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SURVEYS OF LIQUID WASTES FROM MUNITIONS MANUFACTURE[1]

III. SMALL ARMS AMMUNITION

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Previous papers in this series have presented data on the industrial wastes from the manufacture of trinitrotoluene (TNT) and smokeless powder. While the surveys at the various explosives plants were under way, inquiries were received concerning the wastes that might be expected from plants making small arms ammunition. As a result, surveys were made of the industrial wastes at plants manufacturing small arms ammunition (.30 and .50 caliber cartridges). This paper presents the data obtained from the surveys of three such plants. At some of the plants surveyed the sanitary sewage was separated from the industrial waste, while at other plants the sanitary sewage and the industrial waste were so intermingled that it was impracticable to measure and sample them separately.

MANUFACTURING PROCESSES

The manufacture of small arms ammunition consists essentially of forming the brass case, making the projectile, filling the percussion cap, and assembling the component parts, including the powder for propelling the bullet. The major industrial wastes come from that portion of the plant where the cartridge cases and projectile jackets are formed by a series of extrusions, or draws, from purchased brass blanks. Between draws the cases and jackets are annealed, pickled in acid, washed with detergents of various types, and lubricated in preparation for the next draw. Lubricants are used on the dies in the drawing machines and on the cutting tools in certain machine

[1] I. Trinitrotoluene (TNT) wastes and II. Smokeless powder wastes appeared in the PUBLIC HEALTH REPORTS, Vol. 58, No. 37, pp. 1365-1379 (September 10, 1943).

operations. Some liquid wastes come from the lead shop where lead ingots are drawn into wire and then shaped into projectiles. Lubricants are used for cooling dies and cutters on these machines, but the amount of waste is comparatively small.

FLOW MEASUREMENTS AND SAMPLING

Surveys were made at three plants manufacturing small arms ammunition. For the purposes of this report these plants will be designated as plants "A," "B," and "C."

At plant "A" the industrial waste flows included the domestic sewage from the cafeterias, locker rooms, and toilets in the manufacturing buildings. Storm water was discharged through a system of storm water sewers and did not mix with the industrial waste. The sanitary sewer system (actually carrying sanitary sewage plus industrial waste) was so arranged that it was difficult to separate the flows from individual manufacturing buildings. Four sampling points were arranged. One of these was on a sewer that carried the flow from a single .30 caliber building. At this point samples were taken every 40 minutes and composited uniformly over 24 hours. Flows for the period were determined from the water meter that supplied all the water for the building. A second sampling point was on the sewer that carried only the wastes from the primer area. At this point samples were taken and the depth of flow in the sewer was measured every 40 minutes. The flows were computed by Chezy formula and the samples were composited over 24 hours in accordance with the computed flows. There was, however, but little variation in the measured flows. The third sampling point was on the sewer carrying the wastes from a .50 caliber building plus those from the primer area. The sanitary sewage left the building through a separate pipe and entered the main sewer about 200 feet below the sampling point. The volume of waste during a 24-hour period, therefore, was taken to be that registered by the meter supplying all the water to the building minus the sanitary flow (computed from the number of employees) plus the computed flow from the primer area. The quantity of waste products from the .50 caliber building during the 24 hours was obtained by the difference in quantities of waste products at this point and at the sampling point in the primer area. Samples at this point were taken every 40 minutes and composited uniformly over 24 hours. All of the "sanitary sewage" from the plant (sanitary sewage plus industrial waste) and the sewage from the administration area flowed by gravity to the wet well of a pumping station which discharged through a force main to a municipal sewer system. Samples were taken at the inlet to the wet well of the pumping station and composited uniformly over 24 hours. Flows were measured by a Parshall flume and integrating meter at the end

of the force main. This integrator was read every morning by the plant operating force.

At plant "B" the sanitary sewage was separated from the industrial waste, but the industrial wastes are discharged into the storm drains. The waste water from the water treatment plant is carried in the same main sewer that receives the industrial waste from the .50 caliber ammunition manufacturing. For this reason, it was necessary to measure and sample the wastes from the .50 caliber area in two small sewers coming from the manufacturing buildings. V-notch weirs were constructed in these sewers and flow measurements and samples were taken every 30 minutes. These samples were composited for each sewer in accordance with the measured flows and then the two composite samples combined in proportion to the average flows in the two sewers. Thus a single 24-hour sample was obtained from the .50 caliber area. The wastes from the .30 caliber area flowed through another sewer into an open ditch. An end contracted rectangular weir was built in this ditch and an automatic sampler of the paddle wheel type, similar to those used on previous surveys, was installed. This sampler took from 10 to 15 samples per minute, roughly in accordance with the rate of flow. The sampler was visited every 3 hours, a flow measurement made at the weir, and the accumulated sample removed. These 3-hour samples were combined into a 24-hour composite in accordance with the measured flows. Due to heavy storm run-off on the sixth sampling day, the readings and samples from the .30 caliber area for that day had to be disregarded in tabulating results.

At plant "C" the industrial wastes, the sanitary sewage, and the storm drainage were all separated. Industrial wastes from the entire plant were brought by a common sewer to an industrial waste treatment plant. A wooden flume led from a manhole at the end of the sewer to a balancing lagoon. A weir was built in this flume and samples were taken and flow measurements made at this point every 30 minutes. The samples were combined into 24-hour composites in the usual manner. A Kennison flow nozzle with a recorder, including a totalizing dial, was installed between the balancing pond and the first unit of the treatment plant, and this nozzle and recorder were used to determine the actual flow of waste. However, it was deemed inadvisable to use the nozzle for the sampling point since much of the oil and grease in the waste was retained on the surface of the pond.

The sanitary sewage at plant "C" was treated in a plant adjacent to the industrial waste treatment plant. The sewage treatment plant did not include a measuring device, but a weir was installed and samples and flow readings were taken on the same schedule as at the industrial waste plant. This was done in order to obtain an estimate of the proper correction necessary for the sanitary sewage included in the measured flows at plant "A."

Every effort was made to obtain representative samples, but at plants "B" and "C" serious difficulties were experienced with heavy masses of oils and greases floating on the surface of the wastes. At times these floating masses would catch behind the weirs and quickly form a thick mat extending for some distance back up the sewer. When such mats were found, the sampler tried to break them and establish a free flow again before taking the sample. In general, samples were taken in the clear stream between the grease masses in order not to include a disproportionate amount of the scum.

CHARACTER OF THE WASTES

In general, the wastes are composed of various wash waters together with waste lubricants from the drawing machines, overflows, and drainage from the acid pickling baths, and soaps, other detergents, and lubricants from the predraw cleanings. Prominent characteristics of this waste are the copper and zinc content from the acid pickling baths and the grease from cutting oils and soaps. At plant "A" the waste was generally alkaline and the grease occurred as a soapy curd, but at the other two plants the waste was acid and a large amount of heavy grease scum floated in masses on the surface of the sewage and tended to collect in the sewers, forming a heavy mat on the surface of the flowing waste. On occasion this grease has collected on the interior of sewers to such an extent as to affect their capacity seriously within a few months.

The waste is turbid and greenish-grey in color with an oily or soapy odor that at times, when grease scum had stranded and been exposed to the air, resembled the odor of rancid fats.

ANALYTICAL DETERMINATIONS

All analytical work, except the determination of zinc, was done in the trailer laboratory of the United States Public Health Service located within the grounds of the plant. The trailer laboratory was not equipped to determine the zinc, so composite samples representing the waste flow over the entire sampling period at each plant were prepared and sent to the Stream Pollution Investigations Station of the Public Health Service at Cincinnati, Ohio. The following laboratory determinations were made on the wastes in the field laboratory: pH; acidity, both methyl red and phenolphthalein, or alkalinity; odor concentration; copper; grease; 5-day biochemical oxygen demand (B. O. D.); oxygen consumed; sulfates; total solids, volatile and ash; and suspended solids, volatile and ash.

Where possible, all determinations were made in accordance with "Standard Methods for the Examination of Water and Sewage, Eighth Edition." Oxygen consumed was determined by digestion with potassium dichromate instead of the more customary permanganate. Sulfates were determined gravimetrically by precipitating with barium chloride. B. O. D. determinations were made on samples neutralized and then seeded with river water. Copper was determined by the colorimetric carbamate method. Grease was determined gravimetrically after a triple wet extraction with hexane.

Several unsuccessful attempts were made to determine the zinc in the 7-day composite samples from plants "A" and "B" by the method prescribed in "Standard Methods." Finally copper, zinc, chromium, and lead were determined in the composite sample from plant "C" by a method that had been found applicable by the Kansas City Testing Laboratory of Kansas City, Mo. In this method, lead was precipitated from a slightly acidic solution as a sulfate by the addition of an equal volume of alcohol. Copper was precipitated from the lead sulfate filtrate with hydrogen sulfide, the resulting copper sulfide ashed, treated with ammonia, glacial acetic acid, and potassium iodide, and then titrated with sodium thiosulfate. The filtrate from the copper precipitation was slightly alkalinized, the chromium precipitated and filtered out. The chromium was redissolved in hot dilute sulfuric acid, oxidized with potassium permanganate, an excess of ferrous ammonium sulfate added, and then back-titrated with standard permanganate. After removal of the copper, the zinc was precipitated with hydrogen sulfide from a buffered acid solution as zinc sulfide, washed, ignited, and weighed as zinc oxide.

RESULTS AND DISCUSSION

Tables 1, 2, and 3 give the analytical results for the industrial waste flows from different parts of plant "A." Due to the intermingling of domestic sewage and industrial waste as explained in the section on flow measurements and sampling, it was necessary to correct the analytical results as determined in the laboratory to allow for the domestic sewage. This correction was made on the basis of flow and pounds of waste products per capita as determined at plant "C." The results for the .50 caliber area were corrected for the amounts of waste products found to be coming from the priming area. Examination of these tables shows that the strongest waste comes from the .50 caliber area. Although there is no great difference in 5-day B. O. D., oxygen consumed, or volatile solids, this waste contains twice as much grease and nearly 50 percent more copper than does the waste from the .30 caliber area.

TABLE 1.—*Analytical results, plant "A," .30 caliber area*

Sample date	pH	p. p. m.											
		Alkalinity	Grease	Copper	5-day B. O. D.	Oxygen consumed	Total solids			Suspended solids			Sulfate
							Total	Volatile	Ash	Total	Volatile	Ash	
1	9.6	300	240	27	231	146	1,033	453	580	378	287	91	126
2	7.5	229	105	30	125	103	985	360	625	231	183	48	211
3	7.4	193	197	33	171	105	862	324	538	244	198	46	185
4	9.6	330	292	32	273	133	1,628	853	775	424	333	91	165
5	8.0	254	240	30	191	83	1,110	422	688	365	263	102	184
6	9.6	479	300	78	273	97	1,692	867	825	670	529	141	169
7	7.3	183	186	31	154	70	1,270	585	685	647	520	127	187
Average	8.4	281	223	37	203	105	1,226	552	674	422	330	92	175

TABLE 2.—*Analytical results, plant "A", .50 caliber area*

Sample date	pH	p. p. m.											
		Alkalinity	Grease	Copper	5-day B. O. D.	Oxygen consumed	Total solids			Suspended solids			Sulfate
							Total	Volatile	Ash	Total	Volatile	Ash	
1	7.2	194	408	31	273	110	1,400	435	965	541	403	138	437
2	7.4	238	322	48	262	99	1,354	324	1,030	369	282	87	447
3	7.5	258	590	48	398	139	1,669	604	1,065	817	675	142	454
4	6.9	175	242	35	160	67	1,564	400	1,164	402	345	57	495
5	6.8	157	1,020	67	290	127	1,617	585	1,032	678	124	554	535
6	6.9	171	436	71	271	91	1,760	570	1,190	860	615	245	538
7	7.1	409	478	65	309	155	1,980	912	1,068	853	660	193	396
Average	7.1	229	499	52	280	113	1,620	547	1,073	645	443	202	472

TABLE 3.—*Analytical results, plant "A", entire plant*

Sample date	pH	p. p. m.											
		Alkalinity	Grease	Copper	5-day B. O. D.	Oxygen consumed	Total solids			Suspended solids			Sulfate
							Total	Volatile	Ash	Total	Volatile	Ash	
1	7.7	232	184	19	105	89	1,270	448	822	268	205	63	204
2	6.8	188	151	47	95	77	1,288	232	1,056	250	184	66	330
3	8.5	236	210	28	155	51	1,825	515	1,310	262	205	57	224
4	7.9	218	258	13	193	69	1,460	560	900	287	214	73	232
5	7.4	194	186	14	176	69	1,690	383	1,307	326	234	92	244
6	7.6	211	161	76	116	53	1,754	476	1,278	217	149	68	270
7	7.4	214	140	17	145	59	1,755	501	1,254	326	246	80	202
Average	7.6	213	184	31	141	67	1,577	445	1,132	276	205	71	244

Tables 4, 5, and 6 give similar results for plant "B." As the domestic sewage at this plant was separated from the industrial waste, the results given in tables 4 and 5 were determined directly on the composited samples. The results shown in table 6 had to be computed from the measured flows and the total waste products discharged from the two separate areas. Again it is noticeable that the waste from the .50 caliber area is much stronger than that from the .30 caliber area. At this plant the waste, instead of being consistently alkaline, was acid to methyl red about half of the time. Examination of the results from the individual areas shows that the flow from the .30 caliber area was consistently acid, but that from the .50 caliber area was usually alkaline to methyl orange.

TABLE 4.—*Analytical results, plant "B," .30 caliber area*

Sample date [1]	pH	p. p. m.														Odor	
		Acidity		Alkalinity	Grease	Copper	5-day B. O. D.	Oxygen consumed	Total solids			Suspended solids			Sulfate	Concentration	Type
		Methyl red	Phenolphthalein						Total	Volatile	Ash	Total	Volatile	Ash			
1	3.2	64	163	----	144	31	99	47	1,143	520	623	236	236	0	416	4	Oily.
2	3.7	12	55	----	172	28	132	92	735	260	475	200	186	14	259	8	Do.
3	3.5	22	59	----	92	12	93	55	443	93	350	130	120	10	189	16	Do.
4	3.0	47	128	----	164	30	46	46	820	198	622	116	102	14	368	32	Do.
5	3.6	26	98	----	234	28	64	47	790	202	588	144	144	0	329	16	Do.
7	3.4	33	103	----	322	29	75	97	954	251	703	290	224	66	371	4	Do.
8	3.0	57	126	----	187	23	68	66	924	314	610	160	160	0	402	2	Do.
9	2.9	120	227	----	238	28	----	74	1.058	348	710	170	140	30	493	4	Do.
8-day composite	3.3	43	121	----	115	24	[2] 85	68	866	276	590	128	128	0	362	[2] 11	Do.

[1] Sampling day No. 6 omitted because of storm flow.
[2] Computed weighted mean.

TABLE 5.—*Analytical results, plant "B," .50 caliber area*

Sample date	pH	p. p. m.														Odor	
		Acidity		Alkalinity	Grease	Copper	5-day B. O. D.	Oxygen consumed	Total solids			Suspended solids			Sulfate	Concentration	Type
		Methyl red	Phenolphthalein						Total	Volatile	Ash	Total	Volatile	Ash			
1	3.7	22	82	----	636	18	237	103	1,357	839	518	1068	1032	36	286	16	Oily.
2	6.8	----	----	52	424	16	301	129	1,018	558	460	360	340	20	167	64	Soapy.
3	6.6	----	----	53	373	18	234	136	1,174	474	700	260	236	24	293	64	Do.
4	3.0	56	126	----	830	18	103	73	1,173	545	628	306	284	22	372	64	Oily.
5	3.4	34	109	----	646	35	103	98	1,145	635	510	500	500	0	282	128	Do.
6	5.8	----	----	30	377	37	125	134	1,390	694	696	610	466	144	250	32	Soapy.
7	7.2	----	----	65	637	11	148	176	1,547	912	635	756	676	80	248	16	Do.
8	6.2	----	----	27	756	20	137	185	1,315	700	615	850	850	0	302	32	Do.
9	>9.6	----	----	113	530	9	----	156	1,405	841	564	504	384	120	183	64	Oily.
9-day composite	6.4	----	----	21	428	28	[1] 177	130	1,214	649	565	652	636	16	261	[1] 53	Soapy.

[1] Computed weighted mean.

TABLE 6.—*Analytical results, plant "B," combined .30 and .50 caliber areas*

Sample date	p. p. m.												
	Acidity (methyl red)	Alkalinity	Grease	Copper	5-day B. O. D.	Oxygen consumed	Total solids			Suspended solids			Sulfate
							Total	Volatile	Ash	Total	Volatile	Ash	
1	40	------	422	24	177	79	1,267	699	568	707	687	20	342
2	------	20	298	22	217	111	878	410	468	280	263	17	212
3	------	35	282	13	189	110	935	350	585	235	215	20	260
4	52	------	508	24	75	60	1,000	377	623	214	196	18	369
5	30	------	462	32	86	75	985	440	545	410	341	69	302
7	------	22	497	19	116	141	1,287	622	665	552	478	74	302
8	13	------	488	21	105	129	1,130	518	612	525	525	0	349
9	------	8	398	18	136	119	1,250	620	630	341	274	67	323
Average	6	------	419	22	138	103	1,092	505	587	408	372	36	307

Table 7 shows the analytical results on the combined industrial waste from all areas in plant "C." This waste was consistently strongly acid and much stronger than the waste at the other plants. The grease and copper contents were much higher than found elsewhere. As was noted under analytical methods, a mineral analysis for lead, copper, chromium, and zinc was made on the 7-day composite of the waste from this plant. This analysis showed: Copper, 72.7 p. p. m.; chromium, 0.4 p. p. m.; zinc, 56.6 p. p. m.; and lead 0 p. p. m. Similar analyses were not made on the composite wastes from plants "A" and "B," but, as the same composition brass is used, it is probable that the copper-zinc ratio would be approximately the same.

TABLE 7.—*Analytical results, plant "C," entire plant*

Sample date	pH	p. p. m.													Odor	
		Acidity		Alkalinity	Grease	Copper	5-day B. O. D.	Oxygen consumed	Total solids			Suspended solids			Sulfate	Concentration	Type
		Methyl red	Phenol-phthalein						Total	Volatile	Ash	Total	Volatile	Ash			
1	4.2	22	173	----	574	60	208	127	1,510	485	1,025	290	260	30	596	128	Oily.
2	3.2	67	239	----	428	74	212	125	1,500	495	1,005	260	230	30	648	128	Do.
3	3.0	105	293	----	250	66	297	134	1,377	297	1,080	140	138	2	675	64	Do.
4	3.2	76	231	----	520	66	291	126	1,554	479	1,075	334	294	40	648	128	Do.
5	3.9	22	193	----	964	76	559	270	2,490	1,347	1,143	868	810	58	618	128	Do.
6	3.7	21	214	----	543	150	313	270	2,396	1,282	1,114	852	788	64	625	512	Do.
7	3.0	105	331	----	281	110	206	98	1,516	406	1,110	154	136	18	717	128	Do.
Weighted mean	3.5	60	239	----	502	86	295	163	1,753	675	1,078	408	374	34	647	170	Do.

Table 8 compares the analytical results on the total industrial waste flows for the three plants. It is to be expected that the strength of the wastes would vary as there was a large variation in the proportion of .30 and .50 caliber cartridges turned out by the different plants.

However, considering that the raw material (brass) was the same at the three plants and that it was put through the same processes by practically identical machines, it is difficult to explain the extreme variation in the hydrogen-ion concentration of the wastes unless it is ascribed to different detergents used by the various plants which were operated by different management contractors.

TABLE 8.—*Average analytical results, combined areas waste flows*

Plant	p. p. m.												
	Acidity (methyl red)	Alkalinity (methyl orange)	Grease	Copper	5-day B. O. D.	Oxygen consumed	Total solids			Suspended solids			Sulfate
							Total	Volatile	Ash	Total	Volatile	Ash	
"A"	------	213	184	31	141	67	1,577	445	1,132	276	205	71	244
"B"	6	------	419	22	138	103	1,092	505	587	408	372	36	307
"C"	60	------	502	86	295	163	1,753	675	1,078	408	374	34	647
Average	------	------	368	46	191	111	1,474	542	932	364	317	47	399

Table 9 summarizes the waste products found in the industrial wastes per 100,000 rounds of .30 caliber and .50 caliber ammunition and per 100,000 rounds of mixed small arms ammunition. This table again emphasizes the increased amounts of waste products per unit of production with the larger ammunition.

TABLE 9.—*Waste products per 100,000 rounds*

Plant	Million gallons flow	Pounds										
		Alkalinity	Mineral acid	SO_4	Grease	Copper	B. O. D.	Oxygen consumed	Total solids		Suspended solids	
									Volatile	Ash	Volatile	Ash
	.50 CALIBER AMMUNITION											
"A"	.0623	131	------	265	284	29.7	159	64	31.4	504	252	116
"B"	.0975	20	------	212	475	16.3	144	137	567	474	442	39.7
Average	.0799	76	------	239	380	23.0	152	67	299	489	347	78
	.30 CALIBER AMMUNITION											
"A"	.0252	58	------	37	46	7.9	42	22	114	141	69	19
"B"	.0242	------	9.40	73	40	5.4	17	14	58	120	34	3
Average	.0247	------	------	55	43	6.7	30	18	86	131	52	11
	COMBINED OUTPUT											
"A"	.0417	74	------	84	64	10.5	49	23	155	392	71	24.7
"B"	.0408	------	3.0	104	144	7.5	47	40	174	198	129	12.2
"C"	.0256	------	12.9	140	109	18.6	64	35	146	232	81	7.4
Average	.0361	------	------	76	106	12.2	53	33	158	274	94	14.8

At plant "C" a waste treatment plant was in operation to treat the industrial waste before it was discharged to the receiving stream. During the course of the waste survey at this plant, samples were taken of the plant effluent and at a couple of intermediate points on the same time schedule as the samples of industrial waste in order to determine the efficiency of the waste treatment.

The plant consisted of a balancing, or equalizing, lagoon, a grease aeration-flotation unit, a tank for flocculation of the waste with lime and alum, and final settling ponds. A Kennison nozzle with recorder measured the waste flow between the equalizing lagoon and the grease removal tank.

The balancing lagoon was a large pit, square in plan with 3:1 side-slopes covered with crushed stone, and had a detention period of 13.4 hours with the average flow measured during the survey period. The waste was admitted to the pond through an E-shaped series of bottom-perforated troughs covering about half of the surface and was taken off by a double weir launder near the opposite bank. Because of the large amount of oil and grease scum that collected on the surface of the lagoon, a grease trap was built into the sewer just ahead of the pond to intercept the grease and flush it directly to the grease removal tank.

The grease-removal tank was rectangular in plan with the flow entering at one end and passing out over a baffled weir at the other. A full depth transverse baffle about seven-tenths of the distance from the inlet to the outlet divided the tank into aeration and flotation sections. The aeration section contained two American Well Works down-draft aerators and had a detention period of 2.1 hours. The quiescent flotation section had a detention period of 0.74 hour and an overflow rate of 2,120 gallons per square foot of surface area per 24 hours. It had been expected that most of the grease would rise to the surface on this flotation section, but a large proportion of it remained in the aeration portion of the unit. The grease was skimmed by hand at frequent intervals into two longitudinal troughs along the outside of the tank and then scraped into a large earth storage pit. Arrangements were made to add sulfuric acid to the waste ahead of the grease removal unit to aid in separation of the grease, but this was not necessary during the period of the survey.

After grease removal, lime sludge from the water-softening plant and dry hydrated lime were added to the waste to make it slightly alkaline and alum was added, if necessary, for additional flocculation. After addition of the chemicals, the waste passed to a rectangular flocculator with a detention period of 2.39 hours. This flocculation

tank contained three American Well Works turbine pump agitators for stirring.

From the flocculator the waste passed to the final settling lagoons before being discharged. These lagoons were excavated pits, rectangular in plan, with 3:1 side slopes. The waste entered at one end through a bottom-perforated trough extending the width of the tank and was removed by means of a double weir trough at the other end. No means were provided for sludge removal. It had been planned to use one lagoon only until it was filled with sludge, an estimated period of 2 years, and then to put the other lagoon into service, but at the time of the survey both units were being used in parallel. The combined detention period was 73.6 hours, disregarding sludge deposits.

The treatment plant produced an effluent that would probably not be detrimental to any stream into which it might be discharged. The final effluent was clear, colorless, practically neutral, without any noticeable odor, and reasonably low in copper, grease, and B. O. D. Table 10 shows the average analytical results of the samples taken at various points in the plant.

TABLE 10.—*Average analytical results, waste treatment plant*

Sampling point	pH	p. p. m.												Odor	
		Acidity		Alkalinity	Grease	Copper	Total solids			Suspended solids			5-day B. O. D.	Concentration	Type
		Methyl red	Phenolphthalein				Total	Volatile	Ash	Total	Volatile	Ash			
1. Raw waste	3.5	60	239	----	709	86	1,763	684	1,079	413	379	34	298	174	Oily.
2. After grease removal	3.6	55	211	----	54	82	----	----	----	----	----	----	----	55	Do.
3. Influent final settling	6.9	----	----	333	----	64	----	----	----	867	358	509	----	48	Soapy.
4. Final effluent	6.9	----	----	43	8	9	1,510	302	1,208	25	13	12	47	14	Do.

The plant accomplished a reduction of 84 percent in biochemical oxygen demand and 94 percent in suspended solids, although the reduction in volatile suspended solids (those that might decompose in the receiving stream) was 96½ percent. The greater portion of the grease was removed in the aeration and flotation unit where 92½ percent of the hexane soluble material was removed. This grease, as removed, had a specific gravity of 0.8363 and a moisture content of 35.07 percent. It had an ash content of 6.54 percent, copper 0.52 percent, and hexane soluble material 58.36 percent, based on the average of two check determinations of a sample of the grease removed over a 3-day period. Of the grease passing the flotation unit, 85 percent was removed by the flocculation and settling, giving an over-all removal of 99 percent. Practically all of the copper was removed by the flocculation and settling, although the analysis of the

grease showed that some remained in this material. The total removal of copper averaged 89½ percent.

As has been noted, the flow at plant "A" was consistently alkaline for 24-hour composites. To have treated this flow by the same method used at plant "C" would have required large amounts of acid. It is of interest to note, however, that the copper apparently was contained in the soapy curd. On several samples copper determinations were made before and after filtering the waste through filter paper. This filtration of the waste showed a reduction of 89 to 97 percent in the copper. It is possible that a combination of settling and mechanical filtration could remove enough of the grease and copper from a waste like that at plant "A" so that the effluent could be treated biologically in a manner similar to any normal municipal sewage.

SUMMARY

Results of industrial waste surveys at three large plants manufacturing small arms ammunition (.30 and .50 caliber military cartridges) are presented. Although the plants were very similar and of approximately the same size, there were marked differences in the waste flows. This was due in part to differences in the proportion of .30 and .50 caliber cartridges being manufactured at the different plants and in part to other unknown causes. There is a greater waste flow and larger actual amounts of waste products per 100,000 rounds of finished ammunition from the manufacture of .50 caliber cartridges than from the manufacture of .30 caliber. Average results, however, would indicate that per 100,000 rounds of mixed ammunition there could be expected a flow of 36,000 gallons containing about 100 pounds of grease, 12 pounds of copper, and 95 pounds of volatile suspended solids, and a 5-day B. O. D. population equivalent of 300 people.

A description is given of a plant treating this waste by means of grease flotation and chemical precipitation. Operating results of this treatment are tabulated.

IV. TETRYL WASTES

By Russell S. Smith, *Public Health Engineer, United States Public Health Service, Stream Pollution Investigations, Cincinnati, Ohio*

This report, the fourth of a series of five on the liquid wastes resulting from munitions manufacturing, presents the data gathered from surveys of two plants manufacturing tetryl. This explosive, which is less resistant to shock than trinitrotoluene (TNT), is used as a booster charge to detonate the main explosive charge in shells and bombs.

MANUFACTURING PROCESSES

Tetryl, or 2, 4, 6-trinitrophenylmethylnitramine, is made by the nitration of dimethylaniline, boiling the product in water to remove some of the impurities, then dissolving it in acetone and filtering to remove certain insoluble impurities, and finally recrystallizing.

The dimethylaniline is dissolved in concentrated sulfuric acid and this solution is run into the nitrating acid (a mixture of nitric and sulfuric acids) in the nitrator. After the nitration is completed the mixture is allowed to cool and the crude tetryl crystallizes out. This crude tetryl is separated from the spent nitrating acid on open vacuum filters and is washed with hot water to remove the last traces of the nitrating acid and certain water soluble impurities. It is then dissolved in acetone, the solution run into recrystallizing vats, and the tetryl is recrystallized under controlled conditions so as to form small free-flowing crystals. These crystals, after drying, are packed and sent to storage magazines awaiting shipment.

SAMPLING AND FLOW MEASUREMENTS

In making the surveys of waste flows from tetryl manufacturing no account was taken of the flows from power house and acid manufacturing areas. In general, a plant manufactures more than one type of explosive. The power house and acid areas serve the entire plant and it is practically impossible to ascribe the proper proportion of the flow from these areas to the manufacturing of a particular explosive. These flows are essentially cooling water, possibly slightly contaminated with acid, and may be discharged without damage to a stream.

In plant "A" waste discharge pumps were so adjusted that the main sewer from the tetryl area flowed full at all times. Direct measurements of the waste discharge were, therefore, impracticable and waste flows were based on water furnished the area. This water was from three sources, two of which were equipped with meters. Water from the other source had to be estimated from data supplied by the plant operating forces.

Sampling of the waste was done over a 24-hour period every other day for 2 weeks, thus obtaining the equivalent of a full week of operation. During the sampling periods, dip samples were taken from a manhole on the main waste sewer from the area every 20 minutes and composited uniformly into 12-hour samples. All analytical determinations were made on these composite samples.

In plant "B", a contracted weir with a 3-foot crest was placed in the ditch carrying the waste water from the tetryl area. The head on the weir was read every 3 hours to determine the flow from the area. A paddle wheel sampler was installed in the ditch which put about 15 samples per minute into a pail. These samples were collected every

3 hours and composited according to the measured flow into a 24-hour sample. All analytical determinations were made on these 24-hour samples. Flow measurements were made and samples taken over a 24-hour period every other day for 16 days, thus obtaining a representative week's operation of the plant.

ANALYTICAL DETERMINATIONS

The following laboratory determinations were made on the composite samples of the waste: pH; color; odor concentration; acidity, both methyl red and phenolphthalein; 5-day biochemical oxygen demand (B. O. D.); oxygen consumed; sulfates; nitrite nitrogen; nitrate nitrogen; soap hardness; total solids, volatile and ash; and suspended solids, volatile and ash.

In general, all determinations were made in accordance with the procedures of "Standard Methods of Analysis for Water and Sewage, Eighth Edition." The pH of the waste was determined colorimetrically with an occasional potentiometric check using the glass electrode. Color was determined by the use of a standard color comparator using glass standards based on the cobalt color scale. Oxygen consumed was determined by digestion with potassium dichromate in accordance with the customary practice of the Stream Pollution Investigations Station laboratory of the United States Public Health Service.

The 5-day biochemical oxygen demand results were very erratic. During preliminary work with a large number of catch samples, concentrations of 5, 10, 25, 50, and 100 percent of the waste were set up after neutralizing and seeding. The 5-percent and 10-percent concentrations gave such small oxygen depletions in 5 days that slight inaccuracies in reading a burette would introduce large proportionate errors. The concentrations of 50 percent and 100 percent showed smaller depletions than those of 25 percent; hence it was concluded that the waste was toxic to the seeding organisms in the larger concentrations. The results in concentrations of 5 percent and 10 percent did not check with those in concentrations of 25 percent. Consideration of these facts led to the adoption of the 25-percent concentration for all B. O. D. determinations on this waste. The results are reported, but, because of evident inconsistencies, reliance should not be given to them as a measure of the strength of the waste.

When making the oxygen consumed determination, interference was found in some cases and erratic results ensued. Apparently at intervals there was some substance in the waste which made it impossible to reach a final end point when backtitrating the excess dichromate. The nature and source of this interfering substance are not known. It was found difficult to obtain check results with duplicate samples and the digestion time was lengthened to 4 to 5 hours but longer digestion periods apparently tended to result in decomposition of the

reagent. The oxygen consumed results appear to be more reliable than the B. O. D. results, although inconsistencies are to be noted.

RESULTS AND DISCUSSIONS

Tables 1 and 2 give the analytical results for the various composite samples at the two plants. In table 1, the "day" sample on the sixth day shows plainly that something unusual occurred in the plant operating routine. Acidity, sulfates, nitrogen, and solids in the waste doubled or trebled. Evidently either some acid was lost by a spill or overflow into the sewer, or, more probably, a charge was "drowned" or dumped because of a dangerously rapid rise in temperature during nitration. The results for this period are so far out of line with the other data that they have not been included in the average, but it is important to note that such accidents may take place at any time with their attendant effects upon the receiving stream. The results show that this type of waste is normally very uniform in character, strongly acid and clear, but that over half of the solids present, both suspended and total, are of a volatile nature. Although these records do not indicate it, the waste has a slight yellow-green color and an oily odor.

TABLE 1.—*Analytical results, plant "A"*

Sample date	Sampling period	pH	Color	Odor concentration	p. p. m.											
					Acidity		5-day B. O. D.	Oxygen consumed	SO_4	Soap hardness	Nitrogen		Total solids		Suspended solids	
					Methyl red	Phenolphthalein					NO_3	NO_2	Volatile	Ash	Volatile	Ash
1	Day	1.9	105	4	564	595	12.5	9.1	668	594	2.1	150	250	530	8	24
	Night	1.9	100	4	680	695	11.1	9.6	790	552	4.5	70	430	450	9	4
2	Day	1.9	95	4	612	632	22.1	6.8	708	538	2.6	140	326	478	9	9
	Night	1.8	100	2	701	714	21.8	9.8	837	512	3.0	90	827	439	18	2
3	Day	1.9	105	4	604	744	5.1	13.0	824	456	2.1	160	460	425	11	7
	Night	1.9	105	4	634	652	19.8	9.7	734	422	3.1	130	800	420	12	5
4	Day	2.0	95	4	481	503	1.0	9.4	644	473	3.0	110	310	440	4	6
	Night	2.0	95	4	502	518	4.2	12.1	643	397	3.8	100	455	445	8	15
5	Day	1.8	85	8	753	794	3.5	11.9	825	504	4.5	85	387	423	11	0
	Night	1.8	80	8	702	723	1.8	10.5	683	418	6.0	110	727	423	12	3
6	Day	1.6	125	8	2,020	2,060	4.9	16.3	1,764	392	25.0	400	1,815	465	23	14
	Night	1.8	110	4	608	624	17.8	(1)	703	281	5.5	110	290	440	8	7
7	Day	2.0	100	16	659	688	6.9	11.3	760	285	2.8	100	766	424	12	4
	Night	1.9	105	16	761	791	7.1	10.0	820	314	5.0	120	434	436	13	2
Average		1.9	100	6	734	759	10.0	10.7	812	438	5.2	133	591	445	11	8
Average, excluding "6-day."		1.9	98	6	635	659	10.4	10.3	740	442	3.7	113	497	443	10	7
Maximum		2.0	125	16	2,020	2,060	22.1	16.3	1,764	594	25.0	400	1,815	530	23	24
Minimum		1.6	80	2	481	503	1.0	6.8	643	281	2.1	70	250	420	4	0

[1] Interference.

TABLE 2.—*Analytical results, plant "B"*

Sample day	pH	Color	Odor concentration	p. p. m.										
				Acidity		5-day B. O. D.	Oxygen consumed	SO_4	Soap hardness	Nitrogen		Total solids		Suspended solids	
				Methyl red	Phenol-phthalein					NO_3	NO_2	Volatile	Ash	Volatile	Ash
1	2.2	85	2	224	316	6.9	15.8	264	163	1.6	35	174	291	7	18
2	2.3	85	2	182	228	7.2	12.5	237	150	1.0	8	304	286	15	57
3	2.5	90	2	232	273	5.4	11.7	262	146	1.6	40	280	285	9	31
4	2.4	100	2	256	294	10.3	21.0	278	136	1.0	30	330	245	5	20
5	2.3	160	2	407	444	23.8	29.1	415	148	1.6	40	577	313	13	51
6	2.3	220	1	423	471	10.5	15.1	448	161	1.6	80	602	331	10	27
7	2.0	120	2	632	697	9.2	18.6	630	167	1.8	80	859	354	5	26
8	2.4	150	1	428	467	11.1	17.0	443	134	1.2	80	546	278	10	23
Average	2.3	126	2	348	399	10.6	17.6	372	151	1.4	49	459	298	9	32
Maximum	2.5	220	2	632	697	23.8	29.1	630	167	1.8	80	859	354	15	57
Minimum	2.0	85	1	182	228	5.4	11.7	237	134	1.0	8	174	245	5	18

Table 3 indicates the average characteristics of the waste that might be expected from this type of explosive manufacture. Table 4 shows the quantities of waste products to be expected per 10,000 pounds of explosive produced. The population equivalent based on the biochemical oxygen demand is given, although this figure is naturally subject to the inaccuracies discussed under the B. O. D. determination and too great reliance should not be placed on it.

TABLE 3.—*Average of analytical results*

Plant	pH	Color	Odor concentration	p. p. m.										
				Acidity		5-day B. O. D.	Oxygen consumed	SO_4	Soap hardness	Nitrogen		Total solids		Suspended solids	
				Methyl red	Phenol-phthalein					NO_3	NO_2	Volatile	Ash	Volatile	Ash
"A"	1.9	98	6	635	659	10.4	10.3	740	442	3.7	113	497	443	10	7
"B"	2.0	126	2	348	399	10.6	17.6	372	151	1.4	49	459	298	9	32
Average	2.0	112	4	492	529	10.5	15.0	556	297	2.6	81	478	371	10	20

Except for the acidity, the waste apparently would not cause any serious trouble in the receiving stream. However, in common with the wastes from all types of explosive plants, it is high in nitrates and these might help to promote an increase in algae growths in the receiving stream. These growths could be the cause of tastes and odors in a water supply and might cause difficulty in a water treatment plant by shortening filter runs. If discharged into a good sized river and adequately mixed, the waste apparently should not require treatment before discharge.

TABLE 4.—*Waste quantities*

	Waste per 10,000 pounds of explosives produced		
	Plant "A"	Plant "B"	Average
Flow.....million gallons	0.91	0.68	0.80
Free mineral acid as H_2SO_4.....pounds	4,830	1,970	3,400
Sulfates.....do	5,630	2,100	3,865
Nitrite nitrogen.....do	28	8	18
Nitrate nitrogen.....do	867	278	572
Total solids:	7,150	4,275	5,713
Volatile.....do	3,780	2,590	3,185
Ash.....do	3,370	1,685	2,528
Suspended solids:	129	232	180
Volatile.....do	76	51	63
Ash.....do	53	181	117
Oxygen consumed.....do	78	100	89
5-day B. O. D.....do	79	60	68
Population equivalent (B. O. D.)	465	354	409

Tests for toxicity of the waste were made at the National Institute of Health of the United States Public Health Service by Dr. L. T. Fairhall, principal industrial toxicologist. A composite sample of the waste was neutralized to a pH of 7, made isotonic with sodium chloride, and sterilized in an autoclave for an hour. Two mice were each given a ½-ml. interperitoneal injection of the sterilized waste, one guinea pig was given 2 ml. of sterilized waste interperitoneally, and one rabbit was given an intravenous injection of 15 ml. All results were negative and the animals showed no ill effects from the different injections. It was concluded, therefore, that the waste apparently was not toxic.

V. NITROGLYCERINE WASTES

By RUSSELL S. SMITH, *Public Health Engineer, United States Public Health Service, Stream Pollution Investigations, Cincinnati, Ohio*

This is the fifth and last of a series of five reports on the liquid wastes resulting from the manufacture of munitions of various types. Nitroglycerine is not used to a great extent in munitions work and the wastes from its manufacture are but a minor problem when considering munitions wastes as a whole. However, some of this product is being manufactured for incorporation into military explosives of certain types and it was considered advisable to obtain data on the wastes when the opportunity occurred. The data presented in this report are based on a survey of a single plant of moderate size.

DESCRIPTION OF PROCESS

The manufacture of nitroglycerine consists simply of nitrating commercial glycerine with a mixture of nitric and sulfuric acids. As in other nitrating processes, the sulfuric acid serves to absorb the

water formed by the reaction between the glycerine and the nitric acid and thus prevents the dilution of the nitric acid. When the reaction is completed, the charge in the nitrator is run off into a separating tank and allowed to stand until the nitroglycerine (a heavy oily liquid) has separated by flotation from the acid. After separation, the nitroglycerine is drawn off to washing tanks where it is repeatedly washed with small amounts of water, compressed air being frequently used for mixing. It is then washed with a weak solution of sodium carbonate to neutralize any acid that may not have been removed by the wash water. This neutralization is followed by washings with clear water until the alkali has been entirely removed. After washing, the nitroglycerine is placed in a lead lined storage tank to allow the water to separate and the nitroglycerine is withdrawn as a clear yellow oil ready for use.

FLOW MEASUREMENTS AND SAMPLING

A single 12″ sewer carried all the wastes from the plant. The sewer was carried as a closed tile pipe through the manholes and was laid on a steep grade. This made it inadvisable to install a weir, so an opening large enough to make it possible to take samples was made in the top of the pipe in one of the manholes. The depth of flow in the pipe was measured through this opening and flows were calculated by the Chezy formula for flows in open channels, using the Kutter formula to determine the coefficient of flow.

Samples were taken every 90 minutes over 24 hours every other day for a period of 2 weeks. These individual samples were composited in accordance with the flow measurements into 24-hour samples and all analyses were made on these composite samples.

ANALYTICAL DETERMINATIONS

The following determinations were made on the wastes from the manufacture of nitroglycerine: color; odor; pH; acidity, both methyl red and phenolphthalein; alkalinity; total solids, volatile and ash; suspended solids, volatile and ash; nitrite and nitrate nitrogen; soap hardness; oxygen consumed; and 5-day biochemical oxygen demand (B. O. D.)

All analyses, with the following exceptions, were made in accordance with the procedures given in "Standard Methods of Analysis for Water and Sewage, Eighth Edition." Color was determined by use of a standard comparator using glass standards based on the cobalt scale. Sulfates were determined gravimetrically by precipitation with barium chloride. Oxygen consumed was determined by digestion with potassium dichromate instead of permanganate.

RESULTS AND DISCUSSION

Table 1 gives the analytical results of the 24-hour composite samples. These results, particularly the acidity, would indicate offhand very erratic operation of the plant. However, data on the daily use of raw materials and daily production (not quoted) show that the plant was in remarkably uniform operation. The only explanation that can be given for the extreme variation from day to day in the analytical results is that the sampling interval inadvertently approximated very closely a multiple of the normal plant operating cycle. Such approximation would lead to taking samples from nearly the same point in

TABLE 1.—*Analytical results*

Sample day	Relative flow [1]	pH	Color	Odor concentration	p. p. m.											
					Acidity		Alkalinity	SO_4	Nitrogen		Total solids		Suspended solids		5-day B. O. D.	Oxygen consumed	Soap hardness
					Methyl red	Phenolphthalein			NO_3	NO_2	Volatile	Ash	Volatile	Ash			
1	90	6.0	20	4	----	------	43	37	5.0	140	195	401	6	4	4.5	Trace	38
2	104	>9.6	50	1	----	------	385	61	9.0	110	633	147	5	7	6.3	8.4	28
3	103	>9.6	45	1	----	------	407	32	17.0	80	200	750	3	1	7.6	16.6	21
4	90	1.7	15	4	774	834	----	22	6.0	180	260	496	9	5	7.3	65.4	96
5	92	6.3	----	1	----	------	131	63	11.0	300	497	437	4	8	25.5	38.4	47
6	102	>9.6	60	1	----	------	449	81	8.0	200	250	920	12	20	11.5	25.2	22
7	99	>9.6	38	1	----	------	236	32	8.0	160	284	318	2	4	4.7	34.4	30
8	109	<1.6	28	1	936	1,050	----	253	7.0	700	357	377	6	23	4.2	57.4	168
9	111	2.1	8	2	257	300	----	116	4.0	260	370	420	3	0	3.7	47.8	97
Average	100	------	32	1.8	218	242	184	77	8.3	237	338	474	6	8	8.4	32.4	61
Maximum	111	>9.6	60	4	936	1,050	449	253	17.0	700	633	750	12	23	25.5	65.4	168
Minimum	90	<1.6	8	1	0	0	0	22	4.0	80	195	147	2	0	3.7	Trace	21

[1] Percent of average.

the operating cycle over the 24 hours. Examination of the daily results, however, would seem to indicate that during the nine sampling days, the sampling time was fairly well distributed over the manufacturing cycle and that the average results should be reasonably reliable.

Table 2 shows the quantities of waste products that were found per 1,000 pounds of nitroglycerine manufactured.

Examination of the results obtained from the survey at this one plant would indicate that, except for the intermittent acidity, the waste from nitroglycerine manufacture would not cause serious difficulty in the receiving stream. Organic matter is low, the 5-day B. O. D. being generally lower than that of the effluent from a municipal sewage treatment plant with secondary treatment. Sulfates and soap hardness may be slightly high, but should not cause any serious difficulty. The nitrate nitrogen content might cause increased algal growth but is not as high as that from a smokeless powder plant. It

would seem that neutralization of the acid would be the only treatment required. This neutralization would be greatly aided by an adequate balancing pond ahead of the neutralization plant to prevent the passage of sudden flushes of strongly acid waste through the plant without adequate neutralization. In many cases such a balancing pond, if of sufficient size, would be all the treatment needed.

TABLE 2.—*Waste quantities per 1,000 lbs. of explosive*

Sample day	1	2	3	4	5	6	7	8	9	Average
Flow.....million gallons..	0.020	0.029	0.029	0.026	0.026	0.029	0.028	0.031	0.031	0.0276
Free mineral acid as H_2SO_4 pounds..	0	0	0	165	0	0	0	240	67	51.0
Alkalinity as $CaCO_3$..do....	7	95	143	0	28	108	55	0	0	47.4
Sulfates.....do....	6	15	11	5	14	20	7	65	30	18.9
NO_2 nitrogen.....do....	0.8	2.2	6.0	1.3	2.4	1.9	1.9	1.8	1.0	2.11
NO_3 nitrogen.....do....	23.8	27.0	28.1	38.3	65.4	48.2	37.3	180	68.0	57.4
Total solids:										
Volatile.....do....	33	155	70	55	108	60	66	92	97	80.7
Ash.....do....	68	36	264	105	95	222	74	97	109	117.5
Suspended solids:										
Volatile.....do....	1.0	1.2	1.1	1.9	0.9	2.9	0.7	1.5	0.8	1.30
Ash.....do....	0.7	1.7	0.4	1.1	1.7	4.8	0.9	5.9	0	1.88
Oxygen consumed....do....	0	2.1	5.8	13.9	7.9	6.1	8.0	14.7	12.5	7.70
5-day B. O. D.....do....	0.8	1.5	2.7	1.6	5.6	2.8	1.1	1.1	1.0	1.97
Population equivalent (B. O. D.).....	4.5	9.1	15.7	9.1	32.6	16.3	6.5	6.4	5.7	11.58
Total hardness as $CaCO_3$ pounds..	6	7	7	20	10	5	7	43	25	14.4

PREVALENCE OF POLIOMYELITIS

During the first half of the current year, a total of 1,084 cases of poliomyelitis was reported in the United States, of which more than 58 percent occurred in three States—California (350), Texas (240), and Arizona (46). The next highest figure (37) was for New York State.

In California an unusual incidence was noted from the first of the year, especially in Los Angeles County, and has continued to date. During the latter part of the second quarter of the year, rather sharp increases were reported in Kern and Fresno Counties, and, during the third quarter, in the San Francisco and the north central areas, including Santa Clara, Contra Costa, San Francisco, Sonoma, Solano, and Calaveras Counties.

In Arizona the first reported cases occurred in Pinal, Maricopa, and Yuma Counties. Up to the end of May, 31 cases had been reported in these three counties, and they were the only counties in the State which had reported cases. During June, 1 case each was reported in three additional counties, Yavapai, Gila, and Greenlee.

In Texas from 4 to 9 cases were reported weekly during January, but the incidence declined during February, March, and April. It began to increase again in June, and by the end of July about 100 cases were being reported weekly in the State. The earliest cases (reported during January), and the highest incidence up to the end

of May, occurred in Bexar County. One or two cases were reported in a few other (36) scattering counties up to the end of May. During June a rapidly increasing incidence began to be reported in Harris, Dallas, Tarrant, Galveston, and Lamar Counties. These counties have reported the largest numbers of cases to date.

During the first part of July, the incidence of the disease increased rapidly in Oklahoma and continued an upward trend in both California and Texas. In the last week of July, a sharp rise in the numbers of cases was reported in Kansas, and during August increases were noted in Colorado, Utah, Washington, Missouri, Kentucky, Nebraska, Iowa, Illinois, Connecticut, Rhode Island, and Massachusetts. The accompanying table shows the cases reported, by States, from January to July 3, and by weeks from July 3 to September 11. The South Atlantic States, most of the East South Central States, the northern New England States, and the three northern Mountain States have been comparatively free from the disease to date.

Poliomyelitis cases reported, by States, January–September 11, 1943

Division and State	Cases reported											Total, January–September 11	
		Week ended—										Number of cases	Case rate per 100,000 population (annual basis)
	January–July 3	July				August				September			
		10	17	24	31	7	14	21	28	4	11		
New England States:													
Maine	4	-----	2	-----	-----	-----	-----	-----	2	1	2	11	2.0
New Hampshire	1	-----	-----	-----	-----	-----	-----	-----	-----	1	-----	2	0.6
Vermont	1	-----	-----	-----	2	2	-----	-----	1	-----	3	9	4.0
Massachusetts	17	-----	-----	-----	1	-----	1	7	8	20	23	77	2.7
Rhode Island	4	-----	1	1	1	6	8	8	12	11	10	62	12.8
Connecticut	4	1	3	2	7	24	27	47	39	44	25	223	18.4
Middle Atlantic States:													
New York	37	5	11	10	10	18	30	42	42	58	68	331	3.7
New Jersey	10	1	-----	-----	3	1	5	-----	6	9	7	42	1.5
Pennsylvania	17	-----	3	2	-----	1	3	4	9	5	8	52	0.8
East North Central States:													
Ohio	14	3	-----	2	5	6	1	14	11	18	20	94	2.0
Indiana	8	-----	-----	1	2	1	3	1	19	3	16	54	2.3
Illinois	14	5	2	7	6	34	70	117	194	192	189	830	15.7
Michigan	12	-----	2	1	8	4	4	11	9	18	34	103	2.8
Wisconsin	11	-----	-----	1	-----	1	1	1	8	18	14	55	2.7
West North Central States:													
Minnesota	5	2	2	-----	2	6	5	14	10	11	14	71	4.0
Iowa	6	1	2	-----	-----	1	5	8	13	33	23	92	5.8
Missouri	12	-----	4	4	8	7	11	14	24	30	21	135	5.5
North Dakota	0	1	-----	-----	-----	-----	2	1	1	2	-----	7	1.9
South Dakota	3	-----	-----	-----	-----	1	-----	-----	-----	-----	3	7	1.8
Nebraska	8	-----	-----	1	-----	3	5	5	17	17	30	86	10.4
Kansas	17	5	7	7	30	43	89	76	66	90	47	477	40.5
South Atlantic States:													
Delaware	0	-----	-----	-----	-----	-----	-----	-----	-----	3	1	4	2.1
Maryland	0	-----	1	1	1	-----	-----	-----	1	-----	-----	4	0.3
District of Columbia	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	4	0.7
Virginia	16	1	1	2	3	2	3	4	1	-----	3	36	1.9
West Virginia	7	-----	-----	-----	1	-----	2	1	4	-----	1	16	1.3
North Carolina	9	-----	1	3	1	2	3	1	1	3	2	26	1.1
South Carolina	7	-----	-----	2	-----	-----	-----	1	2	1	-----	13	1.0
Georgia	6	-----	1	1	1	1	-----	-----	1	1	1	13	0.6
Florida	12	-----	2	-----	-----	-----	-----	-----	-----	-----	-----	14	1.0

Poliomyelitis cases reported, by States, January–September 11, 1943—Continued

Division and State	Cases reported											Total, January–September 11	
		Week ended—											
		July				August				September		Number of cases	Case rate per 100,000 population (annual basis)
	January–July 3	10	17	24	31	7	14	21	28	4	11		
East South Central States:													
Kentucky	22	2	----	----	11	8	3	22	16	10	8	102	5.7
Tennessee	7	3	----	----	----	----	1	2	----	2	2	17	0.9
Alabama	15	1	3	----	2	1	1	2	3	----	2	30	1.6
Mississippi	16	----	2	----	1	2	----	3	1	2	----	27	1.9
West South Central States:													
Arkansas	20	3	7	6	6	4	5	8	4	1	1	65	5.2
Louisiana	10	----	----	10	----	4	7	6	2	1	3	43	2.7
Oklahoma	33	44	39	42	30	52	40	38	36	17	36	407	28.0
Texas	240	90	102	96	105	62	67	52	75	62	50	1,001	22.9
Mountain States:													
Montana	0	----	----	----	----	----	----	----	----	9	----	9	2.8
Idaho	2	----	----	----	----	----	----	1	----	----	2	5	1.5
Wyoming	2	----	----	----	----	----	----	----	1	5	3	11	7.0
Colorado	7	1	1	5	----	15	7	20	21	20	35	132	18.1
New Mexico	8	----	1	2	1	5	5	1	4	12	3	42	12.4
Arizona	46	----	3	4	----	1	2	5	8	1	7	77	19.4
Utah	14	----	2	----	3	6	9	16	13	76	40	179	44.4
Nevada	1	1	2	----	----	2	----	----	----	----	3	9	9.8
Pacific States:													
Washington	20	----	----	2	2	5	13	20	25	19	7	113	8.9
Oregon	7	----	----	3	4	8	13	11	24	16	26	112	14.2
California	350	75	90	111	104	111	94	163	138	114	111	1,461	28.6
Total	1,084	245	297	329	361	450	545	747	872	956	906	6,792	----
Total to date	1,084	1,329	1,626	1,955	2,316	2,766	3,311	4,058	4,930	5,886	6,792	6,792	7.7

A total of 6,792 cases of poliomyelitis has been reported in the United States this year up to September 11. The following table shows the numbers of cases reported for the corresponding period and for the entire year for the years 1934–42, together with the percentage of the total cases that occurred in the 36-week period and the date of the peak week of the year:

Cases of poliomyelitis reported in the United States 1934–42 [1]

Year	First 36 weeks of year (approximately January–Sept. 11)	Total, 52 weeks [2]	Percent reported during first 36 weeks	Date of peak week of year
1934	4,980	7,274	68	June 23.
1935	6,424	10,732	60	August 31.
1936	1,822	4,494	41	October 3.
1937	5,512	9,451	58	September 18.
1938	1,162	1,709	68	August 27.
1939	3,445	7,288	47	September 16.
1940	4,059	9,769	42	September 14.
1941	4,611	9,056	51	August 30.
1942	2,169	4,193	52	September 12.

[1] Figures are totals of weekly telegraphic reports received from the State health officers and are slightly less in most instances than those published in the annual summaries, which are based on final reports.
[2] For case rates by geographic divisions, 1934–42, see Public Health Reports for July 16, 1943, p. 1110.

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 SEPTEMBER 11, 1943

Summary

The incidence of poliomyelitis declined slightly during the week. A total of 906 cases was reported, as compared with 956 for the preceding week and 436 for the 5-year (1938–42) median. States reporting the largest numbers (last week's figures in parentheses) are as follows: *Increases*—Massachusetts 23 (20), New York 68 (58), Ohio 20 (18), Michigan 34 (18), Nebraska 30 (17) Oklahoma 36 (17), Colorado 35 (20), and Oregon 26 (16); *decreases*—Connecticut 25 (44), Illinois 189 (192), Iowa 23 (33), Kansas 47 (90), Texas 50 (62), Utah 40 (76, delayed reports included), and California 111 (114). The cumulative total for the first 36 weeks of the year is 6,792, as compared with 2,169 for the same period of 1942 and a 5-year median of 3,445. (See also p. 1412.)

A total of 173 cases of meningococcus meningitis was reported, as compared with 151 last week and a 5-year median of 36. States reporting the largest numbers (last week's figures in parentheses) are as follows: New York 23 (19), California 17 (14), Massachusetts 13 (4), Pennsylvania 13 (14). No other State reported more than 9 cases. The cumulative total for the first 36 weeks of the year is 14,018, as compared with 2,541 for the same period last year and a 5-year median of 1,514.

Cumulative totals for the first 36 weeks of the year for other diseases included in the following table (corresponding figures for last year in parentheses) are as follows: Anthrax 47 (61), diphtheria 8,010 (8,192), dysentery, all forms, 15,683 (11,967), infectious encephalitis 503 (377), influenza 83,394 (82,365), leprosy 19 (35), measles 540,027 (468,385), Rocky Mountain spotted fever 391 (406), scarlet fever 100,121 (91,272), smallpox 618 (625), tularemia 625 (691), typhoid and paratyphoid fever 3,849 (4,700), endemic typhus fever 2,628 (2,232), whooping cough 139,920 (130,991).

A total of 6,985 deaths was recorded in 89 large cities of the United States for the current week, as compared with 7,195 last week and a 3-year (1940–42) average of 6,796. The cumulative total for the first 36 weeks of the year is 305,119, as compared with 278,612 for the comparable period last year.

Telegraphic morbidity reports from State health officers for the week ended September 11, 1943, and comparison with corresponding week of 1942 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 1938–42	Week ended		Median 1938–42	Week ended		Median 1938–42	Week ended		Median 1938–42
	Sept. 11, 1943	Sept. 12, 1942		Sept. 11, 1943	Sept. 12, 1942		Sept. 11, 1943	Sept. 12, 1942		Sept. 11, 1943	Sept. 12, 1942	
NEW ENGLAND												
Maine	1	1	1				7	4	4	1	1	0
New Hampshire	0	0	0				0	4	0	0	0	0
Vermont	3	0	0				7	4	4	0	0	0
Massachusetts	1	3	2				52	41	31	13	2	1
Rhode Island	0	1	0				10	5	1	2	1	0
Connecticut	1	1	0	2	1		11	5	5	3	1	0
MIDDLE ATLANTIC												
New York	8	5	8		[1]2	[1]1	73	21	71	23	6	3
New Jersey	3	3	3	1	7	5	77	20	20	9	4	1
Pennsylvania	5	3	10		1		22	36	33	13	4	4
EAST NORTH CENTRAL												
Ohio	11	3	10	2	6	6	22	12	12	5	0	1
Indiana	4	6	6	1		8	18	8	5	3	0	0
Illinois	7	14	14	3	4	3	33	9	21	9	2	2
Michigan [2]	2	3	3	1	2		93	23	13	8	0	0
Wisconsin	0	0	1	10	17	15	90	54	53	5	0	0
WEST NORTH CENTRAL												
Minnesota	3	0	5		1	1	54	9	9	1	0	0
Iowa	4	3	3		1	1	3	4	4	5	0	0
Missouri	9	3	4	1		1	5	9	6	6	1	0
North Dakota	2	0	1	1		1	3	0	1	1	0	0
South Dakota	1	4	2		1		1	2	2	1	3	0
Nebraska	3	4	0	3	1		5	15	1	0	0	0
Kansas	3	2	3	4	3	1	3	3	3	1	0	0
SOUTH ATLANTIC												
Delaware	0	0	0				3	1	1	0	0	0
Maryland [2]	1	1	1		2	1	16	9	5	2	4	1
District of Columbia	0	3	1	1			4	4	2	2	1	0
Virginia	12	22	22	65	138	77	36	8	8	4	2	2
West Virginia	8	16	7		2	5	11	1	1	2	1	1
North Carolina	34	38	38		4	1	10	10	10	1	1	1
South Carolina	15	25	30	142	227	179	11	10	10	1	2	0
Georgia	19	31	31	1	11	14	6	0	1	1	2	1
Florida	6	2	8	2		1	4	10	4	0	0	0
EAST SOUTH CENTRAL												
Kentucky	4	5	9	2		1	4	20	6	1	0	1
Tennessee	14	12	16	6	3	11	4	17	17	6	2	1
Alabama	49	17	33	9	24	24	23	3	3	3	1	1
Mississippi [2]	10	8	18							5	0	1
WEST SOUTH CENTRAL												
Arkansas	7	13	15	3	5	4	3	5	5	1	0	0
Louisiana	5	4	4	6	5	1	2	2	2	4	1	0
Oklahoma	2	6	6	2	19	19	0	6	6	2	0	0
Texas	18	32	32	273	143	101	25	2	15	2	1	1
MOUNTAIN												
Montana	3	0	0		1	4	13	2	2	1	0	0
Idaho	0	0	0	1			0	0	0	0	0	0
Wyoming	0	0	0		15		14	5	3	0	1	0
Colorado	18	8	8	4	19	10	2	5	9	3	0	1
New Mexico	0	2	4		1		1	0	0	0	0	0
Arizona	0	1	1	21	27	14	2	1	3	3	0	0
Utah [2]	0	0	0		3	2	1	15	9	0	0	0
Nevada	0	0					6	0		0	0	
PACIFIC												
Washington	3	5	1				5	35	8	1	0	0
Oregon	3	1	1		2	3	31	21	7	2	1	0
California	12	10	10	14	9	9	55	47	47	17	1	0
Total	314	321	360	581	707	511	881	527	527	173	46	36
36 weeks	8,010	8,192	9,458	83,394	82,365	152,791	540,027	468,385	468,385	14,018	2,541	1,514

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended September 11, 1943, and comparison with corresponding week of 1942 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever [3]		
	Week ended		Median 1938–42	Week ended		Median 1938–42	Week ended		Median 1938–42	Week ended		Median 1938–42
	Sept. 11, 1943	Sept. 12, 1942		Sept. 11, 1943	Sept. 12, 1942		Sept. 11, 1943	Sept. 12, 1942		Sept. 11, 1943	Sept. 12, 1942	
NEW ENGLAND												
Maine	2	4	2	4	8	1	0	0	0	0	1	1
New Hampshire	0	0	0	2	3	1	0	0	0	0	0	0
Vermont	3	4	0	3	2	2	0	0	0	1	2	0
Massachusetts	23	1	3	58	58	23	0	0	0	7	2	2
Rhode Island	10	1	0	4	1	1	0	0	0	1	1	0
Connecticut	25	5	4	15	13	8	0	0	0	1	0	1
MIDDLE ATLANTIC												
New York	68	29	29	51	59	59	0	0	0	2	16	17
New Jersey	7	22	22	13	26	26	0	0	0	3	6	6
Pennsylvania	8	7	11	35	47	47	0	0	0	12	15	22
EAST NORTH CENTRAL												
Ohio	20	13	17	65	41	52	0	0	0	7	6	22
Indiana	16	11	4	15	16	16	0	0	0	4	5	9
Illinois	189	44	21	56	39	72	0	0	0	8	9	17
Michigan [3]	34	10	10	31	32	47	0	0	0	7	0	6
Wisconsin	14	1	5	44	38	46	0	0	0	1	1	2
WEST NORTH CENTRAL												
Minnesota	14	3	12	18	15	20	0	0	0	0	0	0
Iowa	23	8	3	15	11	13	0	6	0	1	2	3
Missouri	21	8	1	7	28	19	0	0	0	7	8	9
North Dakota	0	1	1	0	4	4	0	0	0	0	1	1
South Dakota	3	0	0	5	9	4	0	1	0	0	0	0
Nebraska	30	8	1	12	4	4	0	0	0	0	0	0
Kansas	47	4	4	21	14	30	0	1	0	2	2	5
SOUTH ATLANTIC												
Delaware	1	0	0	2	1	1	0	0	0	1	2	2
Maryland [3]	0	2	2	8	9	13	0	0	0	0	2	5
District of Columbia	2	0	2	1	6	3	0	0	0	1	0	1
Virginia	3	9	9	28	22	18	0	0	0	10	11	16
West Virginia	1	3	2	32	32	19	0	0	0	9	4	9
North Carolina	[4] 2	7	7	52	43	34	0	0	0	2	4	9
South Carolina	0	3	3	5	16	12	0	0	0	6	8	18
Georgia	1	3	2	12	23	16	0	0	0	5	1	15
Florida	0	0	0	2	1	4	0	0	0	1	1	1
EAST SOUTH CENTRAL												
Kentucky	8	6	6	10	21	23	0	0	0	11	11	27
Tennessee	2	13	3	28	49	28	2	0	0	9	18	27
Alabama	2	1	2	14	32	16	0	0	0	0	1	12
Mississippi [3]	0	4	1	6	11	9	0	0	0	12	2	7
WEST SOUTH CENTRAL												
Arkansas	1	6	1	0	3	4	0	0	0	3	6	24
Louisiana	3	5	2	5	3	3	0	0	0	24	11	12
Oklahoma	36	1	1	0	19	11	0	0	0	17	5	28
Texas	50	6	4	20	10	20	0	1	0	10	21	40
MOUNTAIN												
Montana	0	0	0	6	9	4	0	0	0	0	2	2
Idaho	2	0	0	3	2	2	0	0	0	0	1	2
Wyoming	3	0	0	3	1	1	0	0	0	0	0	0
Colorado	35	0	3	14	8	8	0	0	0	2	1	6
New Mexico	3	1	1	2	1	1	0	0	0	2	2	5
Arizona	7	2	0	3	0	1	0	0	0	4	2	3
Utah [3]	40	0	0	7	3	4	0	0	0	0	0	0
Nevada	3	0	------	2	0	------	0	0	0	0	2	------
PACIFIC												
Washington	7	1	1	17	7	10	0	1	0	1	6	2
Oregon	26	0	4	6	4	4	0	0	0	2	0	2
California	111	10	10	42	29	42	0	0	0	3	1	7
Total	906	267	436	804	830	830	2	4	4	194	202	463
36 weeks	[4] 6,792	2,169	3,445	100,111	91,272	118,940	618	625	1,988	3,849	4,700	6,247

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended September 11, 1943, and comparison with corresponding week of 1942 and 5-year median—Con.

Division and State	Whooping cough			Week ended Sept. 11, 1943								
	Week ended		Median 1938–42	Anthrax	Dysentery			Encephalitis, infectious	Leprosy	Rocky Mt. spotted fever	Tularemia	Typhus fever
	Sept. 11, 1943	Sept. 12, 1942			Amebic	Bacillary	Unspecified					
NEW ENGLAND												
Maine	16	40	26	0	0	0	0	0	0	0	0	0
New Hampshire	0	1	0	0	0	0	0	0	0	0	0	0
Vermont	16	46	20	0	0	0	0	0	0	0	0	0
Massachusetts	53	201	81	0	0	5	0	1	0	0	0	0
Rhode Island	38	4	6	0	0	0	0	0	0	0	0	0
Connecticut	34	69	52	0	0	5	0	0	0	0	0	0
MIDDLE ATLANTIC												
New York	204	325	316	1	5	164	0	2	0	0	0	0
New Jersey	115	197	157	1	0	0	0	1	0	2	0	0
Pennsylvania	128	247	250	1	0	0	0	0	0	0	0	0
EAST NORTH CENTRAL												
Ohio	117	160	167	0	0	1	0	0	0	0	0	0
Indiana	68	56	26	0	0	0	0	0	0	1	0	0
Illinois	171	385	231	0	0	2	0	3	0	0	1	0
Michigan [2]	209	226	190	0	0	10	0	0	0	0	0	0
Wisconsin	184	194	194	0	0	0	0	0	0	0	1	0
WEST NORTH CENTRAL												
Minnesota	52	48	48	0	2	0	0	0	0	0	0	0
Iowa	35	19	19	0	0	0	0	0	0	0	0	0
Missouri	14	14	24	0	0	0	3	1	0	0	1	0
North Dakota	79	6	15	0	0	0	0	0	0	0	0	0
South Dakota	4	4	4	0	0	0	0	0	0	0	0	0
Nebraska	15	15	8	0	0	0	0	0	0	0	0	0
Kansas	20	14	33	0	0	0	0	1	0	0	0	0
SOUTH ATLANTIC												
Delaware	2	0	5	0	0	0	0	0	0	0	0	0
Maryland [3]	71	43	43	0	0	0	12	0	0	0	0	0
District of Columbia	9	26	11	0	0	0	0	0	0	0	0	0
Virginia	119	24	39	0	0	0	340	0	0	3	1	0
West Virginia	28	3	11	0	0	0	0	0	0	0	0	0
North Carolina	80	66	109	0	0	1	0	0	0	0	0	2
South Carolina	63	31	36	0	0	18	0	0	0	0	0	5
Georgia	19	33	26	0	0	3	2	0	0	0	1	64
Florida	21	2	2	0	12	1	1	0	0	0	0	8
EAST SOUTH CENTRAL												
Kentucky	40	29	41	0	0	0	0	0	0	0	1	0
Tennessee	34	63	35	0	0	0	5	0	0	0	2	5
Alabama	1	40	14	0	0	0	0	0	0	0	0	14
Mississippi [2]	----	----	----	0	0	0	0	0	0	0	1	3
WEST SOUTH CENTRAL												
Arkansas	14	14	14	0	1	5	0	0	0	0	2	0
Louisiana	1	4	4	0	0	12	0	0	0	0	0	8
Oklahoma	9	4	8	0	0	0	0	0	0	0	0	0
Texas	134	88	88	0	35	218	0	0	0	0	0	49
MOUNTAIN												
Montana	7	20	10	0	0	0	0	0	0	0	0	0
Idaho	4	3	3	0	0	0	0	0	0	0	0	0
Wyoming	3	6	5	0	0	0	0	0	0	1	1	0
Colorado	61	10	23	0	0	22	0	0	0	1	0	0
New Mexico	11	6	6	0	0	7	1	0	0	0	0	0
Arizona	3	3	4	0	1	0	26	0	0	0	0	0
Utah [2]	50	10	24	0	0	0	0	0	0	0	0	0
Nevada	1	4	----	0	0	0	0	0	0	0	2	0
PACIFIC												
Washington	23	25	25	0	0	2	0	1	0	0	0	0
Oregon	39	6	20	0	0	0	0	0	0	0	0	0
California	72	114	116	0	4	6	0	18	0	0	0	1
Total	2,491	2,948	2,948	3	60	482	390	28	0	8	14	159
36 weeks	139,920	130,991	134,239	47	1,495	11,578	610	503	19	391	625	2,628
36 weeks, 1942	----	----	----	61	764	6,310	4,893	377	35	406	691	2,232

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

[3] Including paratyphoid fever cases reported separately as follows: Michigan, 1; Massachusetts, 7; New Mexico, 1; South Carolina, 3; Texas, 1; California, 1.

[4] Late information shows 3 cases in North Carolina for week ended Aug. 14, 1943, instead of 4 as previously reported.

WEEKLY REPORTS FROM CITIES

City reports for week ended August 28, 1943

This table lists the reports from 87 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								
NEW ENGLAND												
Maine:												
Portland	0	0	------	0	0	2	2	0	2	0	0	1
New Hampshire:												
Concord	0	0	------	0	0	0	1	0	2	0	1	0
Vermont:												
Barre	0	0	------	0	0	0	0	0	0	0	0	0
Massachusetts:												
Boston	0	0	------	0	6	2	6	4	17	0	0	24
Fall River	0	0	------	0	1	0	0	1	2	0	0	0
Springfield	0	0	------	0	3	0	0	1	1	0	0	0
Worcester	0	0	------	0	0	0	2	0	4	0	0	2
Rhode Island:												
Providence	0	0	1	0	7	1	2	5	1	0	0	7
Connecticut:												
Bridgeport	0	0	------	0	0	0	0	1	1	0	1	0
Hartford	0	0	------	0	1	2	1	1	1	0	0	3
New Haven	0	0	------	0	0	0	0	17	1	0	1	6
MIDDLE ATLANTIC												
New York:												
Buffalo	0	0	------	0	0	3	2	6	1	0	0	9
New York	8	0	------	0	60	12	38	22	25	0	4	96
Rochester	0	0	------	0	1	1	5	1	1	0	0	11
Syracuse	0	0	------	0	1	0	3	0	2	0	0	17
New Jersey:												
Camden	1	0	------	0	0	0	0	0	0	0	0	2
Newark	0	0	------	1	7	0	4	0	2	0	1	30
Trenton	0	0	1	0	0	0	1	0	0	0	0	0
Pennsylvania:												
Philadelphia	2	0	2	0	1	10	13	1	10	0	0	93
Pittsburgh	4	1	------	0	7	1	11	1	3	0	2	12
Reading	0	0	------	0	1	0	0	0	0	0	1	10
EAST NORTH CENTRAL												
Ohio:												
Cincinnati	1	0	------	1	1	0	3	0	1	0	0	5
Cleveland	1	0	2	1	0	2	3	3	13	0	0	40
Columbus	1	0	1	1	2	0	0	0	5	0	0	3
Indiana:												
Fort Wayne	0	0	------	0	0	0	0	0	0	0	0	0
Indianapolis	0	0	------	0	0	1	0	0	0	0	0	19
South Bend	0	0	------	0	2	0	0	0	0	0	0	0
Terre Haute	0	0	------	0	0	0	0	0	0	0	1	0
Illinois:												
Chicago	1	0	------	0	12	8	17	136	13	0	3	80
Springfield	0	0	------	0	0	1	0	0	1	0	0	0
Michigan:												
Detroit	1	0	------	0	14	5	11	0	0	0	0	47
Flint	0	0	------	0	0	0	0	0	1	0	0	2
Grand Rapids	0	0	------	0	6	0	0	0	0	0	0	13
Wisconsin:												
Kenosha	0	0	------	0	0	0	0	0	1	0	0	0
Milwaukee	0	0	------	0	5	2	2	0	2	0	0	89
Racine	0	0	------	0	1	0	0	0	1	0	0	8
Superior	0	0	------	0	17	0	0	0	0	0	0	6
WEST NORTH CENTRAL												
Minnesota:												
Duluth	0	0	------	0	6	0	0	1	0	0	0	9
Minneapolis	0	0	------	0	3	0	3	6	8	0	1	1
St. Paul	0	0	------	0	3	0	4	2	1	0	0	19
Missouri:												
Kansas City	0	0	------	0	3	2	5	11	6	0	0	8
St. Louis	0	0	1	0	2	1	7	2	9	0	0	17

City reports for week ended August 28, 1943—Continued

	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								
WEST NORTH CENRAL—continued												
North Dakota:												
Fargo	0	0	------	0	4	0	0	1	0	0	0	1
Nebraska:												
Omaha	4	0	------	0	0	0	0	8	0	0	0	1
Kansas:												
Topeka	0	0	------	0	1	0	0	2	3	0	0	3
Wichita	0	0	------	0	0	0	1	3	2	0	0	5
						0						
SOUTH ATLANTIC												
Delaware:												
Wilmington	0	1	------	0	0	0	0	0	1	0	0	5
Maryland:												
Baltimore	1	0	1	0	3	2	7	1	9	0	1	71
Cumberland	0	0	------	0	0	0	0	0	0	0	0	0
Frederick	0	0	------	0	0	0	0	0	0	0	0	0
District of Columbia:												
Washington	0	0	------	1	6	0	3	0	3	0	0	26
Virginia:												
Lynchburg	0	0	------	0	11	0	1	0	2	0	0	6
Richmond	0	0	------	0	0	0	0	1	1	0	0	1
Roanoke	0	0	------	0	0	0	0	0	0	0	0	0
West Virginia:												
Wheeling	0	0	------	0	0	0	1	0	1	0	0	12
North Carolina:												
Raleigh	0	0	------	0	0	0	0	0	0	0	0	0
Winston-Salem	1	0	------	0	0	0	2	0	3	0	0	9
South Carolina:												
Charleston	1	0	2	0	1	0	1	0	0	0	0	0
Georgia:												
Atlanta	1	0	------	0	0	0	1	0	4	0	1	0
Brunswick	0	0	------	0	0	0	1	0	0	0	0	0
Savannah	0	0	------	0	0	1	2	0	1	0	0	0
Florida:												
Tampa	0	0	1	1	0	1	1	0	0	0	0	0
EAST SOUTH CENTRAL												
Tennessee:												
Memphis	0	0	------	0	0	0	1	0	4	0	0	11
Nashville	0	0	------	0	1	0	0	0	1	0	0	7
Alabama:												
Birmingham	0	0	1	0	1	2	1	0	2	0	0	4
Mobile	1	0	------	1	0	0	0	0	0	0	0	0
WEST SOUTH CENTRAL												
Arkansas:												
Little Rock	0	0	------	0	0	0	0	0	0	0	0	0
Louisiana:												
New Orleans	0	0	1	1	1	0	4	3	0	0	1	4
Shreveport	0	0	------	0	0	0	3	1	0	0	5	0
Texas:												
Dallas	0	0	------	0	0	0	2	8	1	0	1	8
Galveston	0	0	------	0	0	0	0	0	0	0	1	0
Houston	0	0	------	0	4	0	3	2	0	0	0	6
San Antonio	1	0	1	1	0	0	3	2	1	0	1	0
MOUNTAIN												
Montana:												
Billings	0	0	------	0	2	0	0	0	0	0	0	1
Great Falls	0	0	------	0	2	0	0	0	0	0	0	5
Helena	0	0	------	0	0	0	0	0	0	0	0	0
Missoula	0	0	------	0	0	0	0	0	0	0	0	0
Idaho:												
Boise	0	0	------	0	0	0	0	0	0	0	0	1

City reports for week ended August 28, 1943—Continued

	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								
MOUNTAIN—continued												
Colorado:												
Denver	0	0	1	0	4	0	3	6	1	0	0	22
Pueblo	0	0	------	0	1	0	0	5	3	0	0	6
Utah:												
Salt Lake City	0	0	------	0	2	0	0	3	0	0	0	20
PACIFIC												
Washington:												
Seattle	1	0	------	0	13	0	1	4	0	0	0	14
Spokane	2	0	------	0	2	0	0	1	4	0	0	6
Tacoma	1	0	------	0	1	0	0	0	0	0	0	6
California:												
Los Angeles	3	1	3	0	22	3	4	25	10	0	2	36
Sacramento	3	0	------	0	0	0	0	9	0	0	0	1
San Francisco	0	0	1	0	8	0	10	7	2	0	0	22
Total	40	3	20	8	263	65	202	314	197	0	29	1,014
Corresponding week, 1942	39	5	31	10	124	19	230	62	204	0	32	1,127
Average, 1938–42	51	------	30	[1] 8	[2] 176	------	[1] 206	------	190	2	52	1,224

Dysentery, amebic.—Cases: New York, 1.
Dysentery, bacillary.—Cases: Buffalo, 2; New York, 11; Rochester, 1; Chicago, 1; Detroit, 4; St. Louis, 1; Baltimore, 3; Charleston, S. C., 6; Atlanta, 1; Los Angeles, 6.
Dysentery, unspecified.—Cases: Baltimore, 17; Richmond, 4; San Antonio, 3.
Rocky Mountain spotted fever.—Cases: Pittsburgh, 2.
Typhus fever.—Cases: Charleston, S. C., 7; Atlanta, 1; Brunswick, 2; Savannah, 12; Birmingham, 3; New Orleans, 1; Dallas, 3; Houston, 4; Los Angeles, 2.

[1] 3-year average, 1940–42.
[2] 5-year median.

Rates (annual basis) per 100,000 population, by geographic groups, for the 87 cities in the preceding table (estimated population, 1942, 34,594,100)

	Diphtheria case rates	Encephalitis, infectious, case rates	Influenza		Measles case rates	Meningitis, meningococcus, case rates	Pneumonia death rates	Poliomyelitis case rates	Scarlet fever case rates	Smallpox case rates	Typhoid and paratyphoid fever case rates	Whooping cough case rates
			Case rates	Death rates								
New England	0.0	0.0	2.5	0.0	44.7	17.4	34.8	74.5	79.5	0.0	7.5	107
Middle Atlantic	6.7	0.4	1.3	0.4	34.8	12.0	34.3	13.8	19.6	0.0	3.6	125
East North Central	2.9	0.0	1.8	1.2	35.0	11.1	21.0	81.2	22.2	0.0	2.3	182
West North Central	8.0	0.0	2.0	0.0	44.1	6.0	40.1	72.2	58.1	0.0	2.0	138
South Atlantic	7.0	1.7	7.0	3.5	36.7	7.0	34.9	3.5	43.7	0.0	3.5	227
East South Central	5.9	0.0	5.9	5.9	11.9	11.9	11.9	0.0	41.6	0.0	0.0	131
West South Central	2.9	0.0	5.9	5.9	14.7	0.0	44.0	46.9	5.9	0.0	26.4	53
Mountain	0.0	0.0	8.0	0.0	88.4	0.0	24.1	112.6	32.2	0.0	0.0	442
Pacific	17.5	1.7	7.0	0.0	80.4	5.2	26.2	80.4	28.0	0.0	3.5	149
Total	6.0	0.5	3.0	1.2	39.6	9.8	30.4	47.3	29.7	0.0	4.4	153

PLAGUE INFECTION IN CALIFORNIA, COLORADO, AND MONTANA

Plague infection has been reported proved in pools of fleas, ticks, and tissue from ground squirrels, *C. beecheyi*, and prairie dogs collected in California, Colorado, and Montana as follows:

CALIFORNIA

Kern County.—July 9, in pools of 504 fleas from 48 ground squirrels (3 lots), taken on a ranch at Bear Valley, 6 miles north of California Institution for Women, and 65 lice from 48 ground squirrels from the same location; July 12, 54 fleas from 7 ground squirrels taken on a ranch 1 mile west of Cummings Valley School.

Monterey County.—From a ranch 10 miles south and 14 miles east of Monterey—July 1, a pool of 200 fleas from 35 ground squirrels, 2 pools, each of 175 fleas from 35 ground squirrels, 29 ticks from 35 ground squirrels, and 145 fleas from 35 ground squirrels; July 2, 26 ticks from 29 ground squirrels, 250 fleas from 29 ground squirrels (2 lots); July 13, 2 pools, each of 200 fleas from 16 ground squirrels; from an estate 12 miles south and 12 miles east of Monterey—July 9, 2 pools, each of 175 fleas from 33 ground squirrels, 190 fleas from 33 ground squirrels, 200 fleas from 33 ground squirrels; July 12, 175 fleas from 27 ground squirrels, and 700 fleas from 27 ground squirrels (4 lots); from a ranch at Indian Valley, 11 miles east of Bradley—August 5, a pool of 6 ground squirrels.

COLORADO

Huerfano County.—August 16, 876 fleas from 97 prairie dogs (*Cynomys gunnisoni*) taken at a location 15 miles northwest of Walsenburg, on State Highway No. 69.

MONTANA

Garfield County.—In pools of fleas from prairie dogs (*Cynomys ludovicianus*) collected as follows: August 9, a pool of 50 fleas from 18 prairie dogs taken approximately 15 miles southwest of Jordan; August 10, 82 fleas from 82 prairie dogs taken 35 miles south of Jordan along State Highway No. 22; August 11, 94 fleas from 89 prairie dogs taken approximately 13 miles northwest of Jordan.

TERRITORIES AND POSSESSIONS

Hawaii Territory

Honolulu—Dengue fever.—Information dated September 2, 1943, states that 21 more cases of dengue fever have been reported in the city of Honolulu, T. H., bringing the total number of cases reported to date to 165.

Plague (human).—On August 22, 1943, 1 death from bubonic plague occurred in an 11-year-old female in Honokaa, Hamakua District, Island of Hawaii, T. H. This brings the total deaths from plague in Hamakua District to 5, the 4 previous deaths occurring on March 5, March 28, April 11, and May 3, 1943, respectively.

FOREIGN REPORTS

ANGOLA

Notifiable diseases—April–June 1943.—During the months of April, May, and June 1943, cases of certain notifiable diseases were reported in Angola as follows:

Disease	April		May		June	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Beriberi	12	3	18	2	19	2
Cerebrospinal meningitis	1		1		2	1
Chickenpox	14					
Diphtheria	1		2			
Dysentery (amebic)	159	7	194	7	143	6
Dysentery (bacillary)	10		2		6	2
Gonorrhea	308		231		267	
Grippe, infectious	1,073	14	1,151	23	1,244	17
Hookworm disease	721	4	454	6	419	9
Leprosy	7	1	6		7	
Lethargic encephalitis					2	1
Measles	153	13	172	8	83	3
Mumps	19	2	7		17	
Pneumonia	210	31	170	25	232	34
Poliomyelitis	5				1	
Rabies	1	1				
Relapsing fever	44	7	26		29	1
Scarlet fever			1	1		
Sleeping sickness	197	4	200	12	191	18
Smallpox	2		10		53	
Syphilis	399		468	1	464	2
Tetanus	7	2	1	1		
Trachoma					1	1
Tuberculosis (respiratory)	51	3	62	6	53	10
Typhoid and paratyphoid fever	17		9	1	6	
Whooping cough	370	10	334	24	281	21
Yaws	859		921		930	

CANADA

Provinces—Communicable diseases—Week ended August 14, 1943.—During the week ended August 14, 1943, 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
Chickenpox		7		15	77	3	15	15	19	151
Diphtheria		10	1	15			1		1	28
Dysentery (bacillary)				6						6
Encephalitis, infectious								1	1	2
German measles				1	6		1	7		15
Influenza					20	3			1	24
Measles		11	1	118	154	57	29	62	30	462
Meningitis, meningococcus		1			1					2
Mumps		28		4	51	17	2	23	27	152
Poliomyelitis				1	2		1	2		6
Scarlet fever		12	3	35	29	9	7	11	14	120
Tuberculosis (all forms)	7	2	7	95	42	18	20	4	26	221
Typhoid and paratyphoid fever			11	18	4					33
Undulant fever				12	3				1	16
Whooping cough		1		147	169	13	27	17	17	391

CUBA

Sagua La Grande—Typhoid fever.—According to reports received, typhoid fever has reached epidemic proportions in Sagua La Grande, Cuba. The following table shows the numbers of cases and deaths reported for the 6 weeks ended August 21, 1943:

Week ended—	Cases	Deaths	Week ended—	Cases	Deaths
July 17, 1943	23	2	Aug. 14, 1943	40	3
July 24, 1943	49	1	Aug. 21, 1943	23	3
July 31, 1943	45	7			
Aug. 7, 1943	29	0	Total	209	16

GERMANY

Infectious diseases—Week ended July 31, 1943, and January 1 to July 25, 1943—Comparative.—Cases of certain infectious diseases have been reported in Germany for the week ended July 31, 1943, and for the period January 1 to July 25, 1943, compared with the same period of 1942 as follows:

Disease	Week ended July 31, 1943	January 1–July 25—		Disease	Week ended July 31, 1943	January 1–July 25—	
		1943	1942			1943	1942
Anthrax		7	14	Psittacosis		16	3
Cerebrospinal meningitis	43	1,448	1,660	Ptomaine poisoning	31	526	1,093
Diphtheria	4,005	111,401	107,794	Scarlet fever	7,845	161,327	190,804
Dysentery (infectious)	72	1,440	1,876	Tuberculosis (all forms)	2,863	72,871	68,521
Inflammation of the brain	17	265	212	Typhoid fever	172	6,197	2,488
Koerner's disease	94	3,220	4,174	Weil's disease	1	45	7
Malaria	26	172	222	Whooping cough	2,258	65,981	27,712
Paratyphoid fever	59	2,084	764	Wounds by bites	12	316	367
Poliomyelitis	15	393	456				

SWEDEN

Notifiable diseases—June 1943.—During the month of June 1943, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	5	Poliomyelitis	23
Diphtheria	106	Scarlet fever	2,404
Dysentery	60	Syphilis	82
Encephalitis, epidemic	1	Typhoid fever	6
Gonorrhea	1,572	Undulant fever	3
Hepatitis, epidemic	245	Weil's disease	9
Paratyphoid fever	13		

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 diseases 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

Egypt—Port Said.—Plague has been reported in Port Said, Egypt, as follows: Weeks ended July 24, 1943, 2 cases; July 31, 1 death; August 7, 1 case; August 21, 1 case, 1 death.

French West Africa—Dakar.—For the period August 1–10, 1943, 3 cases of plague with 2 deaths were reported in Dakar, French West Africa.

Yellow Fever

Belgian Congo—Leopoldville Province—Kinzao.—On July 26, 1943, 1 death from yellow fever was reported in Kinzao, Leopoldville Province, Belgian Congo.

DEATHS DURING WEEK ENDED SEPTEMBER 4, 1943

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

	Week ended Sept. 4, 1943	Corresponding week, 1942
Data from 89 large cities of the United States:		
Total deaths	7,812	7,609
Average for 3 prior years	7,472	
Total deaths, first 35 weeks of year	322,451	294,979
Deaths under 1 year of age	594	631
Average for 3 prior years	538	
Deaths under 1 year of age, first 35 weeks of year	23,021	19,877
Data from industrial insurance companies:		
Policies in force	65,792,967	65,002,571
Number of death claims	10,624	10,125
Death claims per 1,000 policies in force, annual rate	8.4	8.1
Death claims per 1,000 policies, first 35 weeks of year, annual rate	9.9	9.3

COURT DECISIONS ON PUBLIC HEALTH

Typhus fever—contraction by bakery employee—liability of employer.—(Georgia Court of Appeals, Division No. 1; *Blair* v. *Fulton Bakery, Inc.*, 24 S.E.2d 598; decided March 6, 1943.) An action was brought against a bakery to recover damages for the alleged negligence of the defendant in failing to furnish the plaintiff with a safe and healthy place in which to work. The plaintiff, after working for about 9 months for the defendant as a baker, contracted typhus fever. Among other things, the plaintiff alleged that after becoming ill he learned that the defendant had contracted with people in the business of exterminating rats to spread rat poison to kill rats that lived and bred in the bakery and that the defendant negligently allowed the rats so killed to remain under some old and unused machinery and pieces of metal. As the proximate result of the defendant's so doing, the plaintiff alleged that he was bitten by fleas from such dead rats and contracted typhus fever. Another averment was that when a rat dies the fleas "then leave" the body of the rat and "seek out a live being on which to live and secure nourishment from said being's blood stream." The defendant demurred to the petition, thus admitting all facts well pleaded but challenging that they were legally sufficient to constitute a cause of action. The lower court found in the defendant's favor and its judgment was affirmed by the Court of Appeals of Georgia.

Following are some of the views expressed by the appellate court: An employer is not an insurer of the safety of his employees and is bound only to the exercise of reasonable care; it is as much a master's duty to use reasonable care to protect his servants against dangers of the employment which may reasonably be expected to produce disease as it is to use reasonable care to protect against dangers which may produce physical injuries; a master is bound to exercise ordinary care

in furnishing the servant a safe place in which to work, but the latter must exercise like care in discovering any defects therein; a master is not liable unless by the exercise of ordinary care and diligence he could have reasonably apprehended that his negligence would or might result in injury to some one of his servants; and an employer is not bound to foresee and give warning of remote, improbable, and exceptional occurrences, his duty being limited to such perils as reasonably are to be anticipated.

The court of appeals said that "to require of the defendant the duty of finding each dead rat and removing its body from the bakery before the fleas could leave the bodies, would be very much like demanding that the defendant do an impossible thing." According to the court there was nothing in the petition which constituted a sufficient allegation that the defendant knew or by the exercise of ordinary care should have known that any of its employees would contract typhus fever by reason of the rats being killed and left in the bakery.

Children bitten by rats—action against owners of adjoining premises.—(California District Court of Appeal, First District, Division 2; *Coole et al.* v. *Haskins et al.*, 135 P.2d 176; decided March 23, 1943.) The plaintiffs were children of 2 and 3 years of age, respectively. They brought an action to recover damages for personal injuries alleged to have been sustained when bitten by rats. The complaint alleged that they were bitten while sleeping in a portion of the premises owned by the defendants and rented to the parents of plaintiffs as a residence. The defendants operated a restaurant on an adjoining portion of the premises owned by them. Negligence and the maintenance of a nuisance were charged by the plaintiffs. It was alleged that discarded food and vegetable matter, refuse, and debris were allowed to accumulate about said premises and restaurant so that rats were attracted to and infested the same, thereby causing the premises to become unfit for human habitation, and also that such condition was allowed to continue despite requests to remedy it. In support of their action the plaintiffs relied in part upon section 1803 of the California Health and Safety Code, which required every person possessing any place infested with rodents, as soon as he knew of their presence, to proceed at once and continue in good faith to endeavor to exterminate them. One allegation of the complaint was that the above-mentioned condition commenced in June 1941 and was known to defendants at all times and that the plaintiffs were bitten in October 1941.

The trial court sustained the defendants' demurrer and dismissed the complaint, but the California District Court of Appeal took the view that the allegations of the complaint were sufficient to state causes of action based upon negligence and upon the maintenance of a nuisance. While, said the court, the complaint is based upon an

unusual set of facts and no authority directly in point has been called to our attention, "this is no valid objection provided the facts alleged bring the causes within recognized general principles of law." A prior case was quoted from to the effect that no person is permitted by law to use his property in such a manner that damage to his neighbor is a foreseeable result.

With respect to the defendants' contention that their duties toward plaintiffs began and ended with their duties as lessors of the portion of the premises in which plaintiffs resided and that the complaint failed to show a violation of defendants' duties as such lessors, the court stated that, as it viewed the complaint, the gist of plaintiffs' causes of action was an alleged violation by defendants of their duties as owners and possessors of the adjoining property rather than an alleged violation of defendants' duties as lessors.

Another claim of the defendants was that the plaintiffs and their parents assumed as a matter of law the risk of being bitten by rats inasmuch as they continued to occupy the premises from June to October. According to the court, it seemed certain that it could not be said as a matter of law from the plaintiffs' allegations that the plaintiffs, aged 2 and 3 years, respectively, assumed the risk involved here. If it could be said that the allegations showed that the parents assumed the risk, such assumption by them "should not be permitted to affect the rights of their minor children. * * * the assumption of risk by parents should not be held to preclude a recovery by a minor child on his own behalf."

The lower court's judgment was reversed with directions to overrule the defendants' demurrer.