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A SUMMARY OF CENSUS DATA ON WATER TREATMENT PLANTS IN THE UNITED STATES [1]

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Concurrently with the Nation-wide census of sewerage systems in the continental United States begun in February 1939, a summary of which has been published in Public Health Reports, March 20, 1942 (Reprint No. 2363), the United States Public Health Service has conducted a similar census of water treatment plants.

The data on which the census has been based were furnished by the sanitary engineering divisions of the various States on data forms for individual plants, distributed through the district offices of the United States Public Health Service. The completed individual forms were returned to the Cincinnati station, where the material was condensed and compiled on tabulation forms, copies of which were sent back to the respective States for checking. The checked and corrected material was then mimeographed and arranged in individual pamphlets by States, for general distribution.

Grateful acknowledgment is due to the personnel of these organizations, who have collaborated both willingly and effectively in the very considerable task of furnishing basic data in detail for the individual plants, at a cost of much time and effort. In some instances the records of the divisions were made available to representatives of the Public Health Service for transcription.

As the checked tabulations were received throughout the year 1941 and in one instance in early 1942, the mimeographed booklets for water treatment plants represent substantially the close of 1940, with 1941 data included in some States.

Each mimeographed booklet presents a tabulation of individual plants in the State serving communities of a resident population of 100 or more. The tabulations show for each plant the population of

[1] From the Division of Public Health Methods, National Institute of Health.

communities served, plant ownership, sources of supply, date started, rated capacity, population served, output, treatment facilities or practices, laboratory control where furnished by a plant, and water storage capacity.

In addition, most plants are identified as to principal functional use, such as purification, softening, iron and manganese removal, etc. With a few modifications, these classifications have been used in the summaries herein presented.

The assembly, compilation, and presentation of detailed data in mimeographed pamphlets for each State was organized and conducted by Passed Assistant Sanitary Engineer Vernon G. McKenzie at the United States Public Health Service Stream Pollution Investigations Station at Cincinnati.

The summary has been divided into five tables for convenience in presentation, table 1 being a general integration of the classified plants given in tables 2, 3, and 4, together with information on communities, ownership, and sources of supply. Tables 2, 3, and 4 contain the classified tabulations of plants, together with their respective populations served, output, and percentage capacity operation, where such information was substantially complete. Table 5 presents an independent summarization of selected facilities or practices of interest drawn from all types of plants.

In summarizing the census data it became evident that, because of omissions of basic data on population served and output for many of the individual plants, a complete and useful summary of these items for some States could not be given at this time. For most States these items were fairly complete and by filling in the small percentage of omissions encountered in these cases a more complete and substantially correct summary has been made possible for the bulk of the States. Omissions in population served were supplied from the population of the individual community and the output, estimated as 100 gallons per capita per day, applied to the population served. A similar procedure was followed in the case of a few capacities supplied in terms of output figures.

Enumeration of plants by number under general classifications and selected facilities is fairly complete for the country as a whole. The cases of omissions due to lack of detail are covered in the footnotes. In cases of communities supplied by two or more plants of dissimilar classification, the total population served has been in general allocated to the separate plants in proportion to their respective outputs. In the absence of these figures, or where output was also reported as a total figure, the break-down was made on the basis of capacity. A few cases in which such procedure was not considered practicable are covered by footnotes. Plant ownership figures in some instances fall short of the total number of plants reported because of the omission of plants with ownership unknown and cases in which "both" types of ownership were reported. It is hoped, by subsequent annual supplements and revisions, to iron out such difficulties and gradually to complete, so far as possible, the basic information on all plants.

Table 1 is in the nature of a general summary of population, sources of supply, and treatment plants. From it some general observations may be drawn. Assuming the populations served, in 7 States and the District of Columbia, for which figures are lacking, to be approximately equal to the census populations of the communities served (shown in parentheses, table 1), the total population served by community water treatment plants in continental United States is about 74,300,000, or equivalent to practically 100 percent of the urban and 56 percent of the total population according to the United States Census of 1940. Raw water supplies are drawn for treatment from surface sources at 2,618, or 49 percent of the total number of plants for which sources are known, 2,486, or 46 percent, from ground sources, and 262, or 5 percent, from combinations of both surface and ground sources. On the basis of the 62,500,000 population served in 41 States for which this information is available, 73 percent received treated water from surface sources, 19 percent from ground sources, and 8 percent from combinations of the two. It may be mentioned in this connection that, in order to avoid duplication or confusion in the data presented, emergency or auxiliary plants and water supplies, where readily identified, were not enumerated. It may be that some of the supplies reported as both "surface" and "ground" result from the inclusion of a separate or auxiliary supply not thus identified.

Water treatment plants of all types considered total 5,372, of which, on the basis of known cases, 69 percent are municipally owned and 31 percent are privately owned.

Based on the 29 States for which both population served and total output figures are available, the 49,963,000 population served and 5,943 million gallons per day output indicate an average per capita plant output of 119 gallons per capita daily.

Tables 2, 3, and 4 present summaries of plants classified as to type or principal functions. With slight modification, these were adopted from the basic classifications of the mimeographed booklets giving the data for individual plants. The elements presented under each classification include number of plants, population served, plant output, and percentage capacity operation. These are summarized in table 1.

TABLE 1.—*General summary*

State	Population			Source of treated water supplies						Treatment plants—all types				
	U. S. Census of 1940		Estimated population served	Surface		Ground		Both		Number	Ownership		Rated plant capacity, million gallons per day	Plant output, million gallons per day
Name	Total	Urban		Number	Estimated population served	Number	Estimated population served	Number	Estimated population served		Public	Private		
Alabama	2,832,961	855,941	1,049,000	59	768,700	104	258,700	5	21,900	168	84	84	163	84
Arizona	499,261	173,981	(151,000)	3		16		4		23	10	12		
Arkansas	1,949,387	431,910	439,000	28	273,600	58	145,900	2	19,100	88	61	27		33
California	6,907,387	4,902,265	4,224,000	79	1,480,000	36	485,100	17	2,258,400	132	78	53		
Colorado	1,123,296	590,756	497,000	34	473,600	6	22,200	1	1,000	41	40	1	261	108
Connecticut	1,709,242	1,158,162	1,474,000	70	1,448,600	10	21,600	2	3,700	82	26	56		164
Delaware	266,505	139,432	129,000	3	129,000	0		0		3	2	1	33	15
District of Columbia	663,091	663,091	(487,000)	2		0		0		2	2		160	
Florida	1,897,414	1,045,791	704,000	16	146,900	53	521,200	2	36,000	71	51	18	181	85
Georgia	3,123,723	1,073,808	927,000	70	672,000	93	243,300	4	12,100	167	138	29	185	106
Idaho	524,873	176,708	94,000	11	44,300	6	30,100	2	19,400	19	13	5		
Illinois	7,897,241	5,809,000	(5,804,000)	107		142		2		251	225	25		1,060
Indiana	3,427,796	1,887,712	1,795,000	45	1,097,000	140	616,500	2	81,000	187	142	44	460	196
Iowa	2,538,268	1,084,231	1,120,000	36	353,100	160	752,400	2	14,700	198	191	7		
Kansas	1,801,028	753,941	746,000	55	458,300	48	278,700	3	9,300	106	97	9	189	80
Kentucky	2,845,627	849,327	1,052,000	93	898,700	74	125,100	10	28,500	177	121	56		94
Louisiana	2,363,880	980,439	793,000	24	744,800	13	48,500	0		37	23	13	169	80
Maine	847,226	343,057	474,000	73	418,700	16	42,300	7	13,000	96	38	58		
Maryland	1,821,244	1,080,351	1,525,000	23	1,336,300	25	157,500	9	31,000	57	31	26		
Massachusetts	4,316,721	3,859,476	3,303,000	60	2,769,500	28	419,600	14	114,300	102	85	17		293
Michigan	5,256,106	3,454,867	(3,176,000)	67		26		*3		98	81	14		
Minnesota	2,792,300	1,390,098	1,144,000	30	710,100	41	145,800	1	287,700	72	68	4	438	104
Mississippi	2,183,796	432,882	251,000	3	104,000	27	114,800	1	32,000	31	20	3	43	21
Missouri	3,784,664	1,960,696	2,002,000	64	1,814,400	59	121,700	3	66,000	126	97	27	478	242
Montana	559,456	211,535	232,000	31	197,000	12	14,500	3	20,100	46	36	9		
Nebraska	1,315,834	514,148	(411,000)	8		21		0		29	27	2		
Nevada	110,247	43,291	(38,000)	4		3		1		8	3	5		
New Hampshire	491,524	283,225	278,000	29	189,600	11	73,800	4	14,300	44	32	12		
New Jersey	4,160,165	3,394,773	3,564,000	42	2,315,400	123	1,059,500	10	189,500	175	92	83		375
New Mexico	531,818	176,401	97,000	8	43,500	6	53,000	0		14	8	6	14	7
New York	13,479,142	11,165,893	11,566,000	271	8,934,000	135	1,502,000	*24	*1,130,000	431	298	119		1,567
North Carolina	3,571,623	974,175	1,175,000	121	1,084,100	41	89,800	1	600	163	137	19		
North Dakota	641,935	131,923	105,000	9	88,900	8	14,500	1	1,100	18	15	0		9
Ohio	6,907,612	4,612,986	4,530,000	85	3,476,800	139	966,700	5	86,100	229	204	25		476
Oklahoma	2,336,434	879,663	819,000	77	722,100	22	74,600	*4	*13,300	104	98	6		
Oregon	1,089,684	531,675	(528,000)	63		15		8		86	61	25		
Pennsylvania	9,900,180	6,586,877	8,122,000	326	6,967,000	206	675,300	71	479,700	603	204	391		1,008
Rhode Island	713,346	653,383	657,000	12	646,600	4	7,400	1	3,000	17	9	11		51

South Carolina	1,899,804	466,111	553,000	40	462,100	23	80,600	2	10,200	65	58	7	120	53
South Dakota	642,961	158,087	112,000	8	59,100	22	43,100	1	10,200	31	29	2		
Tennessee	2,915,841	1,024,637	1,098,000	27	578,100	99	493,500	4	26,000	130	99	31		103
Texas	6,414,824	2,911,389	2,271,000	123	1,385,100	100	878,600	3	7,500	226	181	45		
Utah	550,310	305,493	230,000	7	5,700	13	77,200	*2	*146,800	24	18	6		
Vermont	359,231	123,239	61,000	7	58,700	1	2,000	0		8	6	2		9
Virginia	2,677,773	944,675	(1,196,000)	74		73		6		153	101	51		
Washington	1,736,191	921,969	1,067,000	59	736,700	23	244,000	7	85,900	89	59	27		360
West Virginia	1,901,974	534,292	787,000	100	523,100	134	259,100	6	4,600	240	78	162		56
Wisconsin	3,137,587	1,679,144	1,363,000	21	976,200	66	378,600	1	8,000	88	81	7	409	153
Wyoming	250,742	93,577	88,000	11	39,900	5	24,600	1	23,500	17	13	3	43	16
	131,669,275	74,421,133	74,308,000	2,618	45,631,300	2,486	11,563,400	262	5,309,500	5,372	3,668	1,645	3,346	7,003

See footnotes at end of table 5

TABLE 2.—*Classified plant summary—Rapid sand filter purification plants*

State	Purification				Combined purification and iron and manganese removal				Combined purification and softening				Combined purification, iron and manganese removal and softening			
	Number	Estimated population served	Plant output, million gallons per day	Per-cent of ca-pacity	Number	Esti-mated popula-tion served	Plant output, million gallons per day	Per-cent of ca-pacity	Number	Estimated population served	Plant output, million gallons per day	Per-cent of ca-pacity	Number	Esti-mated popula-tion served	Plant output, million gallons per day	Per-cent of ca-pacity
Alabama	63	677, 300	50. 69	55	0				0				0			
Arizona	(*)				0				0				0			
Arkansas	29	293, 200	22. 27	48	1	500	0. 05		0				0			
California	*35	861, 100			0				0				0			
Colorado	23	346, 600	75. 42	38	0				0				0			
Connecticut	20	327, 800	36. 38	68	0				0				0			
Delaware	2	*7, 000	*. 35	*58	0				0				0			
District of Columbia	1				0				0				0			
Florida	*9	87, 100	10. 53	29	0				5	128, 300	14. 66	59	0			
Georgia	71	667, 300	78. 96	60	2	10, 800	. 90	39	1	6, 000	1. 50	65	0			
Idaho	3	14, 900	4. 62	57	0				0				0			
Illinois	93		66. 03	39	0				8		18. 96	47	3		11. 08	97
Indiana	38	†582, 100	†74. 07	†52	0				1	100, 000	11. 10	46	1	7, 800	. 90	45
Iowa	27	192, 700	15. 44	45	0				6	128, 300	11. 00	41	0			
Kansas	40	277, 400	32. 04	53	0				17	174, 700	17. 19	38	0			
Kentucky	95	902, 100	85. 35	37	0				3	5, 500	. 16	14	0			
Louisiana	5	97, 600	7. 42	41	0				16	618, 600	63. 24	47	0			
Maine	13	75, 300	7. 72	36	0				0				0			
Maryland	*3	1, 117, 400	119. 00		0				0				0			
Massachusetts	9	292, 700	26. 38	55	0				0				0			
Michigan	32		333. 76	45	0				10		37. 83	41	0			
Minnesota	11	372, 800	35. 88	17	0				7	309, 000	23. 00	49	0			
Mississippi	4	136, 000	11. 45	53	0				0				0			
Missouri	69	1, 841, 600	229. 00	52	0				5	44, 500	3. 83	29	0			
Montana	8	72, 200	19. 27	48	0				2	10, 600	1. 25	31	0			
Nebraska	7				0				0				0			
Nevada	1	3, 000	1. 50	130	1	600	. 06	24	1	2, 500	1. 50	100	0			
New Hampshire	6	16, 200	1. 73		0				0				0			
New Jersey	*28	1, 232, 700	107. 25		0				0				0			
New Mexico	3	8, 500	. 32	77	0				0				0			
New York	96	1, 891, 200	269. 81		1	3, 200	. 40	19	0				0			
North Carolina	92	883, 600			0				1	1, 800			0			
North Dakota	6	26, 500	2. 56	62	0				5	70, 800	6. 16	32	0			
Ohio	53	2, 305, 800	265. 96	48	0				33	1, 261, 300	129. 81	42	0			
Oklahoma	**34	185, 300			0				x2	216, 700			0			
Oregon	15				0				0				0			
Pennsylvania	162	2, 809, 300	299. 16		3	169, 200	11. 05		14	372, 100	27. 83		0			

Rhode Island	8	567,800	45.14	42	0	------	------	------	0	------	------	------	0	------	------	------
South Carolina	40	391,900	39.70	50	0	------	------	------	0	------	------	------	0	------	------	------
South Dakota	5	33,500	2.65	33	0	------	------	------	3	30,200	2.62	41	0	------	------	------
Tennessee	*36	628,500	61.90	43	0	------	------	------	0	------	------	------	0	------	------	------
Texas	70	1,249,500	------	------	0	------	------	------	3	39,400	------	------	0	------	------	------
Utah	3	1,900	------	------	0	------	------	------	0	------	------	------	0	------	------	------
Vermont	2	27,300	1.73	58	0	------	------	------	0	------	------	------	0	------	------	------
Virginia	*55	------	------	------	0	------	------	------	1	------	------	------	0	------	------	------
Washington	8	34,600	7.80	------	0	------	------	------	0	------	------	------	0	------	------	------
West Virginia	*81	389,800	28.75	------	0	------	------	------	**8	108,200	8.78	------	0	------	------	------
Wisconsin	15	950,100	114.30	40	0	------	------	------	1	9,500	.47	23	0	------	------	------
Wyoming	6	42,400	8.56	45	0	------	------	------	0	------	------	------	0	------	------	------
	1,535	22,921,600	2,600.	------	8	184,300	12.	------	153	3,638,000	381.	------	4	7,800	12.	------

See footnotes at end of table 5.

Table 3.—*Classified plant summary—Slow sand filter purification plants, iron and manganese removal and softening plants*

State	Slow sand filter purification				Iron and manganese removal				Softening				Combined iron and manganese removal and softening			
	Number	Estimated population served	Plant output, million gallons per day	Percent of capacity	Number	Estimated population served	Plant output, million gallons per day	Percent of capacity	Number	Estimated population served	Plant output, million gallons per day	Percent of capacity	Number	Estimated population served	Plant output, million gallons per day	Percent of capacity
Alabama	2	2,900	0.13	23	9	24,300	1.07	44	3	900	0.04	33	0			
Arizona	(*)				0				1				0			
Arkansas	0				34	68,800	4.53		1	2,300	.23	29	3	13,200	0.85	32
California	2	22,700			2	9,000			11	149,700			0			
Colorado	2	67,000	16.00	45	0				0				0			
Connecticut	6	285,300	26.62	71	0				0				0			
Delaware	1	(*)	(*)	(*)	0				0				0			
District of Columbia	1				0				0				0			
Florida	0				5	5,900	.56	20	16	196,700	28.82	62	2	20,800	2.66	63
Georgia	0				6	6,500	.62	42	3	13,600	1.18	32	0			
Idaho	0				0				0				0			
Illinois	0				30		7.03	56	5		2.10	33	53		13.33	41
Indiana	1	(†)	(†)	(†)	14	113,900	11.64	40	2	2,500	.09	10	10	26,200	2.50	35
Iowa	0				71	122,900	7.02	30	28	85,600	6.22	38	3	2,700	.10	25
Kansas	0				10	129,300	12.80	63	5	25,900	2.18	40	3	13,400	2.21	58
Kentucky	1	1,700	.07	65	5	9,400	.67	25	12	46,600	3.38	57	3	2,200	.07	37
Louisiana	*1	400	.40	80	3	18,800	1.69	45	11	55,700	6.98	53	0			
Maine	5	20,300	1.73		2	9,500	1.26		0				0			
Maryland	0				6	8,400	1.65		1	1,000			0			
Massachusetts	17	378,300	33.20	55	11	219,000	14.77	49	0				0			
Michigan	0				3		4.73		3				3		2.68	67
Minnesota	0				27	82,900	6.90	29	7	214,600	20.78	16	1	1,000	.03	14
Mississippi	0				12	47,200	3.44	52	0				1	700	.03	30
Missouri	1	400	.004	5	8	14,800	2.14	64	20	36,400	2.57	25	4	9,300	.74	43
Montana	0				0				1	800			0			
Nebraska	0				9				0				5			
Nevada	0				0				0				0			
New Hampshire	4	21,700	1.67		3	16,800	.99		0				0			
New Jersey	4	16,600	1.28		25	220,200	16.15		1	14,800	1.25		0			
New Mexico	0				1	35,000	2.50	42	0				0			
New York	29	305,500	34.81		16	†117,300	†10.36		11	33,000	2.21		0			
North Carolina	3	92,300			11	12,800			3	8,400			3	32,900		
North Dakota	0				2	2,800	.27		2	2,300	.18		1	800	.02	17
Ohio	0				26	66,300	4.11	36	61	271,400	15.37	32	16	60,700	4.20	44
Oklahoma	0				0				3	9,500			0			
Oregon	0				0				0				0			
Pennsylvania	14	2,338,500	362.05		4	7,100	.41		11	145,800	5.24		3	43,000	3.26	
Rhode Island	0				0				0				0			

South Carolina	0				5	14,200	1.13	36	2	11,200	.55	50	2	2,900	.13	31
South Dakota	0				6	11,500	.88	33	0				2	4,500	.23	32
Tennessee	0				12	299,500	25.92	42	0				0			
Texas	0				14	35,500			12	58,500			0			
Utah	0				0				0				0			
Vermont	1	6,600	1.50		0				0				0			
Virginia	0				3				5				0			
Washington	0				1	14,000	1.25	63	0				0			
West Virginia	0				41	68,300	3.00		11	8,600	.42		8	53,500	3.82	
Wisconsin	1	8,000	1.30	81	19	80,100	7.04	42	6	12,000	.55	23	12	29,800	2.46	35
Wyoming	2	11,000	1.40	25	0				0				0			
	98	3,579,200	482.		456	1,892,000	157.		258	1,407,800	100.		138	317,600	39.	

See footnotes at end of table 5.

TABLE 4.—*Classified plant summary—Simple chlorination and miscellaneous treatment*

State	Simple chlorination and miscellaneous treatment (with chlorination)											Miscellaneous treatment (without chlorination)								
	Number	Estimated population served	Plant output, million gallons per day	Percent of capacity	Adjunctive facilities							Number	Estimated population served	Plant output, million gallons per day	Percent of capacity	Treatment included				
					None	Aeration	Corrosion control	Sedimentation	Coagulation, sedimentation	Ammonia	Other					Aeration	Corrosion control	Sedimentation	Coagulation, sedimentation	Other
Alabama	86	334,600	31.99	49	73	5	5		1	3		5	9,300	0.52	25	5				
Arizona	19				16					3		0								
Arkansas	19	60,100	5.33	31	14	1		1	2	2		1	600	.03	33	1		1		
California	81	3,171,600			55	6	1	4	11	10	**2	0								
Colorado	15	82,900	16.05	57	14				1			1	300	.10	100					*1
Connecticut	54	856,200	100.63		45		5	1		3		2	4,600	.37			2			
Delaware	0											0								
District of Columbia	0											0								
Florida	18	200,100	22.71	46	10	7			1			15	61,800	4.99	30	15	2			
Georgia	75	218,000	22.37	55	66	1	5			1	**3	9	5,100	.32	18	2	8			
Idaho	16	78,900			14					1	*1	0								
Illinois	58		940.96		52		1			5		1		.50		1				
Indiana	120	587,100	61.98	33	109	5	3	1	2	3	**1	0								
Iowa	63	588,000			62				1	1	*1	0								
Kansas	21	111,600	12.63	26	20				1	1		10	14,000	1.32	28	10		10		
Kentucky	53	74,400	3.65		42	6	1	1	4	1		5	10,300	.82	21	4			1	*1
Louisiana	1	2,200	.22		0				1			0								
Maine	76	368,800			58		2		1	17	*1	0								
Maryland	27	172,500			22	1	2			3		7	12,800			6	6			
Massachusetts	54	2,339,900	215.22		45		5			4		11	73,400	5.04		1	11			
Michigan	47				41					6		0								
Minnesota	19	163,300	17.24	22	17					2		0								
Mississippi	10	62,400	5.04	41	6	3	3					4	4,500	.74	51	4	3			
Missouri	19	55,400	3.33	38	11	1		1	4	3		0								
Montana	36	147,900			33			1		2		0								
Nebraska	8				7				1	1	*1	0								
Nevada	5				3				2	2	*2	0								
New Hampshire	28	214,700			27		1					3	8,400				3			
New Jersey	108	2,007,500	242.21		99	6	4			3		9	69,700	5.59		7	4			
New Mexico	10	53,000	4.10	55	5			3		2		0								
New York	270	†1,552,300	†239.96		217	8	8	1	2	41	‡3	8	112,800	11.25		3	8			
North Carolina	47	138,800			40	1	1			5		3	3,800			1	4			
North Dakota	1	700	.03	25	0			1				1	700				1			
Ohio	40	564,100	56.81		39					1		0								
Oklahoma	33	56,900			26			1	6			0								

Oregon	70				56	2	1	3		12		1					1			
Pennsylvania	386	2,215,700	291.63		357	11	6	2	2	12	*2	6	21,400	2.27		2	3		1	
Rhode Island	9	89,200	5.36		8		1					0								
South Carolina	7	97,600	8.77	34	4		3			1		9	35,100	2.31	23	4	7			
South Dakota	15	32,800			10					5		0								
Tennessee	77	160,900	14.05		69	4	3		5			4	7,500	1.36		3	1			
Texas	114	841,100			48	9	2	7	36	14	*3	16	47,200			10	1	2	5	*1
Utah	19	226,700			11			1	1	6		2	1,700			1				**1
Vermont	5	26,800	5.99		5							0								
Virginia	85				78	2	3	1		2	**1	1								†1
Washington	80	1,018,100	350.9		68		1		1	11		0								
West Virginia	86	153,500	11.15		78	3	5		1	2		3	4,500	.26		3				
Wisconsin	34	273,300	26.63	28	30	1	1			2		0								
Wyoming	8	33,100	5.50	31	7					1		1	1,500	.25				1		
	2,529	19,432,700	2,722.		2,117	83	73	49	87	194	21	138	511,000	38.		83	65	14	7	5

See footnotes at end of table 5.

Table 2 consists of rapid sand filter purification plants, including those having adjunctive functions such as iron and manganese removal, softening, or both.

Table 3 includes slow sand filter purification plants, and other plants whose classified functional use is iron and manganese removal, softening, or both.

Table 4 consists of all plants not included in the above categories. These are subdivided into two miscellaneous groups, the one consisting of plants providing chlorination only, or chlorination plus other treatment short of rapid or slow sand filtration, and the other, plants providing similar miscellaneous treatment without chlorination. In connection with the latter group, it is to be pointed out that plants in tables 2 or 3 do not necessarily provide chlorination.

The percentage distribution of plants by number and population served for the 32 States [2] for which both figures are available is as follows:

Table	Classification	Percent of total by—	
		Number	Population served
2	Rapid sand filter purification plants	(34.4)	(53.1)
2	Purification (only)	30.6	44.0
2	Purification and iron and manganese removal	.2	.5
2	Purification and softening	3.6	8.6
2	Purification, iron and manganese removal, and softening	0	0
3	Slow sand filter purification plants	1.7	8.7
3	Iron and manganese removal plants	9.7	3.0
3	Softening plants	5.8	2.7
3	Combination iron and manganese removal and softening plants	1.9	.7
4	Simple chlorination and miscellaneous treatment (with chlorination)	43.8	31.1
4	Miscellaneous treatment (without chlorination)	2.7	.7
	Total for 32 States	100.0	100.0

Table 5 summarizes selected information drawn from all plants regardless of type or function. The items presented include chlorination, softening, iron and manganese removal, rapid sand filtration, ammoniation, activated carbon, and laboratory control (by plant laboratories). Additional details, such as type of aeration, mixing, sedimentation basins, coagulants used, application of chlorine or ammonia as gases or compounds, recarbonation and corrosion control practices, and water storage capacities, are available in the mimeographed booklets. Most of these items are not at present suitable for complete presentation by States, because of omissions in detail in many instances.

[2] Representing 65 percent of the 48 States and the District of Columbia, 64 percent of the total plants enumerated, and 50 percent of the total estimated population served.

TABLE 5.—*Summary of selected facilities at plants of all types*

State	Total plants all types		Chlorination		Softening				Iron and manganese removal		Rapid sand filtration				Ammonia	Activated carbon	Laboratory control (at plant)		
					Lime-soda		Zeolite				Gravity		Pressure						
	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day			Chemical	Bacteriological	Both
Alabama	168	84	162	83.87	0		3	0.04	9	1.07	65	51.48	6	0.24	4	3	69		2
Arizona	23		23		0		1		0		(*)		(*)		4	0			
Arkansas	88	33	59	31.46	4	1.08	0		38	5.43	41	24.74	7	.48	5	10			3
California	132		120		8		3		2		†22		18		19	10			
Colorado	41	108	34	103.20	0		0		0		**21	75.17	2	.25	0	0			
Connecticut	82	164	73	138.42	0		0		0		16	35.51	4	.87	6	4	9		7
Delaware	3	15	3	14.65	0		0		0		2	*.35	0		0	0			
District of Columbia	2		2		0		0		0		1		0		2	2			2
Florida	71	85	46	78.40	19	44.77	4	1.37	7	3.22	*21	*31.49	*3	*.43	16	10	11	1	7
Georgia	167	106	155	105.18	3	2.50	1	.18	8	1.52	*79	82.40	*3	35.93	15	7	38		23
Idaho	19		19		0		0		0		3	4.62	0		5	3	1		3
Illinois	251	1,060	193	1,053.00	34	40.58	35	4.89	86	31.44	124	112.53	56	11.18	35	89	120		53
Indiana	187	196	183	192.82	3	12.38	11	2.21	25	15.04	45	†94.89	11	1.43	24	29	13	8	22
Iowa	198		111		23	16.70	14	.62	74	7.12	**57	35.47	62	3.11	9	26	30		10
Kansas	106	80	84	75.56	25	21.58	0		13	15.01	69	63.52	4	.29	23	42	38		8
Kentucky	177	94	170	93.26	16	3.59	2	(†)	8	.74	104	88.71	9	.47	21	35	36		10
Louisiana	37	80	36	79.88	25	70.34	3		3	1.69	22	73.18	4	.60	3	4	19		4
Maine	96		96		0		0		2	1.26	9	7.11	5	1.56	22	3	1		1
Maryland	57		42		0		1		6	1.65	*3	119.00	1	1.36	5	5			
Massachusetts	102	293	70	255.78	0		0		11	14.77	10	26.69	0		7	6	9		6
Michigan	98		92		13	49.54	3	(†)	6	7.41	43	382.71	2	1.04	28	29		18	42
Minnesota	72	104	42	78.82	13	43.75	2	.11	28	6.93	29	63.00	17	1.68	16	10			
Mississippi	31	21	25	19.62	0		1	.03	13	3.47	7	14.15	8	.64	1	0			
Missouri	126	242	107	238.59	19	6.07	10	.85	12	2.91	85	236.54	9	.54	22	37	31		26
Montana	46		46		2	1.25	1		0		10	20.52	0		14	5	4		2
Nebraska	29		19		4		1		14		16		4		3	4	1		
Nevada	8		8		1	1.50	0		1	.06	1	1.50	2	1.56	2	3			3
New Hampshire	44		33		0		0		3	.99	6	1.73	0		0	4	1		
New Jersey	175	375	143	362.64	0		1	1.25	25	16.14	26	87.61	27	36.81	35	11			
New Mexico	14	7	14	6.92	0		0		1	2.50	3	2.81	1	.01	3	1			
New York	431	1,567	365	† 423.95	0		11	2.24	9	† 10.75	† 70	251.33	† 35	31.25	82	67		17	72
North Carolina	163		147		4		3		14		90		12		29	37	12		77
North Dakota	18	9	14	9.00	7	6.34	1	.01	3	.29	13	8.94	0		6	4	2		4
Ohio	229	476	142	462.84	89	143.54	21	5.85	42	8.31	146	410.99	28	3.91	21	32	59	7	87
Oklahoma	104		**103		(†)		(†)		0		††32		4		10				
Oregon	86		85		0		0		0		*8		*8		17	8			

TABLE 5.—*Summary of selected facilities at plants of all types*—Continued

State	Total plants all types		Chlorination		Softening				Iron and manganese removal		Rapid sand filtration				Ammonia	Activated carbon	Laboratory control (at plant)		
					Lime-soda		Zeolite				Gravity		Pressure						
	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day	Number	Plant output, million gallons per day			Chemical	Bacteriological	Both
Pennsylvania	603	1,003	588	999.24	† 17	† 28.66	† 8	† 5.48	10	14.72	179	563.95	8	9.22	49	56			
Rhode Island	17	51	17	50.50	0		0		0		6	44.20	2	.94	2	5	1		2
South Carolina	65	53	49	49.02	1	.50	3	.18	7	1.26	43	40.32	3	1.01	16	19	3		26
South Dakota	31		29		5	2.85	0		8	1.11	14	6.24	2	.14	9	2			
Tennessee	130	103	107	77.05	0		0		12	25.92	** 32	61.26	5	.68	10	12	9		17
Texas	226		191		10		5		14		62		17		19	27	5	1	52
Utah	24		22		0		0		0		(†)		† 3		6	0			
Vermont	8	9	6	7.52	0		0		0		2	1.73	0		0	1			
Virginia	153		152		1		5		3		* 53		6		11	17	3		12
Washington	89	360	89	360.00	0		0		1	1.25	8	7.55	1	1.50	12	0	7	6	
West Virginia	240	56	202	54.49	22	9.98	6	3.04	49	6.81	† 90	40.73	40	3.43	13	30	52	1	26
Wisconsin	88	153	59	149.85	9	2.54	10	.94	31	9.50	26	120.48	19	.91	13	11	14	5	13
Wyoming	17	16	13	14.13	0		0		0		4	8.08	2	.48	2	0	1		1
	5,372	7,003	4,590	5,670.	377	510.	170	29.	598	220.00	4,818	3,303.	460	154.	676	720	599	64	623

Arizona:
*Total of 3 filter purification plants in State, type filters not specified.
California:
*Exclusive of 1 plant, population served estimated at 9,400, type filter not specified.
**Contact filter at 1 plant, activated carbon at other.
†Exclusive of 2 plants, type filter not specified.
Colorado:
*Filter only, type not specified.
**Exclusive of 1 plant, type filter not specified.
Delaware:
*Exclusive of Wilmington, total population served 122,000 and total output 14.3 million gallons per day furnished by a rapid sand filter plant and a slow sand filter plant.
Florida:
*Exclusive of 1 purification plant, capacity 0.51 million gallons per day, population served 3,500, output 0.15 million gallons per day, type filter not specified.
**Exclusive of 2 plants, type filters not specified.
Nevada:
*Activated carbon at both plants.
New Jersey:
*Exclusive of 1 purification plant serving 2,900, output 0.50 million gallons per day, type filter not specified.
New York:
*Exclusive of 1 source unknown, population served 240.
†Exclusive of New York City, data for complete allocation of population served and output to classified plants not at hand. Total population served 7,550,000, total output 998 million gallons per day. Plants enumerated as 15 chlorination; 1 aeration, coagulation, sedimentation, and chlorination; and 8 iron and manganese removal plants, 7 of which have filters. Chlorination enumerated as 1 plant for some supply systems possibly consist of more than 1 plant.
††2 activated carbon, 1 contact filter.
Oklahoma:
*Exclusive of 1 source unknown serving 8,537.
**Exclusive of 30 purification plants serving 347,500, type filter not specified.

Georgia:
- *1 plant 35.2 million gallons per day output with both gravity and pressure filters reported on both columns.
- **Calcite sand filters.

Idaho:
- *Coagulation, sedimentation, contact filter, and chlorination at 1 plant.

Indiana:
- **Activated carbon.
- †Exclusive of Indianapolis, total population served 375,000 and total output 33.5 million gallons per day furnished by 2 rapid sand filter plants, 1 slow sand filter plant, and untreated well supply.

Iowa:
- *Activated carbon.
- **Exclusive of 3 plants, type filter not specified.

Kentucky:
- *Distillation.
- †Output 1 plant 0.02, other unknown.

Louisiana:
- *Plant also softens. 5 other slow sand filter plants in the State are classified functionally as softening plants only.

Maine:
- *Contact filter.

Maryland:
- *Exclusive of 13 purification plants, population served 212,700, output 23.93 million gallons per day, type filters not specified.

Michigan:
- *Exclusive of 2 sources unknown.
- †Output 1 plant 0.62 million gallons per day, other 2 unknown.

Nebraska:
- *Activated carbon.
- xExclusive of 2 purification-softening plants serving 2,700, type filter not specified.
- xxExclusive of 1 unknown.
- †7 plants soften, detail incomplete.
- ††Exclusive of 34 filters, type not specified.

Oregon:
- *1 plant having both gravity and pressure filters carried in both columns.

Pennsylvania:
- *Activated carbon.
- †Exclusive of 3 plants, total output 2.28 million gallons per day, type softening not specified.

Tennessee:
- *Exclusive of 1 purification plant serving 1,300, capacity 0.30 million gallons per day output 0.14 million gallons per day, type filter not specified.
- **Exclusive of 8 plants, total output 21.50 million gallons per day, type filter not specified.

Texas:
- *Charcoal filter.

Utah:
- *Exclusive of 2 sources unknown serving 600.
- **Filter only, type not specified.
- †Of total of 4 filter plants in State, 3 are pressure type, other not identified.

Virginia:
- *Exclusive of 3 purification plants, type filter not specified.
- **Activated carbon filter for dechlorination.
- †Granular carbon pressure filter.

West Virginia:
- *Exclusive of 1 purification plant serving 400, output 0.005 million gallons per day, type filter not specified.
- **Exclusive of 1 purification-softening plant serving 75, type filter not specified
- †Exclusive of 3 plants, type filter not specified.

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Referring to chlorination in table 5, it appears that 86 percent of the total number of plants provide chlorination. On a flow basis, about 94 percent of the total 6,005 million gallons per day for 30 States for which output data are available receives chlorination, as compared with 85 percent on the basis of number of plants. Referring to softening, it appears that on the basis of the number of plants, lime or lime-soda softening constitutes 69 percent and zeolite 31 percent in the 33 States softening. Twenty of the 33 States having softening practices give output figures showing that, whereas on a plant enumeration basis the percentage distribution is about the same as above (67 percent and 33 percent respectively), on the basis of plant output, lime or lime-soda softening is used for 94 percent of the output, as against 6 percent for zeolite, indicating the use of zeolite in small installations. The hypothetical average output for plants having softening in these same States is about 1.29 million gallons per day per plant for lime or lime-soda as against 0.18 million gallons per day per plant for zeolite.

Gravity or pressure rapid sand filters are identified at 2,278, or 42 percent of the total number of plants in the country. In the 30 States [3] in which rapid sand filters were completely identified and for which outputs were available, gravity filters are used in 82 percent of the installations and pressure in 18 percent of the installations. On a flow basis for the same plants, gravity filters handle 96 percent of the total output and pressure, 4 percent, indicating small pressure filter installations on the average.

Ammoniation is practiced at 676 plants, or 13 percent of the total plants surveyed and at 15 percent of all of the plants using chlorine. Activated carbon is used at 720 plants.

Plant laboratory control is reported for 1,286 plants, or 24 percent of the total plants, with a distribution of 47 percent chemical control, 5 percent bacteriological control, and 48 percent both.

Iron and manganese removal is practiced at 598 plants in 36 States, or in about 12 percent of the total plants in those States.

It is hoped to compile and issue annual supplements to the individual State booklets showing new installations and additions to existing plants and an annual summary similar to the one here presented. This provides the opportunity to complete gradually the detailed information on existing plants toward the ultimate objective of a complete, authentic, and up-to-date annual record of community water treatment in the United States. At intervals of 5 or 10 years, this information can be incorporated into a complete inventory of plant detail brought to date. Although some of this work may have to be curtailed during the war period, it is hoped that the plan indicated may be followed as an ultimate objective.

[3] Includes New York State exclusive of New York City.

A CONTRIBUTION ON THE TOXICITY OF ALGAE [1]

By R. E. WHEELER, *Surgeon (R)*, JAMES B. LACKEY, *Senior Biologist*, and STUART SCHOTT, *Assistant Chemist, United States Public Health Service*

By comparison with the literature on the role of algae in causing tastes and odors in drinking water, the literature on the toxicity of algae is far from voluminous. The latter is to be found chiefly in veterinary publications and has been ably summarized by Fitch and several collaborators (*1*) in a paper describing an outbreak of fatal poisoning among turkeys, ducks, and geese after drinking from a lake where a thick scum of blue-green algae formed. Subsequently, Deem and Thorpe (*2*) reported a similar occurrence under comparable conditions. These authors report deaths in experimental animals (guinea pig, rabbit, and fowl) in a surprisingly short time after administration of algae (chiefly *Anabaena flosaquae* and *Microcystis flos aquae*) by mouth or parenterally. They report "foamy tears" as an agonal finding in guinea pigs.[2] Fitch et al. showed among other findings that the toxic substance was nonvolatile, was heat stable at 102–104° C. for 100 hours when dry but unstable at 100° C. when wet; that it does not migrate under an imposed electrical potential; that it can be dialyzed through collodion; and that "it can exist in the water around the algae, for the liquid separated from the algae is toxic." There is some evidence that the same algae may be toxic at one time and not at another—as though the toxic phase might be a stage of development or of decomposition.

One other contribution has been made recently on algal toxicity, namely, the paper of Sommer and his colleagues (*3*) on the discovery of a highly potent toxic substance in certain marine dinoflagellates. This substance was discovered during the course of studies on the toxicity of shellfish, the ingestion of which caused paralytic shellfish poisoning. The biochemical and physical properties of this poison, differing in some respects from those described by Fitch et al., are presented by Müller (*4*).

No human outbreaks have ever been traced to algal contamination of drinking water, although occasional mention is made of algal blooms in connection with outbreaks presumably waterborne for which bacterial explanations were not found (*5*). The little data available suggest that algal poisons work rather on the central nervous system than on the gastrointestinal tract. It seems probable that tastes and odors almost invariably associated with extensive algal pollution would impel humans to seek other sources of drinking water before imbibing

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[1] From the Stream Pollution Investigations Station (Cincinnati, Ohio) of the Division of Public Health Methods, National Institute of Health.

[2] A finding not uncommon in guinea pigs with acetyl-choline poisoning is described by Tashiro (Tashiro S., Badger, E., Younker, W.: "Is Chromodachryorrhoea a Diapedesis of the Red Corpuscles?" Proc. Soc. Exp. Biol. and Med., 45: 377 (1940).

enough of the polluted water to be harmful. However, the veterinary experience justifies some effort at determining whether there may be a potential toxicity in algal pollution even though the practical risk may be slight. It should be noted that the presence of algae in drinking water, in addition to causing tastes and odors, may have some importance from the standpoint of the allergist as algae may, on occasion, liberate considerable amounts of protein in water. If allergic reactions to algal proteins do occur, they would be as uncommon as they would be obscure and hardly likely to occur as a public health problem. However, one important effect of algal growth in water must be that nutritive constituents for bacterial growth are afforded when the algae decompose. The biologist is well acquainted with the rise in bacterial population following the death of an algal bloom in a reservoir or in cultures. The present note is concerned primarily with the question of more direct types of toxicity.

EXPERIMENTS WITH FRESH MATERIAL

During the course of field trips in connection with the Ohio River Pollution Survey, samples were collected from bodies of water containing algal "water blooms." One of the first of these was obtained from a stock watering pond in northern Kentucky. The sample taken on September 18 contained a predominance of *Microcystis aeruginosa* and *Anabaena spiroides*. A second lot of material, collected on October 1, showed *Microcystis aerugonisa* almost exclusively and further samples collected on October 4, 7, and 15 contained the *Microcystis* only. After the middle of October cold weather put an end to the "bloom" and to the possibility of working with fresh material.

Through the cooperation of Dr. Theodore Olson, additional *Microcystis* material was obtained from a Minnesota bloom. Its properties proved to be nearly identical with those of the material collected locally.

Microcystis aeruginosa is one of the Myxophyceae or blue-green algae, a species which occurs in large irregular colonies. Sometimes individual colonies are large enough to be seen with the unaided eye. They consist of myriads of small cells, about 8 to 12 microns in diameter, loosely aggregated with a common gelatinous envelope whose periphery is usually free of cells but offers an attachment for other algae, bacteria, and protozoa, and is a matrix containing many bacteria. Any colony of *Microcystis aeruginosa* is, therefore, virtually a microcosm, but its vast bulk is composed of its own cells and the jelly they have secreted. Colonies are usually olive green, and a bloom of the species is olive green or green. Attempts were made to grow *Microcystis aeruginosa* in bacteria-free culture but these were unsuccessful, this being one of the algae not thus far grown successfully in pure culture in laboratory. The gelatinous envelope surrounding the algal colonies is, moreover, ideally suited for entangling or adsorbing bacteria so that enormous numbers of the bacteria must be injected with the algae when administered in the living state. This envelope could also serve as an "insulator" between the algae and the animal, limiting the exchange of poisonous substances from the former to the latter and retarding somewhat the break-down of the algal cells in their new environment.

However this may be, the results of experiments with fresh material were hardly dramatic or conclusive. The algae were filtered from the water of the samples and resuspended in just enough water to permit the material to flow through a 16-gage needle attached to a glass hypodermic syringe. The results may be briefly summarized as follows:

1. Mice receiving the algae subcutaneously or intraperitoneally invariably died when the dose was more than 0.25 ml. Death seldom occurred in less than 16 hours or in more than 36 hours.
2. One guinea pig given 2 ml. intraperitoneally died in 24 hours.
3. One rabbit given 5 ml. intraperitoneally showed no ill effects.
4. Guinea pigs given 4 ml. by mouth showed no ill effects.
5. Mice receiving the algae by mouth either by injection with a blunt needle passed along the esophagus directly into the stomach or by adding algae to the drinking water nearly always survived.
6. Injections of the pond water after filtering off the algae did not affect the animals although the injected material contained relatively large numbers of bacteria.
7. Injections of other micro-organisms living in the pond—chiefly ciliates and flagellates—had no effect when given to mice intraperitoneally.

PRESERVATION OF ALGAL MATERIAL

Since a shortage of fresh material for further study was anticipated, attempts were made to preserve the algae. Two lots obtained on the seventh and fifteenth of October were tested for toxicity in mice and showed the usual delayed death. One lot concentrated by filtration was put in the freezing unit of the electric refrigerator where it quickly froze and remained frozen for 2 months. It never thawed appreciably even during defrosting. Another lot similarly concentrated was put in vials, quickly frozen in dry ice, dehydrated *in vacuo*, and sealed.

EXPERIMENTS WITH PRESERVED MICROCYSTIS AERUGINOSA

These methods of preservation caused a rather dramatic change in the toxicity of the material. When portions of the algae, which had been frozen in the refrigerator, were thawed out and injected, death occurred in mice within much shorter periods and the minimal lethal dosage was found to be only 0.025 ml. Furthermore, the toxic substance had gone into solution, for filtrates of diluted frozen algae were found to bè quite as toxic as when unfiltered material was used.

The two methods of preservation gave quite comparable results. When the dehydrated material was resuspended in the original volume of water, its toxicity was found likewise to have increased to exactly the same degree. Because control studies with the fresh material just prior to freezing had shown no accelerated death and no increase in toxicity, it is concluded that this enhancement did not take place prior to preservation.

When preserved material was given, death was seldom delayed in mice longer than an hour and a half after administration of the algae, and no death even with very large doses was ever observed to have occurred in less than 40 minutes. The shortest death time noted for guinea pigs was 3 hours and survival for more than 4 hours was noted for those receiving 1.0 and 2.0 ml. intraperitoneally. The syndrome of rapid death with "foamy tears" described by workers with other algae was not observed with this *Microcystis* material.

Most of the experiments to be outlined below were conducted with mice as the test animal, for they reacted very uniformly to various doses and types of material. The dosages were given subcutaneously. When more than the lethal dose of preserved material was given parenterally, mice behaved normally for half an hour, eating and drinking as usual. Then they had periods of apathy alternating with restlessness and exaggerated response to stimuli. During this interval the ears and tails became chalky white and the eyes considerably lighter pink in color. The final stage was one of rapid superficial respiration, the animal lying quietly with death determined only by the cessation of respiration.

When post mortem was done at once after respiration stopped there was no bleeding on cutting through the skin or abdominal wall. The heart ventricle was found to be quite contracted and colorless, but beating slowly. The auricles were dilated and beat twice or more for each ventricular beat, or quite dissociated from the ventricles. Invariably the liver was enormously dilated and dark. The intestines were contracted and the visceral circulation no more in evidence than the peripheral, except that the engorged liver bled profusely when incised.

Death in mice supervened too rapidly after subcutaneous injection to be explained by the hypothesis of bacterial invasion but the possibility of bacterial toxic action had to be considered. Four lots of algal material were accordingly prepared: (1) pasteurized at 80° C. for 20 minutes; (2) filtered through a Jenkins filter; (3) autoclaved at 15 pounds for 15 minutes; (4) unsterilized preserved material as a control. Bacteriological studies of the pasteurized material showed

10 colonies per ml., all being spore-formers. The filtered and autoclaved lots were sterile. Mice receiving uniform doses of all four types of material died and the time taken for death to supervene was fairly uniform. Subsequently it was determined that the toxic substance could be dialyzed through collodion sacs and through Fourex condoms, very little toxicity being demonstrable for the material in the sac after 18 hours. Therefore, the hypothesis of a bacterial toxin appeared to be unlikely.

As the toxic substance appeared to be of a chemical nature, an attempt was made to determine its properties as a clue to its identity. These facts were determined:

1. When the dialysate is concentrated *in vacuo* and the residue dried in a vacuum oven, an amorphous brown somewhat oily substance of high toxicity is obtained. The minimal lethal dose for mice was 0.0004 mg. No crystals were observed.

2. Extracts with water and alcohol are toxic but those with ether, benzene, or chloroform are not toxic.

3. The toxic substance is only stable to heating (boiling or autoclaving) in neutral solution and is destroyed by heat in 1 percent acid or alkaline solution.

4. There is no loss of toxicity in sterile (autoclaved) solutions over a period of a month but unsterile solutions gradually lose their potency.

5. The toxic substance readily adsorbs on activated carbon; when the carbon is filtered out the clear filtrate is nontoxic but the carbon residue is toxic for mice, the toxic action being somewhat delayed (10 hours).

6. The quinone test for amines, the Benedict test for carbohydrates, the Millon test for proteins, and the sodium picrate test for cyanides were all negative. However, because of the limited quantity of material available, these tests were run on dilute solutions and are not considered conclusive. On the basis of the solubility as determined from the toxicity of the extracts, the possibility that the toxicity was due to either of the cyanogenetic glucosides (*6*), amygdonitrile glucoside or amygdalin, can be ruled out.

Further attempts to determine the properties and nature of the toxic agent were impossible because of lack of material. It was thought that an organic ester such as acetylcholine might be involved but attempts to protect mice against toxic doses by simultaneously administering 1.3 mg. of atropin as an antidote failed. The sublethal dose of physostigmine for mice was found to be 0.013 mg. and this, combined with a sublethal dose of toxic material, did not show synergistic action. The acetylcholine hypothesis was therefore discarded.

Although the toxic substance was found to be comparatively inert when given by mouth to mice, an attempt was made to determine the extent to which it would survive in aqueous solutions subjected to various types of water treatment. The limited amount of material available made it impossible to make these tests comparable to the treatment procedures in regular use in water treatment plants but the procedures were followed as nearly as could be done with laboratory equipment.

Water was added to preserved algae until a 10-percent suspension of the original volume was obtained. The minimal lethal dose of this suspension was found to be 0.25 ml. The material was then allowed to settle at 20° C. for 24 hours, the supernatant fluid decanted, coagulated with alum, and filtered through a Gooch crucible to remove the coagulum. The filtrate appeared to have enhanced toxicity, for on two separate occasions mice receiving the minimal lethal dose of 0.25 ml. died after very short intervals (40 minutes). This filtrate was then chlorinated on one occasion with 100 parts per million of chlorine for 12 hours and on another with 8.4 parts per million for 12 hours. Substantial chlorine residuals were demonstrated at the end of the period on both occasions. Mice receiving a 0.25 ml. dose of the material at this stage of the treatment died within the same short intervals noted for filtrate from alum treatment alone. However, when activated carbon in comparatively large amounts was added and the suspension filtered, no toxicity could be demonstrated in the filtrate in doses of 1.0 ml. Carbon added in the small amounts corresponding to those actually used in water treatment was distinctly less effective, death occurring with doses of 0.5 ml., but not with doses of 0.25 ml. Control mice which received corresponding dosages of alum, chlorine, and activated carbon showed no ill effects.

The above work was done with *Microcystis aeruginosa* from several sources. At the same time an effort was made to test other blue-green algae in the same way. One practically pure culture of *Aphanizomenon flos aquae* was obtained from Minnesota, and a second was collected locally. Local collections of *Anabaena spiroides* and of *Oscillatoria sp.*, both of approximately the same density and purity, were made. Each of these was treated in the same way as described for *Microcystis* before administration to mice. None of these harmed the mice, at least as far as was detectable, and certainly none were toxic as was the *Microcystis*. Evidently the toxic principle of *Microcystis aeruginosa* is not present in all blue-green algae.

DISCUSSION

The toxic effect described above does not appear to be a bacterial one. However, proof that the algae themselves are the source of the poison is not complete. The gelatinous envelope of *Microcystis* colonies would be an ideal adsorbing agent for any organic or inorganic poison in water and would tend to concentrate it markedly. Against this possibility is (a) the fact that freezing the material greatly enhances its toxic action, and (b) algae collected on different dates showed slightly different toxicity, but this was found to be due to differences in the degree of concentration after collection. The dry weight of the minimal lethal dose was found to be fairly uniform.

The hypothesis of adsorption cannot be ruled out by these limited observations but it would appear unlikely. Similarly, the hypothesis of relatively stable toxic protein decomposition products due to bacterial action remains a possibility. If *Microcystis aeruginosa* could be grown on artificial media free of bacteria, these effects could be more definitely evaluated. However, lack of toxicity on such media would not necessarily mean that there is no toxicity when the alga is grown under natural conditions.

Because of the lack of toxicity of this substance when given by mouth and because of the definite delay in the development of toxic symptoms after subcutaneous injection, it is possible that a complex and essentially nontoxic organic compound is altered after injection and becomes toxic.

The alternative is that *Microcystis aeruginosa* contains, or on occasion may contain, a toxic substance *per se*.

SUMMARY

1. Freshly collected *Microcystis aeruginosa* was found to be somewhat toxic for mice and guinea pigs when given parenterally but to be slightly, if at all, toxic when given by mouth.

2. Frozen, or frozen and vacuum dried, *Microcystis aeruginosa* was found to be much more toxic than freshly collected material for mice and guinea pigs.

3. The toxic substance was found to withstand autoclaving but only in neutral solution, to be dialyzable, and to be soluble in alcohol.

4. The toxic substance survives the laboratory equivalent of a water purification process—alum coagulation, chlorination, and filtration. It is adsorbed upon carbon but only when this is used in comparatively large amounts.

5. Three other blue-green algae were nontoxic to mice.

REFERENCES

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DEATHS DURING WEEK ENDED OCTOBER 24, 1942

[From the Weekly Mortality Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Oct. 24, 1942	Corresponding week 1941
Data from 87 large cities of the United States:		
Total deaths	8,381	7,858
Average for 3 prior years	7,921	
Total deaths, first 42 weeks of year	348,982	349,163
Deaths per 1,000 population, first 42 weeks of year, annual rate	11.6	11.6
Deaths under 1 year of age	598	575
Average for 3 prior years	493	
Deaths under 1 year of age, first 42 weeks of year	23,965	21,986
Data from industrial insurance companies:		
Policies in force	65,171,079	64,549,170
Number of death claims	12,457	11,681
Death claims per 1,000 policies in force, annual rate	10.0	9.4
Death claims per 1,000 policies, first 42 weeks of year, annual rate	9.1	9.5

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED OCTOBER 31, 1942

Summary

Meningococcus meningitis continues persistently above the 5-year (1937–41) median expectancy. A total of 68 cases was reported for the current week, as compared with 61 for the preceding week and a 5-year median of 35 cases for the week. The highest incidence rates have been reported in the eastern States and in the Pacific area. Low rates obtain in both the North and South Central areas.

The current year will mark a record high incidence of endemic typhus fever. To date, 3,013 cases have been reported, which is a larger number than that recorded for any entire year since cases of this disease have been reported to the Public Health Service. A total of 111 cases was reported during the current week, as compared with 123 for the preceding week and 104 for the next earlier week.

The incidence of poliomyelitis declined from 165 to 140 cases. California, with 21 cases, was the only State reporting more than 12 cases for the current week.

The number of reported cases of influenza increased slightly—from 1,143 to 1,339. Of the current total, the South Atlantic and South Central areas reported 1,100, or 82 percent.

The incidence of most of the other communicable diseases included in the following table remained low. Two cases of anthrax were reported in Pennsylvania, 12 cases of infectious encephalitis in California, and 1 case of leprosy in Texas.

The crude death rate for the current week in 88 large cities in the United States is 12.0 per 1,000 population, as compared with 11.7 for the preceding week and with 11.1 for the 3-year (1939–41) average. The cumulative death rate for this group of cities to date this year is 11.7, as compared with 11.6 for the corresponding period in 1941. This is the first instance in which the current cumulative rate has exceeded that for last year.

Telegraphic morbidity reports from State health officers for the week ended October 31, 1942, and comparison with corresponding week of 1941 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median 1937–41	Week ended—		Median 1937–41	Week ended—		Median 1937–41	Week ended—		Median 1937–41
	Oct. 31, 1942	Nov. 1, 1941		Oct. 31, 1942	Nov. 1, 1941		Oct. 31, 1942	Nov. 1, 1941		Oct. 31, 1942	Nov. 1, 1941	
NEW ENG.												
Maine	0	0	1	-----	-----	-----	1	55	19	2	0	0
New Hampshire	0	1	0	4	-----	-----	8	0	1	1	0	0
Vermont	0	1	0	-----	-----	-----	63	2	4	0	0	0
Massachusetts	1	2	4	-----	-----	-----	171	145	78	4	1	1
Rhode Island	2	1	1	-----	-----	-----	15	10	3	1	0	0
Connecticut	0	1	0	7	1	1	34	43	8	1	1	0
MID. ATL.												
New York	20	22	22	[1] 9	[1] 1	[1] 8	83	101	101	17	1	2
New Jersey	6	10	9	6	6	5	22	17	17	4	1	1
Pennsylvania	21	9	22	-----	1	-----	112	112	112	7	2	2
E. NO. CEN.												
Ohio	25	21	34	6	11	18	23	52	25	2	2	2
Indiana	4	22	25	14	16	10	16	3	9	1	3	1
Illinois	17	16	32	5	8	8	16	31	31	2	0	2
Michigan [2]	6	5	7	1	-----	1	39	35	44	0	1	2
Wisconsin	0	4	3	22	10	27	43	110	67	0	1	1
W. NO. CEN.												
Minnesota	3	0	2	-----	-----	2	12	6	9	1	1	1
Iowa	1	8	9	3	1	1	14	21	9	0	0	1
Missouri	6	3	19	2	6	6	1	3	4	0	3	0
North Dakota	0	5	3	-----	-----	2	1	15	7	0	0	0
South Dakota	1	3	2	-----	-----	-----	1	1	4	0	0	0
Nebraska	2	2	2	5	-----	-----	29	3	2	0	0	0
Kansas	5	2	4	-----	6	6	16	29	10	0	0	0
SO. ATL.												
Delaware	0	4	0	-----	-----	-----	1	1	1	0	0	0
Maryland [2]	4	5	5	1	5	6	8	16	6	1	0	0
Dist. of Col.	0	4	4	1	1	-----	0	0	1	1	0	0
Virginia	46	37	43	182	70	60	12	36	20	4	1	1
West Virginia	14	10	28	7	2	6	2	61	7	0	0	1
North Carolina	59	140	140	2	-----	2	1	84	68	2	2	2
South Carolina	30	32	31	201	293	293	4	34	3	0	1	1
Georgia	33	34	42	2	14	14	1	5	2	1	0	1
Florida	33	1	8	8	22	2	2	3	3	1	0	0
E. SO. CEN.												
Kentucky	22	13	22	1	7	5	2	49	35	0	0	2
Tennessee	15	27	29	37	14	14	5	10	5	3	2	2
Alabama	41	23	40	68	28	33	1	51	5	2	1	4
Mississippi [2]	17	20	17	-----	-----	-----	-----	-----	-----	1	0	0
W. SO. CEN.												
Arkansas	20	29	25	23	41	24	9	17	5	1	0	0
Louisiana	5	4	21	2	9	9	0	1	1	0	0	0
Oklahoma	23	11	19	62	50	33	2	5	2	0	0	0
Texas	54	77	39	503	759	194	12	38	10	0	4	1
MOUNTAIN												
Montana	4	0	1	-----	2	7	9	19	34	0	0	0
Idaho	0	0	0	2	-----	-----	26	27	9	0	0	0
Wyoming	0	3	1	26	4	1	3	4	2	1	0	0
Colorado	10	4	9	34	14	7	6	33	24	0	0	0
New Mexico	1	1	1	2	1	1	7	63	19	0	0	0
Arizona	6	0	5	44	85	66	14	75	3	0	0	0
Utah [2]	0	0	0	1	4	4	112	5	7	0	0	0
Nevada	0	0	-----	-----	-----	-----	1	0	-----	0	0	-----
PACIFIC												
Washington	0	1	2	-----	-----	-----	264	3	9	1	2	1
Oregon	6	0	3	13	13	15	83	19	14	1	0	0
California	33	15	15	33	48	13	24	225	55	5	0	1
Total	596	633	840	1,339	1,553	976	1,331	1,678	1,678	68	30	35
43 weeks	11,789	12,359	17,800	89,696	499,509	175,897	474,381	833,621	354,791	2,911	1,704	1,704

See footnotes at end of table.

***Telegraphic morbidity reports from State health officers for the week ended October 31, 1942, and comparison with corresponding week of 1941 and 5-year median*—Continued**

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median 1937–41	Week ended—		Median 1937–41	Week ended—		Median 1937–41	Week ended—		Median 1937–41
	Oct. 31, 1942	Nov. 1, 1941		Oct. 31, 1942	Nov. 1, 1941		Oct. 31, 1942	Nov. 1, 1941		Oct. 31, 1942	Nov. 1, 1941	
NEW ENG.												
Maine	2	0	0	11	12	9	0	0	0	2	1	1
New Hampshire	3	1	0	9	7	3	0	0	0	0	0	0
Vermont	3	1	0	1	3	6	0	0	0	0	0	1
Massachusetts	1	7	3	189	145	80	0	0	0	2	2	2
Rhode Island	0	0	0	6	4	4	0	0	0	1	0	0
Connecticut	0	0	0	19	17	23	0	0	0	0	1	2
MID. ATL.												
New York	6	67	14	200	178	176	0	0	0	8	9	11
New Jersey	11	20	4	60	73	62	0	0	0	1	4	4
Pennsylvania	3	14	8	115	111	177	0	0	0	6	11	15
E. NO. CEN.												
Ohio	4	9	8	184	116	178	0	0	0	14	5	13
Indiana	4	2	4	51	51	101	0	1	1	0	2	2
Illinois	8	20	16	160	148	213	1	0	2	13	2	15
Michigan [2]	4	11	11	53	131	178	0	1	1	4	5	5
Wisconsin	1	5	5	122	111	111	0	0	0	1	1	1
W. NO. CEN.												
Minnesota	3	5	12	53	45	57	0	0	1	0	1	1
Iowa	3	1	3	54	39	66	0	1	1	0	4	2
Missouri	1	2	1	59	52	64	0	1	1	1	3	9
North Dakota	0	1	0	12	12	12	0	1	1	0	1	1
South Dakota	2	0	2	20	6	14	2	0	0	0	0	0
Nebraska	6	0	1	13	8	15	1	0	0	0	4	0
Kansas	11	1	1	60	48	67	0	1	0	3	0	2
SO. ATL.												
Delaware	0	5	0	11	6	7	0	0	0	1	0	0
Maryland [3]	0	6	2	32	39	35	0	0	0	3	5	5
Dist. of Col	0	2	1	22	12	12	0	0	0	1	0	1
Virginia	1	7	4	77	50	53	0	0	0	9	14	6
West Virginia	0	2	1	48	75	86	0	0	0	0	3	5
North Carolina	2	4	2	128	102	92	0	0	0	3	4	4
South Carolina	2	3	0	10	17	17	0	0	0	4	5	5
Georgia	1	5	1	50	18	33	0	0	0	5	7	8
Florida	2	7	1	7	6	4	0	0	0	3	1	1
E. SO. CEN.												
Kentucky	1	7	5	62	50	73	0	1	0	3	11	11
Tennessee	1	23	1	81	59	59	0	0	0	9	12	6
Alabama	4	22	3	36	58	39	0	0	0	3	3	4
Mississippi [2]	2	0	0	14	12	15	0	0	0	3	0	4
W. SO. CEN.												
Arkansas	2	5	2	5	6	16	0	0	0	6	9	11
Louisiana	1	0	1	5	4	12	0	0	0	3	5	8
Oklahoma	0	1	1	20	21	21	0	0	2	0	1	7
Texas	12	4	3	57	37	48	1	0	1	12	6	14
MOUNTAIN												
Montana	0	1	1	8	25	23	0	0	0	0	0	3
Idaho	0	0	1	4	14	13	0	0	1	0	0	3
Wyoming	0	0	0	1	5	5	0	0	0	0	2	0
Colorado	1	1	2	9	18	23	1	1	3	5	1	3
New Mexico	1	1	0	3	3	7	0	0	0	1	6	6
Arizona	1	0	0	0	0	1	0	0	0	4	0	1
Utah [2]	3	4	3	12	5	10	0	0	0	0	1	0
Nevada	0	0	-----	0	0	------	0	0	-----	0	0	-----
PACIFIC												
Washington	3	1	1	19	44	25	2	0	1	1	1	3
Oregon	3	2	2	9	12	17	0	0	1	0	3	2
California	21	5	9	103	89	106	1	0	1	0	3	5
Total	140	285	247	2,284	2,104	2,511	9	8	25	135	159	268
43 weeks	3,519	8,165	8,165	102,851	102,650	133,540	683	1,215	8,662	6,001	7,505	11,271

See footnotes at end of table

Telegraphic morbidity reports from State health officers for the week ended October 31, 1942—Continued

Division and State	Whooping cough, Week ended— Oct. 31, 1942	Whooping cough, Week ended— Nov. 1, 1941	Anthrax	Week ended Oct. 31, 1942: Dysentery, Amebic	Dysentery, Bacillary	Dysentery, Unspecified	Encephalitis, infectious	Leprosy	Rocky Mt. spotted fever	Tularemia	Typhus fever
NEW ENG.											
Maine	46	14	0	0	0	0	0	0	0	0	0
New Hampshire	2	7	0	0	0	0	0	0	0	0	0
Vermont	49	19	0	0	0	0	0	0	0	0	0
Massachusetts	190	168	0	0	1	0	1	0	0	0	0
Rhode Island	4	28	0	0	0	0	0	0	0	0	0
Connecticut	58	84	0	0	0	0	0	0	0	0	0
MID. ATL.											
New York	444	426	0	1	32	0	1	0	0	1	0
New Jersey	169	164	0	1	1	0	0	0	0	0	0
Pennsylvania	238	199	2	0	0	0	0	0	0	0	0
E. NO. CEN.											
Ohio	189	196	0	0	0	0	0	0	0	0	0
Indiana	19	19	0	0	0	0	0	0	0	0	0
Illinois	171	161	0	0	4	0	0	0	0	0	0
Michigan [2]	154	335	0	0	4	0	0	0	0	0	0
Wisconsin	130	308	0	0	0	0	0	0	0	0	0
W. NO. CEN.											
Minnesota	18	66	0	0	0	0	0	0	0	0	0
Iowa	16	20	0	0	0	0	0	0	0	0	0
Missouri	8	11	0	0	0	0	0	0	0	0	0
North Dakota	6	8	0	0	0	0	0	0	0	1	0
South Dakota	0	8	0	0	0	0	0	0	0	0	0
Nebraska	10	6	0	0	0	.	0	0	0	0	0
Kansas	30	40	0	0	0	0	0	0	0	0	0
SO. ATL.											
Delaware	4	3	0	0	0	0	0	0	0	0	0
Maryland [2]	87	31	0	0	0	2	0	0	0	0	0
Dist. of Col.	14	24	0	0	0	0	0	0	0	0	0
Virginia	11	61	0	0	0	59	0	0	2	0	1
West Virginia	22	13	0	0	0	0	0	0	0	0	0
North Carolina	42	103	0	0	0	0	0	0	1	0	6
South Carolina	6	77	0	0	6	0	0	0	0	0	4
Georgia	11	20	0	0	1	0	0	0	0	0	36
Florida	3	18	0	5	1	0	1	0	0	0	9
E. SO. CEN.											
Kentucky	32	100	0	0	3	0	0	0	0	0	0
Tennessee	21	45	0	0	0	43	0	0	1	0	1
Alabama	31	5	0	0	0	0	0	0	0	0	14
Mississippi [2]	------	------	0	0	0	0	0	0	0	0	1
W. SO. CEN.											
Arkansas	34	17	0	1	0	0	0	0	0	0	2
Louisiana	4	6	0	2	6	0	0	0	0	0	2
Oklahoma	6	1	0	0	0	0	0	0	0	0	0
Texas	69	88	0	16	98	0	0	1	0	1	34
MOUNTAIN											
Montana	18	39	0	0	0	0	0	0	0	0	0
Idaho	3	6	0	0	0	0	0	0	0	0	0
Wyoming	1	8	0	0	0	0	0	0	0	0	0
Colorado	7	38	0	0	0	0	0	0	0	0	0
New Mexico	6	6	0	1	2	0	1	0	0	0	0
Arizona	3	10	0	0	0	28	0	0	0	0	0
Utah [2]	9	20	0	0	0	0	0	0	0	0	0
Nevada	0	0	0	0	0	0	0	0	0	0	0
PACIFIC											
Washington	13	64	0	0	0	0	0	0	0	0	0
Oregon	2	16	0	0	0	0	0	0	0	0	0
California	187	185	0	8	11	0	12	0	0	0	1
Total	2,597	3,291	2	35	170	132	16	1	4	3	111
43 weeks	149,727	177,485	------	------	------	------	------	------	------	------	------

[1] New York City only.
[2] Period ended earlier than Saturday.

WEEKLY REPORTS FROM CITIES

City reports for week ended October 17, 1942

This table lists the reports from 85 cities of more than 10,000 population distributed throughout the United States, and represents a cross section of the current urban incidence of the diseases included in the table

	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
Atlanta, Ga	0	0	13	0	1	0	3	0	8	0	0	1
Baltimore, Md	2	0	6	2	0	4	10	0	5	0	0	59
Billings, Mont	0	0		0	0	0	0	0	2	0	0	4
Birmingham, Ala	0	0	3	0	0	0	1	0	5	0	0	0
Boise, Idaho	0	0		0	0	0	0	0	0	0	0	0
Boston, Mass	0	0		0	7	1	10	0	49	0	1	60
Bridgeport, Conn	0	0		0	0	0	1	0	1	0	0	1
Brunswick, Ga	0	0		0	0	0	0	0	0	0	0	0
Buffalo, N. Y	0	0		0	10	0	3	0	4	0	0	15
Camden, N. J	1	0		0	0	0	1	0	4	0	0	14
Charleston, S. C	0	0	9	0	0	0	0	1	1	0	0	0
Chicago, Ill	12	0	2	3	6	4	29	4	38	0	3	88
Cincinnati, Ohio	7	0		0	3	0	0	5	14	0	1	11
Cleveland, Ohio	2	0	1	1	1	0	4	1	25	0	0	28
Columbus, Ohio	0	0		0	0	1	2	0	19	0	0	4
Concord, N. H	0	0		0	1	0	0	0	0	0	0	0
Cumberland, Md	0	0		0	0	0	1	0	1	0	0	0
Dallas, Texas	4	0		0	2	0	2	0	4	0	0	13
Denver, Colo	6	0	12	2	2	0	7	0	8	0	0	0
Detroit, Mich	12	0		1	5	1	13	4	10	0	0	88
Duluth, Minn	0	0		0	2	0	2	0	2	0	0	6
Fall River, Mass	4	0		0	0	1	1	0	6	0	0	1
Flint, Mich	0	0		0	0	0	2	0	3	0	0	19
Fort Wayne, Ind	0	0		0	0	0	1	0	0	0	2	1
Frederick, Md	0	0		0	0	0	0	0	0	0	0	0
Galveston, Tex	0	0		0	0	0	2	0	1	0	0	0
Grand Rapids, Mich	0	0		1	2	0	3	0	0	0	0	3
Great Falls, Mont	0	0		0	0	0	0	0	1	0	0	0
Hartford, Conn	1	0		0	1	1	0	1	0	0	0	9
Helena, Mont	0	0		0	0	0	0	0	0	0	0	0
Houston, Tex	8	0		0	0	0	3	0	2	0	0	4
Indianapolis, Ind	0	0		0	2	0	8	1	6	0	0	20
Kansas City, Mo	1	0	1	1	1	0	2	0	10	0	0	2
Kenosha, Wis	0	0		0	1	0	0	0	5	0	0	6
Little Rock, Ark	0	0		0	0	0	4	0	2	0	0	0
Los Angeles, Calif	6	0	8	1	4	0	9	4	8	0	1	11
Lynchburg, Va	0	0		0	1	0	0	0	1	0	0	0
Memphis, Tenn	0	0		0	1	0	9	1	3	0	0	17
Milwaukee, Wis	0	0	1	1	14	0	2	0	19	0	0	22
Minneapolis, Minn	3	0		0	1	0	1	1	9	0	0	5
Missoula, Mont	0	0		0	0	0	0	0	0	0	0	0
Mobile, Ala	1	0	10	1	0	0	1	0	1	0	0	0
Nashville, Tenn	0	0		0	0	0	1	0	4	0	0	0
Newark, N. J	0	0	4	0	5	2	0	0	1	0	0	19
New Haven, Conn	0	0	1	0	0	0	1	0	7	0	0	12
New Orleans, La	1	0	1	1	0	0	6	1	3	0	1	0
New York, N. Y	17	0	6	0	14	3	43	7	62	0	4	131
Omaha, Nebr	0	0		0	1	0	1	0	4	0	0	0
Philadelphia, Pa	1	0		0	47	4	18	1	25	0	0	102
Pittsburgh, Pa	0	0		0	1	0	12	0	3	0	1	7
Portland, Me	0	0		0	2	1	1	2	1	0	0	4
Providence, R. I	0	0		0	0	2	2	0	0	0	1	17
Pueblo, Colo	0	0		0	0	0	1	0	3	0	0	0
Racine, Wis	0	0		0	2	0	0	0	7	0	0	1
Raleigh, N. C	0	0		0	0	0	0	0	0	0	0	0
Reading, Pa	0	0		0	0	1	0	0	0	0	0	6
Richmond, Va	0	0	1	1	0	0	3	0	3	0	0	0

City reports for week ended October 17, 1942

	Diphtheria cases	Encephalitis, infectious, cases	Influenza Cases	Influenza Deaths	Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
Roanoke, Va	0	0		0	0	0	0	0	1	0	0	0
Rochester, N. Y	0	0		0	1	0	4	0	3	0	0	10
Sacramento, Calif	2	0		0	2	1	3	0	6	0	1	1
Saint Joseph, Mo	0	0		0	1	0	2	0	1	0	0	0
Saint Louis, Mo	1	0		0	1	0	9	2	9	0	0	8
Saint Paul, Minn	0	0		0	1	0	4	0	3	0	0	24
Salt Lake City, Utah	0	0		0	17	0	3	1	4	0	0	4
San Antonio, Tex	2	0		0	0	0	3	3	1	0	0	1
San Francisco, Calif	1	0	1	0	6	0	8	0	8	0	0	14
Savannah, Ga	0	0		0	0	0	0	0	0	0	0	5
Seattle, Wash	0	0		0	1	0	5	0	1	0	0	8
Shreveport, La	0	0		0	0	0	5	0	3	0	0	0
South Bend, Ind	0	0		0	0	0	0	0	0	0	0	0
Spokane, Wash	1	0		0	2	1	3	1	1	0	1	0
Springfield, Ill	0	0		0	1	0	0	0	0	0	0	3
Springfield, Mass	0	0	1	0	4	0	2	0	29	0	0	2
Superior, Wis	0	0		0	0	0	0	0	1	0	0	5
Syracuse, N. Y	0	0		0	1	0	1	3	6	0	0	15
Tacoma, Wash	0	0		1	20	0	0	0	3	0	0	0
Tampa, Fla	0	0		0	0	0	2	0	0	0	1	0
Topeka, Kans	0	0		0	0	0	2	0	2	0	0	0
Trenton, N. J	0	0		0	0	0	1	0	1	0	0	9
Washington, D. C	3	0	2	1	0	2	10	0	15	0	2	0
Wheeling, W. Va	0	0		0	0	0	0	0	0	0	0	0
Wichita, Kans	0	0		0	0	0	4	0	9	0	1	4
Wilmington, Del	0	0		1	0	1	6	1	1	0	1	0
Winston-Salem, N. C	2	0		0	2	0	2	0	5	0	0	5
Worcester, Mass	0	0		0	1	0	5	0	8	0	0	11

Dysentery, amebic—Cases: New York, 3; Rochester, 1; St. Louis, 1.

Dysentery, bacillary—Cases: Baltimore, 7; Charleston, S. C., 14; Chicago, 2; Detroit, 3; Los Angeles, 2; New York, 9; Philadelphia, 1; Richmond, 1; San Francisco, 1.

Dysentery, unspecified—Cases: San Antonio, 2.

Typhus fever—Cases: Atlanta, 1; Houston, 1; Nashville, 4; New Orleans, 2; Shreveport, 1; Tampa, 1; Winston-Salem, 1; delayed report, week ended Oct. 3, Washington, D. C., 1.

Rates (annual basis) per 100,000 population for the group of 85 cities included in the preceding table (estimated population, 1942, 33,923,846)

Period	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
Week ended Oct. 17, 1942	15.52	12.76	2.92	30.89	47.65	80.08	0.00	3.38	144.33
Average for week 1937–41	15.84	9.63	2.64	[1] 40.85	[2] 51.42	77.36	0.31	6.37	153.32

[1] Median.
[2] 3-year (1939–41) average, 45.9.

PLAGUE INFECTION IN CALIFORNIA

Under date of October 16, 1942, plague infection was reported proved in pools of ectoparasites from rodents and from a jack rabbit collected in California as follows:

Kern County.—July 29, 2 ticks from 1 jack rabbit, *Lepus californicus*, taken 10 miles west of Wheeler Ridge; July 30, 53 fleas from

4 ground squirrels, *C. beecheyi*, taken 7 miles south and 5 miles west of Tehachapi; 32 lice and 200 fleas from 31 ground squirrels, *C. beecheyi*, taken 12 miles east of Wheeler Ridge.

Mono County.—September 4, 49 fleas from 21 ground squirrels, *C. beldingi*, taken 1 mile south and 1 mile west of Mammoth Post Office, 29 fleas from 27 chipmunks, *Eustamias* sp., and 52 fleas from 36 golden mantled ground squirrels, *C. lateralis* sp., taken 1 mile south and 2 miles west of Mammoth Post Office; September 8, 9, and 21, respectively, 99 fleas from 49 golden mantled ground squirrels, 24 fleas from 22 chipmunks, and 15 fleas from 16 golden mantled ground squirrels, all taken one-half mile east of Mammoth Post Office.

Siskiyou County.—September 15, 144 fleas from 11 ground squirrels, *C. douglasii*, taken 4½ miles north of Gazelle.

TERRITORIES AND POSSESSIONS

Virgin Islands of the United States

Notifiable diseases—July–September 1942.—During the months of July, August, and September 1942, cases of certain notifiable diseases were reported in the Virgin Islands as follows:

Disease	July	August	September	Disease	July	August	September
Chickenpox	2	------	1	Mumps	6	------	2
Filariasis	8	11	4	Schistosomiasis	------	------	2
German measles	1	------	------	Syphilis	34	22	18
Gonorrhea	11	16	8	Trachoma	------	------	1
Hookworm disease	2	3	3	Tuberculosis	5	4	------
Malaria	------	1	------	Typhus fever	------	------	1
Meningococcus meningitis	------	1	------	Whooping cough	------	3	2

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended October 3, 1942.—During the week ended October 3, 1942, cases of certain communicable diseases were reported by the Dominion Bureau of Statistics of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		3			2		1	1	2	9
Chickenpox		1	1	93	64	21	27	15	26	248
Diphtheria	3	13	3	23	2	4	1	5	2	56
Dysentery				29			1			30
Encephalomyelitis							1			1
German measles		1		3	6		1			11
Influenza		2			3				5	10
Lethargic encephalitis						1			1	2
Measles				76	12	6	19	2	11	126
Mumps		14	2	63	88	8	17	20	97	309
Pneumonia					4	2			6	12
Poliomyelitis		6	2	9	1				2	20
Scarlet fever		6	6	83	45	6	17	30	22	215
Trachoma									2	2
Tuberculosis	1	3	13	128	51	13	11		13	233
Typhoid and paratyphoid fever			2	18	2	1		1		24
Undulant fever					2	1			2	5
Whooping cough		12	3	300	66	27	5	14	39	466
Other communicable diseases		4			312	21	1	7		345

EGYPT

Infectious diseases—First quarter 1942.—During the first quarter of 1942, certain infectious diseases were reported in Egypt as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	4		Pneumonia	1,801	1,499
Cerebrospinal meningitis	98	38	Poliomyelitis	2	1
Chickenpox	433	3	Puerperal septicemia	91	49
Diphtheria	469	239	Rabies	12	11
Dysentery	602	109	Scarlet fever	16	
Erysipelas	877	89	Tetanus	105	81
Influenza	3,087	84	Tuberculosis	1,679	1,047
Leprosy	171	17	Typhoid fever	706	160
Lethargic encephalitis	2	2	Typhus fever	7,720	1,225
Malaria	467	14	Undulant fever	2	
Measles	2,318	660	Whooping cough	890	47
Mumps	617	2			

Vital statistics—First quarter 1942.—Following are the numbers of births and deaths for the first quarter of 1942 for all localities of Egypt having a health bureau:

Number of live births	65,974
Births per 1,000 population	47.6
Deaths, all causes	38,741
Deaths per 1,000 population	27.9
Deaths under 2 years of age	7,521
Deaths under 2 years of age per 1,000 live births	114

JAMAICA

Communicable diseases—4 weeks ended August 29, 1942.—During the 4 weeks ended August 29, 1942, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox	1	8	Tuberculosis	36	63
Diphtheria	7	3	Typhoid fever	12	30
Dysentery	5	3	Typhus fever	8	3
Leprosy	1	4			

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—Except in cases of unusual prevalence, only those places are included which had not previously reported any of the above-mentioned diseases, except yellow fever, during the current year. All reports of yellow fever are published currently.

A cumulative table showing the reported prevalence of these disesaes for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

(Few reports are available from the invaded countries of Europe and other nations in war zones.)

Plague

Morocco.—Plague has been reported in Morocco as follows: Week ended October 3, 1942, 2 cases; week ended October 10, 1942, 3 cases.

Typhus Fever

Algeria.—Typhus fever has been reported in Algeria as follows: September 11–20, 1942, 89 cases; September 21–30, 1942, 101 cases.

Hungary.—For the week ended October 10, 1942, 8 cases of typhus fever were reported in Hungary.

Morocco.—For the week ended October 3, 1942, 25 cases of typhus fever were reported in Morocco, and for the week ended October 10, 1942, 30 cases were reported.

Rumania.—For the week ended October 17, 1942, 35 cases of typhus fever were reported in Rumania.

Tunisia.—Correction.—For the period September 1–10, 1942, according to a later report received, only 133 cases of typhus fever were reported in Tunisia, instead of 1,333 cases as previously reported.

Turkey.—For the week ended October 17, 1942, 4 cases of typhus fever were reported in Turkey.

COURT DECISION ON PUBLIC HEALTH

Milk ordinance inspection fees upheld.—(Kentucky Court of Appeals; *City of Newport et al.* v. *Hiland Dairy Company et al.*; decided June 16, 1942.) A city milk control ordinance provided, among other things, for the payment of a monthly inspection fee by the owner or operator of a milk plant whose milk and milk products were sold in the city. Such fee was based upon the weight of all milk and milk products received or produced at the milk plant and entitled the owner or operator of such plant to regular inspections, which included systematic and regular inspections of the premises and equipment of all milk producers who supplied milk or milk products to such plant for determination of grade. The fee paid to the city was deemed to be consistent with the actual value of the services rendered by the city.

In considering certain questions involving the above-mentioned provisions the Court of Appeals of Kentucky said that the purpose back of the ordinance was the sale of pure milk in the city and that the ordinance was directed primarily at those who sought to distribute milk. The distributors, according to the court, were the ones benefited mainly by the ordinance because, if they were unwilling to obtain a license and to sell the character of milk called for, they would be denied the privilege of doing business in the city. This disposed of the question of the city's right to impose an inspection fee upon the distributors which would be adequate to inspect their plants, as well as the plants of the producers from whom they purchased milk.

Relative to the basing of the fee upon the volume of milk coming into the distributor's plant rather than upon the volume of milk sold in the city, the conclusion was reached that this was not an unreasonable or arbitrary act on the city's part. It was said that at first blush this might seem unfair but the necessity for inspecting all the milk handled by a distributor was apparent when it was considered that the milk, whether gathered in the distributor's own vehicles or purchased at his doors from producers, was so mixed and commingled that it was impossible to trace the product of any one producer. Should impure milk from only one herd reach a distributor's plant it could contaminate his whole supply. Furthermore, the inspector's duties would be the same regardless of the amount of milk a distributor might sell within the city. For example, said the court, if a distributor gathered milk from 20 farms but sold only 10 percent of it in the city, it would still be the inspector's duty to inspect all of the 20 producing plants, as well as the distributor's plant. "Unless proper facilities were established, there would be no way of segregating milk going to consumers in the city."

The next question considered was whether the levying of the inspection fees was unreasonable and arbitrary as between distributors, the example being cited of a small distributor paying a very small fee while a large distributor would be required to pay a much larger fee even though the major part of his milk might be sold outside the city. The levy, said the court, was upon a class and involved the volume of business done or, at least, the possibilities for business. "Such a plan seems reasonable to us. Because of the unusual character of the commodity under consideration and the possibility of a very small amount of impure milk contaminating a large amount of it, we fail to see how one can seriously contend that the levying of the fee on the basis of the volume of milk coming into the plant is arbitrary." It was pointed out that the large distributor who sold the major portion of his milk outside the city could, if he so desired, arrange his facilities for handling separately that part of his milk sold in the city.

With respect to the remaining question as to whether the fees would produce an amount in excess of that necessary to carry out the purposes of the ordinance, it was stated that this condition, if it should arise, could be readily adjusted, since the ordinance clearly set forth that it was the city's intent to collect only an amount sufficient to effectuate the ordinance.