrin in major river basins, September 1964

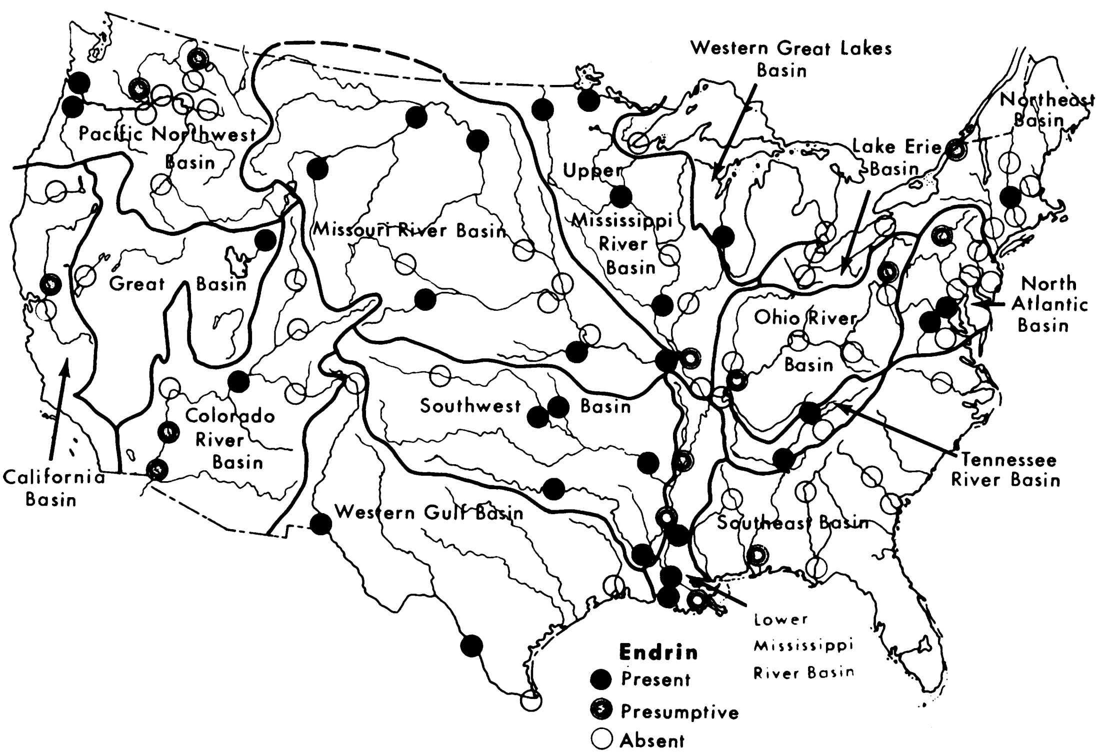


Figure 3. Occurrence of DDT in major river basins, September 1964

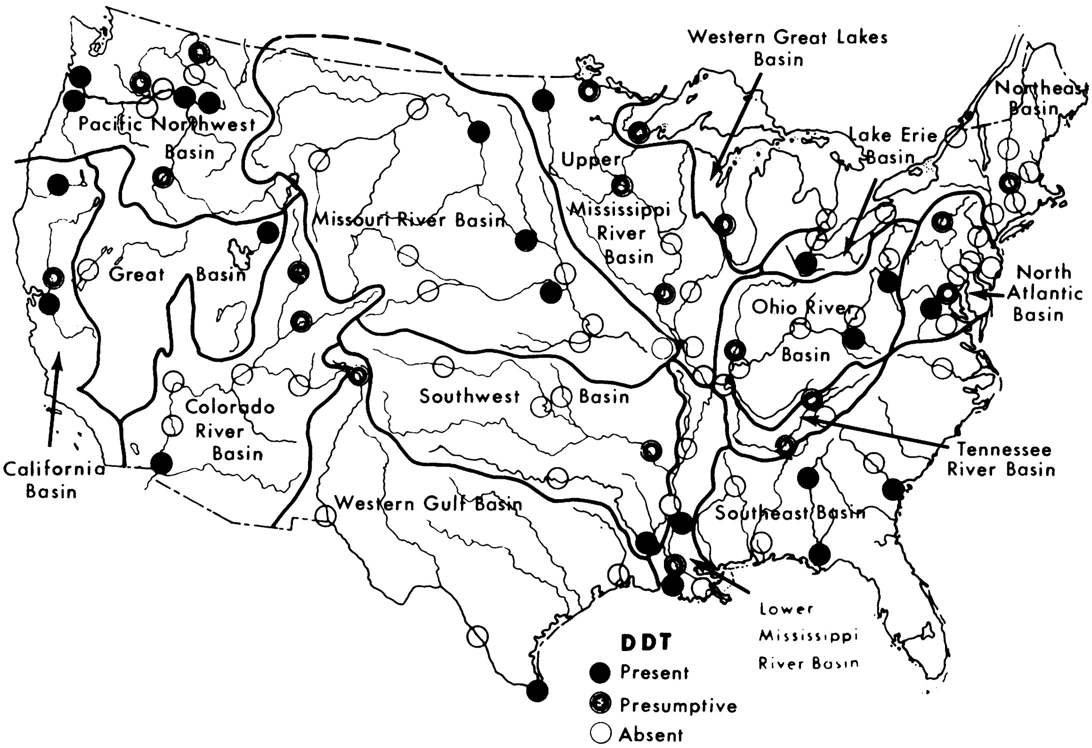


Figure 4. Occurrence of DDE in major river basins, September 1964

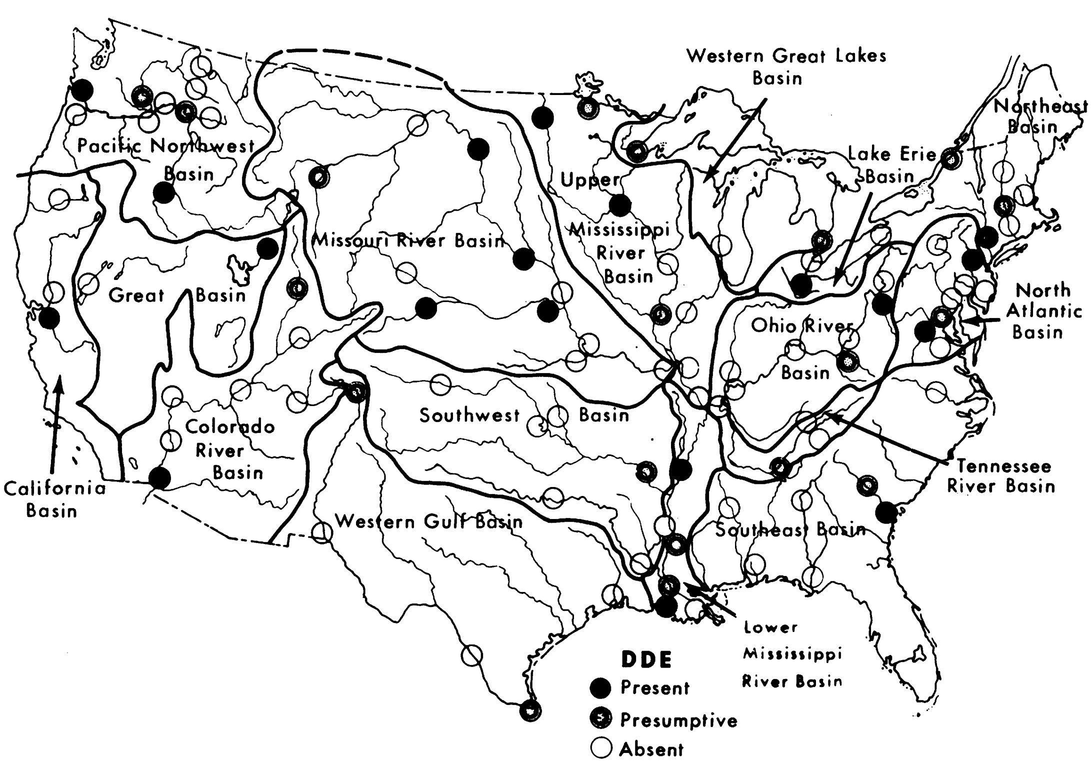


Figure 5. Occurrence of aldrin in major river basins, September 1964

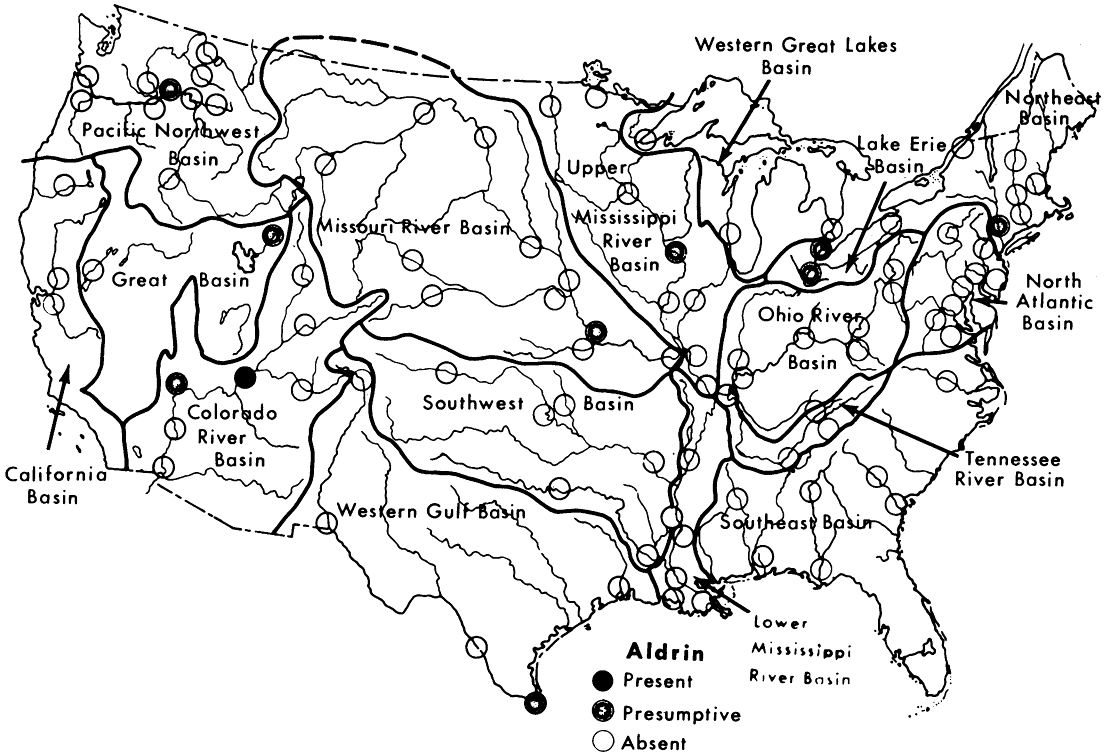


Figure 6. Occurrence of heptachlor in major river basins, September 1964

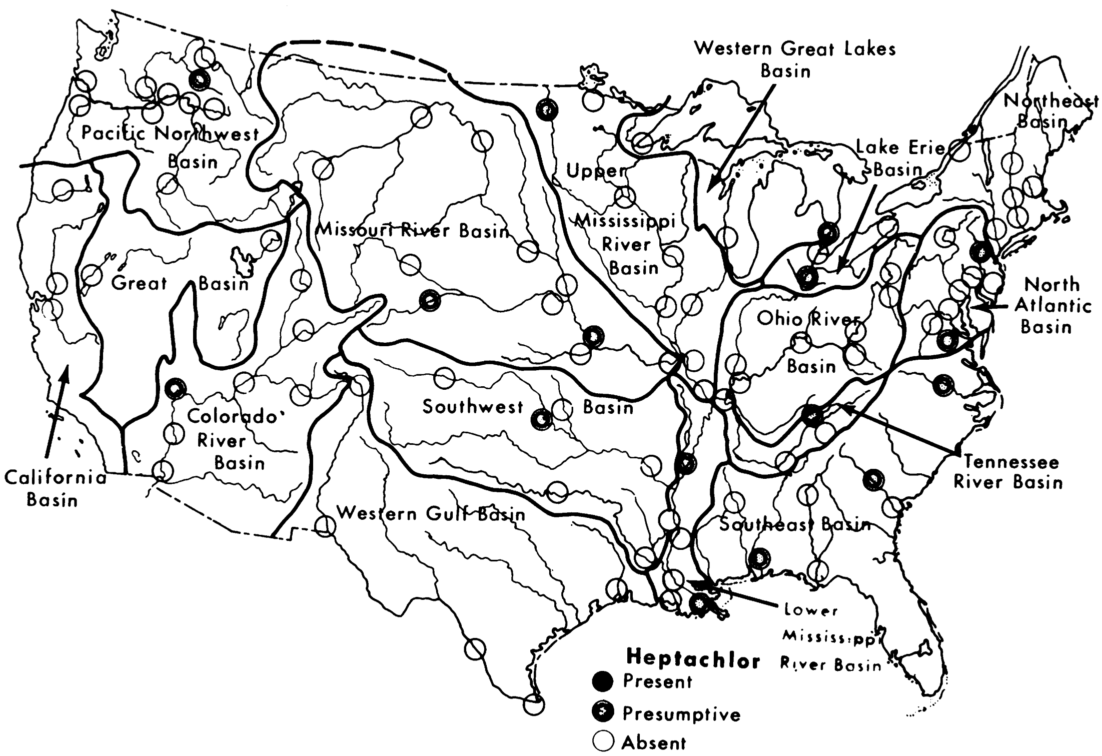
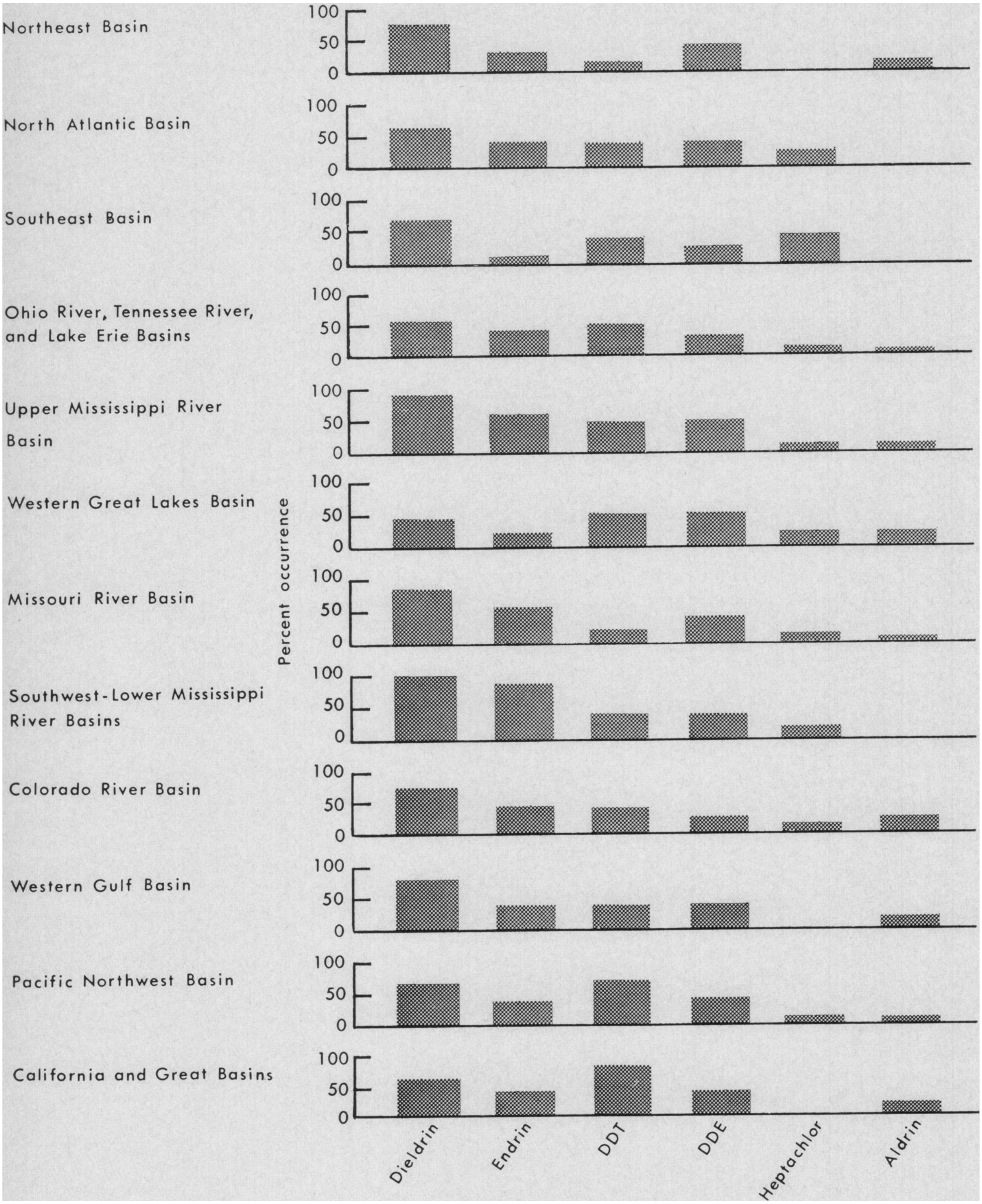


Figure 7. Frequency of occurrence of 6 chlorinated hydrocarbon pesticides in 12 water basin areas, September 1964



reference library of extracts from more than 5,000 carbon adsorption method samples from 108 stations throughout the nation since 1958 has been assembled at the Water Quality Section laboratories in Cincinnati. It has been demonstrated that, as new analytical techniques are developed and become routine surveillance tools, these extracts are providing a source of historical data that are otherwise not available. To this end, and as time permits, more of the stored extracts are being reexamined in order to develop information on the rates at which levels of pesticides in the nation's surface waters have changed.

Summary

Extensive surveillance for chlorinated hydrocarbons and other synthetic organic pollutants has been underway by the Public Health Service for several years. Recent development of analytical procedures capable of measuring pesticides in the parts-per-trillion range on grab samples made it desirable to conduct a special synoptic survey of pesticide pollution in the various U.S. river systems during September 1964.

In order of frequency of occurrence, dieldrin, endrin, DDT, and DDE were found in all major river basins. Heptachlor and aldrin were less abundant. DDD was detected at only one sampling station; presumptive evidence of benzene hexachloride was observed at only one station; and no indication of heptachlor epoxide was seen at any station. These latter results may have been due to the lower sensitivity of the procedure for these three compounds. Generally, both the occurrences and concentrations found in grab samples from the synoptic survey were in accord with the results of previous analyses of samples obtained by the carbon adsorption method.

Table 2. Levels of dieldrin, endrin, DDT, and DDE, by order of decreasing concentration for 10 synoptic sampling stations at which the highest levels were observed, September 1964

River and location	Dieldrin [1]	River and location	Endrin [1]	River and location	DDT [1]	River and location	DDE [1]
Savannah: North Augusta, S.C.	>0.118	Potomac: Great Falls, Md.	>0.094	Maumee: Toledo, Ohio.	0.087	Maumee: Toledo, Ohio.	0.015
Merrimack: Lowell, Mass.	>.071	Rio Grande: El Paso, Tex.	.067	Red (North): Grand Forks, N. Dak.	.072	Bear: Preston, Idaho.	.011
Potomac: Great Falls, Md.	>.040	Big Horn: Hardin, Mont.	.026	San Joaquin: Vernalis, Calif.	.066	Mississippi: St. Paul, Minn.	.011
Rio Grande: El Paso, Tex.	.032	Mississippi: Vicksburg, Miss.	.025	Atchafalaya: Morgan City, La.	.047	South Platte: Julesburg, Colo.[2]	.009
Schuylkill: Philadelphia, Pa.	>.032	Connecticut: Northfield, Mass.	.025	Mississippi: Vicksburg, Miss.	.041	Delaware: Martins Creek Pa.	.008
Platte: Plattsmouth, Nebr.	.023	Red (North): Grand Forks, N. Dak.	.023	Bear: Preston, Idaho.	.034	Mississippi: West Memphis, Ark.	.007
Connecticut: Northfield, Mass.	>.022	Mississippi: New Roads, La.	.023	Columbia: Clatskanie, Oreg.	.034	Columbia: Clatskanie, Oreg.	.005
Savannah: Port Wentworth, Ga.	.020	Yellowstone: Sidney, Mont.	.021	Red (South): Alexandria, La.	.031	San Joaquin: Vernalis, Calif.	.005
Mississippi: Vicksburg, Miss.	.017	Columbia: Clatskanie, Oreg.	.019	Willamette: Portland, Oreg.	.029	Snake: Payette, Idaho.	.005
Mississippi: New Roads, La.[3]	.016	Atchafalaya: Morgan City, La.	.018	Apalachicola: Chattahoochee, Fla.	.027	7 different sampling points.[4]	.004

[1] Concentration, µg./l.
[2] Adopting average of north and south channels (see table 1).
[3] Apalachicola River at Chattahoochee, Fla., showed same concentration.
[4] See table 1.

Figure 8. Chlorinated hydrocarbon pesticide data reported by two stations

RETRIEVAL DATE: 11/27/64

480071
RIO GRANDE AT BROWNSVILLE
TEXAS
WESTERN GULF
RIO GRANDE-LOWER-BELOW PECOS RIVER
AGENCY: 000001 TYPE: 010

DATE FROM TO	TIME OF DAY	00007 SAMPLES IN COMPOSIT	39330 ALDRIN WHL SMPL UG/L	39340 BHC WHL SMPL UG/L	39360 DDD WHL SMPL UG/L	39365 DDE WHL SMPL UG/L	39370 DDT WHL SMPL UG/L	39380 DIELDRIN WHL SMPL UG/L	39390 ENDRIN WHL SMPL UG/L	39410 HCHLR WHL SMPL UG/L	39420 HCHLR-EP WHL SMPL UG/L
11 19 62 12 04 62	C		0.000	0.000	0.000	0.000	0.000M	0.000	0.000	0.000	0.000
01 07 63 01 18 63	C		0.000	0.000	0.000	0.000	0.000M	0.000	0.000	0.000	0.000
06 22 63 07 01 63	C		0.000	0.000	0.000	0.000	0.144	0.001	0.000	0.000	0.000
02 03 64 02 05 64	C		0.000	0.000	0.010	0.000N	0.009	0.001	0.004	0.000	0.000
03 04 64 03 06 64	C		0.000	0.000	0.000	0.001	0.002	0.001	0.001	0.000	0.000
09 21 64	08 00		0.00 N	0.00	0.00	0.00	0.025	0.005	0.00	0.00	0.00

RETRIEVAL DATE: 11/27/64

210020
MISSISSIPPI R AT NEW ORLEANS
LOUISIANA
SOUTHWEST L MISSISSIPPI
LOWER MISSISSIPPI-NATCHEZ TO GULF
AGENCY: 000001 TYPE: 010

DATE FROM TO	TIME OF DAY	00007 SAMPLES IN COMPOSIT	39330 ALDRIN WHL SMPL UG/L	39340 BHC WHL SMPL UG/L	39360 DDD WHL SMPL UG/L	39365 DDE WHL SMPL UG/L	39370 DDT WHL SMPL UG/L	39380 DIELDRIN WHL SMPL UG/L	39390 ENDRIN WHL SMPL UG/L	39410 HCHLR WHL SMPL UG/L	39420 HCHLR-EP WHL SMPL UG/L
05 19 57 05 24 57	C		0.000	0.000	0.000	0.000	0.000M	0.000	0.000	0.000	0.000
09 19 58 10 08 58	C		0.000	0.000	0.000	0.000N	0.000N	0.001K	0.001	0.000	0.000
09 30 59 10 07 59	C		0.000	0.000	0.000N	0.000N	0.000N	0.001K	0.000	0.000	0.000
10 17 60 10 24 60	C		0.000	0.000	0.000	0.000N	0.000N	0.014	0.064	0.000	0.000
09 05 61 09 13 61	C		0.000	0.000	0.000	0.000	0.000N	0.006	0.029	0.000	0.000
08 20 62 08 27 62	C		0.000	0.000	0.000N	0.000	0.000N	0.015	0.160	0.000	0.000
08 05 63 08 08 63	C		0.000	0.000	0.000	0.000	0.000	0.013	0.074	0.000	0.000
09 06 63 09 12 63	C		0.000	0.000	0.000	0.000	0.000	0.032	0.082	0.000	0.000
09 13 63 09 20 63	C		0.000	0.000	0.000	0.000	0.000	0.024	0.083	0.000	0.000
10 02 63 10 08 63	C		0.000	0.000	0.000	0.000	0.000	0.007	0.060	0.000	0.000
10 10 63 10 15 63	C		0.000	0.000	0.000	0.000	0.000	0.011	0.134	0.000	0.000
10 23 63 10 28 63	C		0.000	0.000	0.000	0.000	0.000	0.034	0.054	0.000	0.000
11 19 63 11 24 63	C		0.000	0.000	0.000	0.000	0.000	0.005	0.019	0.000	0.000
12 09 63 12 14 63	C		0.000	0.000	0.000	0.000	0.000	0.015	0.140	0.000	0.000
01 24 64 01 30 64	C		0.000N	0.000	0.000N	0.000N	0.000	0.011	0.051	0.000	0.000
02 07 64 02 11 64	C		0.000	0.000	0.000	0.000	0.000	0.015	0.102	0.000	0.000
02 19 64 02 24 64	C		0.000	0.000	0.000N	0.000N	0.000N	0.012	0.066	0.000	0.000
03 05 64 03 11 64	C		0.000	0.000	0.000	0.000	0.000	0.005	0.041	0.000	0.000
04 03 64 04 08 64	C		0.000	0.000	0.000N	0.000	0.000	0.002	0.005	0.000	0.000
04 08 64 04 16 64	C							0.001	0.004		
04 16 64 04 22 64	C							0.001	0.003		
04 22 64 04 30 64	C							0.002	0.004		
04 30 64 05 12 64	C							0.001	0.002		
05 12 64 05 19 64	C							0.002	0.003		
05 19 64 05 27 64	C							0.003	0.007		
05 27 64 06 02 64	C							0.002	0.005		
06 02 64 06 15 64	C							0.001K	0.001		
06 15 64 06 23 64	C							0.003	0.009		
06 23 64 07 01 64	C							0.011	0.033		
07 01 64 07 08 64	C							0.003	0.005		
07 08 64 07 16 64	C							0.004	0.006		
07 16 64 07 27 64	C							0.007	0.015		
09 23 64	06 00		0.00	0.00	0.00	0.00	0.00	0.00 N	0.00 N	0.00 N	0.00

NOTES TO FIGURE 8

The following remarks have been set aside to qualify pesticide data:

Remark	*Meaning*
Blank	No remark
J	Results not accurate
K	Actual value less than value shown
L	Actual value greater than value shown
M	Presence of material verified but not quantitated
N	Presumptive

Additional abbreviations and their meanings are as follows:

Abbreviation	*Meaning*
"C" in "time of day" column	Indicates a composite sample collected over a period of time. If a column headed "samples in composite" is not shown on the printout, or if such a column is blank for any composite sample, then it can be assumed that the composite sample was collected by the carbon adsorption method. Reported pesticide concentrations for carbon adsorption samples represent the minimum concentrations actually present in the water being sampled because of the unknown sampling efficiency of this technique.
UG/L	Micrograms of pesticide per liter of water sample (parts per billion).
UG/KG	Micrograms of pesticide per kilogram (1,000 grams) of dry solids (parts per billion).

A reference library of stored extracts from more than 5,000 samples collected at 108 pollution surveillance stations since 1958 is being reexamined, as time permits, to develop data on rates at which pesticide levels in the nation's surface waters have changed.

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Program Notes

Day-Hospital Program

Hillside, a voluntary psychiatric hospital in Glen Oaks, N.Y., has begun an experimental day-hospital program. The first 6-month pilot phase is being financed by a $27,300 grant from the New York City Community Mental Health Board. Dr. William Benjamin, senior psychiatrist at Hillside, is supervising the program, the first of its kind to be initiated in Queens and Long Island.

Twelve men and women requiring psychiatric treatment but not the seclusion and protection of hospitalization were selected for the program from the Hillside inpatients. All 12 were more than 17 years of age and lived within easy commuting distance.

The program was initially planned to serve as a transition for patients from full hospitalization to return to the community. Future plans call also for inclusion of some persons under treatment at Hillside as outpatients.

State Air Pollution Control

The New York State Air Pollution Control Board recently adopted a system establishing outdoor air quality levels and classifications to protect the State's air resources. These standards will be applied to a locality only after completion of a comprehensive area study, including an inventory of sources and emissions, operation of air sampling networks, meteorological investigations, assessment of effects, and consideration of the area's social, economic, and physical makeup.

The system lists permissible levels of soot, suspended dust, sulfuric acid mist, beryllium, hydrogen sulfide, oxidants, fluorides, and radioactive, odorous, and toxic substances for each of 16 zone classifications.

In Louisiana, the State board of health, through its section of occupational health and safety, serves as the fact-finding and operating agency of an Air Control Commission created by legislation signed by the Governor July 12, 1964. As board president, Dr. T. N. Armistead serves as the commission's chairman.

Idaho Unit for Mentally Retarded

A unique medical building has been completed in Idaho for Nampa State School, an institution for the mentally retarded operated by the Idaho State Department of Health. According to Dr. Erwin C. Sage, the superintendent, the facility is the first designed solely for medical care of the mentally retarded in which all components of treatment and care are housed under one roof.

In the one-story structure, four wings radiate from a central area. One wing houses all admission and evaluation facilities, a second houses patients with ordinary medical problems, a third has facilities and services for totally incapacitated crib patients, and the fourth is used for emotionally disturbed and psychotic patients. The central area contains the food distribution, central supply, and surgical facilities, outpatient treatment center, physical therapy department, brace shop, and other medical services.

Addiction Control in Colleges

An institute for prevention of narcotics addiction among college students, co-sponsored by the New York State Health Department's bureau of narcotics control and the International Narcotics Officers Enforcement Association, was held in Albany, N.Y., January 18–19, 1965.

College and secondary school administrators, faculty, and security officers, as well as law enforcement officers, social workers, and persons in allied professions were invited. Henry L. Giordino, U.S. Narcotics Commissioner, was the featured speaker.

In 1964, according to John J. Bellizzi, director of the health department's bureau of narcotics control, 15 colleges in the State reported student users of marijuana or narcotics. Teaching college officials how to detect on-campus users would enable enforcement officers to round up sellers before the problem becomes widespread, he said.

Mississippi's Child Immunization

A statewide survey in Mississippi revealed that of children under 5 years, 58 percent had a complete series of poliomyelitis injections; nearly 71 percent had completed the series for diphtheria, whooping cough, and tetanus; 34.7 percent were protected against smallpox; only 28 percent had the complete typhoid immunization series.

Recreation Aids Arthritic Patients

The eastern Pennsylvania chapter of the Arthritis Foundation, with the aid of a Public Health Service grant, is developing a recreation program designed to help severely disabled patients with arthritis break out of social isolation.

Twenty-five patients ranging in age from 20 to 68 volunteered for the project. Before the study, pain and crippling from arthritis kept them virtually homebound.

Two of them are now enrolled in swimming sessions sponsored by the Philadelphia Department of Recreation. The younger of the two also has participated in specially adapted sports at a local Y.M.C.A. Another of the 25 volunteers, a 34-year-old woman, is currently a volunteer recreation aid working with children at a city recreation center. The older patients of the group now participate in cultural and social activities at Golden Age Centers.

Items for this page: Health departments, health agencies, and others are invited to share their program successes with others by contributing items for brief mention on this page. Flag them for "Program Notes" and address as indicated in masthead.
