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THE VACUUM-CYANIDE METHOD OF DELOUSING CLOTHING AND BAGGAGE

Experimental Data Upon Which the Procedure at the New York Quarantine Station is Based

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During the early part of the World War it became apparent that the problem of excluding typhus fever from the United States would be largely the problem of excluding European lice from the United States.

The approved method of disinfesting clothing and baggage by steam was not entirely satisfactory. Felt, rubber, leather, fur, and other materials which are frequently made up into clothing, or bags and trunks, which almost invariably have leather, paper and glue about them, are damaged by steam. It required time and labor to open each package, sort out the articles that steam would damage, sterilize the remainder, and repack. Even then, it was known that articles exempted carried lice, and these articles either had to be treated separately by some different process or allowed to pass with nothing done.

The ideal method should kill all animal and insect life within a package that has neither been opened nor unlocked, and do it without damage to the contents. It should also be sufficiently rapid to allow clothing to be disinfested while the owner is taking a bath. With these requirements in mind, Surgeon Grubbs [1] studied the problem at the Boston quarantine station of the Public Health Service, and in 1916 introduced a method of treating clothing and baggage with a vacuum hydrocyanic acid gas process. For this he used a metal sterilizing chamber, created in it a vacuum of from 15 to 17 inches, introduced cyanide gas, and restored atmospheric pressure which forced the gas into the materials. The Department of Agriculture [2] had introduced a similar process to kill bollworms in imported cotton and Assistant Surgeon General Creel and Asst. Surg. F. M. Faget [3] had shown that HCN gas was lethal to body lice.

[1] Public Health Reports, Vol. 31, No. 42, Oct. 20, 1916.
[2] Fed. Hort. Bd. 21, Dec. 4, 1915, and circular of Mar. 16, 1916.
[3] Public Health Reports, June 9, 1916.

In 1921, Surgeon Grubbs came to the New York quarantine station and introduced the vacuum cyanide method. As many as 2,000 persons a day were being landed for disinfestation and there was a special need for a rapid method. As it was realized that previous studies had not been completed, the quarantine station laboratory was directed to determine more exactly the limitations of the vacuum cyanide method or to find something better.

A new battery of double-jacketed steam sterilizing chambers was installed at Hoffman Island and adapted for this method by connecting them up with a motor-driven air pump, capable of giving either a vacuum up to 30 inches of mercury, or a positive pressure of about 25 pounds, within a few minutes. The battery consisted of one chamber of 640 cubic feet capacity and five chambers of 84 cubic feet capacity each, all piped so that each chamber could be individually and quickly connected with either the cyanide generator or the air pump. This was in addition to the usual steam connections. As the immigrants arrived on the dock, they left their baggage and passed on to the bathhouse. The baggage, for the most part unopened, was placed in the large sterilizer. All the clothing worn, including hats, shoes, etc., was put in individual mesh bags and treated in the small sterilizers while the immigrants were bathing. Baggage and clothing were treated alike, but in different sterilizers, as follows: Placed in sterilizers and a vacuum of 15 to 17 inches created, on which HCN was generated from 72 ounces NaCN per 1,000 cubic feet, restored atmospheric pressure and waited 15 minutes. Created a second vaccum of 15 to 17 inches, opened outside air valves to restore atmospheric pressure and kept air pump going for 5 minutes to wash out the gas. This entire process requires from 35 to 40 minutes. Controls of the efficiency of this work soon demonstrated that lice near the center of large bundles were not all being killed.

Many factors had to be considered, such as concentration of the HCN gas, initial vacuum, length of exposure to the gas, and the amount and kind of materials to be penetrated. It was necessary to run a series of experiments that would subject lice and lice ova to all the combinations of these various factors, and it was also desired to try certain other gases.

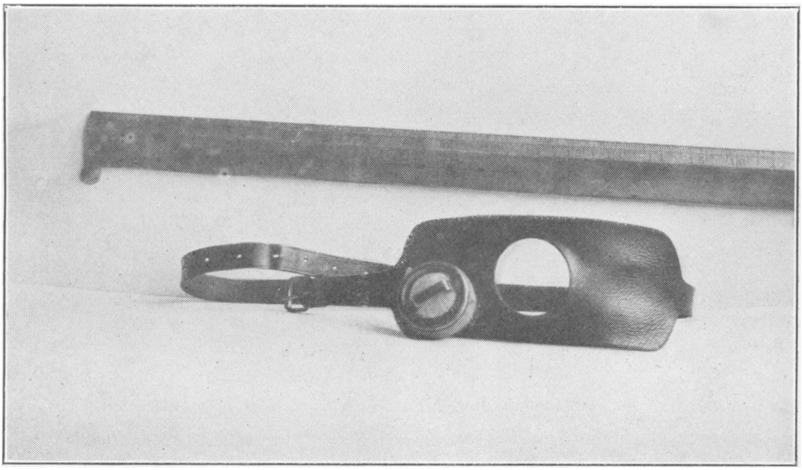
In planning the experiments it was realized that to arrive at any definite conclusions an abundant supply of lice and fresh ova should be constantly available over a period of several months. The supply of lice obtainable from immigrants was uncertain and far below the number desired for experimentation. Hence, it became necessary to raise them and this was done very succesfsully in the feeding box described by Nuttall and by Wolbach (see Plate I, A). This is a round metal ointment box, the bottom and top of which are almost entirely cut out and replaced by silk bolting cloth, 66 strands to the inch, through which lice may feed but not escape. The silk is held in place by strips of adhesive plaster and may be easily replaced when soiled. The lid of the box is also sealed with a strip of adhesive. Strips of thin black felt, upon which the lice might cling and deposit their eggs, are coiled, watch-spring fashion, and placed in the box. Ova are easily seen and counted on black felt, the nap of which is long enough for their easy deposition. A long strip of felt is left in the box continuously to serve as a "nest egg." The strips used for the experiments are replaced by new felt every four days. The ova thus obtained, being less than five days old, are fresh and preclude the possibility of experimenting with any empty hatched egg cases. A wide leather strap is used to bind the box to the surface of the skin.

The lice (*Pediculus humanus* (*vestimenti*)) originally put into the box were obtained from healthy infested immigrants—3 from Ireland, 7 from Greece, 2 from England, and 1 from Italy. The box was worn next to the skin constantly for four weeks before enough lice were present for experimental purposes. After that the box literally teemed with them. At first the irritation to the skin was rather severe; but after a month or so did not cause any especial discomfort. The box was shifted to a different position at least every 12 hours, and it was found that the lice multiplied much faster when the box was worn continuously day and night. After several months the skin areas available for feeding purposes became somewhat thickened and eczematous from the constant irritation—"vagabond skin"—the lice could not feed so well thereon, and multiplication was not so rapid. It was possible, however, for more than a year to obtain from this one box an average of over a hundred lice in different stages of development and a hundred fresh ova every four days. Each time the box was opened, the silk mesh was cleaned or replaced, and the moults and the brown dust-like feces were removed by blowing across the box or dusting it gently with a camel's hair brush.

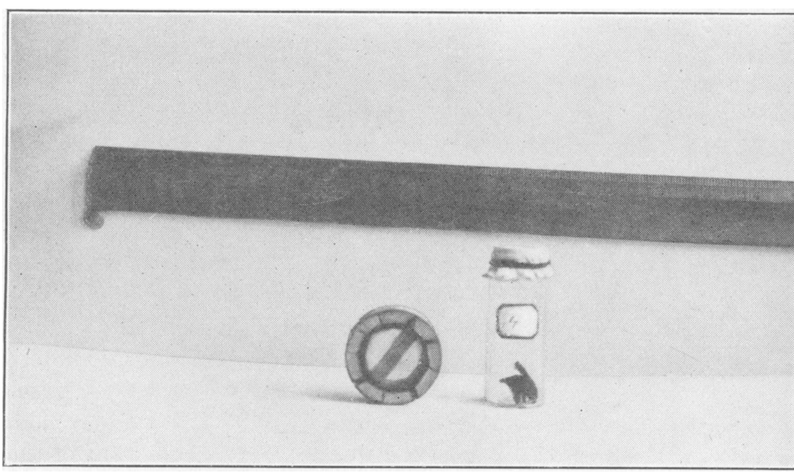
Specimens were prepared shortly before each experiment. When taking the strips of felt out of the feeding box they were cut so as to obtain bits with from 10 to 20 lice and as many eggs for each separate specimen. These bits of felt, with lice and eggs undisturbed, were placed into specimen boxes made of cardboard pill boxes, the top and bottom of which had been replaced with bolting silk (Plate I, B). This allowed free circulation of the gas to the lice, but confined them and protected them from trauma. Care was taken not to subject the specimens to any undue heat or cold, or abrupt changes of temperature. In most of the experiments, in order to give uniform but different degrees of protection, the specimens were put in what was called the "standard bundle." Gray blankets, approximately 75 per cent wool, weighing

$4\frac{3}{4}$ pounds each, were used. These blankets were thoroughly aired out during the four-day intervals between experiments. The specimens numbered and recorded, were rolled up in these blankets, in the same manner each time, so that the specimen in the center would have 48 thicknesses of blanket covering it; the others had, successively, 40, 32, 24, 16, and 8 thicknesses covering them. This standard bundle measured about 72 inches by 116 inches around its short and long axes, respectively, and weighed about 40 pounds. In some experiments a specimen was placed, fully exposed, outside of the bundle. One or two specimen boxes for each experiment were not put into the chamber but were kept as controls to check the hatching (the live lice being removed and the ova left). Upon removal from the chamber each specimen was examined immediately, and lice remaining active were removed from the felt. Inactive lice and the ova were left on the bits of felt, dropped into small clean wide-mouthed glass bottles (Plate I, B), covered by cloth, and put into a moderately moist incubator at 30° C. Lice failing to respond by movement of the legs when gently prodded with a fine wire were classified, for practical purposes, as inactive. Lice apparently dead after gassing often recovered activity later. Specimens were examined frequently for several hours, at first. Later the specimens were examined twice daily to remove any lice that had regained activity and to watch for the hatching of ova. Careful records were kept showing all factors of the experiments, such as temperature, amounts of chemicals (concentration of gas), initial vacuum, length of exposure, secondary vacuum, positive air pressure, and amount if used, and the time of the different steps and of the entire process. The serial number of each specimen box showing number of lice and number of ova in each, number of folds of blanket in which wrapped, condition of the lice in each specimen at time of removal from chamber, time and number of lice recovering activity later, and the date and number of ova hatching was also recorded. With the naked eye it was easy to see each newly hatched larva on the black felt. They stayed on the felt closely until about 24 hours old, when they often left it to die. Ova were watched for hatching for 15 days. The egg cases were then examined under a hand lens and the number of empty cases compared with the number of larva recorded as having hatched. In the control specimens (not gassed) usually about 50 per cent of the ova would hatch. In no control did all fail to hatch. That about 30° C., moderately moist, was the best incubating temperature, was confirmed by numerous trials.

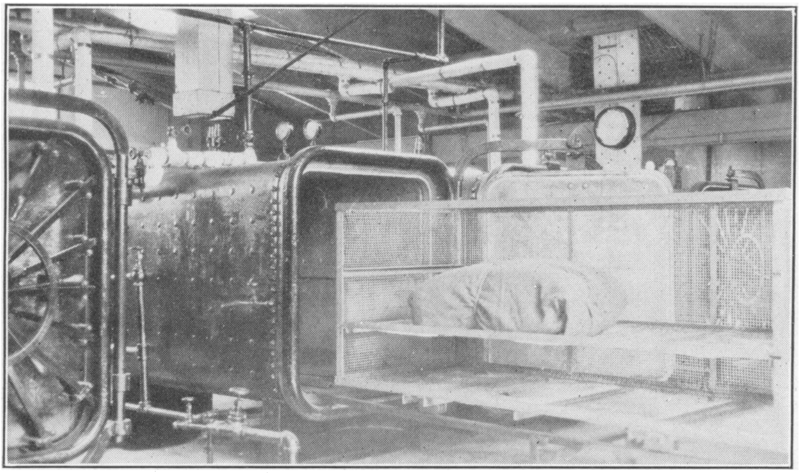
For the generation of hydrocyanic acid gas the chemicals used were (*a*) sodium cyanide, 96 to 98 per cent, containing 51 to 52 per cent cyanogen, used fresh from air-tight cans as received from the manufacturers, (*b*) commercial sulphuric acid, 66° Baumé, and



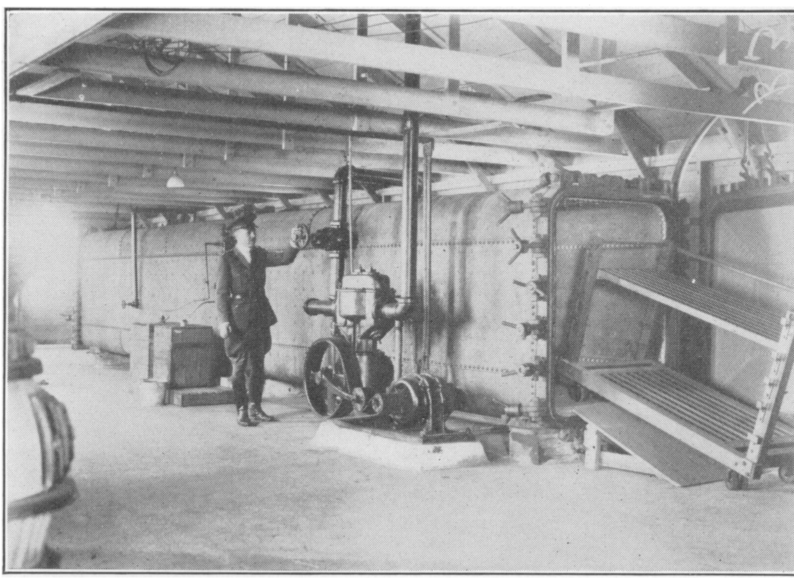
A. Louse feeding box and strap for attaching same to arm or leg



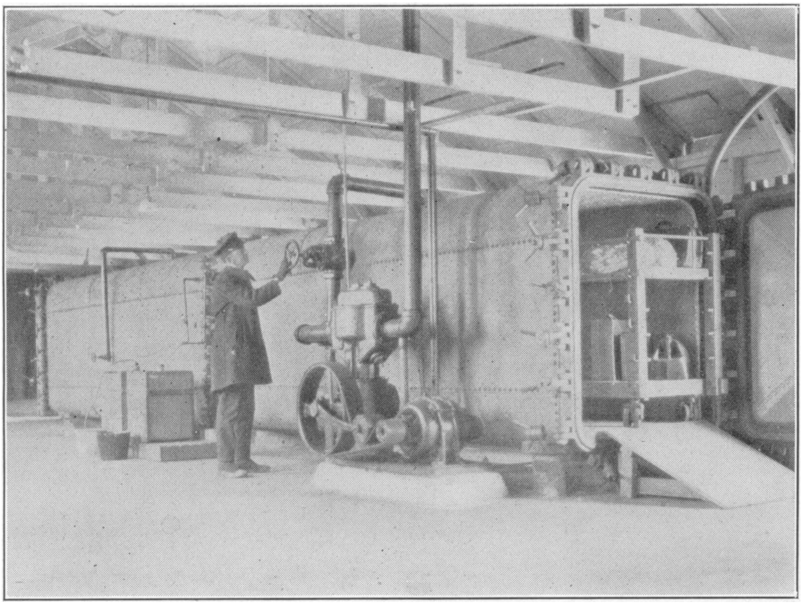
B. Specimen box and bottle



A. Small fumigating chamber for clothing, showing the "standard bundle" used in the experiments



B. Large baggage fumigating chamber, showing an empty truck



Large baggage fumigating chamber, showing buckets containing acid solution at side of generator and the baggage on a truck (*c*) tap water, in proportion of 1 ounce sodium cyanide to 1½ fluid ounces acid and 2 fluid ounces water. The essential steps of the routine, and also the experimental process were as follows: The required amount of dry sodium cyanide was placed in a generator, which had two outlet pipes with valves. One of these pipes was connected with the sterilizers; to one was attached a flexible hose. The acid and water were mixed in a pail. The material to be deloused was placed in the chamber, the doors were tightly closed, and the air was exhausted to the desired degree by the motor-driven pump. The flexible hose was then placed in the diluted acid, the valve to the air pump closed and that to the generator opened. This drew the acid into the generator containing the sodium cyanide. The gas generated rapidly and was drawn immediately over into the sterilizing chamber. Generation was usually completed in less than 3 minutes. A valve was then opened to break the vacuum to atmospheric pressure; the violent inrush of air was sufficient to thoroughly stir the gas to uniform diffusion. The valve was then closed. In some of the experiments, positive air pressure was now obtained, the idea being to further force the gas into the mass of fabrics. After the desired time of exposure, the gas was exhausted by the vacuum pump and expelled through a pipe leading out through the roof. This secondary vacuum was then broken and the vacuum pump allowed to run for from 5 to 7 minutes with an outside valve to the chamber open. The secondary vacuum and flow of fresh air from bottom to top of chamber was to wash out the gas before removing the material. In cold weather sufficient steam was admitted to the jacket of the chamber to warm the interior sufficiently to prevent chilling the specimens. The temperature could be determined by watching a thermometer extending into the interior.

This experimental work extended over a period of more than a year, but without interfering with the routine duties of the worker. About 175 tests were made, including many which were repeated one or more times. Approximately 700 specimen boxes, with 10,000 lice and as many fresh-laid ova, were used. The majority of the tests were made with the cyanide gases under all conceivable variations of the factors involved and under varying atmospheric conditions. In general, quite consistent results were obtained, the degree of penetration of gas with lethal effect being fairly uniform under similar conditions, and varying regularly as conditions were varied. In fact, it became possible toward the end of the work to predict with almost mathematical exactness just what results would ensue if lice and ova were subjected to any certain combination of factors. Rarely were "freak" results obtained, such as finding one louse alive after being fully exposed to a high concentration for considerable time.

VACUUM AND PRESSURE

To determine what effect would be produced on lice and ova by factors other than the gas, a series of experiments was run without gas (Table 1). The first two experiments approximated closely the usual steps in the routine delousing process and in the experimental tests. The results show that the vacuum and air pressure used later in the gas experiments had, *per se*, no effect on lice or lice ova.

TABLE 1.—*Showing effect of vacuum and pressure on lice and lice ova*

Experiment No.	Procedure	Results
1	Initial vacuum 18 inches obtained in 2 minutes; held 3 minutes; broken to 0 (atmospheric pressure) and held 15 minutes Second vacuum 18 inches obtained in 2 minutes; broken and air pumped through chamber for 7 minutes.	All lice active; ova hatched.
2	Initial vacuum 26 inches obtained in 2½ minutes; held 3 minutes; broken to 0 and held 30 minutes. Second vacuum 26 inches obtained in 2½ minutes; broken and air pumped through chamber for 7 minutes.	All lice active; ova hatched.
3	6 alternate vacuums of 26 inches obtained and broken to 0 within period of 27 minutes.	All lice active; ova hatched.
4	Initial vacuum 22 inches held for 3 minutes, then broken to 0; air pressure 15 pounds obtained and held for 15 minutes, then broken to 0. Second vacuum 22 inches obtained and held for 3 minutes, then broken to 0.	All lice active; ova hatched.
5	Initial vacuum 26 inches held for 3 minutes; broken; air pressure 15 pounds obtained and held for 30 minutes; broken; second vacuum 26 inches obtained and held 3 minutes, then broken.	All lice active; ova hatched. (During the 30 minutes the pressure fell to 12 pounds.)
6	Initial vacuum of 26 inches obtained; broken to 0; 15 pounds air pressure obtained; broken to 0—this done for 6 alternate vaccuums and air pressures over a period of 60 minutes.	All lice active; ova hatched.

HYDROCYANIC ACID GAS

Table 2 gives merely a few representative experiments, selected and arranged in such an order as to show the effects of hydrocyanic acid gas, from the amount sublethal to fully exposed lice in 15 minutes, up through varying and increasing concentrations of gas, vacuums, and pressures, lengths of exposure, degrees of protective covering to the specimens, etc., to beyond the highest practical in routine delousing work. Only the essential data are given, the details as to number of lice and ova, days of incubation before hatching, amount of secondary vacuum, etc., being omitted for the sake of brevity and simplicity. Interspersed are several practical tests made with clothing and baggage of immigrants in the course of actual delousing. A comparison of the way the specimens were wrapped or protected in clothing or baggage, and the results in these tests, with the wrapping and results in the experimental "standard bundle" tests, is interesting.

TABLE 2.—*Showing effect of hydrocyanic acid gas on lice and lice ova*

Experiment No.	Sodium cyanide; ounces per 1,000 cubic feet	Specimen No.	Degree of protection of specimen; how wrapped	Initial vacuum in inches	Followed by pressure in pounds	Time of exposure at 0 (or under pressure) (minutes)	Total time in chamber (minutes)	Condition of lice upon removal from chamber	Condition of lice later	Ova hatching at 30° C.
1	4.76	1	Fully exposed	26	----	120	139	All inactive	Part revived	Part hatched.
		2	do	26	----	120	139	do	do	Do.
2	5.95	1	Fully exposed	26	----	15	27	Part active	Part revived	Part hatched.
		2	do	26	----	15	27	do	do	Do.
3	11.9	1	Fully exposed	26	----	15	27	All inactive	Part revived	Part hatched.
		2	do	26	----	15	27	do	do	Do.
4	17.9	1	Fully exposed	26	----	15	29	All inactive	None revived	Part hatched.
5	23.8	1	Fully exposed	18	----	15	28	All inactive	None revived	None hatched.
		2	do	18	----	15	28	do	do	Do.
6	31.3	1	Fully exposed	18	----	15	29	All inactive	None revived	None hatched.
		2	4 folds blanket	----	----	----	----	do	do	Do.
		3	16 folds blanket	----	----	----	----	Part active	All revived	Part hatched.
		4	32 folds blanket	----	----	----	----	All active	----	Do.
7	31.3	1	8 folds blanket in center of pile of mesh bags.	18	----	15	27	Part active	All revived	Part hatched.
8	31.3	1	8 folds blanket in leather valise.	18	----	15	27	All inactive	All revived	Part hatched.
		2	16 folds blanket in leather valise.	----	----	----	----	Part active	do	Do.
9	60	1	Fully exposed	26	----	105	126	All inactive	None revived	None hatched.
		2	16 folds blanket	----	----	----	----	do	do	Do.
		3	24 folds blanket	----	----	----	----	do	Part revived	Do.
		4	32 folds blanket	----	----	----	----	Part active	Part revived	Part hatched.
		5	40 folds blanket	----	----	----	----	do	do	Do.
		6	48 folds blanket	----	----	----	----	do	All revived	Do.
		7	56 folds blanket	----	----	----	----	All active	do	Do.
10	71.8	1	Fully exposed	0	----	15	21	All inactive	None revived	None hatched.
		2	8 folds blanket	----	----	----	----	Part active	All revived	Part hatched.
		3	16 folds blanket	----	----	----	----	All active	----	Do.
		4	24 folds blanket	----	----	----	----	do	----	Do.
		5	32 folds blanket	----	----	----	----	do	----	Do.
11	71.8	1	Fully exposed	0	----	60	72	All inactive	None revived	None hatched.
		2	8 folds blanket	----	----	----	----	do	Part revived	Do.
		3	16 folds blanket	----	----	----	----	Part active	do	Do.
		4	24 folds blanket	----	----	----	----	do	All revived	Do.
		5	32 folds blanket	----	----	----	----	All active	----	Part hatched.
		6	40 folds blanket	----	----	----	----	do	----	Do.
12	71.8	1	8 folds blanket	18	----	15	27	All inactive	Part revived	None hatched.
		2	16 folds blanket	----	----	----	----	Part active	All revived	Do.
		3	24 folds blanket	----	----	----	----	All active	----	Part hatched.
		4	32 folds blanket	----	----	----	----	do	----	Do.
		5	40 folds blanket	----	----	----	----	do	----	Do.
		6	48 folds blanket	----	----	----	----	do	----	Do.
13	71.8	1	8 folds blanket in center of pile of 21 mesh bags.	18	----	15	25	Part active	All revived	Part hatched.
14	71.8	1	Wrapped in clothing in mesh bag. Bag in center of pile of 45 mesh bags.	18	----	15	27	Part active	All revived	Part hatched.
15	71.8	1	8 folds blanket	26	----	15	28	All inactive	Part revived	None hatched.
		2	16 folds blanket	----	----	----	----	Part active	do	Do.
		3	24 folds blanket	----	----	----	----	All active	----	Part hatched.
		4	32 folds blanket	----	----	----	----	do	----	Do.
		5	40 folds blanket	----	----	----	----	do	----	Do.
		6	48 folds blanket	----	----	----	----	do	----	Do.

TABLE 2.—*Showing effect of hydrocyanic acid gas on lice and lice ova*—Continued

Experiment No.	Sodium cyanide; ounces per 1,000 cubic feet	Specimen No.	Degree of protection of specimen; how wrapped	Initial vacuum in inches	Followed by pressure in pounds	Time of exposure at 0 (or under pressure) (minutes)	Total time in chamber (minutes)	Condition of lice upon removal from chamber	Condition of lice later	Ova hatching at 30° C.
16	71.8	1	8 folds blanket	26		30	44	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					Part active	Part revived	Do.
		4	32 folds blanket					do	All revived	Do.
		5	40 folds blanket					All active		Part hatched.
		6	48 folds blanket					do		Do.
17	71.8	1	8 folds blanket	26	15	15	35	All inactive	None revived	None hatched.
		2	16 folds blanket					do	Part revived	Do.
		3	24 folds blanket					Part active	do	Part hatched.
		4	32 folds blanket					All active		Do.
		5	40 folds blanket					do		Do.
		6	48 folds blanket					do		Do.
18	71.8	1	8 folds blanket	26		60	73	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					do	do	Do.
		4	32 folds blanket					Part active	Part revived	Do.
		5	40 folds blanket					do	All revived	Part hatched.
		6	48 folds blanket					All active		Do.
19	[1] 71.8	1	8 folds blanket	26		15	28	All inactive	None revived	None hatched.
		2	16 folds blanket					Part active	Part revived	Do.
		3	24 folds blanket					All active		Part hatched.
		4	32 folds blanket					do		Do.
		5	40 folds blanket					do		Do.
		6	48 folds blanket					do		Do.
20	71.8	1	8 folds blanket	26	15	30	51	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					Part active	Part revived	Do.
		4	32 folds blanket					do	All revived	Part hatched.
		5	40 folds blanket					All active		Do.
		6	48 folds blanket					do		Do.
21	143	1	Fully exposed	0		15	22	All inactive	None revived	None hatched.
		2	8 folds blanket					Part active	All revived	Do.
		3	16 folds blanket					All active		Part hatched.
		4	24 folds blanket					do		Do.
		5	32 folds blanket					do		Do.
		6	40 folds blanket					do		Do.
		7	48 folds blanket					do		Do.
22	143	1	Fully exposed	0		60	72	All inactive	None revived	None hatched.
		2	8 folds blanket					do	do	Do.
		3	16 folds blanket					do	do	Do.
		4	24 folds blanket					Part active	Part revived	Do.
		5	32 folds blanket					do	do	Do.
		6	40 folds blanket					All active		Part hatched.
		7	48 folds blanket					do		Do.
23	143	1	Fully exposed	18		15	23	All inactive	None revived	None hatched.
		2	4 folds blanket					do	do	Do.
		3	32 folds blanket					do	Part revived	Do.
24	143	1	8 folds blanket	26		15	47	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					do	do	Do.
		4	36 folds blanket					do	Part revived	Do.
25	143	1	8 folds blanket	26	15	15	49	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					do	do	Do.
		4	32 folds blanket					do	Part revived	Do.
		5	40 folds blanket					Part active	do	Do.
		6	48 folds blanket					All active		Part hatched.
26	214.2	1	8 folds blanket	26		15	34	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					do	do	Do.
		4	32 folds blanket					do	Part revived	Do.
		5	40 folds blanket					Part active	All revived	Part hatched.
		6	48 folds blanket					All active		Do.

[1] Interior of chamber at 72° C.

Table 2.—*Showing effect of hydrocyanic acid gas on lice and lice ova*—Continued

Experiment No.	Sodium cyanide; ounces per 1,000 cubic feet	Specimen No.	Degree of protection of specimen; how wrapped	Initial vacuum in inches	Followed by pressure in pounds	Time of exposure at 0 (or under pressure) (minutes)	Total time in chamber (minutes)	Condition of lice upon removal from chamber	Condition of lice later	Ova hatching at 30° C.
27	238	1	32 folds blanket	26	12	45	73	All inactive	None revived	None hatched.
		2	40 folds blanket					do	do	Do.
		3	48 folds blanket					do	do	Do.
28	285.7	1	8 folds blanket	0		60	72	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					Part active	Part revived	Part hatched.
		4	32 folds blanket					do	All revived	Do.
		5	40 folds blanket					All active		Do.
		6	48 folds blanket					do		Do.
29	285.7	1	Wrapped in clothing and placed in wicker suit case.	18		15	33	All inactive	None revived	None hatched.
		2	8 folds blanket in fiberoid suit case.					do	do	Do.
		3	In loose folds of clothing in mesh bag.					do	do	Do.
30	285.7	1	8 folds blanket	26		15	33	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					do	do	Do.
		4	32 folds blanket					do	Part revived	Do.
		5	40 folds blanket					Part active	All revived	Do.
		6	48 folds blanket					All active		Part hatched.
31	285.7	1	Wrapped in clothing in clothing bag in center of pile of 52 bags of clothing.	26	12	15	37	Part active	Part revived	Part hatched.
		2	Wrapped in clothing in clothing bag at edge of pile of 52 bags of clothing.					All inactive	None revived	None hatched.
32	285.7	1-10	Wrapped in clothes in mesh bags. Bags placed on wire racks allowing circulation of gas.	26		15	33	All inactive [1]	None revived[1]	None hatched.
33	285.7	1	24 folds blanket	26		30	49	All inactive	None revived	None hatched.
		2	32 folds blanket					do	do	Do.
		3	40 folds blanket					do	do	Do.
		4	48 folds blanket					Part active	Part revived	Do.
34	285.7	1	In clothing in wicker suit case.	26		30	48	All inactive	None revived	None hatched.
		2	In clothing in leather suit case.					do	Part revived	Do.
		3	In clothing in canvas suit case.					do	do	Do.
		4	In folds clothing in bag in center pile of six bags of clothing.					do	None revived	Do.
35	285.7	1	Wrapped in clothing in mesh bag in center of pile of 11 bags of clothing.	26		30	48	All inactive	None revived	None hatched.
		2	Wrapped in fur overcoat in valise in center of pile of 11 bags.					do	Part revived	Do.
36	285.7	1	8 folds blanket in leather valise.	26		60	80	All inactive	None revived	None hatched.
		2	8 folds blanket in fiberoid suit case.					do	do	Do.
		3	8 folds blanket in wood veneer case.					do	do	Do.

[1] Same results in all 10 specimens.

TABLE 2.—*Showing effect of hydrocyanic acid gas on lice and lice ova*—Continued

Experiment No.	Sodium cyanide; ounces per 1,000 cubic feet	Specimen No.	Degree of protection of specimen; how wrapped	Initial vacuum in inches	Followed by pressure in pounds	Time of exposure at 0 (or under pressure) (minutes)	Total time in chamber (minutes)	Condition of lice upon removal from chamber	Condition of lice later	Ova hatching at 30° C.
37	427.2	1	8 folds blanket	26	----	15	36	All inactive	None revived	None hatched.
		2	16 folds blanket	----	----	------	----	do	do	Do.
		3	24 folds blanket	----	----	------	----	do	do	Do.
		4	32 folds blanket	----	----	------	----	do	Part revived	Do.
		5	40 folds blanket	----	----	------	----	do	do	Do.
		6	48 folds blanket	----	----	------	----	do	do	Do.
38	547.6	1	16 folds blanket	26	----	15	38	All inactive	None revived	None hatched.
		2	24 folds blanket	----	----	------	----	do	do	Do.
		3	32 folds blanket	----	----	------	----	do	do	Do.
		4	40 folds blanket	----	----	------	----	do	do	Do.
		5	48 folds blanket	----	----	------	----	do	Part revived	Part hatched.
39	738	----	Chamber full of pillows and blankets. Specimens placed from side to center.	26	----	30	49			
		1	At side wall	----	----	------	----	All inactive	None revived	None hatched.
		2	One-fifth way in	----	----	------	----	do	do	Do.
		3	Two-fifths way in	----	----	------	----	do	do	Do.
		4	Three-fifths way in	----	----	------	----	do	do	Do.
		5	In center	----	----	------	----	do	do	Do.
		6	In 8 folds blanket in center of chamber.	----	----	------	----	do	do	Do.
		7	In 16 folds blanket in center.	----	----	------	----	do	Part revived	Do.
		8	In 24 folds blanket in center.	----	----	------	----	do	do	Do.

RETENTION OF HYDROCYANIC ACID GAS BY FABRICS

In the use of the higher concentrations of hydrocyanic acid gas (above 143 ounces sodium cyanide per 1,000 cubic feet) for delousing, it was shown that it was essential to take time and care to air out the clothing bundles well before returning them to the immigrants. In certain cases definite symptoms of hydrocyanic acid gas poisoning were noticed. This is usually in cold weather when heavy clothing was worn and the immigrants sat about in warm rooms after dressing. On account of these experiences and the reports of certain deaths under similar circumstances, several experiments were made which show that hydrocyanic acid gas, especially when forced into fabrics by the vacuum method, will be retained a considerable time. A single experiment will suffice:

Six clean woolen blankets, combined weight 27 pounds, were folded and stacked, one above the other, in one of the clothing sterilizers, 84 cubic feet capacity. The doors were closed and 26 inches vacuum was obtained. Hydrocyanic acid gas in proportion of that from 285.7 ounces sodium cyanide per 1,000 cubic feet was generated and drawn into the chamber. The vacuum was broken, and after 30 minutes a second vacuum of 26 inches was obtained, broken, and the chamber washed through by the vacuum pump for 7 minutes. The doors at either end of the chamber were then opened wide and the chamber aired free from all traces of gas. The blankets were taken out-of-doors, unfolded, and each was shaken in the breeze several times. They were then returned to the floor of the chamber in a loose heap. An adult white rat in a wire cage was placed on the floor of the chamber two feet away from the blankets and both doors were closed. After nine minutes the doors were reopened. There was a faint odor of hydrocyanic acid gas in the chamber and the rat was dead.

CYANOGEN CHLORIDE-HYDROCYANIC ACID GAS MIXTURE

Using the same apparatus and the same steps of procedure as used with hydrocyanic acid gas, 26 experiments were made with cyanogen chloride-hydrocyanic acid gas mixture. The gas was generated by mixing sodium cyanide, 4 parts, sodium chlorate, 3 parts, commercial hydrochloric acid, 20° Baumé, 17 parts, and warm tap water, 17 parts. These proportions had been prescribed for ship fumigation. Generation of this gas was slower than that of hydrocyanic acid, about 10 minutes being required. It had been demonstrated to be more toxic to white rats than straight hydrocyanic acid gas in the same concentration. A brief summary of some of these experiments is here given:

TABLE 3.—*Showing effect of cyanogen chloride-hydrocyanic acid gas on lice and lice ova*

Experiment No.	Sodium cyanide; ounces per 1,000 cubic feet	Specimen No.	Degree of protection of specimen; how wrapped	Initial vacuum in inches	Followed by pressure in pounds	Time of exposure at 0 (or under pressure) (minutes)	Total time in chamber (minutes)	Condition of lice upon removal from chamber	Condition of lice later	Ova hatching at 30° C
1	4	1	Fully exposed	26		120	144	All inactive	Part revived	Part hatched.
		2	do					do	do	None hatched.
2	5.95	1	Fully exposed	26		15	40	Part active	Part revived	Part hatched.
		2	do					All inactive	do	Do.
3	11.9	1	Fully exposed	26		15	39	All inactive	Part revived	Part hatched.
		2	do					do	do	None hatched.
		3	do					do	do	Part hatched.
		4	do					do	do	Do.
4	17.9	1	Fully exposed	26		15	39	All inactive	Part revived	None hatched.
		2	do					do	None revived	Do.
5	23.8	1	Fully exposed	26		15	44	All inactive	None revived	None hatched.
		2	do					do	do	Do.
6	60	1	8 folds blanket	26		30	57	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					do	do	Do.
		4	32 folds blanket					Part active	Part revived	Do.
		5	40 folds blanket					do	do	Part hatched.
		6	48 folds blanket					All active		Do.
7	118	1	8 folds blanket in oilcloth suit case in center of pile of baggage and clothing bags.	26		30	56	Part active	All revived	Part hatched.
8	118	1	8 folds blanket	26		30	57	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					do	do	Do.
		4	32 folds blanket					do	do	Do.
		5	40 folds blanket					Part active	Part revived	None hatched.
		6	48 folds blanket					do	do	Part hatched.
9	238	1	8 folds blanket	26		15	43	All inactive	None revived	None hatched.
		2	16 folds blanket					do	do	Do.
		3	24 folds blanket					do	do	Do.
		4	32 folds blanket					Part active	Part revived	Part hatched.
		5	40 folds blanket					do	All revived	Do.
		6	48 folds blanket					All active		Do.
10	238	1	24 folds blanket	26		30	59	All inactive	None revived	None hatched.
		2	32 folds blanket					do	do	Do.
		3	40 folds blanket					do	do	Do.
		4	48 folds blanket					do	do	Do.

The cyanogen chloride-hydrocyanic acid gas has practically replaced all other ship fumigants at the New York quarantine station, largely because it has an odor and is lachrymatory and irritating to the nose and throat, which gives warning and makes for safety. It was hoped that this gas mixture would also give a warning if too much remained in clothing or baggage after disinfestation. If so, this would obviate having to take the extra care and time in/airing out the bundles and would allow a much desired reduction of 10 to 15 minutes in the time of their return to the immigrants. We were disappointed to find, however, that, in addition to taking longer to generate the gas, the cyanogen chloride part of the mixture seemed to ventilate out of fabrics more readily than the hydrocyanic acid part. Under certain conditions the warning factor of the cyanogen chloride would be aired out, but enough of the hydrocyanic acid gas left in to be dangerous. This was demonstrated by a number of experiments, of which two are quoted here:

(1) In performing experiment No. 8, Table 3, two clean woolen blankets were folded tightly into a black oilcloth suit case and gassed with the specimens (118 ounces sodium cyanide per 1,000 cubic feet, initial vacuum of 26 inches, exposure 30 minutes). The suit case was not opened until five hours later. There remained no odor of cyanogen chloride in the blankets and no lachrymatory effect. There was, however, a distinct typical odor of hydrocyanic acid gas.

(2) An experiment, similar to the one showing the retention of hydrocyanic acid gas by fabrics (above), was performed, using six blankets and cyanogen chloride-hydrocyanic acid gas in concentration of that from 143 ounces sodium cyanide per 1,000 cubic feet, initial vacuum of 26 inches, and 120 minutes' exposure. The chamber and the blankets were aired for several minutes until there remained no odor of cyanogen chloride and no lachrymatory effect. The blankets were returned to the chamber in a loose heap, a white rat in a wire cage was introduced, and the chamber closed for nine minutes. Upon opening up, the odor of hydrocyanic acid gas was present in the chamber, but there was no odor of cyanogen chloride and no lachrymatory effect. The rat was dead.

This apparent tendency of the cyanogen chloride gas to leave fabrics more readily than the hydrocyanic acid gas might be remembered in doing cyanogen chloride-hydrocyanic acid gas ship fumigations. The medical officer comes to depend largely upon the absence of the odor and the lachrymatory effect of cyanogen chloride in determining whether a compartment has been safely ventilated after fumigation. It is entirely possible that a ship after inspection may be declared safe and free from gas because these warning signs are absent and yet enough hydrocyanic acid gas remain if mattresses, pillows, and blankets in large quantities are present, to produce unpleasant or even fatal results.

OTHER GASES

During the course of the experiments with the cyanide gases the effects on lice of a few other available gases were tried. Sulphur dioxide and chlorine could not be used because of their bleaching effects on fabrics. The gases used were ether, chloroform, formaldehyde, carbon bisulphide, and carbon tetrachloride. All these, except formaldehyde and carbon tetrachloride, presented some factor such as inflammability, cost, etc., which would preclude their use as general delousing agents. Only a few tests were made, but they indicated that to obtain good results such high concentrations would be necessary that the cost would be prohibitive and the time of the fumigation process too long.

(1) *Ether.*—The chamber was warmed up to about 39° C. Specimens of lice and fresh-laid ova were fully exposed in the chamber. A vacuum of 26 inches was obtained. A bottle containing ether in proportion of 143 fluid ounces per 1,000 cubic feet, warmed in a water bath, was connected and the ether vapor drawn into the chamber by the vacuum. The vacuum was broken to 0 by drawing warm air from an adjacent heated chamber. After 15 minutes' exposure all the lice were found active and about 50 per cent of the ova subsequently hatched at 30° C. incubation.

(2) *Chloroform.*—Exactly the same procedure was followed, using 143 fluid ounces chloroform per 1,000 cubic feet, as is described with ether above, and with the same results on lice and lice ova.

(3) *Carbon bisulphide.*—Using the same procedure, except that the chamber was warmed to 30° C., 36 fluid ounces of carbon bisulphide per 1,000 cubic feet were used, with the same results on lice and lice ova.

(4) *Carbon tetrachloride.*—Using the same procedure as with ether, 107 fluid ounces of carbon tetrachloride per 1,000 cubic feet caused some of the lice to become inactive, but all revived and some of the ova subsequently hatched.

(5) *Carbon bisulphide and carbon tetrachloride.*—A mixture of carbon bisulphide and carbon tetrachloride, 36 fluid ounces and 107 fluid ounces, respectively, per 1,000 cubic feet, were used, and about 50 per cent of the lice were inactive after 20 minutes' exposure, but all revived later. About 50 per cent of the ova subsequently hatched.

(6) *Formaldehyde.*—(*a*) With lice and fresh ova fully exposed and the air in the chamber warm and moist, potassium permanganate and formalin (40 per cent) were mixed in a container in the chamber, in proportion of 6.8 ounces potassium permanganate and 16.9 fluid ounces formalin per 1,000 cubic feet, and chamber was closed for 60 minutes. Lice all remained active and about 50 per cent of the ova subsequently hatched.

(*b*) With 13.6 ounces potassium permanganate and 33.8 fluid ounces per 1,000 cubic feet formalin, mixed in a retort outside of chamber by slowly and carefully adding the formalin to the permanganate, and the formaldehyde gas was drawn into the warm, moist chamber by a vacuum of 26 inches therein, vacuum broken to 0, and 60 minutes' exposure, the lice remained active and some of the ova subsequently hatched.

HEAT

The facilities at hand during the experiments with lice afforded an opportunity to test the efficiency of the generally accepted methods of delousing clothing by dry heat and steam, to determine the effect of different degrees of heat with varying combinations and degrees of moisture, vacuum pressure (air and steam), time of exposure, circulation of air in the chamber, and protection of the specimens by different amounts of wrapping in blankets, and to determine the effect of such procedures upon such articles as might be exposed to them in the disinfection of immigrants' clothing. After numerous experiments the conclusion was reached that the only reliable way of using heat in the routine delousing of clothing bundles is the established, but slow, method of sorting out and treating articles not damaged by steam by introducing the steam into the chamber under vacuum, running the steam pressure up to at least 15 pounds for 15 minutes, releasing the pressure, and drawing a secondary vacuum to aid in drying out the bundles.

OBSERVATIONS

While making the experiments upon which this article is based, certain observations were made not related to the main purpose of the investigation, but worthy of record:

1. About four months after beginning to raise lice by allowing them to feed upon the skin, some of the fine brown feces were accidently blown up into the experimenter's face while cleaning out the box. Almost immediately his eyes became red and watery and a profuse, thin discharge from the nose and a series of about 20 or 30 violent sneezes followed. This soon passed off without further symptoms. Water, acetone, alcohol, ether, and chloroform extracts were made from both louse bodies and louse feces, and when vaccinated with these the subject showed a very rapid and pronounced skin reaction. The water and alcohol extracts gave the stronger reactions. Several other persons vaccinated with the same extracts showed no reactions. Unfortunately, the subject had not been tested with louse extracts previous to starting to raise the lice. These extracts were kept in the ice box and were potent with the subject and impotent with control persons up to six months later. Just before discontinuing to feed the lice, a fresh set of extracts was made. These gave skin reactions on the subject for a few months after he had discontinued feeding the lice, but the reaction had entirely disappeared by the end of the fifth month.

2. At no time during the 14 months while constantly feeding 800 to 1,000 lice did any toxic symptoms appear, such as general malaise, depression, fever, and rash at areas other than where lice were fed, as described by Moore.[1]

3. Mature lice were usually killed by HCN and CNCl–HCN more readily than were the larva or the first stage nymphs.

4. Lice often changed color to red or reddish brown when killed by HCN or CNCl–HCN.

5. It has been assumed that cloth having a deep nap, such as plush, would give a certain degree of protection to lice from toxic gases. Careful observation, however, failed to show that they ever burrowed into fabrics as if seeking such protection.

6. Contrary to usual belief, lice ova were found to be as easily destroyed by cyanide gases as were lice. This is explained by the fact that the operculum of the ovum has numerous perforations through which gas may penetrate, whereas the louse is able to close its breathing stigmata tightly and to live for a considerable time on its internal air reserve.

7. Attempts were made at various times to neutralize the toxicity of hydrocyanic acid gas, using ammonia and formaldehyde, but without result of practical value.

8. The experiments with formaldehyde gas, as may be expected from observations with regard to other insects, indicate that destruction of lice or their eggs could not be expected from the concentration usually recommended for room fumigation.

CONCLUSIONS

1. The use of vacuum to force cyanide gas into packages to destroy insect life was introduced by the United States Department of Agriculture to kill bollworms in cotton bales, and, as adopted by Surgeon Grubbs for destroying lice in clothing and baggage, is an improvement over the steam method, since the packages are undisturbed and the contents uninjured. It has, however, distinct limitations.

2. Cyanide gas penetrates fabrics so slowly that it is applicable to delousing only when aided by an initial vacuum; the higher the vacuum the quicker and deeper the penetration.

3. The efficiency and practicability of the vacuum cyanide method in routine delousing of clothing and baggage of immigrants depend upon a proper balance of the three important factors, concentration of the gas, degree of initial vacuum, and length of exposure.

4. Lice and lice ova are easily killed by the cyanide gases. The minimum lethal concentrations of HCN gas and of CNCl–HCN gas mixture for fully exposed lice and lice ova, 15 minutes' exposure, was

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[1] Jour. Amer. Med. Assn. Nov. 2, 1918, vol. 71, pp. 1481–1482.

determined to be that from about 18 ounces of sodium cyanide per 1,000 cubic feet.

5. Vacuums of 26 inches of mercury and air pressures of 15 pounds and combinations of these, used without gas over longer periods of time than those used in actual delousing, have no effect on lice and lice ova.

6. An air pressure of 15 pounds produced and held after the introduction of gas into the chamber does not appreciably aid in the penetration of the gas.

7. Dry heat of 72° C., with vacuum of 26 inches and 15 minutes' exposure, did not appreciably aid the vacuum in the penetration of the gas.

8. A secondary vacuum is of aid in clearing gas out of clothing bundles.

9. High concentrations of HCN require that materials be well ventilated after fumigation.

10. The odor and the lachrymatory effect of CNCl-HCN gas mixture may ventilate out, leaving a dangerous amount of HCN in fabrics. Hence there is no advantage in using CNCl-HCN rather than HCN.

11. Ship fumigation with cyanide gases (5 ounces sodium cyanide per 1,000 cubic feet for two hours without vacuum) can not be expected to kill all lice or lice ova.

12. The vacuum hydrocyanic acid gas method prescribed for the fumigation of imported compressed cotton bales (see Experiment No. 9, Table 2) was tried repeatedly but failed to destroy lice or lice ova protected by 16 to 24 folds of wool blanket.

13. The experiments made in this study, together with records of actual operations, definitely indicate the proper combination of HCN concentration, initial vacuum, and time of exposure necessary to destroy lice or lice ova in immigrants' clothing and ordinary baggage. The process is an improvement over the steam method, especially for baggage, and the factors prescribed are within practical limits.

RECOMMENDATIONS

As a result of this study the following recommendations were made and were adopted as the procedure to be used at the New York quarantine station:

(*a*) That the use of hydrocyanic acid gas be continued as a routine delousing agent for the clothing of immigrants, using from 143 to 285.7 ounces sodium cyanide per 1,000 cubic feet (12 ounces to 24 ounces per 84 cubic foot chamber), or from 72 to 143 fluid ounces of liquid HCN, that the initial vacuum be 26 inches, and that the exposure be for at least 30 minutes.

(*b*) That in loading the sterilizing chambers the clothing bags and the baggage be placed on wire racks, thus separating them somewhat, rather than packing them in tightly without the racks.

(*c*) That after fumigation, the clothing bags be hung up, out of doors if possible, but at least in a stream of fresh air, until odor of gas disappears, before being returned to the immigrants.

(*d*) That the same concentration of gas and initial vacuum as recommended for clothing bags be used for baggage, but that the time of exposure be 1 hour. That the covers of trunks and other very large cases be opened for fumigation. As it is usually at least 8 to 24 hours after fumigation before the immigrant has the opportunity of unpacking his larger pieces of baggage, airing of same is not necessary.

(*e*) That the clothing of immigrants with typhus, or exposed to typhus, be sterilized by the vacuum pressure steam process; shoes, hats, suit cases, etc., which steam would injure, to be subjected to the standard vacuum cyanide process.

ACKNOWLEDGMENT

Grateful acknowledgment is made to Surg. S. B. Grubbs for many helpful suggestions on this work.

A STUDY OF THE EFFECTS OF ANIONS UPON THE PROPERTIES OF "ALUM FLOC"

By Lewis B Miller, Associate Chemist, Hygienic Laboratory, United States Public Health Service

In considering the formation of that complex substance commonly called "alum floc," it is convenient to distinguish two aspects. The first is the ionic equilibria involved when solutions of aluminium salts are mixed with alkaline waters. The second is the physical properties of the insoluble product formed, especially with reference to its existence in the colloidal, dispersed state and in the flocculated state. However, these two aspects are interconnected, since the physical properties of the solid phase are determined by its composition, and this in turn is a function of the ionic composition of the mixed solutions. Previous work (Miller, 1924) showed that the nature and concentration of the negative ions exert a great effect upon the composition and physical properties of the floc. These studies have now been extended. Anions not common to natural waters have been used to develop principles and the unique properties of the floc from *alum* are emphasized.

As a preliminary step in this study there were made electrometric titration curves of aluminium salts by sodium hydroxide in the presence of several anions. The work of Theriault and Clark (1923) on the titration of alum and aluminium chloride was repeated and corroborated. Then since the pure aluminium salts could not be readily prepared for all of the negative ions which it was desired to study, the procedure was governed as follows: Preliminary experiments with aluminium chloride in presence of sodium sulphate as well as results in other lines (Miller, 1924) indicated that the effect of the monovalent chloride anion was practically completely masked by the presence of polyvalent anions. Therefore, experiments with polyvalent anions were conducted by introducing the aluminium ion into the solution as aluminium chloride and the polyvalent anion as the

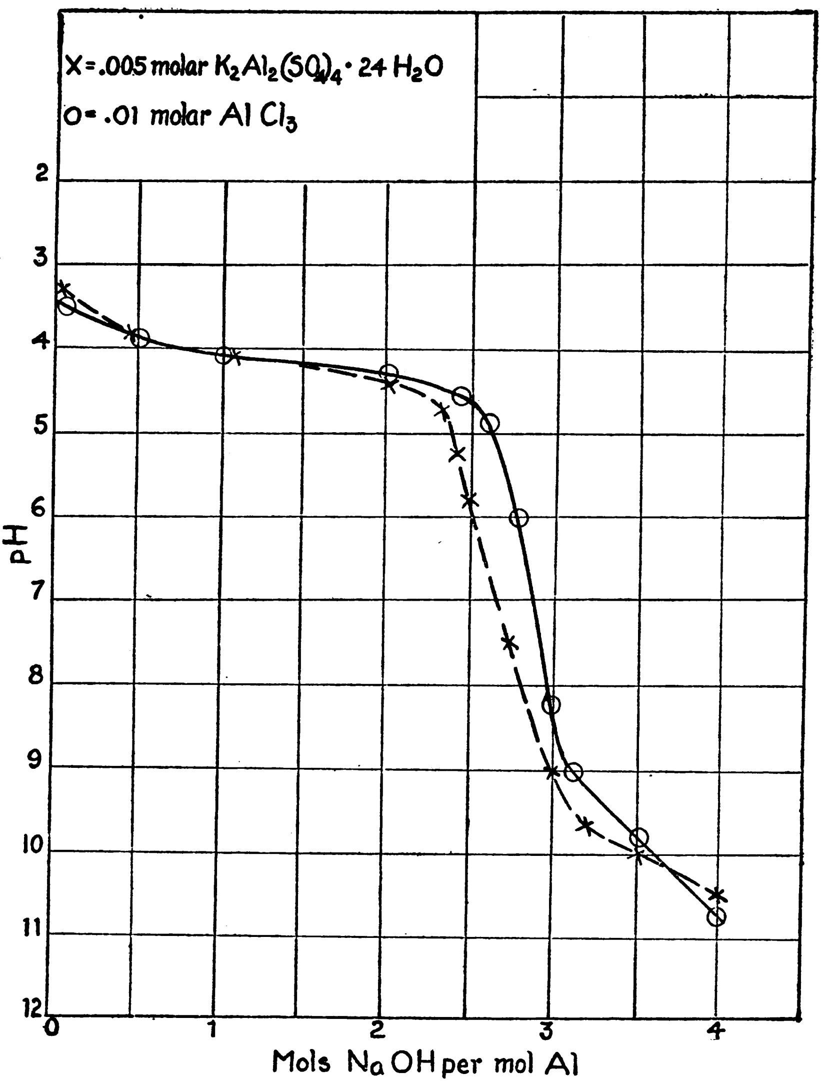


FIG. 1

potassium or sodium salt which yielded the anion in question. Four of these titration curves are shown in Figures 1 and 2. While they differ considerably in detail they all agree in showing a decided drop in potential before the "three equivalents of alkali" axis is reached, indicating that the floc is carrying down acid constituents from solution. This fact was also determined qualitatively upon the precipitates formed in presence of the various anions and a quantitative study made in presence of some of them (Miller, 1923 and 1924).

In the experimental work described in this paper, only very pure materials were used. C. P. chemicals were purified further by the usual methods. Solutions were made up in distilled water and standardized. Since the purpose of the research is to discover the fundamental principles underlying commercial water purification by

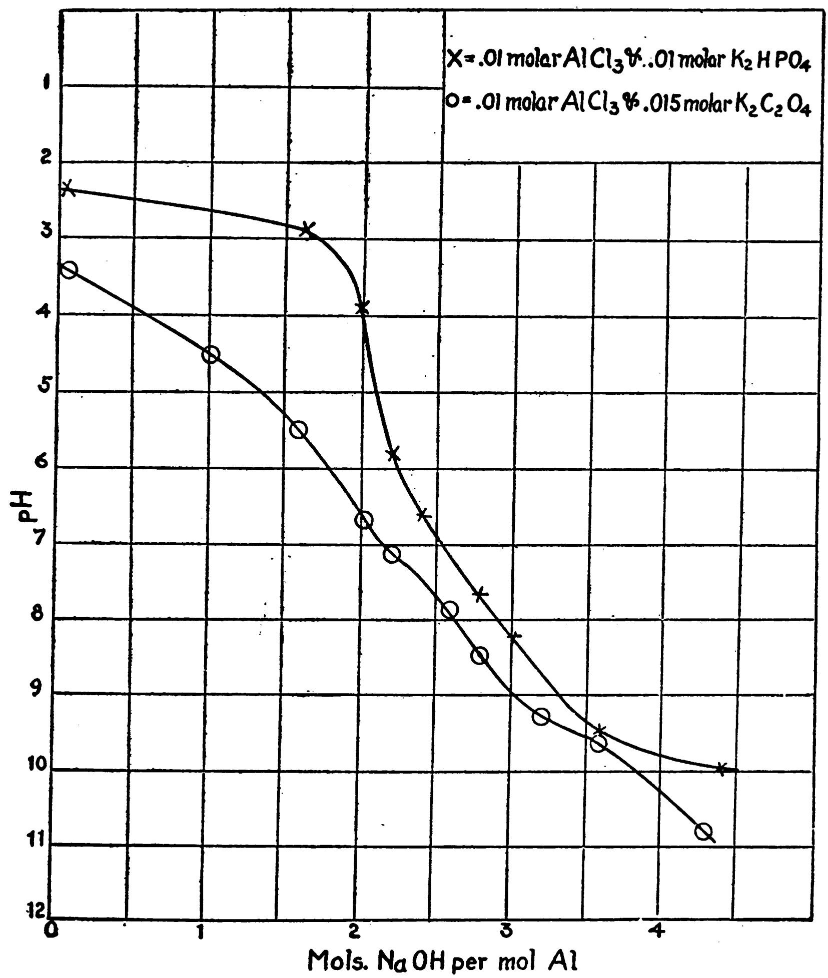


FIG. 2

alum, the solutions were as dilute as could be conveniently handled in the laboratory.

In the early part of the work upon alum at the Hygienic Laboratory the qualitative observation was made that when alum is treated with sodium hydroxide the region of hydrion concentration over which flocculation takes place is quite different from that in which flocculation occurs if aluminium chloride and sodium hydroxide are used. This suggests that the anions may determine the pH range over which flocculation or coagulation of the floc takes place. Several studies appear in the literature which, while not made with this specific purpose in view, throw light upon this subject. (In this connection

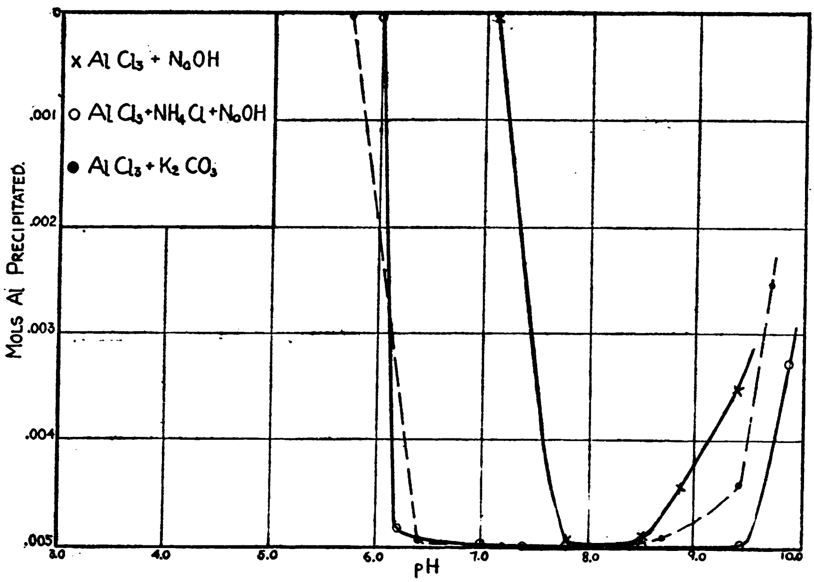


FIG. 3

see Blum, 1916; Buswell and Edwards, 1922; Wolman and Hannan, 1921; Daniels, 1923; Baylis, 1923; Theriault and Clark, 1923; Hatfield, 1924; Miller, 1923; Greenfield and Buswell, 1922; and Smith, 1920.) These papers include studies, from both practical and theoretical points of view, upon natural waters in filter plants and upon pure solutions in the laboratory. In general, these studies agree in showing a zone of fairly complete coagulation of alum (with corresponding low content of soluble aluminium in the filter effluent) covering a rather broad region of hydrion concentration. However, there is considerable divergence in the results of the various investigators as to the exact region of hydrion concentration over which coagulation occurs. This fact supports the idea that the mineral content of the water, or, more specifically, the anion content of the water, may influence the location of the zone of coagulation.

In order to test this hypothesis a series of experiments was conducted using the following procedure: Five hundred c. c. portions of aluminium salt solution, in the presence of various negative ions, were precipitated by the slow addition of 500 c. c. of a sodium hydroxide solution with mechanical stirring. The final concentration of Al was 0.005 molar. After the addition of the reagent had been completed, the solution was permitted to stand a half hour. The hydrion concentration was then determined colorimetrically. The solution was filtered through quantitative filter paper, the precipitate washed thoroughly with ammonium nitrate and ignited to constant weight. The amount of aluminium precipitated was

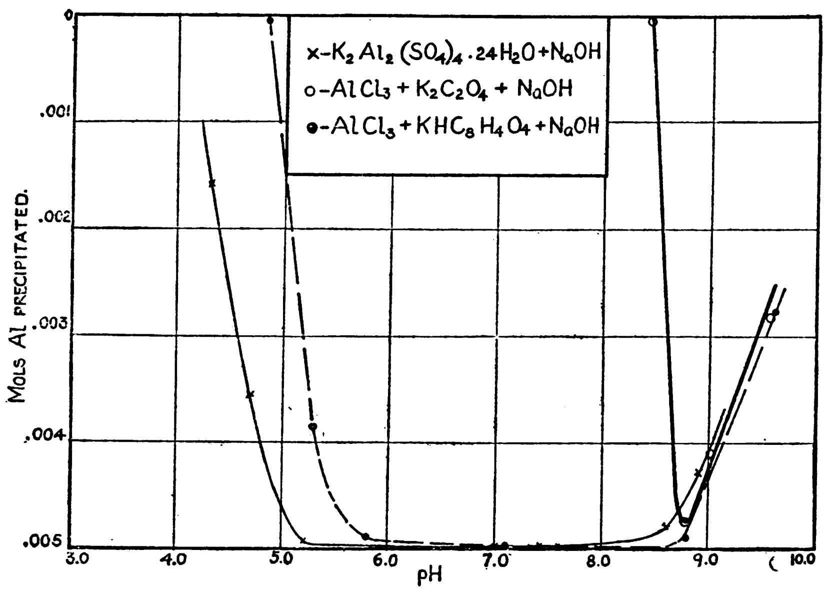


FIG. 4

then calculated from the weight of the alumina and the residual aluminium remaining in solution by difference. The numerical results are given in Tables 1 to 8, and these results plotted as "quantity of aluminium precipitated" against "hydrion concentration" are shown in Figures 3 to 5.

The effect of chloride and sulphate ion was studied by the addition of alkali to aluminium chloride and potassium alum. As in the titration experiments, the effect of other negative ions was studied by introducing the aluminium as aluminium chloride and the polyvalent anions as the potassium or sodium salt which yielded the anion in question.

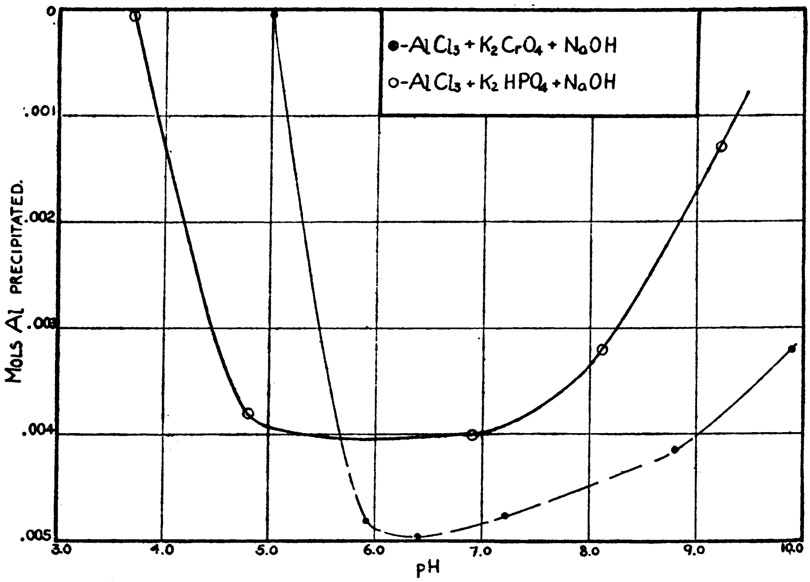


FIG. 5

TABLE 1

(0.005 molar aluminium chloride and sodium hydroxide)

Exp. No.	pH	Equivalents NaOH added per mol Al	Mols Al precipitated, determined as Al_2O_3	Remarks
1	5.0	2.50	0	Solution slightly opalescent.
2	7.1	2.90	0	Solution distinctly opalescent.
3	7.8	2.95	.00494	Good floc; filtrate clear.
4	8.5	3.00	.00495	Do.
5	8.8	3.10	.00442	Do.
6	9.4	3.40	.00304	Do.

TABLE 2

(0.005 molar aluminium chloride, 0.5 molar ammonium chloride and sodium hydroxide)

Exp. No.	pH	Equivalents NaOH added per mol Al	Mols Al precipitated, determined as Al_2O_3	Remarks
47	5.5	2.50	0	Clear solution; no floc.
57	6.0	2.65	0	Solution opalescent; no floc.
55	6.2	2.70	.00483	Good floc; clear filtrate.
53	6.8	2.85	----------	Do.
48	7.0	2.95	.00495	Do.
49	7.4	3.40	.00508	Do.
50	7.8	4.00	.00508	Do.
51	8.5	6.00	.00508	Do.
52	8.5	8.00	----------	Do.
54	9.4	180.00	.00506	Do.
56	9.8	----------	.00277	Do.

The results in Table 2 when compared to those in Table 1 show the "salting out" effect of the strong ammonium chloride solution upon the colloidal floc present. The results in Table 2 agree with those of Blum (1916) for the analytical determination of aluminium.

TABLE 3

(0.005 molar aluminium chloride and potassium carbonate)

Exp. No.	pH	Equivalents K_2CO_3 added per mol Al	Mols Al precipitated, determined as Al_2O_3	Remarks
36	4.6	2.00	0	Opalescent solution; no floc.
37	5.0	2.40	0	Do.
38	5.3	2.80	0	Do.
39	5.7	3.00	0	Do.
43	6.1	3.20	.00265	Fair floc; filtrate opalescent.
40	6.4	3.50	.00496	Good floc; filtrate clear.
41	7.2	4.00	.00496	Do.
42	8.7	5.00	.00491	Do.
44	9.4	6.00	.00440	Do.
45	9.4	7.00	----------	Do.
46	9.7	10.00	.00252	Do.

TABLE 4

(0.0025 molar potassium alum, $K_2Al_2(SO_4)_4 \cdot 24H_2O$, and sodium hydroxide)

pH	Equivalents NaOH added per mol Al	Mols Al precipitated	Remarks
4.3	1.200	0.001590	Good floc; filtrate clear.
4.7	1.800	.003551	Do.
5.2	2.400	.004882	Do.
5.8	2.500	.004937	Do.
6.2	2.600	.004960	Do.
6.7	2.700	.004993	Do.
7.0	2.723	.004990	Do.
7.4	2.800	.004984	Do.
7.6	2.850	.004980	Do.
8.6	2.950	.004785	Do.
8.9	3.100	.004279	Do.

The results in Table 4 are taken from Table 4 of the article by Miller, 1923. In this work residual aluminium was determined by filtering off the floc from a two liter sample, evaporating the filtrate to small volume, and determining aluminium as alumina by Blum's (1916) method.

TABLE 5

(0.005 molar aluminium chloride, 0.0075 molar potassium oxalate and sodium hydroxide)

Exp. No.	pH	Equivalents NaOH added per mol Al	Mols Al precipitated, determined as Al_2O_3	Remarks
9	7.0	1.80	0	Faintly opalescent; no floc.
7	8.0	2.20	0	Do.
10	8.4	2.60	0	Opalescent; no floc.
11	8.8	2.90	.00477	Floc; filtrate clear.
8	9.0	3.00	.00410	Do.
12	9.6	3.40	.00284	Do.

TABLE 6

(0.005 aluminium chloride, 0.0075 molar potassium acid phthalate, and sodium hydroxide)

Exp. No.	pH	Equivalents NaOH added per mol Al	Mols Al precipitated, determined as Al_2O_3	Remarks
29	3.8	1.00	0	Clear solution; no floc.
30	4.8	2.00	0	Opalescent; no floc.
31	5.3	3.00	0.00385	Fair floc; filtrate opalescent.
34	5.8	3.50	.00489	Good floc; filtrate clear.
32	7.1	4.00	.00510	Do.
35	8.8	4.50	.00489	Do.
33	9.6	5.00	.00277	Do.

TABLE 7

(0.005 molar aluminium chloride, 0.0075 molar potassium chromate, and sodium hydroxide)

Exp. No.	pH	Equivalents NaOH added per mol Al	Mols Al precipitated, determined as Al_2O_3*	Remarks
13	4.8	0	0	Opalescent; no floc.
14	4.8	0.40	0	Do.
15	5.0	1.00	0	Incipient flocculation; will not filter.
18	5.9	1.50	.00561	Floc; filtrate opalescent.
16	6.4	2.00	.00614	Do.
19	7.2	2.50	.00546	Do.
17	8.8	3.00	.00512	Floc; filtrate clear.
29	9.8	3.40	.00322	Do.

* Precipitate contains chromate which will not wash out.

TABLE 8

(0.005 molar aluminium chloride, 0.005 molar secondary potassium acid phosphate, and sodium hydroxide)

Exp. No.	pH	Equivalents NaOH added per mol Al	Mols Al precipitated, determined as $AlPO_4$*	Remarks
21	2.6	0	0	Solution clear.
22	3.0	1.00	0	Solution opalescent; no floc.
25	3.3	1.50	0	Very opalescent; no floc.
26	3.4	1.75	0	Increasing opalescence; no floc.
27	3.7	1.90	0	Do.
23	4.8	2.00	.00388	Floc; filtrate opalescent.
28½	6.9	2.50	.00403	Floc; filtrate slightly opalescent.
24	8.1	3.00	.00321	Floc; filtrate clear.
28	9.2	3.50	.00130	Do.

* It was assumed that the precipitate had the composition, $AlPO_4$.

The data in Tables 7 and 8 are much less reliable than the remainder of the data. In Table 7 the values are considerably too high, due to the fact that chromate is carried down which can not be readily removed from the precipitate. In Table 8 it is assumed that the precipitate has the composition $AlPO_4$. That aluminium precipitates as the neutral phosphate in solutions weakly acid with acetic acid is well known. Whether this composition extends to high pH values is questionable in light of recent work on the composition of the aluminium precipitate from alum (Miller, 1923). The results do indicate definitely, however, the range of hydrion concentration over which flocculation occurs in presence of chromate and phosphate ion.

The results thus far have been obtained by experimenting with solutions 0.005 molar with respect to aluminium. It was desired to extend these investigations to solutions approaching in strength those used in the actual operation of water purification. Solutions 0.0005 molar with respect to aluminium of aluminium chloride and of potassium alum were made up, treated by sodium hydroxide, and analyzed as before. The results are given in Tables 9 and 10 and plotted in Figure 6. The regions of flocculation are seen to be approximately the same as for the more concentrated solutions.

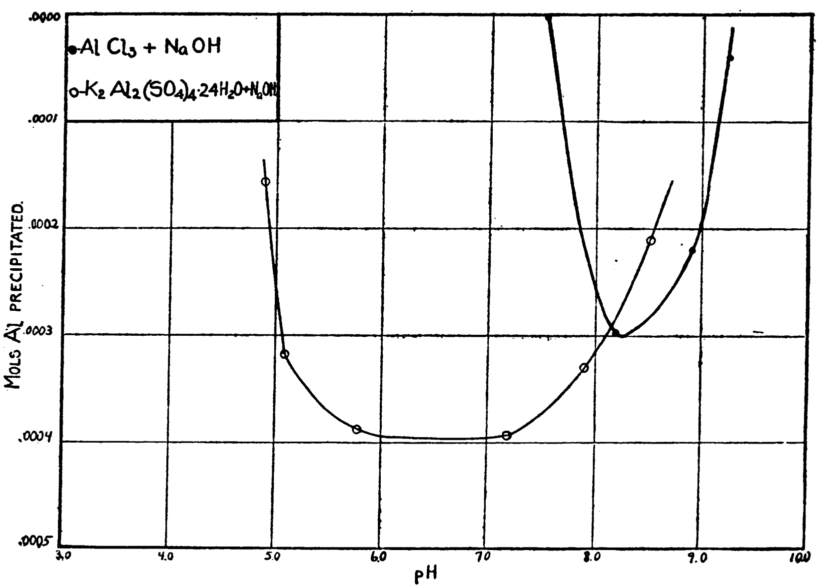


FIG. 6

TABLE 9

[0.0005 molar aluminium chloride and sodium hydroxide]

Exp. No.	pH	Equivalents NaOH added per mol Al	Mols Al ppt. determined as Al_2O_3	Remarks
60	5.8	2.90	0	No floc.
61	6.3	3.00	0	Do.
66	6.9	3.20	0	Do.
67	7.5	3.30	0	Do.
62	8.1	3.40	....	Flocculation.
64	8.2	3.80	.00030	Do.
63	8.9	4.00	.00022	Do.
65	9.2	4.30	.00009	Do.

TABLE 10

(0.00025 molar potassium alum, $K_2Al_2(SO_4)_4.24H_2O$, and sodium hydroxide)

Exp. No.	pH	Equivalents NaOH added per mol Al	Mols Al precipitated, determined as Al_2O_3	Remarks
76	4.9	0.8	.00016	Flocculation.
75	5.0	1.2	----------	Do.
73	5.1	1.6	.00032	Do.
72	5.8	2.0	.00039	Do.
71	7.2	2.4	.00039	Do.
70	7.9	2.7	.00033	Do.
74	8.5	3.0	.00021	Do.

The results tabulated here show the regions of hydrion concentration over which flocculation occurs in the presence of various negative ions for that complex substance commonly called alum floc and often incorrectly termed aluminium hydroxide. In the strictest sense these data do not represent the range of hydrion concentration over which the alum floc is "insoluble." Witness, for example, the case of the oxalate. In this example, in passing from lower to higher pH values the solutions become more and more opalescent, indicating that there is an insoluble substance present in the highly dispersed colloidal state. It is not until the pH rises to the value of 8.8 that flocculation occurs. Similarly the presence of ammonium chloride in relatively high concentration assists the coagulation of the colloidal floc produced by mixing aluminium chloride and sodium hydroxide and very perceptibly broadens the coagulation zone.

It must be emphasized that alum floc, while it sometimes exists in the state of a colloidal suspension, is quite different in a relative sense from what is often described in the literature as colloidal aluminium hydroxide. If, for example, an aluminium chloride-ammonia mixture is placed in a collodion bag and dialyzed, the resulting colloidal material becomes more and more sensitive to the presence of coagulating anions as dialysis proceeds. If dialyzed sufficiently long, coagulation will take place spontaneously. If the process is stopped just before this stage is reached a product is secured which is exceedingly sensitive, requiring the merest trace of coagulating anion to render it unstable. The material termed alum floc which sometimes exists in the colloidal state is, as has been shown, sensitive especially to polyvalent anions and hydrion concentration. As compared to the dialyzed sol, however, it requires enormous quantities of coagulating anion to affect it.

These data make evident the importance of the negative ion in the flocculation of the solid phase. The hydrion zone of coagulation may be controlled at will by varying the negative ions present in solution. Coagulation must therefore be partially dependent upon the coagulating effect of the anions and partially upon the hydrion concentration. While it appears that polyvalent anions are, in general, more efficient than monovalent anions in producing coagulation, the effect of each anion seems to be specific in determining the particular region of hydrion concentration over which flocculation will occur. The sulphate anion is unique among the anions studied in that it produces (under the conditions described) a comparatively good floc over a broad range of hydrion concentration. The existence of a colloidal, opalescent suspension has never been observed with pure alum solutions. It occurred with all other anions studied.

As a further example of the strong coagulating effect of the sulphate ion as compared to the chloride ion we cite the following: If very dilute solutions of aluminium chloride (0.0005 molar) and sodium hydroxide be mixed in such proportions that somewhat less than three mols of sodium hydroxide per mol of aluminium chloride are present no floc will form and the solutions will remain perfectly clear and transparent. If, then, an equivalent quantity of neutral sodium sulphate is added, flocculation takes place. If more concentrated solutions of aluminium chloride (0.01 molar) are used, the solutions become opalescent upon addition of sodium hydroxide. As more and more sodium hydroxide is added, the opalescence increases until three mols of sodium hydroxide per mol aluminium chloride are added, at which point flocculation takes place. Upon permitting these opalescent solutions to stand, a process of solution, dispersion, or both occurs, so that at the end of several days the solutions are clear and transparent, or nearly so. If to the opalescent solution which first forms or to the clear solution which finally results sodium sulphate be added, flocculation takes place. The photographs in Plate I illustrate the facts just stated. Since it was desired that the opalescence should be plainly discernible in the photographs, relatively strong (0.01 molar) solutions of aluminium chloride were used. To these were added increasing amounts of sodium hydroxide. The pH was determined colorimetrically. For Plate I (A) from left to right we have the following data:

	Tube No.—				
	1	2	3	4	5
Mols NaOH per mol $AlCl_3$	1.0	2.3	2.5	2.7	3.0
pH	4.2	4.4	5.2	6.1	8.7

As increasing amounts of sodium hydroxide are added, opalescence increases until three equivalents of the reagent per mol aluminium chloride have been added. At this point flocculation occurs. Plate

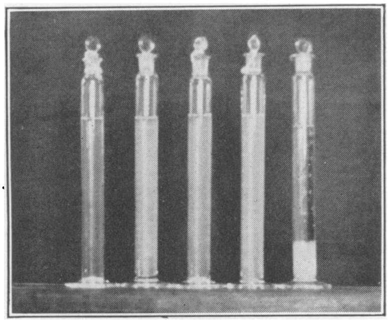
I(B) shows the effect of the addition of three equivalents of sodium sulphate per mol aluminium chloride to the above mixtures. Good flocculation occurs in every case. A slight increase in pH value is noted when sodium sulphate is added. Below are the data for Plate I(B):

	Tube No.—				
	1	2	3	4	5
Mols NaOH per mol $AlCl_3$	1.0	2.3	2.5	2.7	3.0
pH	4.2	4.6	5.3	6.9	9.0
Mols Na_2SO_4 per mol $AlCl_3$	1.5	1.5	1.5	1.5	1.5

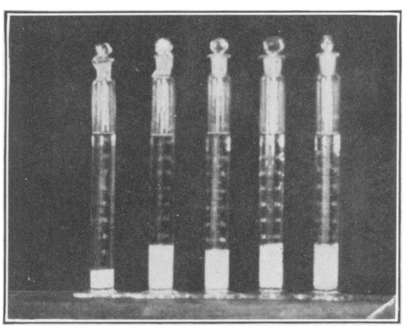
As noted above, a relatively high concentration of aluminium chloride was used in order to make the results plainly evident in the photographs. The principle thus illustrated applies to more dilute solutions.

When flocculation of the aluminium chloride-sodium hydroxide mixtures is produced by the addition of sodium sulphate as described above, an analysis of the floc by the method of Miller (1923) shows that the floc contains approximately the same proportion of sulphate as would be contained by a floc at the same hydrion concentration produced from alum and sodium hydroxide. This co-precipitation of an acid component has already been dealt with by an analytical method (Miller 1923 and 1924).

Theriault and Clark (1923) have made a study of the region of hydrion concentration over which *rapid* flocculation of alum at high dilutions occurs when the alum is added to alkaline solutions or to buffered solutions. Their results show that, as the alum solutions become increasingly dilute, the pH zone of rapid flocculation rapidly narrows, giving a maximum rate of flocculation at a pH of 5.5. Hatfield (1924), in data obtained with alum upon Lake St. Clair water by the method of Theriault and Clark, found a maximum rate of flocculation at a pH of 6.1 to 6.3. In contrast to this, he observed a much broader zone of hydrion concentration (pH 5.8 to pH 7.5) in which the filter effluent was practically free from soluble aluminium. These results are in accord with the broad zone of coagulation for alum described in this paper. Now it is obvious that the zone of *rapid* coagulation must lie within the zone of coagulation for any particular anion; but it does not necessarily follow that the two zones will coincide. The results just cited plainly indicate that for alum they do not. It is of considerable interest and perhaps significance that for alum the zone of most rapid flocculation lies in the most acid portion of the zone of coagulation. This is the portion of the zone of coagulation in which the solid phase is highest in sulphate content.

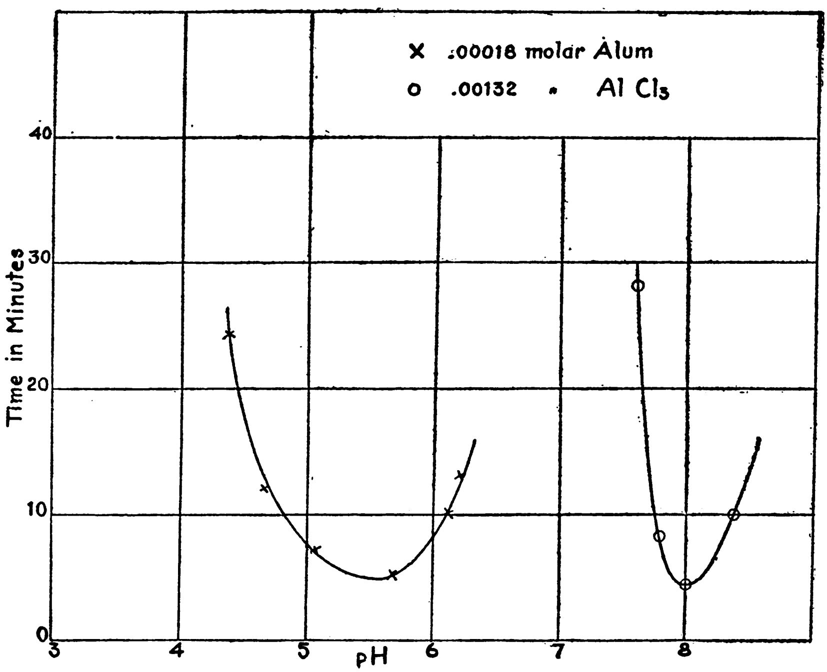


A



B

Theriault and Clark (1923) have suggested, with reservations, that the pH value of 5.5 at which maximum rate of flocculation of alum occurs is of significance in the determination of the isoelectric point for aluminium hydroxide. Hatfield (1924) refers to his values of pH 6.1 to pH 6.3 as indicating the "apparent isoelectric point" of aluminium hydroxide. As the results upon the effect of anions in determining the hydrion zone of coagulation suggest, and as will be shown in a moment, the hydrion zone of *rapid* flocculation may be varied at will by a variation in the anions present in solution. The results of the investigators just quoted, while of value and importance



FIG, 7

to the water works profession as a determination of the zone of hydrion concentration in which flocculation occurs most rapidly for the conditions described, is not of significance as a direct experimental method for the determination of the true isoelectric point of aluminium hydroxide.

Theriault and Clark (1923) in their determination of the zone of hydrion concentration at which the maximum rate of flocculation occurs, used solutions containing 100 parts per million of alum with success. When solutions of aluminium chloride and sodium hydroxide of the same molar concentrations as the above are used, no flocculation occurs within 24 hours. It is necessary to increase the aluminium chloride concentration to 0.00132 molar in order to secure flocculation within a reasonable time. In Figure 7 is plotted the time of first appearance of floc against pH for solutions of 0.00018 molar alum and 0.00132 molar aluminium chloride to which have been added varying quantities of sodium hydroxide. The pH was determined colorimetrically. The pH value at which alum solutions flocculate most rapidly is at or near the value of 5.5. For aluminium chloride the pH value is 8.0. This illustrates the point just discussed—that the hydrion concentration at which the rate of floc formation is greatest may be varied by a change in the anion content of the solution. The far greater molar concentration of aluminium chloride (as compared to alum) necessary to produce a floc within a few minutes is an added proof of the strong coagulating action of the sulphate ion.

It has been stated in this paper that 0.005 molar solutions of aluminium chloride do not flocculate with increased additions of sodium hydroxide until practically three mols of sodium hydroxide per mol of aluminium chloride have been added, this mixture having a hydrion concentration of about pH 8.5. At lower pH values a colloidal suspension forms giving the solution an opalescent appearance. The addition of sodium sulphate to these colloidal suspensions causes flocculation to take place. In Table 11 are given data showing the smallest quantities of sodium sulphate which, when added to one liter quantities of 0.005 molar aluminium chloride-sodium hydroxide mixtures cause complete flocculation of the colloidal material, leaving the supernatant liquid clear and sparkling after the floc has settled. As the pH of the solution increases, it requires less and less sulphate ion to cause flocculation, until at pH 9.0 flocculation occurs spontaneously.

TABLE 11.—*Smallest quantity of Na_2SO_4 that will cause flocculation of NaOH mixtures at different pH values*

Experiment No.	pH	Equivalents NaOH per mol $AlCl_3$	Equivalents Na_2SO_4 per mol $AlCl_3$	Experiment No.	pH	Equivalents NaOH per mol $AlCl_3$	Equivalents Na_2SO_4 per mol $AlCl_3$
13	4.6	2.00	0.7	27	8.4	2.90	0.2
16	4.9	2.40	0.7	31	9.0	3.10	0
21	6.8	2.75	0.3				

The results obtained in this investigation may serve to explain the reason for the variable results obtained by different investigators relative to the region of pH over which flocculation occurs in water purification and to the region in which considerable soluble aluminium is found in the filter effluent. The cause, in all probability, lies in the effect of the negative ions present in the raw water or which are subsequently added, and, perhaps, also to organic and colloidal matter likewise present in the raw water. (See Baylis, 1923, and Smith, 1920.) That the results of different investigators for alum do not differ as widely as the results described in this paper is probably due to the strong influence of the divalent negative sulphate ion in coagulating the insoluble aluminium compound formed.

The effect of different anions in determining the hydrion zone of flocculation is not limited to the aluminium precipitate. Experiments upon ferric chloride and ferric sulphate show that the same principles apply there. It seems altogether probable that these principles will likewise apply to many of the metals which form insoluble hydroxides. The application of these principles should be of importance to such industries as, for example, the paper and mordant dyeing industries which make use of metallic hydroxide precipitate. The power to control the formation of a precipitate in one pH range or prevent it in another by a variation of anion, or the knowledge that the removal of interfering anions will improve the character of the precipitate, must certainly find application in many ways.

In water purification by alum there are at least three chemical factors necessary for successful clarification: (1) There must be added a certain minimum quantity of aluminium ion; (2) there must be present an anion of strong coagulating power, such as the sulphate ion; (3) the hydrion concentration must be properly adjusted. As the work of Theriault and Clark (1923) and of Langelier (1923) suggest, and as the work of Baylis (1923) proves, it may be cheaper to add a minimum quantity of alum and adjust to the desired pH value by the addition of mineral acid than to add a larger quantity of alum. Under certain conditions the purchase or manufacture of an acid alum may prove to be more economical. Likewise, for a water of low alkalinity which requires an alum-lime dosage it may prove profitable to use a basic alum together with slight additions of acid or lime to secure the proper hydrion concentration. Or it may be that a source of aluminium ion other than alum may be found sufficiently cheap to warrant its use together with a larger quantity of sulphuric acid, the latter to be the source of sulphate ion and the means of adjusting hydrion concentration. It is not the purpose of this paper to discuss relative costs or to suggest new methods of alum manufacture. It is merely desired to point out a few rather obvious possibilities for the application of the principles discussed. The alert engineer will make use of these or any other applications which appear feasible. In closing let it be again emphasized that the sulphate ion and the aluminium ion are of coordinate importance in water clarification. In buying aluminium sulphate the water works superintendent purchases two values: a potential supply of aluminium ion which with alkaline waters will form an insoluble material and a potential supply of sulphate ion which of all ions studied is best qualified to yield a suitable floc. It is indeed fortunate for the progress of water purification by coagulants that one of the earliest and cheapest commercial methods discovered for the formation of aluminium compounds chanced to be the reaction of sulphuric acid with bauxite.

The above considerations apply to those procedures in water clarification which make use of the properties of the ordinary floc. There are, however, phases of water clarification such as the removal of certain types of color where other aspects of the problem must be considered. These we shall treat in a subsequent paper.

In this article the importance of the negative ion content of the solution in relation to some of the chemical and physical properties of alum floc has been established. The bearing upon water purification by the alum process has been discussed. In this connection the effect of several negative ions upon the form of the electrometric titration curve has been demonstrated. The relation of hydrion concentration and anion content of the solution to the formation of the aluminium precipitate has been determined for several anions. The dependence of the physical state of the insoluble aluminium compounds formed—their existence in colloidal suspension or as coagulated precipitate—upon the anions present has been emphasized. The lack of agreement in the literature upon the region of hydrion concentration in which coagulation of alum takes place has been explained as partially due to the negative ion content of the solutions in question and to the presence of colloidal material such as silicic acid or organic matter. The relation of "hydrion zone of coagulation" to "hydrion zone of rapid coagulation" for aluminium sulphate and aluminium chloride has been determined. For aluminium sulphate it has been demonstrated that the "hydrion zone of rapid coagulation" tends to shift towards the more acid portion of the "hydrion zone of coagulation." A few possible applications of the principles discussed in this paper have been pointed out, and in particular the coordinate importance of the aluminium ion and of the sulphate ion for current water works practice has been emphasized.

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CONFERENCE BOARD OF PHYSICIANS IN INDUSTRY

Abstracts of Minutes of Meeting held in New York, January 16, 1925

Below are printed brief abstracts of the minutes of the recent meeting of the Conference Board of Physicians in Industry. Inasmuch as the conference board represents a group of physicians in industrial concerns employing between 600,000 and 700,000 persons, it is believed that their opinions may be of considerable interest and importance.

ABSTRACTS OF MINUTES OF FORTY-SIXTH MEETING, CONFERENCE BOARD OF PHYSICIANS IN INDUSTRY, HELD IN NEW YORK JANUARY 16, 1925

At its forty-sixth meeting, held in New York, January 16, 1925, the Conference Board of Physicians in Industry reviewed the methods in use for the care of trivial injuries. While it was agreed that many trifling injuries created no disability and required no redressing, it was also stated that many serious infections entailing much loss of time and production arose from the neglect of such cases. This was emphasized by figures on infections submitted by the members. Over 2,000 infection cases were reported among 32,500 workers during 1924, and of this number only about 20 had received treatment prior to the appearance of the infection. It was thus seen that where prompt medical attention is given to injuries, infections are practically eliminated, and that practically all infections in such injuries result from delay in reporting for treatment.

In view of the experience of the members as noted above, it was the consensus of opinion that all industrial injuries should have first-aid treatment, which, in the absence of physician or nurse, might be given by a trained first-aid attendant. Where this is done and the employee continues at his regular work without visiting the medical department, a record of the case should be made by the one rendering the initial treatment and sent immediately to the medical department. The physician should either see these cases or obtain a report on them within 24 or 48 hours. It is much better for the physician or nurse to treat all injuries, but in large plants, particularly those with scattered units, this is not practicable, and, under the circumstances, the services of trained first-aid attendants may be utilized.

The treatment of more serious cases was also discussed, particularly those cases drawing compensation benefits. In the experience of the members, the most beneficial results to the worker who is recovering from an injury are obtained in cases where he is returned to employment pending complete recovery. Certain types of workers are unfavorably influenced by prolonged periods of idleness pending complete recovery, and it is hard to get such persons to again take up their usual employment. Compensation boards frequently permit the worker to prolong his idleness on the ground that he has not recovered from the effects of the injury.

It was the unanimous conclusion of the board that these practices were factors in delayed recovery and in the development of traumatic neuroses and certain cases of malingering. It was urged that compensation boards give more careful consideration to the question of returning the injured worker to some sort of employment as soon as it was safe to do so. It has been the experience of members that many injured workers will do better active work with the injured part at their regular occupation than they will by going through passive movements and specified active exercises at home or in a physiotherapeutic clinic. The mental stimulation which comes from regular employment is much more beneficial than that obtained in a clinic where the patient has nothing to divert his attention from his own injuries and those of others around him.

It is realized that in many cases a certain amount of physiotherapeutic treatment is necessary before any work can be attempted. The board believes, however, that supervised active motion of the previously injured part, carried out as work in the factory, leads to recovery more promptly than any other form of treatment.

F. L. Rector, M. D.,
Secretary, Conference Board of Physicians in Industry.

DEATHS DURING WEEK ENDED FEBRUARY 7, 1925

Summary of information received by telegraph from industrial insurance companies for week ended February 7, 1925, and corresponding week of 1924. (From the Weekly Health Index, February 10, 1925, issued by the Bureau of the Census, Department of Commerce)

	Week ended Feb. 7, 1925	Corresponding week, 1924
Policies in force	58, 552, 142	54, 928, 791
Number of death claims	11, 254	10, 730
Death claims per 1,000 policies in force, annual rate	10. 0	10. 2

Deaths from all causes in certain large cities of the United States during the week ended February 7, 1925, infant mortality, annual death rate, and comparison with corresponding week of 1924. (From the Weekly Health Index, February 10, 1925, issued by the Bureau of the Census, Department of Commerce)

City	Week ended Feb. 7, 1925		Annual death rate per 1,000 corresponding week, 1924	Deaths under 1 year		Infant mortality rate, week ended Feb. 7, 1925 [2]
	Total deaths	Death rate [1]		Week ended Feb. 7, 1925	Corresponding week, 1924	
Total (64 cities)	7,621	14.4	[3] 14.0	922	[3] 916	-----
Akron	51	-----	-----	9	5	99
Albany [4]	44	19.2	22.4	6	4	133
Atlanta	69	15.5	22.9	6	20	-----
Baltimore [4]	255	16.7	17.5	34	30	99
Birmingham	71	18.0	21.8	8	8	-----
Boston	289	19.2	14.4	35	28	93
Bridgeport	27	-----	-----	3	5	43
Buffalo	129	12.1	13.4	20	23	81
Cambridge	35	16.2	9.8	2	2	34
Camden	36	14.6	11.1	4	6	66
Chicago [4]	753	13.1	12.0	121	105	107
Cincinnati	132	16.8	18.5	12	12	71
Cleveland	209	11.6	10.9	25	20	62
Columbus	79	15.0	13.6	9	1	85
Dallas	61	16.4	13.0	7	6	-----
Dayton	41	12.4	15.1	3	6	48
Denver	76	-----	-----	7	8	-----
Des Moines	32	11.2	9.0	3	3	51
Detroit	273	-----	-----	49	38	83
Duluth	31	14.6	8.7	2	2	42
Erie	22	-----	-----	5	6	98
Fall River [4]	25	10.8	10.8	4	7	58
Flint	24	-----	-----	6	8	99
Fort Worth	29	9.9	9.5	2	0	-----
Grand Rapids	33	11.4	14.4	6	9	93
Houston	55	-----	-----	10	3	-----
Indianapolis	90	13.1	13.5	9	10	62
Jacksonville, Fla	44	21.9	20.9	3	8	67
Jersey City	84	13.9	14.2	12	10	84
Kansas City, Kans	30	12.6	12.8	4	3	84
Kansas City, Mo	97	13.8	14.8	11	12	-----
Los Angeles	262	-----	-----	24	23	67
Louisville	78	15.7	18.8	12	12	105
Lowell	39	17.5	10.8	11	6	191
Lynn	32	15.9	14.1	4	3	106
Memphis	68	20.3	20.6	12	8	-----
Milwaukee	107	11.1	11.8	24	13	110
Minneapolis	93	11.4	10.7	9	11	48
Nashville [4]	44	18.5	18.2	0	11	-----
New Bedford	29	11.2	11.8	5	9	83
New Haven	41	11.9	19.6	3	9	39
New Orleans	165	20.8	22.7	17	18	-----
New York	1,689	14.4	13.5	180	176	72
Bronx Borough	204	11.8	10.1	24	16	83
Brooklyn Borough	531	12.4	12.0	55	61	58
Manhattan Borough	755	17.4	17.1	87	86	87
Queens Borough	150	13.6	10.3	10	10	50
Richmond Borough	49	19.1	14.8	4	3	72
Newark, N. J	97	11.2	10.1	10	10	46
Norfolk	30	9.2	9.5	5	5	89
Oakland	48	9.9	12.7	7	6	82
Oklahoma City	29	14.2	8.5	2	0	-----
Omaha	77	19.0	10.5	8	5	77
Paterson	27	9.9	11.1	2	4	34
Philadelphia	584	15.4	13.6	73	69	92
Pittsburgh	234	19.3	18.6	37	42	130
Portland, Oreg	61	11.3	10.9	8	4	83
Providence	89	18.9	17.1	11	19	88
Richmond	60	16.8	17.0	10	11	121
Rochester	85	13.4	-----	12	-----	95
St. Louis	247	15.7	15.7	22	25	-----
St. Paul	55	11.7	14.3	2	8	17
Salt Lake City [4]	25	10.0	13.0	4	8	63

[1] Annual rate per 1,000 population.
[2] Deaths under 1 year per 1,000 births—an annual rate based on deaths under 1 year for the week and estimated births for 1924. Cities left blank are not in the registration area for births.
[3] Data for 63 cities.
[4] Deaths for week ended Friday, February 6, 1925.

Deaths from all causes in certain large cities of the United States during the week ended February 7, 1925, infant mortality, annual death rate, and comparison with corresponding week of 1924. (From the Weekly Health Index, February 10, 1925, issued by the Bureau of the Census, Department of Commerce)—Continued

City	Week ended Feb. 7, 1925		Annual death rate per 1,000 corresponding week, 1924	Deaths under 1 year		Infant mortality rate, week ended Feb. 7, 1925
	Total deaths	Death rate		Week ended Feb. 7, 1925	Corresponding week, 1924	
San Antonio	62	16.3	21.8	9	12	
San Francisco	146	13.7	14.6	12	11	69
Schenectady	17	8.7	13.5	2	4	56
Seattle	63			6	6	61
Somerville	20	10.2	9.3	1	4	27
Spokane	27			3	3	65
Springfield, Mass	48	16.4	9.5	8	2	119
Syracuse	56	15.2	12.8	4	5	50
Tacoma	17	8.5	7.1	1	1	24
Toledo	73	13.2	14.5	5	8	45
Trenton	56	22.1	15.7	8	6	130
Washington, D. C	143	15.0	14.2	10	16	56
Waterbury	27			4	6	88
Wilmington, Del	36	15.4	10.4	7	2	160
Worcester	55	14.4	16.8	6	10	69
Yonkers	23	10.7	11.4	4	4	88
Youngstown	38	12.4	14.5	7	4	89

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

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Reports for Week Ended February 14, 1925

ALABAMA

	Cases
Chicken pox	33
Diphtheria	11
Dysentery	3
Influenza	758
Lethargic encephalitis	2
Malaria	9
Measles	40
Mumps	51
Ophthalmia neonatorum	1
Paratyphoid fever	1
Pellagra	2
Pneumonia	192
Scarlet fever	26
Smallpox	216
Tetanus	1
Trachoma	10
Tuberculosis	29
Typhoid fever	13
Whooping cough	32

ARKANSAS

Cerebrospinal meningitis	1
Chicken pox	45
Diphtheria	16
Influenza	245
Malaria	18
Measles	27
Mumps	89
Pellagra	2
Scarlet fever	25
Smallpox	18
Tuberculosis	15
Typhoid fever	6
Whooping cough	21

CALIFORNIA

	Cases
Cerebrospinal meningitis—San Bernardino County	1
Diphtheria	130
Influenza	77
Lethargic encephalitis—Alameda	1
Measles	28
Poliomyelitis:	
Hanford	1
Kings County	1
Long Beach	1
North Sacramento	1
Oakland	1
Scarlet fever	137
Smallpox:	
Los Angeles	50
Oakland	14
San Diego	14
San Francisco	9
Scattering	50
Typhoid fever	5

CONNECTICUT

Chicken pox	88
Diphtheria	50
German measles	45
Influenza	21
Lethargic encephalitis	1
Measles	68
Mumps	35
Paratyphoid fever	1
Pneumonia (all forms)	119
Scarlet fever	194
Septic sore throat	7
Trichinosis	1
Tuberculosis (all forms)	23
Typhoid fever	8
Whooping cough	65

DELAWARE

	Cases
Chicken pox	5
Diphtheria	2
Influenza	8
Mumps	5
Pneumonia	4
Scarlet fever	11
Tuberculosis	7
Typhoid fever	4
Whooping cough	1

FLORIDA

Diphtheria	8
Influenza	55
Malaria	7
Pneumonia	3
Scarlet fever	2
Smallpox	1
Typhoid fever	20

GEORGIA

Cerebrospinal meningitis	1
Chicken pox	58
Conjunctivitis (infectious)	3
Dengue	1
Diphtheria	31
Dysentery	4
Hookworm disease	8
Influenza	956
Lethargic encephalitis	1
Malaria	24
Measles	5
Mumps	62
Pellagra	9
Pneumonia	127
Rabies in man	1
Scarlet fever	14
Septic sore throat	8
Smallpox	13
Tuberculosis (pulmonary)	39
Typhoid fever	13
Whooping cough	45

ILLINOIS

	Cases
Cerebrospinal meningitis:	
Madison County	1
Montgomery County	1
Diphtheria:	
Cook County	68
Scattering	41
Influenza	33
Measles	635
Pneumonia	365
Poliomyelitis—Cook County	1
Scarlet fever:	
Cook County	311
Jefferson County	27
Kane County	17
Madison County	11
Peoria County	10
Rock Island County	10
St. Clair County	17
Schuyler County	12
Will County	14
Scattering	113
Smallpox:	
Madison County	9
St. Clair County	10
Scattering	26
Tuberculosis	211
Typhoid fever	10
Whooping cough	296

INDIANA

Chicken pox	119
Diphtheria	40
Influenza	101
Measles	140
Mumps	4
Pneumonia	15
Scarlet fever:	
Allen County	22
Clark County	25
Delaware County	9
Elkhart County	14
Fulton County	10
Huntington County	13
St. Joseph County	32
Scattering	91
Smallpox:	
Decatur County	20
Kosciusko County	12
Miami County	9
Vigo County	15
Scattering	75
Trachoma	1
Tuberculosis	34
Typhoid fever	3
Whooping cough	23

IOWA

Diphtheria	18
Scarlet fever	38
Smallpox	25

KANSAS

Chicken pox	128
Diphtheria	22
German measles	1
Influenza	21
Lethargic encephalitis	3
Malaria	1
Measles	8
Mumps	503
Pneumonia	46
Scarlet fever	101
Smallpox	4
Tuberculosis	10
Typhoid fever	1
Whooping cough	23

LOUISIANA

Diphtheria	16
Influenza	56
Malaria	1
Pneumonia	65
Scarlet fever	14
Smallpox	24
Tuberculosis	36
Typhoid fever	18
Whooping cough	3

MAINE

	Cases
Cerebrospinal meningitis	1
Chicken pox	43
Diphtheria	4
German measles	15
Influenza	11
Influenza reported as "devil's grip"	4
Measles	1
Mumps	72
Pneumonia	9
Scarlet fever	20
Septic sore throat	2
Tuberculosis	11
Typhoid fever	2
Whooping cough	1

MARYLAND [1]

Cerebrospinal meningitis	1
Chicken pox	94
Diphtheria	54
German measles	7
Lethargic encephalitis	1
Influenza	130
Measles	92
Mumps	67
Ophthalmia neonatorum	1
Paratyphoid fever	1
Pneumonia (all forms)	169
Scarlet fever	144
Septic sore throat	3
Tuberculosis	66
Typhoid fever	6
Whooping cough	123

MASSACHUSETTS

Actinomycosis	1
Cerebrospinal meningitis	3
Chicken pox	247
Conjunctivitis (suppurative)	30
Diphtheria	136
German measles	538
Influenza	89
Lethargic encephalitis	3
Measles	572
Mumps	92
Ophthalmia neonatorum	40
Pneumonia (lobar)	243
Poliomyelitis	1
Scarlet fever	410
Septic sore throat	5
Tetanus	1
Trichinosis	1
Tuberculosis (all forms)	158
Typhoid fever	14
Whooping cough	170

MICHIGAN

Diphtheria	69
Measles	204
Pneumonia	116
Scarlet fever	348
Smallpox	8
Tuberculosis	57
Typhoid fever	6
Whooping cough	80

[1] Week ended Friday.

MINNESOTA

	Cases
Chicken pox	118
Diphtheria	73
Lethargic encephalitis	1
Measles	38
Pneumonia	7
Scarlet fever	245
Smallpox	76
Tuberculosis	45
Typhoid fever	3
Whooping cough	40

MISSISSIPPI

Cerebrospinal meningitis	1
Diphtheria	12
Influenza	399
Scarlet fever	2
Smallpox	15
Typhoid fever	3

MISSOURI

(Exclusive of Kansas City)

Chicken pox	72
Diphtheria	73
Influenza	22
Lethargic encephalitis	1
Measles	3
Mumps	53
Ophthalmia neonatorum	1
Pneumonia	7
Scarlet fever	196
Smallpox	14
Trachoma	2
Tuberculosis	32
Typhoid fever	2
Whooping cough	10

MONTANA

Diphtheria	6
Scarlet fever	30
Smallpox	40

NEW JERSEY

Cerebrospinal meningitis	2
Chicken pox	187
Diphtheria	89
Influenza	20
Measles	128
Pneumonia	160
Scarlet fever	286
Smallpox	3
Trachoma	1
Typhoid fever	5
Whooping cough	191

NEW MEXICO

Chicken pox	14
Diphtheria	14
German measles	1
Influenza	45
Measles	48
Mumps	8
Pneumonia	26
Scarlet fever	8
Septic sore throat	1

NEW MEXICO—continued

	Cases
Trachoma	1
Tuberculosis	15
Typhoid fever	1
Whooping cough	6

NEW YORK

(Exclusive of New York City)

Cerebrospinal meningitis	1
Diphtheria	111
Influenza	45
Lethargic encephalitis	6
Measles	252
Pneumonia	368
Poliomyelitis	2
Scarlet fever	346
Smallpox	9
Typhoid fever	13
Whooping cough	242

NORTH CAROLINA

Cerebrospinal meningitis	1
Chicken pox	122
Diphtheria	32
Measles	19
Ophthalmia neonatorum	1
Scarlet fever	37
Septic sore throat	1
Smallpox	84
Whooping cough	91

OKLAHOMA

(Exclusive of Oklahoma City and Tulsa)

Chicken pox	26
Diphtheria	22
Influenza	456
Pneumonia	173
Scarlet fever	38
Smallpox	14
Typhoid fever	11

OREGON

Chicken pox	21
Diphtheria:	
Portland	17
Scattering	8
Lethargic encephalitis	[1] 1
Measles	6
Mumps	18
Pneumonia	6
Poliomyelitis	1
Scarlet fever	22
Smallpox:	
Portland	17
Scattering	2
Typhoid fever	4
Whooping cough	16

SOUTH DAKOTA

Chicken pox	7
Diphtheria	1
Mumps	1
Pneumonia	2
Scarlet fever	35
Smallpox	2
Typhoid fever	1
Whooping cough	3

[1] Death.

TEXAS

	Cases
Anthrax	1
Chicken pox	167
Dengue	36
Diphtheria	62
Dysentery (epidemic)	6
Influenza	4,961
Lethargic encephalitis	2
Malta fever	1
Measles	173
Mumps	188
Ophthalmia neonatorum	2
Paratyphoid fever	4
Pellagra	20
Pneumonia	431
Scarlet fever	59
Smallpox	47
Trachoma	2
Tuberculosis	107
Typhoid fever	10
Whooping cough	215

VERMONT

Chicken pox	38
Diphtheria	5
Measles	4
Mumps	48
Scarlet fever	8
Typhoid fever	2
Whooping cough	3

VIRGINIA

Smallpox—Fairfax County	1

WASHINGTON

Chicken pox	125
Diphtheria	40
German measles	105
Lethargic encephalitis	1
Measles	4
Mumps	107
Pneumonia	2
Poliomyelitis—Lewis County	1
Scarlet fever	41
Smallpox	19
Tuberculosis	56
Typhoid fever	10
Whooping cough	3

WEST VIRGINIA

Cerebrospinal meningitis—Wheeling	1
Diphtheria	8
Scarlet fever	7
Smallpox	7

WISCONSIN

Milwaukee:	
Cerebrospinal meningitis	1
Chicken pox	43
Diphtheria	17
German measles	345
Measles	284
Mumps	75
Pneumonia	6
Poliomyelitis	1
Scarlet fever	25
Smallpox	7
Tuberculosis	16
Whooping cough	32

WISCONSIN—continued

Scattering:	Cases
Chicken pox	203
Diphtheria	29
German measles	9
Influenza	83
Measles	138
Mumps	67
Pneumonia	14
Poliomyelitis	3
Scarlet fever	134
Smallpox	57

WISCONSIN—continued

Scattering—Continued	Cases
Tuberculosis	21
Typhoid fever	2
Whooping cough	46

WYOMING

	Cases
Chicken pox	12
Diphtheria	1
Measles	2
Mumps	3
Pneumonia	2
Scarlet fever	2

Reports for Week Ended February 7, 1925

NEBRASKA

	Cases
Chicken pox	31
Diphtheria	12
German measles	1
Influenza	30
Measles	2
Mumps	3
Pneumonia	2
Scarlet fever	29
Septic sore throat	1
Smallpox	28
Tuberculosis	1
Typhoid fever	3
Whooping cough	3

NORTH DAKOTA

	Cases
Cerebrospinal meningitis	1
Chicken pox	3
Diphtheria	5
German measles	1
Measles	1
Pneumonia	14
Scarlet fever	55
Smallpox	3
Tuberculosis	1
Whooping cough	4

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of monthly State reports is published weekly and covers only those States from which reports are received during the current week:

State	Cerebrospinal meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
December, 1924										
Wyoming		1			2			16	10	
January, 1925										
Arizona		13			290			29	83	1
Connecticut	5	246	28	1	232		3	814	0	16
Indiana	2	257	383				2	927		55
Michigan		421	30	1	707		6	1,310	151	54
Missouri	5	355	114	2	30	0	1	1,242	56	17
Vermont		10			8			104		4
Wyoming		7	1		5			37	7	1

Number of Cases of Certain Communicable Diseases Reported for the Month of November, 1924, by State Health Officers

State	Chicken pox	Diphtheria	Measles	Mumps	Scarlet fever	Smallpox	Tuberculosis	Typhoid fever	Whooping cough
Alabama	175	180	59	79	117	182	107	75	61
Arizona	20	16	36	61	39	31	45	10	14
Arkansas	61	53	17	20	24	64	[1] 35	96	40
California	932	787	120	316	543	383	640	158	320
Colorado [5]									
Connecticut	245	221	22	66	432	4	125	12	302
Delaware	4	25	1	3	14	-------	7	2	4
District of Columbia	91	56	2	-------	74	1	117	7	36
Florida	4	95	2	64	15	1	128	50	19
Georgia	74	137	4	54	36	8	[1] 74	35	27
Idaho	-------	10	-------	-------	28	-------	-------	3	-------
Illinois	1,651	693	343	367	1,105	58	880	125	875
Indiana	-------	472	-------	-------	563	-------	-------	77	-------
Iowa	84	82	4	19	160	105	-------	(2)	4
Kansas	639	139	16	382	439	7	193	48	98
Kentucky [3]									
Louisiana	6	130	1	1	42	20	[1] 109	118	17
Maine	299	133	29	225	178	-------	38	35	48
Maryland	258	248	82	29	199	-------	228	61	332
Massachusetts	906	620	379	309	937	-------	498	44	305
Michigan	1,192	565	403	178	1,018	91	463	92	302
Minnesota	855	491	59	-------	836	448	245	12	120
Mississippi	342	173	64	708	79	92	255	220	417
Missouri	209	522	26	66	1,025	37	160	73	47
Montana	158	54	24	9	105	75	35	7	25
Nebraska	-------	94	-------	-------	120	-------	-------	2	-------
Nevada [4]									
New Hampshire [4]									
New Jersey	715	364	133	-------	518	14	365	72	703
New Mexico [5]									
New York	2,008	1,202	551	722	1,468	156	1,702	286	1,126
North Carolina	529	555	154	-------	278	-------	-------	56	360
North Dakota	92	14	68	2	134	39	12	3	32
Ohio	2,118	684	125	397	1,466	360	489	107	502
Oklahoma	22	94	2	3	88	17	26	126	19
Oregon	133	173	24	13	134	39	53	12	-------
Pennsylvania	3,133	1,295	1,147	1,518	1,948	17	460	180	1,201
Rhode Island	-------	57	-------	-------	97	3	-------	10	-------
South Carolina	33	399	1	34	7	25	5	5	20
South Dakota	109	53	6	15	187	49	3	16	19
Tennessee	242	122	28	2	168	39	120	166	108
Texas [3]									
Utah	769	108	134	17	60	17	6	22	66
Vermont	169	29	116	85	79	-------	[1] 18	2	191
Virginia	567	674	207	-------	331	3	[1] 295	79	639
Washington	552	148	39	128	159	97	120	22	27
West Virginia	385	236	70	-------	325	35	36	76	88
Wisconsin	1,152	242	257	317	452	68	136	10	507
Wyoming	55	3	55	17	29	12	1	1	6

[1] Pulmonary.
[2] Reports not required by law.
[3] Reports received weekly.
[4] Reports received annually.
[5] Reports not received at time of going to press.

Case Rates per 1,000 Population (Annual Basis) for the Month of November, 1924

State	Chicken pox	Diphtheria	Measles	Mumps	Scarlet fever	Smallpox	Tuberculosis	Typhoid fever	Whooping cough
Alabama	0.87	0.90	0.29	0.39	0.58	0.91	0.53	0.37	0.30
Arizona	.62	.50	1.11	1.89	1.21	.96	1.39	.31	.43
Arkansas	.41	.35	.11	.13	.16	.43	[1] .23	.64	.27
California	2.91	2.45	.37	.99	1.69	1.19	2.00	.49	1.00
Colorado [1]									
Connecticut	1.99	1.79	.18	.54	3.50	.03	1.01	.10	2.45
Delaware	.21	1.31	.05	.16	.73	-------	.37	.10	.21
District of Columbia	2.54	1.56	.06	-------	2.06	.03	3.26	.20	1.00
Florida	.05	1.08	.02	.73	.17	.01	1.46	.57	.22
Georgia	.30	.55	.02	.22	.15	.03	[1] .30	.14	.11
Idaho	-------	.25	-------	-------	.71	-------	-------	.08	-------
Illinois	2.93	1.23	.61	.65	1.96	.10	1.56	.22	1.55
Indiana	-------	1.90	-------	-------	2.26	-------	-------	.31	-------

[1] Reports not received at time of going to press.

Case Rates per 1,000 Population (Annual Basis) for the Month of November, 1924—Continued

State	Chicken pox	Diphtheria	Measles	Mumps	Scarlet fever	Smallpox	Tuberculosis	Typhoid fever	Whooping cough
Iowa	0.41	0.40	0.02	0.09	0.78	0.52		[2]	0.02
Kansas	4.32	.94	.11	2.58	2.97	.05	1.30	0.32	.66
Kentucky [3]									
Louisiana	.04	.85	.01	.01	.27	.13	[4].71	.77	.11
Maine	4.68	2.08	.45	3.52	2.78		.59	.55	.75
Maryland	2.07	1.99	.66	.23	1.60		1.83	.49	2.66
Massachusetts	2.71	1.86	1.13	.92	2.80		1.49	.13	.91
Michigan	3.58	1.70	1.21	.53	3.05	.27	1.39	.28	.91
Minnesota	4.12	2.37	.28		4.03	2.16	1.18	.06	.58
Mississippi	2.33	1.18	.44	4.82	.54	.63	1.74	1.50	2.84
Missouri	.74	1.84	.09	.23	3.62	.13	.56	.26	.17
Montana	3.06	1.05	.47	.17	2.04	1.45	.68	.14	.48
Nebraska		.85			1.09			.02	
Nevada [4]									
New Hampshire [4]									
New Jersey	2.53	1.29	.47		1.84	.05	1.29	.26	2.49
New Mexico [1]									
New York	2.23	1.34	.61	.80	1.63	.17	1.89	.32	1.25
North Carolina	2.37	2.49	.69		1.25			.25	1.61
North Dakota	1.65	.25	1.22	.04	2.41	.70	.22	.05	.57
Ohio	4.15	1.34	.25	.78	2.88	.71	.96	.21	.98
Oklahoma	.12	.52	.01	.02	.49	.09	.14	.70	.11
Oregon	1.94	2.53	.35	.19	1.96	.57	.77	.18	
Pennsylvania	4.15	1.72	1.52	2.01	2.58	.02	.61	.24	1.59
Rhode Island		1.10			1.87	.06		.19	
South Carolina	.23	2.76	.01	.24	.05	.17	[4].03	.03	.14
South Dakota	2.01	.98	.11	.28	3.45	.90	.06	.30	.35
Tennessee	1.23	.62	.14	.01	.85	.20	.61	.84	.55
Texas [5]									
Utah	19.36	2.72	3.37	.43	1.51	.43	.15	.55	1.66
Vermont	5.85	1.00	4.02	2.94	2.73		[4].62	.07	6.61
Virginia	2.85	3.39	1.04		1.67	.02	[4]1.48	.40	3.22
Washington	4.62	1.24	.33	1.07	1.33	.81	1.01	.18	.23
West Virginia	2.98	1.83	.54		2.52	.27	.28	.59	.68
Wisconsin	5.07	1.07	1.13	1.40	1.99	.30	.60	.04	2.23
Wyoming	3.09	.17	3.09	.96	1.63	.68	.06	.06	.34

[1] Reports not received at time of going to press.
[2] Reports not required by law.
[3] Reports received weekly.
[4] Pulmonary.
[5] Reports received annually.

PLAGUE-ERADICATIVE MEASURES IN THE UNITED STATES

The following items were taken from the reports of plague-eradicative measures from the cities named for the week ended January 31, 1925:

Los Angeles, Calif.

Week ended January 31, 1925:

Number of rats examined	4,076
Number of rats found to be plague infected	3
Number of squirrels examined	54
Number of squirrels found to be plague infected	0

Totals to January 31, 1925:

Number of rats examined	42,249
Number of rats found to be plague infected	81
Number of squirrels examined	1,573
Number of squirrels found to be plague infected	0

Oakland, Calif.

Week ended January 31, 1925:

Number of rats trapped	3,066
Number of rats found to be plague infected	1

Totals to January 31, 1925:

Number of rats trapped	7,343
Number of rats found to be plague infected	14

New Orleans, La.

Week ended January 31, 1925:	
Number of vessels inspected	337
Number of inspections made	795
Number of vessels fumigated with cyanide gas	41
Number of rodents examined for plague	4, 452
Number of rodents found to be plague infected	0
Totals to January 31, 1925:	
Number of rodents examined	26, 837
Number of rodents found to be plague infected	12

SMALLPOX IN TEXAS CITIES

Under date of February 12, 1925, 18 cases of smallpox were reported at Beaumont, Tex., and about 200 cases at Port Arthur. Cases of the disease have also been reported from Tyler, Galveston, Houston, and other Texas cities.

GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES

Diphtheria.—For the week ended January 31, 1925, 35 States reported 1,599 cases of diphtheria. For the week ended February 2, 1924, the same States reported 2,316 cases of this disease. One hundred and three cities, situated in all parts of the country and having an aggregate population of nearly 28,300,000, reported 895 cases of diphtheria for the week ended January 31, 1925. Last year, for the corresponding week, they reported 1,265 cases. The estimated expectancy for these cities was 1,186 cases of diphtheria. The estimated expectancy is based on the experience of the last nine years, excluding epidemics.

Measles.—Thirty States reported 2,226 cases of measles for the week ended January 31, 1925, and 15,229 cases of this disease for the week ended February 2, 1924. One hundred and three cities reported 1,151 cases of measles for the week this year, and 5,458 cases last year.

Scarlet fever.—Scarlet fever was reported for the week as follows: 34 States—this year, 3,969 cases, last year, 4,137; 103 cities—this year, 1,968, last year, 1,766; estimated expectancy, 1,046 cases.

Smallpox.—For the week ended January 31, 1925, 35 States reported 1,223 cases of smallpox. Last year, for the corresponding week, they reported 1,398 cases. One hundred and three cities reported smallpox for the week as follows: 1925, 373 cases; 1924, 333 cases; estimated expectancy, 92 cases. These cities reported, 28 deaths from smallpox for the week this year, 17 of which occurred at Minneapolis.

Typhoid fever.—Two hundred and fifty-six cases of typhoid fever were reported for the week ended January 31, 1925, by 34 States. For the corresponding week of 1924 the same States reported 232 cases. One hundred and three cities reported 97 cases of typhoid fever 'or the week this year, and 76 cases for the week last year. The estimated expectancy for these cities was 53 cases.

Influenza and pneumonia.—Deaths from influenza and pneumonia (combined) were reported for the week by 103 cities as follows: 1925, 1,216 deaths; 1924, 1,185 deaths.

City reports for week ended January 31, 1925

The "estimated expectancy" given for diphtheria, poliomyelitis, scarlet fever, smallpox, and typhoid fever is the result of an attempt to ascertain from previous occurrence how many cases of the disease under consideration may be expected to occur during a certain week in the absence of epidemics. It is based on reports to the Public Health Service during the past nine years. It is in most instances the median number of cases reported in the corresponding week of the preceding years. When the reports include several epidemics, or when for other reasons the median is unsatisfactory, the epidemic periods are excluded and the estimated expectancy is the mean number of cases reported for the week during nonepidemic years.

If reports have not been received for the full nine years, data are used for as many years as possible, but no year earlier than 1915 is included. In obtaining the estimated expectancy, the figures are smoothed when necessary to avoid abrupt deviations from the usual trend. For some of the diseases given in the table the available data were not sufficient to make it practicable to compute the estimated expectancy.

Division, State, and city	Population July 1, 1923, estimated	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
			Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
NEW ENGLAND									
Maine:									
Portland	73,129	15	2	2	0	0	0	24	5
New Hampshire:									
Concord	22,408	0	0	0	0	0	0	0	2
Vermont:									
Barre	[1] 10,008	0	0	0	0	0	0	17	1
Burlington	23,613	0	1	0	0	0	0	9	0
Massachusetts:									
Boston	770,400	50	70	41	7	2	117	5	34
Fall River	120,912	5	7	3	3	2	0	1	8
Springfield	144,227	6	5	2	1	3	58	6	3
Worcester	191,927	25	6	2	0	0	4	3	8
Rhode Island:									
Pawtucket	68,799	1	2	2	0	0	0	0	4
Providence	242,378	0	13	6	0	1	4	0	7
Connecticut:									
Bridgeport	[1] 143,555	4	9	4	3	3	1	0	10
Hartford	[1] 138,036	9	8	18	0	0	1	3	1
New Haven	172,967	15	4	0	0	0	10	0	14
MIDDLE ATLANTIC									
New York:									
Buffalo	536,718	12	26	7	7	0	27	4	20
New York	5,927,625	180	232	185	59	16	57	32	262
Rochester	317,867	5	10	2	0	0	10	31	6
Syracuse	184,511	6	9	3	0	0	2	2	2
New Jersey:									
Camden	124,157	6	5	2	0	0	8	0	5
Newark	438,699	-------	25	-------	-------	-------	-------	-------	-------
Trenton	127,390	3	8	3	0	1	19	0	5
Pennsylvania:									
Philadelphia	1,922,788	127	76	88	-------	5	97	39	96
Pittsburgh	613,442	35	26	9	-------	7	153	28	44
Reading	110,917	20	5	1	0	0	2	2	3
Scranton	140,636	3	6	5	0	1	0	0	10
EAST NORTH CENTRAL									
Ohio:									
Cincinnati	406,312	14	12	7	-------	3	0	5	14
Cleveland	888,519	61	34	30	14	0	2	14	25
Columbus	261,082	13	5	2	0	2	1	4	5
Toledo	268,338	18	7	14	0	0	40	4	4
Indiana:									
Fort Wayne	93,573	5	4	5	0	0	0	0	3
Indianapolis	342,718	52	17	1	-------	2	1	17	11
South Bend	76,709	8	1	0	0	0	[illegible]	0	3
Terre Haute	68,939	0	2	1	0	0	0	0	3

[1] Population Jan. 1, 1920.

City reports for week ended January 31, 1925—Continued

Division, State, and city	Population July 1, 1923, estimated	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
			Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
EAST NORTH CENTRAL—continued									
Illinois:									
Chicago	2,886,121	92	126	67	10	3	238	23	77
Cicero	55,968	0	2	2	0	0	15	0	0
Peoria	79,675	15	1	0	0	0	15	2	3
Springfield	61,833	3	2	8	0	0	1	18	3
Michigan:									
Detroit	995,668	51	71	40	4	4	4	5	44
Flint	117,968	8	10	2	0	0	1	5	1
Grand Rapids	145,947	6	4	2	1	0	12	2	2
Wisconsin:									
Madison	42,519	12	1	1	0	0	0	0	3
Milwaukee	484,595	32	21	11	2	2	219	58	0
Racine	64,393		1						
Superior	[1] 39,671	1	1	2	0	0	0	0	0
WEST NORTH CENTRAL									
Minnesota:									
Duluth	106,289	10	3	0	0	0	0	2	2
Minneapolis	409,125	86	21	30	0	0	1	3	10
St. Paul	241,891	30	14	22	0	0	1	48	8
Iowa:									
Davenport	61,262	5	1	5	0		0	0	
Des Moines	140,923	0	4	1	0		0	0	
Sioux City	79,662	2	1	1	0		0	3	
Waterloo	39,667		1	0	0		0		
Missouri:									
Kansas City	351,819	17	11	6	8	7	3	16	18
St. Joseph	78,232	2	3	3	0	0	1	0	3
St. Louis	803,853	26	52	53	0	0	2	2	
North Dakota:									
Fargo	24,841	7	1	0	0	0	0	7	0
Grand Forks	14,547	0	1	1	0		0	0	
South Dakota:									
Aberdeen	15,829	2		0	0		0	0	
Sioux Falls	29,206	1	1	0	0	0	0	0	0
Nebraska:									
Lincoln	58,761	3	2	4	0	0	3	1	2
Omaha	204,382	6	5	3	0	0	0	0	12
Kansas:									
Topeka	52,555	28	2	0	0	0	2	159	0
Wichita	79,261	15	3	2	0	0	0	2	1
SOUTH ATLANTIC									
Delaware:									
Wilmington	117,728	1	2	4	0	0	2	0	1
Maryland:									
Baltimore	773,580	46	32	19	38	12	4	9	48
Cumberland	32,361		0	1	0	0	0		2
Frederick	11,301		1	0	0	0	0		1
District of Columbia:									
Washington	[1] 437,571	37	18	21	1	1	0		22
Virginia:									
Lynchburg	30,277	4	1	4	0	0	0	34	1
Norfolk	159,089	23	3	1	0	0	0	60	2
Richmond	181,044	4	5	6	0	2	1	0	4
Roanoke	55,502	4	2	2	0	0	1	0	4
West Virginia:									
Charleston	45,597	6	2	1	0	0	8	0	0
Huntington	57,918	0	1	0	0		0	0	
Wheeling	[1] 56,208	2	1	0	0	1	2	0	3
North Carolina:									
Raleigh	29,171	6	1	0	0	0	0	0	0
Wilmington	35,719	6	0	2	0	0	0	8	1
Winston-Salem	56,230	8	1	1	0	0	0	10	3
South Carolina:									
Charleston	71,245	1	2	0	0	0	0	0	4
Columbia	39,688	0	1	0	0	0	0	6	5
Greenville	25,789	0	0	0	0	0	0	0	1

[1] Population Jan. 1, 1920.

City reports for week ended January 31, 1925—Continued

Division, State, and city	Population July 1, 1923, estimated	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
			Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
SOUTH ATLANTIC—con.									
Georgia:									
Atlanta	222,963	0	3	0	3	0	0	1	13
Brunswick	15,937	0	0	0	39	0	0	0	1
Savannah	89,448	0	1	1	28	3	0	13	4
Florida:									
St. Petersburg	24,403	0	0	0	0	0	0	0	0
Tampa	56,050	1	2	0	1	0	0	0	4
EAST SOUTH CENTRAL									
Kentucky:									
Covington	57,877	2	1	0	0	1	0	2	3
Louisville	257,671	5	6	3	1	1	1	1	10
Tennessee:									
Memphis	170,067	11	5	1	....	4	3	1	20
Nashville	121,128	3	1	2	0	3	9	0	2
Alabama:									
Birmingham	195,901	15	3	8	16	4	3	1	15
Mobile	63,858	0	1	1	0	0	0	2	3
Montgomery	45,383	0	1	2	2	0	0	2	0
WEST SOUTH CENTRAL									
Arkansas:									
Fort Smith	30,635	2	1	1	0	....	0	0	....
Little Rock	70,916	1	1	1	2	0	0	0	1
Louisiana:									
New Orleans	404,575	6	15	12	30	8	2	0	0
Shreveport	54,590	2	....	1	0	0	0	0	3
Oklahoma:									
Oklahoma	101,150	2	2	1	0	2	1	1	5
Tulsa	102,018	....	2	2	0	....	0	....	....
Texas:									
Dallas	177,274	6	6	5	....	4	1	1	11
Galveston	46,877	0	1	1	0	0	0	0	6
Houston	154,970	4	4	3	0	0	0	0	10
San Antonio	184,727	0	2	8	4	4	0	0	14
MOUNTAIN									
Montana:									
Billings	16,927	8	1	0	0	0	1	3	1
Great Falls	27,787	0	1	1	0	0	22	1	0
Helena	[1] 12,037	....	0	0	0	0	0	....	0
Missoula	[1] 12,668	....	0	0	0	0	0	....	0
Idaho:									
Boise	22,806	2	1	0	0	0	0	0	0
Colorado:									
Denver	272,031	14	11	11	0	1	3	85	23
Pueblo	43,519	7	3	1	....	3	0	12	6
New Mexico:									
Albuquerque	16,648	3	0	0	0	0	0	0	1
Arizona:									
Phoenix	33,899	0	....	1	0	1	3	0	3
Utah:									
Salt Lake City	126,241	39	3	1	0	0	4	29	3
Nevada:									
Reno	12,429	0	0	0	0	0	0	0	0
PACIFIC									
Washington:									
Seattle	[1] 315,685	66	5	11	0	....	0	33	....
Spokane	104,573	20	3	14	0	....	0	0	....
Tacoma	101,731	9	2	6	0	0	1	4	4
Oregon:									
Portland	273,621	11	7	24	0	0	3	0	0
California:									
Los Angeles	666,853	84	46	47	14	3	3	25	42
Sacramento	69,950	0	2	6	0	0	0	0	1
San Francisco	539,038	27	27	17	25	2	2	33	6

[1] Population, Jan. 1, 1920.

City reports for week ended January 31, 1925—Continued

Division, State, and city	Scarlet fever: Cases, estimated expectancy	Scarlet fever: Cases reported	Smallpox: Cases, estimated expectancy	Smallpox: Cases reported	Smallpox: Deaths reported	Tuberculosis, deaths reported	Typhoid fever: Cases, estimated expectancy	Typhoid fever: Cases reported	Typhoid fever: Deaths reported	Whooping cough, cases reported	Deaths, all causes
NEW ENGLAND											
Maine:											
Portland	2	2	0	0	0	1	1	1	2	2	23
New Hampshire:											
Concord	0	2	0	0	0	0	0	0	0	0	7
Vermont:											
Barre	1	1	0	0	0	1	0	0	0	0	2
Burlington	1	2	0	0	0	1	0	0	0	0	7
Massachusetts:											
Boston	54	106	0	0	0	17	1	0	0	34	247
Fall River	3	1	0	0	0	3	1	0	0	5	43
Springfield	9	21	0	0	0	0	0	2	0	5	45
Worcester	10	8	0	0	0	2	0	0	0	4	53
Rhode Island:											
Pawtucket	1	2	0	0	0	0	0	0	0	0	27
Providence	9	14	0	0	0	3	0	0	1	0	76
Connecticut:											
Bridgeport	6	21	1	0	0	1	0	0	0	0	33
Hartford	6	13	0	0	0	0	0	0	0	16	34
New Haven	8	24	0	0	0	1	1	0	0	5	57
MIDDLE ATLANTIC											
New York:											
Buffalo	21	16	1	1	0	11	1	7	0	24	127
New York	179	282	1	1	0	[1] 107	10	26	6	116	1,568
Rochester	11	42	0	0	0	4	1	0	0	4	65
Syracuse	16	3	0	0	0	1	1	0	0	0	44
New Jersey:											
Camden	2	7	0	9	4	2	0	0	0	0	37
Newark	22	------	0	------	------	------	0	------	------	------	------
Trenton	3	5	0	1	0	2	0	0	1	9	37
Pennsylvania:											
Philadelphia	58	178	1	5	1	31	3	2	0	82	619
Pittsburgh	23	59	0	0	0	8	1	1	1	3	194
Reading	2	2	0	0	0	2	1	1	0	8	27
Scranton	5	1	0	0	0	0	0	0	0	9	------
EAST NORTH CENTRAL											
Ohio:											
Cincinnati	9	12	1	5	0	7	0	4	1	4	132
Cleveland	32	30	2	0	0	15	1	4	0	33	191
Columbus	8	23	1	13	0	1	1	1	0	4	89
Toledo	18	21	4	0	0	6	1	1	1	26	83
Indiana:											
Fort Wayne	3	7	1	0	0	1	0	0	0	2	32
Indianapolis	10	9	2	11	0	3	0	0	0	6	102
South Bend	3	13	1	0	0	0	0	0	0	0	28
Terre Haute	2	8	1	6	0	1	0	0	0	0	23
Illinois:											
Chicago	101	260	3	2	0	58	3	4	1	132	756
Cicero	1	6	0	0	0	0	0	0	0	3	9
Peoria	5	10	1	0	0	1	0	0	0	0	24
Springfield	2	1	0	6	0	0	0	0	0	0	15
Michigan:											
Detroit	84	84	4	8	1	20	1	0	0	38	249
Flint	8	6	2	0	0	1	0	0	0	1	23
Grand Rapids	8	23	1	0	0	0	0	0	0	3	34
Wisconsin:											
Madison	3	2	1	0	0	0	0	0	0	13	8
Milwaukee	39	19	1	2	0	2	1	0	0	23	79
Racine	7	------	0	------	------	------	0	------	------	------	------
Superior	2	3	4	0	0	0	0	0	0	0	4
WEST NORTH CENTRAL											
Minnesota:											
Duluth	5	26	1	3	0	0	1	0	0	0	19
Minneapolis	33	73	8	49	17	6	1	0	0	1	107
St. Paul	24	27	9	2	1	3	1	2	0	16	57

[1] Pulmonary tuberculosis only.

City reports for week ended January 31, 1925—Continued

Division, State, and city	Scarlet fever: Cases, estimated expectancy	Scarlet fever: Cases reported	Smallpox: Cases, estimated expectancy	Smallpox: Cases reported	Smallpox: Deaths reported	Tuberculosis, deaths reported	Typhoid fever: Cases, estimated expectancy	Typhoid fever: Cases reported	Typhoid fever: Deaths reported	Whooping cough, cases reported	Deaths, all causes
WEST NORTH CENTRAL—contd.											
Iowa:											
Davenport	2	4	2	3	-----	-----	0	0	-----	1	-----
Des Moines	8	4	3	2	-----	-----	0	0	-----	0	-----
Sioux City	2	0	1	0	-----	-----	0	0	-----	0	-----
Waterloo	3	0	0	4	-----	-----	0	0	-----	2	-----
Missouri:											
Kansas City	13	127	2	3	0	9	0	0	0	0	104
St. Joseph	3	5	0	0	0	0	0	0	0	0	27
St. Louis	28	97	1	10	0	10	1	4	0	6	231
North Dakota:											
Fargo	1	4	0	0	0	0	0	0	0	0	5
Grand Forks	3	0	1	0	-----	-----	0	0	-----	0	-----
South Dakota:											
Aberdeen	-----	1	-----	0	-----	-----	-----	0	-----	0	-----
Sioux Falls	2	3	0	0	0	0	0	0	0	0	8
Nebraska:											
Lincoln	3	2	0	0	0	0	0	0	0	0	19
Omaha	6	4	2	23	0	1	0	0	0	2	66
Kansas:											
Topeka	2	3	1	0	0	0	0	0	0	1	11
Wichita	2	7	1	0	0	1	0	0	0	2	18
SOUTH ATLANTIC											
Delaware:											
Wilmington	3	1	0	0	0	2	0	0	1	1	27
Maryland:											
Baltimore	37	47	1	0	0	20	2	3	0	66	262
Cumberland	1	1	0	0	0	0	0	0	0	-----	18
Frederick	1	3	0	0	0	0	0	0	0	-----	6
District of Columbia:											
Washington	20	29	1	1	1	8	1	2	0	11	153
Virginia:											
Lynchburg	0	0	0	0	0	1	0	0	0	5	8
Norfolk	1	2	1	0	0	3	0	0	0	14	-----
Richmond	5	0	0	0	0	10	0	1	0	0	61
Roanoke	1	1	0	0	0	1	0	0	0	1	20
West Virginia:											
Charleston	1	1	0	2	0	0	1	4	0	0	19
Huntington	1	1	0	2	-----	-----	0	0	-----	0	-----
Wheeling	1	0	0	0	0	0	1	3	0	2	18
North Carolina:											
Raleigh	1	0	0	2	0	1	0	0	0	1	9
Wilmington	1	0	0	2	0	1	0	0	0	4	7
Winston-Salem	2	0	1	9	0	1	0	0	0	3	24
South Carolina:											
Charleston	2	0	0	0	0	1	0	1	0	0	30
Columbia	1	0	1	0	0	0	0	0	1	2	23
Greenville	1	1	0	0	0	0	0	0	0	0	3
Georgia:											
Atlanta	3	4	1	6	0	3	1	0	0	5	62
Brunswick	0	0	0	0	0	0	0	0	0	0	3
Savannah	1	1	0	0	0	4	1	1	0	1	24
Florida:											
St. Petersburg	1	0	1	0	0	0	0	0	0	0	16
Tampa	0	0	0	0	0	3	1	3	0	0	26
EAST SOUTH CENTRAL											
Kentucky:											
Covington	1	5	0	0	0	1	1	0	0	0	23
Louisville	5	9	1	2	0	16	1	2	0	4	107
Tennessee:											
Memphis	2	7	1	5	0	5	0	0	2	4	123
Nashville	2	5	0	0	0	2	0	0	0	0	49
Alabama:											
Birmingham	3	11	0	104	0	4	1	2	0	0	69
Mobile	0	1	0	1	0	1	0	0	0	0	21
Montgomery	0	0	1	2	0	0	0	0	0	0	15

City reports for week ended January 31, 1925—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
WEST SOUTH CENTRAL											
Arkansas:											
Fort Smith	1	14	0	2	------	------	0	0	------	0	------
Little Rock	1	1	0	1	0	2	0	0	0	1	------
Louisiana:											
New Orleans	3	18	3	0	0	19	2	12	1	7	161
Shreveport	------	0	------	0	0	1	------	0	0	1	35
Oklahoma:											
Oklahoma	2	0	3	0	0	1	0	2	0	0	23
Tulsa	1	4	1	2	------	------	0	0	------	------	------
Texas:											
Dallas	3	1	1	2	0	4	0	0	0	8	50
Galveston	0	0	0	1	0	1	0	1	0	0	16
Houston	1	10	0	7	0	4	0	0	0	0	58
San Antonio	1	0	0	0	0	3	1	0	1	0	------
MOUNTAIN											
Montana:											
Billings	1	7	0	0	0	1	0	0	0	20	7
Great Falls	1	3	2	1	0	0	0	0	0	0	7
Helena	1	0	0	0	0	0	0	0	0	------	1
Missoula	1	1	1	0	0	1	0	0	0	------	5
Idaho:											
Boise	1	1	0	0	0	0	0	0	0	0	6
Colorado:											
Denver	11	8	2	0	0	13	1	0	0	2	95
Pueblo	2	3	0	0	0	0	0	2	0	0	14
New Mexico:											
Albuquerque	1	0	0	0	0	4	0	0	0	0	9
Arizona:											
Phoenix	------	0	------	0	0	9	------	0	0	0	30
Utah:											
Salt Lake City	4	1	3	0	0	1	0	0	0	6	36
Nevada:											
Reno	0	3	0	4	0	0	0	0	0	0	3
PACIFIC											
Washington:											
Seattle	10	9	2	10	------	------	0	0	------	17	------
Spokane	3	1	6	0	------	------	0	0	------	8	------
Tacoma	3	3	2	2	0	1	1	1	0	4	32
Oregon:											
Portland	6	8	5	11	0	0	0	0	0	6	------
California:											
Los Angeles	16	49	2	39	2	37	2	0	0	37	------
Sacremento	2	6	1	3	0	2	1	0	0	0	21
San Francisco	17	10	1	7	1	10	1	0	0	9	153

City reports for week ended January 31, 1925—Continued

Division, State, and city	Cerebrospinal meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, est. expectancy	Cases	Deaths
NEW ENGLAND									
Massachusetts:									
Boston	2	1	1	1	0	0	0	0	0
Springfield	0	0	1	0	0	0	0	0	0
Connecticut:									
Hartford	0	0	1	0	0	0	0	0	0
New Haven	1	1	0	0	0	0	0	0	0
MIDDLE ATLANTIC									
New York:									
Buffalo	1	1	0	0	0	0	0	0	0
New York	14	1	10	5	0	0	1	1	1
Pennsylvania:									
Philadelphia	1	0	0	0	0	0	1	0	0
Pittsburgh	0	0	0	1	0	0	0	1	0
EAST NORTH CENTRAL									
Ohio:									
Cincinnati	0	0	1	0	0	0	0	0	0
Cleveland	0	0	0	0	0	0	0	1	0
Columbus	0	0	1	0	0	0	0	0	0
Illinois:									
Chicago	0	0	3	0	0	0	1	0	0
Peoria	0	0	0	1	0	0	0	0	0
Michigan:									
Detroit	0	0	1	0	0	0	0	0	0
Wisconsin:									
Milwaukee	1	1	0	0	0	0	0	0	0
WEST NORTH CENTRAL									
North Dakota:									
Fargo	1	1	0	0	0	0	0	0	0
SOUTH ATLANTIC									
Maryland:									
Baltimore	0	1	0	0	0	1	1	0	0
District of Columbia:									
Washington	0	0	1	1	0	0	0	0	0
North Carolina:									
Winston-Salem	0	0	0	0	1	0	0	0	0
EAST SOUTH CENTRAL									
Kentucky:									
Louisville	1	0	0	0	0	0	0	0	0
Tennessee:									
Memphis	0	1	0	0	0	0	0	0	0
WEST SOUTH CENTRAL									
Louisiana:									
New Orleans	0	0	0	0	1	1	0	0	0
Texas:									
Houston	0	0	0	0	0	1	0	0	0
MOUNTAIN									
Colorado:									
Denver	0	0	0	1	0	0	0	0	0
Pueblo	1	0	0	0	0	0	0	0	0
Utah:									
Salt Lake City	2	2	0	0	0	0	0	0	0
Nevada:									
Reno	1	0	0	0	0	0	0	0	0
PACIFIC									
Oregon:									
Portland	0	0	0	0	0	0	0	1	0
California:									
Los Angeles	3	0	0	0	0	0	0	0	0
San Francisco	0	0	0	1	0	0	0	0	0

The following table gives the rates per hundred thousand population for 105 cities for the 10-week period ended January 31, 1925. The population figures used in computing the rates were estimated as of July 1, 1923, as this is the latest date for which estimates are available. The 105 cities reporting cases had an estimated aggregate population of nearly 29,000,000 and the 97 cities reporting deaths had more than 28,000, 000 population. The number of cities included in each group and the aggregate populations are shown in a separate table below.

Summary of weekly reports from cities, November 23, 1924, to January 31, 1925—Annual rates per 100,000 population [1]

DIPHTHERIA CASE RATES

	Week ended—									
	Nov. 29	Dec. 6	Dec. 13	Dec. 20	Dec. 27	Jan. 3	Jan. 10	Jan. 17	Jan. 24	Jan. 31
Total	175	[2] 190	[3] 193	[4] 197	150	[4] 155	169	[5] 172	[5] 163	[6] 167
New England	166	258	[3] 208	221	189	258	256	179	171	199
Middle Atlantic	144	170	175	187	149	140	181	188	175	[7] 160
East North Central	173	165	167	185	134	151	132	141	130	[8] 135
West North Central	307	309	265	299	168	176	143	255	199	251
South Atlantic	260	[9] 173	201	150	134	146	173	[5] 106	[5] 138	128
East South Central	120	[10] 98	97	149	51	91	120	91	80	97
West South Central	125	144	209	195	116	148	144	195	162	148
Mountain	162	172	315	248	209	191	239	153	239	134
Pacific	128	252	273	[4] 207	226	[4] 129	194	206	223	293

MEASLES CASE RATES

	Nov. 29	Dec. 6	Dec. 13	Dec. 20	Dec. 27	Jan. 3	Jan. 10	Jan. 17	Jan. 24	Jan. 31
Total	66	[2] 112	[3] 128	[4] 143	105	[4] 158	215	[5] 141	[5] 213	[6] 211
New England	147	164	[3] 282	194	278	380	395	440	497	484
Middle Atlantic	79	105	120	115	235	121	169	157	187	[7] 200
East North Central	85	199	207	317	138	294	417	127	379	[8] 373
West North Central	10	25	35	19	10	10	19	12	27	21
South Atlantic	14	[9] 22	39	24	35	53	83	[5] 43	[5] 38	37
East South Central	0	[10] 0	6	11	0	17	29	46	74	91
West South Central	9	0	0	19	14	9	5	23	14	14
Mountain	29	19	48	57	19	115	134	267	248	286
Pacific	52	136	125	[4] 37	70	[4] 83	194	160	55	17

SCARLET FEVER CASE RATES

	Nov. 29	Dec. 6	Dec. 13	Dec. 20	Dec. 27	Jan. 3	Jan. 10	Jan. 17	Jan. 24	Jan. 31
Total	232	[2] 270	[3] 312	[4] 314	244	[4] 297	369	[5] 355	[5] 370	[6] 362
New England	437	544	[3] 602	552	512	609	661	561	596	534
Middle Atlantic	197	197	260	268	225	286	324	294	326	[7] 317
East North Central	228	257	234	311	230	243	383	375	369	[8] 379
West North Central	508	616	626	601	468	527	757	755	804	779
South Atlantic	128	[9] 171	252	213	132	203	160	[5] 243	[5] 189	185
East South Central	57	[10] 162	109	240	126	172	229	183	183	217
West South Central	93	125	162	185	65	83	148	116	195	204
Mountain	143	296	162	239	191	162	382	534	305	258
Pacific	168	197	218	[4] 134	133	[4] 138	189	183	220	226

[1] The figures given in this table are rates per 100,000 population, annual basis, and not the number of cases reported. Populations used are estimated as of July 1, 1923.
[2] Norfolk, Va., and Memphis, Tenn., not included in calculating the rate. Reports not received at time of going to press.
[3] Worcester, Mass., not included.
[4] Los Angeles, Calif., not included.
[5] Wilmington, Del., not included.,
[6] Newark, N. J., and Racine, Wis., not included.
[7] Newark, N. J., not included.
[8] Racine, Wis., not included.
[9] Norfolk, Va., not included.
[10] Memphis, Tenn., not included.

Summary of weekly reports from cities, November 23, 1924, to January 31, 1925—Annual rates per 100,000 population—Continued

SMALLPOX CASE RATES

	Week ended—									
	Nov. 29	Dec. 6	Dec. 13	Dec. 20	Dec. 27	Jan. 3	Jan. 10	Jan. 17	Jan. 24	Jan. 31
Total	38	[2] 58	[3] 43	[4] 42	41	[4] 40	57	[5] 58	[5] 70	[6] 68
New England	0	0	[3] 0	0	0	0	0	0	0	0
Middle Atlantic	5	5	1	2	2	3	3	10	6	[7] 9
East North Central	14	10	13	14	20	27	40	39	48	[8] 35
West North Central	236	417	255	209	205	129	220	193	180	195
South Atlantic	6	[9] 48	39	22	28	39	30	[5] 64	[5] 38	45
East South Central	74	[10] 204	177	314	183	372	395	217	675	652
West South Central	32	19	14	51	19	32	65	32	32	60
Mountain	10	19	19	29	48	48	29	57	95	48
Pacific	136	113	113	[4] 106	122	[4] 69	148	212	209	177

TYPHOID FEVER CASE RATES

	Nov. 29	Dec. 6	Dec. 13	Dec. 20	Dec. 27	Jan. 3	Jan. 10	Jan. 17	Jan. 24	Jan. 31
Total	29	[2] 45	[3] 43	[4] 56	35	[4] 37	36	[5] 21	[5] 17	[6] 18
New England	22	30	[3] 16	30	17	25	15	25	20	7
Middle Atlantic	46	71	68	101	57	58	49	21	20	[7] 20
East North Central	7	22	32	33	24	28	23	23	11	[8] 10
West North Central	4	8	17	15	19	4	6	10	6	12
South Atlantic	30	[9] 56	35	30	37	41	55	[5] 21	[5] 11	37
East South Central	109	[10] 63	57	51	34	40	51	17	29	23
West South Central	37	60	51	56	28	37	70	70	42	60
Mountain	19	10	19	10	0	0	10	0	48	19
Pacific	17	29	17	[4] 14	15	[4] 5	26	6	15	3

INFLUENZA DEATH RATES

	Nov. 29	Dec. 6	Dec. 13	Dec. 20	Dec. 27	Jan. 3	Jan. 10	Jan. 17	Jan. 24	Jan. 31
Total	10	[2] 12	[3] 17	[4] 16	15	19	21	[5] 22	[5] 22	[6] 23
New England	5	17	[3] 5	15	15	3	17	27	10	27
Middle Atlantic	8	11	22	17	14	21	20	18	20	[7] 15
East North Central	11	9	13	9	16	10	16	15	18	[8] 12
West North Central	7	4	4	9	7	9	13	2	20	15
South Atlantic	14	[9] 11	22	22	14	26	35	[5] 47	[5] 23	39
East South Central	29	[10] 28	23	23	51	63	46	46	63	74
West South Central	25	31	36	41	15	51	41	87	92	82
Mountain	19	29	29	48	10	38	19	29	10	38
Pacific	8	8	4	[4] 17	12	12	20	12	12	20

PNEUMONIA DEATH RATES

	Nov. 29	Dec. 6	Dec. 13	Dec. 20	Dec. 27	Jan. 3	Jan. 10	Jan. 17	Jan. 24	Jan. 31
Total	130	[2] 153	[3] 159	[4] 172	157	203	192	[5] 215	[5] 211	[6] 207
New England	144	127	[3] 109	134	114	174	122	157	216	241
Middle Atlantic	152	188	201	191	178	226	228	260	234	[7] 237
East North Central	93	115	125	146	126	165	152	152	142	[8] 145
West North Central	74	63	88	68	92	101	90	107	120	118
South Atlantic	169	[9] 191	175	248	205	250	246	[5] 294	[5] 275	252
East South Central	246	[10] 211	217	297	206	303	292	189	320	303
West South Central	107	163	178	163	229	341	260	449	362	229
Mountain	124	210	200	276	219	229	229	248	324	315
Pacific	94	168	135	[4] 86	147	188	184	163	208	217

[2] Norfolk, Va., and Memphis, Tenn., not included in calculating the rate. Reports not received at time of going to press.
[3] Worcester, Mass., not included.
[4] Los Angeles, Calif., not included.
[5] Wilmington, Del., not included.
[6] Newark, N. J., and Racine, Wis., not included.
[7] Newark, N. J., not included.
[8] Racine, Wis., not included.
[9] Norfolk, Va., not included.
[10] Memphis, Tenn., not included.

Number of cities included in summary of weekly reports and aggregate population of cities in each group, estimated as of July 1, 1923

Group of cities	Number of cities eporting cases	Number of cities reporting deaths	Aggregate population of cities reporting cases	Aggregate population of cities reporting deaths
Total	105	97	28, 898, 350	28, 140, 934
New England	12	12	2, 098, 746	2, 098, 746
Middle Atlantic	10	10	10, 304, 114	10, 304, 114
East North Central	17	17	7, 032, 535	7, 032, 535
West North Central	14	11	2, 515, 330	2, 381, 454
South Atlantic	22	22	2, 566, 901	2, 566, 901
East South Central	7	7	911, 885	911, 885
West South Central	8	6	1, 124, 564	1, 023, 013
Mountain	9	9	546, 445	546, 445
Pacific	6	3	1, 797, 830	1, 275, 841

FOREIGN AND INSULAR

PLAGUE ON VESSEL

Steamship at Majunga, Madagascar.—During the month of November, 1924, a fatal case of plague, European, was removed from a steamship arrived at Majunga, Madagascar, from Djibuti, a port on the Red Sea.

BOLIVIA

Smallpox—Typhus fever—La Paz—December, 1924.—During the month of December, 1924, 8 cases of smallpox with 4 deaths and 1 case of typhus fever were reported at La Paz, Bolivia. Population, 100,000.

CANADA

Communicable diseases—Ontario—December 28, 1924, to January 31, 1925.—During the period from December 28, 1924, to January 31, 1925, communicable diseases were reported in the Province of Ontario, Canada, as follows:

Disease	1924-1925		1923-1924	
	Cases	Deaths	Cases	Deaths
Cerebrospinal meningitis	7	5	1	1
Chancroid			11	
Chicken pox	810	1	971	
Diphtheria	347	34	318	25
German measles	38		21	
Goiter	77	1	2	1
Gonorrhea	124		142	
Influenza	67	33	20	6
Lethargic encephalitis	5	3	5	3
Measles	2,063		1,222	7
Mumps	1,257		627	
Pneumonia		250		218
Poliomyelitis	2			
Scarlet fever	700	14	870	13
Septic sore throat	8		14	1
Smallpox	27		50	
Syphilis	131		113	
Tetanus				2
Tuberculosis	212	112	172	89
Typhoid fever	53	9	38	5
Whooping cough	489	6	181	6

Smallpox.—Smallpox was reported in 13 localities, the largest number of cases being notified at Welland, viz, 6. Seven localities reported one case each.

CANARY ISLANDS

Plague—Vicinity of Santa Cruz de Teneriffe—January 3, 1925.—The occurrence of a case of plague in the vicinity of Santa Cruz de Teneriffe, Canary Islands, was reported January 3, 1925.

ECUADOR

Plague—Plague-infected rats—Guayaquil—December 16, 1924, to January 15, 1925.—During the period December 16 to 31, 1924, one case of plague was reported at Guayaquil, Ecuador, and 59 rats were found plague-infected out of 9,327 rates taken. During the period January 1 to 15, 1925, six cases of plague with four deaths were reported at Guayaquil and 28 rats found plague-infected out of 8,248 rats taken.

Mortality—Communicable diseases—Quito—December, 1924.—During the month of December, 1924, 149 deaths from all causes were reported at Quito, Ecuador, including dysentery, three deaths; malaria, one death; typhoid fever, one death; tuberculosis, nine deaths. There were 40 deaths of infants under one year of age. Population 100,398.

Typhoid fever prevalence—Quito.—Considerable increase of typhoid fever prevalence was reported at Quito under date of January 14, 1925. Part of the water supply of the city comes from an uncontaminated source and through closed pipes, but another part of the supply is through an open ditch, with consequent danger of pollution. The existence of unsanitary conditions among a considerable number of the population, absence of public and private latrines, and prevalence of flies were reported.

Plague—Chimborazo Province.—According to El Commercio, Quito, plague was reported present in Chimborazo Province, Ecuador, with 14 deaths to January 14, 1925. The occurrence was in two localities in Alausi District, and on the line of the Guayaquil and Quito railway at points not much above the coastal lowlands of Ecuador. It was stated that every effort was being made to prevent spread of the disease.

FINLAND

Communicable diseases—December 16–31, 1924.—During the period December 16 to 31, 1924, communicable diseases were reported in Finland as follows: Diphtheria, 70 cases; lethargic encephalitis, 5; poliomyelitis, 2; scarlet fever, 77; typhoid fever, 20; with 31 cases of paratyphoid fever. Population, 3,435,249.

HAWAII

Plague-infected rat—Honokaa.—A plague-infected rat was reported trapped, January 15, 1925, in the vicinity of the Pacific Sugar Mill Co.'s location at Honokaa, Hawaii.

ITALY

Kala-azar—Leprosy—Catania Province.—During the week ended December 28, 1924, 1 case of kala-azar and 1 case of leprosy were reported in the Province of Catania, Italy.

MADAGASCAR

Plague—November, 1924.—During the month of November, 1924, 182 cases of plague with 157 deaths were reported in the island of Madagascar, the occurrence being mainly distributed in the Provinces of Itasy, Moramanga, and Tananarive. The occurrence at ports was reported as follows: Fort Dauphin at the southern end of the island, 5 cases with 2 deaths; Majunga—1 fatal case, European, from steamship from Djibuti, Red Sea; and 1 case with 1 death at Tamatave. At the interior town of Tananarive, capital of the island, 6 cases with 5 deaths were reported.

MALTA

Communicable diseases—December, 1924—January 1–15, 1925.—Communicable diseases have been reported in the island of Malta as follows: December, 1924—Lethargic encephalitis, 2 cases; Malta (undulant) fever, 43 cases; typhoid fever, 24 cases with 3 deaths. January 1–15, 1925—Chicken pox, 1 case; lethargic encephalitis, 1 case; Malta (undulant) fever, 20 cases; typhoid fever, 6 cases.

MEXICO

Smallpox—Durango—January, 1925.—During the month of January, 1925, smallpox was reported present in Durango, State of Durango, Mexico, with 1 fatal case occurring in the city and 4 fatal cases at ranches in the vicinity. The deaths were stated to be of unvaccinated children. Vaccination of all persons not vaccinated was stated to have been ordered.

Epidemic smallpox—Vera Cruz—October–December, 1924.—Smallpox was reported at Vera Cruz, Mexico, in epidemic form, early in October, 1924. To the end of December, 1924, 68 cases with 31 deaths were reported. At the close of the year Federal authorities in cooperation with the local board of health instituted an investigation of sanitary conditions in Vera Cruz and measures were taken to vaccinate the entire population. It was decided to establish a section of the Federal board of health at Vera Cruz.

RUSSIA

Epidemic malaria—Ossetia, Russia.—Under date of January 3, 1925, malaria in grave epidemic form was stated to be present in 13 villages recently established near Ossetia, in the Caucasus, Russia. All the inhabitants of 12 villages were stated to be affected with the disease, and in one village—Nogir—the number of persons affected was stated to be 90 per cent of the population.

UNION OF SOUTH AFRICA

Plague—December 14-27, 1924.—Plague has been reported in the Union of South Africa as follows: Week ended December 20, 1924—2 fatal cases occurring on farms, 1 in the Vredefort District, Orange Free State, native, bubonic, in locality in which a fatal case occurred in the preceding week; 1 fatal case, native, bubonic, on a farm in the Transvaal; previous fatal case reported. Week ended December 27, 1924—Cape Province, Kimberley District, on farm 4 miles southwest of Kimberley, 2 cases, 1 death, native, bubonic; Orange Free State, Bloemfontein District, on farm 30 miles southwest from Bloemfontein, 1 fatal case, native, bubonic; Brandfort Area, Bloemfontein District, on farm, 2 cases (white) bubonic; Philippolis District, on farm, 1 case, native, bubonic. A suspect case (white) was reported in Boshof District, Transvaal, on farm

Spread of infection among wild rodents.—Under date of December 29, 1924, considerable extension of plague infection among wild rodents was reported in the eastern part of the Orange Free State, with increased danger of spread to the eastern Transvaal.

Smallpox—Typhus fever—November, 1924.—During the month of November, 1924, seven cases of smallpox, of which one case was in a European, and 233 cases of typhus fever with 66 deaths, occurring in the native or colored population, were reported in the Union of South Africa. For distribution of typhus fever occurrence according to States, see page 395.

CHOLERA, PLAGUE, SMALLPOX, AND TYPHUS FEVER

The reports contained in the following tables must not be considered as complete or final as regards either the lists of countries included or the figures for the particular countries for which reports are given.

Reports Received During Week Ended February 20, 1925[1]

CHOLERA

Place	Date	Cases	Deaths	Remarks
Ceylon	Nov. 2-29	2	2	
India:				
Madras	Dec. 21-27	10	6	
Do	Dec. 28-Jan. 10	40	22	
Rangoon	Dec. 7-20	4		

PLAGUE

Place	Date	Cases	Deaths	Remarks
Canary Islands:				
Teneriffe—				
Santa Cruz	Jan. 3	1		In vicinity.
Ceylon:				
Colombo	Dec. 21-27	2		

[1] From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, AND TYPHUS FEVER—Continued

Reports Received During Week Ended February 20, 1925—Continued

PLAGUE—Continued

Place	Date	Cases	Deaths	Remarks
Ecuador:				
Chimborazo Province—				
Alausi District	Jan. 14		14	At two localities on Guayaquil and Quito Railway.
Guayaquil	Dec. 16-31	1		Rats taken, 9,327; rats found plague infected, 59.
Do	Jan. 1-15	6	4	Rats taken, 8,248; rats found plague infected, 28.
Gold Coast	Oct. 1-31	4	4	
Hawaii:				
Honokaa				Jan. 15, 1925: One plague rat trapped. Vicinity of Pacific Sugar Mill Co.'s location.
India:				
Karachi	Jan. 4-10	1	1	
Rangoon	Dec. 7-27	8	7	
Japan	Aug. 10-Nov. 15	12		
Java:				
East Java—				
Soerabaya Residency	Nov. 23-Dec. 13	47	51	
West Java—				
Cheribon	Nov. 18-24		13	
Pekalongan	do		13	
Tegal	do		7	
Madagascar				Nov. 1-30, 1924: Cases, 182; deaths, 157. Bubonic, pneumonic, septicemic.
Province—				
Itasy	Nov. 1-30	3	1	Bubonic.
Moramanga	do	34	25	Bubonic, pneumonic, septicemic.
Tananarive	do	138	127	Bubonic, pneumonic, septicemic. At town of Tananarive, interior, cases, 6; deaths, 5.
Towns (ports)—				
Fort Dauphin	do	5	2	
Majunga	do	1	1	European, on steamship from Djibuti, Red Sea.
Tamatave	do	1	1	
Nigeria	Aug. 1-Oct. 31	309	256	
Union of South Africa:				
Cape Province—				
Kimberley District	Dec. 21-27	2	1	Native; bubonic; occurring on farm 4 miles from Kimberley.
Orange Free State—				
Bloemfontein District	do	1	1	Native; bubonic; occurring on farm 30 miles from Bloemfontein.
Brandfort Area	do	2		White; bubonic; on farm.
Philippolis District	do	1		Native; bubonic; on farm.
Vredefort District	Dec. 14-20	1	1	Native; bubonic; on farm, vicinity of locality of fatal case previously reported.
Transvaal—				
Boshof	do	1	1	Native; bubonic; on farm; fatal case previously reported. Suspect case reported, week ended Dec. 27, 1924.
On vessel:				
Steamship	November, 1924	1	1	At Majunga, Madagascar, from Djibuti, Red Sea port.

SMALLPOX

Place	Date	Cases	Deaths	Remarks
Bolivia:				
La Paz	Dec. 1-31	8	4	
British South Africa:				
Northern Rhodesia	Dec. 9-15	2		
Canada:				
British Columbia—				
Vancouver	Jan. 18-31	55		
Manitoba—				
Winnipeg	Feb. 1-7	2		

CHOLERA, PLAGUE, SMALLPOX, AND TYPHUS FEVER—Continued

Reports Received During Week Ended February 20, 1925—Continued

SMALLPOX—Continued

Place	Date	Cases	Deaths	Remarks
Canada—Continued				
New Brunswick—				
Bonaventure and Gaspe Counties	Jan. 1-31	1		
Ontario				Dec. 28, 1924-Jan. 31, 1925: Cases, 27. In 13 localities.
Ceylon				July 27-Nov. 29, 1924: Cases, 27; deaths, 1.
China:				
Foochow	Dec. 21-27			Present.
Egypt:				
Alexandria	Dec. 24-31	1		
France				Nov., 1924: Cases, 8.
Great Britain:				
England and Wales				Jan. 11-17, 1925: Cases, 113.
Greece				Nov., 1924: Cases, 2; deaths, 1.
India:				
Bombay	Dec. 21-27	7	5	
Karachi	Dec. 28-Jan. 10	13	1	
Madras	Dec. 21-27	27	8	
Do	Dec. 28-Jan. 10	54	18	
Rangoon	Dec. 7-27	30	8	
Italy				Nov. 9-Dec. 6, 1924: Cases, 4.
Japan				Aug. 1-Nov. 15, 1924: Cases, 4.
Java:				
East Java—				
Residency—				
Soerabaya	Nov. 30-Dec. 13	109	23	
West Java—				
Residency—				
Cheribon	Nov. 18-24	1		
Pekalongan	do	2		
Preanger	do	1		
Mexico:				
Durango	Jan. 1-31		5	Occurring in district and town; children.
Mexico City	Jan. 11-24	4		Including municipalities in Federal District.
Tampico	Jan. 21-31	6	1	
Vera Cruz	Jan. 19-25		3	Jan. 1-29, 1925: 34 cases unofficially reported.
Nigeria				Oct. 1-31, 1924: Cases, 4; deaths, 1.
Poland				Sept. 21-Nov. 22, 1924: Cases, 14; deaths, 2.
Portugal:				
Lisbon	Dec. 21-27	6	1	
Do	Dec. 28-Jan. 17	37	7	
Oporto	Jan. 11-17	1		
Russia				July-Sept., 1924: Cases, 1,251.
Spain:				
Madrid	Dec. 1-31		10	
Malaga	Jan. 18-24		10	
Tunis:				
Tunis	Jan. 22-28	13	15	
Union of South Africa				Nov. 1-30, 1924: Cases, 7 (European, 1).
Transvaal	Dec. 14-20			Outbreaks.

TYPHUS FEVER

Place	Date	Cases	Deaths	Remarks
Bolivia:				
La Paz	Dec. 1-31	1		
Bulgaria				Oct. 1-31, 1924: 1 case.
Chile:				
Talcahuano	Jan. 4-10		1	
Valparaiso	Jan. 11-17		2	
Gold Coast				Oct. 1-31, 1924: 1 case.
Greece				Nov. 1-30, 1924: 5 cases.
Japan				Aug. 1-Nov. 15, 1924: 2 cases.
Mexico:				
Mexico City	Jan. 11-24	16		
Poland				Oct. 27-Nov. 15, 1924: Cases, 95; deaths, 10.
Portugal:				
Lisbon	Dec. 29-Jan. 4		2	

CHOLERA, PLAGUE, SMALLPOX, AND TYPHUS FEVER—Continued

Reports Received During Week Ended February 20, 1925—Continued

TYPHUS FEVER—Continued

Place	Date	Cases	Deaths	Remarks
Rumania				Aug. 1-31, 1924: 20 cases, 2 deaths.
Russia				July-Sept., 1924: 5,225 cases.
Leningrad	Oct. 26-Nov. 22	1		
Tunis				Nov. 21-Dec. 20, 1924: 1 case.
Union of South Africa				Nov. 1-30, 1924: Cases, 233; deaths, 66. Colored population.
Cape Province				Nov. 1-30, 1924: Cases, 89; deaths, 16.
Do	Dec. 21-27			Outbreaks.
Natal				Nov. 1-30, 1924: Cases, 105; deaths, 45.
Do	Dec. 14-20			Outbreaks.
Orange Free State				Nov. 1-30, 1924: Cases, 21; deaths, 2.
Transvaal				Nov. 1-30, 1924: Cases, 18; deaths, 3.

Reports Received from December 27, 1924, to February 13, 1925[1]

CHOLERA

Place	Date	Cases	Deaths	Remarks
Ceylon				June 29-Nov. 1, 1924: Cases, 7; deaths, 6.
Colombo	Nov. 16-22	1		
India				Oct. 19-Dec. 6, 1924: Cases, 17,830; deaths, 10,750.
Bombay	Nov. 23-Dec. 20	4	4	
Calcutta	Oct. 26-Dec. 26	54	46	
Madras	Nov. 16-Dec. 20	50	30	
Rangoon	Nov. 9-29	5	2	
Indo-China				Aug. 1-Sept. 30, 1924: Cases, 14; deaths, 10.
Province—				
Anam	Aug. 1-31	1	1	
Cambodia	Aug. 1-Sept. 30	6	5	
Cochin-China	do	7	4	
Saigon	Nov. 30-Dec. 6	1		
Siam:				
Bangkok	Nov. 9-29	4	2	

PLAGUE

Place	Date	Cases	Deaths	Remarks
Azores:				
Fayal Island—				
Castelo Branco	Nov. 25			Present with several cases.
Feteira	do	1		
St. Michael Island	Nov. 2-Jan. 3	30	13	
British East Africa:				
Kenya—				
Uganda	Aug. 1-31	79	62	
Canary Islands:				
Las Palmas				Stated to have been infected with plague Sept. 30, 1924.
Realejo Alto	Dec. 26	3	1	Vicinity of Santa Cruz de Teneriffe.
Celebes:				
Macassar	Oct. 29			Epidemic.
Ceylon:				
Colombo	Nov. 9-Dec. 20	9	8	
China:				
Nanking	Nov. 23-Jan. 3			Present.
Ecuador:				
Guayaquil	Nov. 16-Dec. 15	8	3	Rats taken, 17,677; found infected, 33.

[1] From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, AND TYPHUS FEVER—Continued

Reports Received from December 27, 1924, to February 13, 1925—Continued

PLAGUE—Continued

Place	Date	Cases	Deaths	Remarks
Egypt				Dec 25-31, 1924: Cases, 5. Jan. 1-Dec. 31, 1924: Cases, 373. Corresponding period, 1923: Cases, 1,519. Jan. 1-8, 1925: Cases, 11; deaths, 4.
Do	Jan. 1, 1924-Jan. 1, 1925.	377	194	
City—				
Alexandria	do	2	2	First case, Apr. 2; last case, Nov. 26.
Ismailia	do	1	1	July 6-July 6.
Port Said	do	6	4	Apr. 24-Dec. 7.
Suez	do	20	13	Jan. 2-Dec. 20.
Province—				
Assiout	do	44	35	Apr. 1-Aug. 27.
Behera	do	1	1	Aug. 9.
Beni-Souef	do	4	4	June 21-Dec. 25.
Charkieh	do	1	1	Jan. 31.
Dakhalia	do	1	1	Oct. 1.
Do	Jan. 1-8, 1925	1	1	
Fayoum	Jan. 1, 1924-Jan, 1, 1925.	106	33	Feb. 18-July 18.
Gharbia	do	6	2	Apr. 21-Sept. 2.
Ghirga	do	10	3	Jan. 17-May 13.
Kalioubiah	do	14	4	Jan. 6-Dec. 31.
Do	Jan. 1-8, 1925	3		
Kena	Jan. 1, 1924-Jan. 1, 1925.	45	26	Apr. 9-Nov. 15.
Menoufieh	do	58	36	Jan. 2-June 28.
Do	Jan. 1-8, 1925	7	3	
Minia	Jan. 1, 1924-Jan. 1, 1925.	58	28	Feb. 5-Aug. 1.
Gold Coast				Sept, 1924: Cases, 37; deaths, 38.
Hawaii:				
Honokaa	Nov. 4	1		At Mill Camp, location of Honokaa Sugar Co. Plague-infected rodent found, Dec. 9, 1924, in vicinity of Honokaa village.
India				Oct. 19-Dec. 6, 1924: Cases, 17,096; deaths, 12,897.
Bombay	Nov. 22-Dec. 20	3	2	
Karachi	Nov. 30-Dec. 6	2	1	
Madras Presidency	Nov. 23-Dec. 6	182	128	
Do	Dec. 14-20	161	113	
Rangoon	Oct. 26-Dec. 6	13	13	
Indo-China				Aug. 1-Sept. 30, 1924: Cases, 25; deaths, 20.
Province—				
Anam	Aug. 1-Sept. 30	4	4	
Cambodia	do	18	15	
Cochin-China	do	3	1	
Java:				
East Java—				
Blitar	Nov. 11-22			Province of Kediri; epidemic.
Pare	Nov. 29			Do.
Soerabaya	Nov. 16-22	6	4	
West Java—				
Cheribon	Oct. 14-Nov. 3		14	
Pekalongan	do		29	
Tegal	Oct 14-20		3	
Madagascar:				
Tananarive Province				Oct. 16-Nov. 15, 1924: Cases, 83; deaths, 75.
Tananarive Town	Oct. 16-Nov. 15	6	5	
Other localities	do	77	70	Bubonic, pneumonic, septicemic.
Straits Settlements:				
Singapore	Nov. 9-15	1	1	
Union of South Africa:				
Cape Province—				
De Aar	Nov. 22-29	1		Native.
Dronfield	Dec. 7-13	1		8 miles from Kimberley.
Kimberley	do	1	1	
Maraisburg District	Nov. 22-Dec. 13	4	2	Bubonic, on Goedshoop Farm.
Orange Free State—				
Hoopstad	Dec. 7-13	1		On farm.
Kroonstad	Nov. 22-29	1		Bubonic; mild; from Grandstable Farm, Hoopstad district.
Vredefort	Dec. 7-13	1	1	On farm.

CHOLERA, PLAGUE, SMALLPOX, AND TYPHUS FEVER—Continued

Reports Received from December 27, 1924, to February 13, 1925—Continued

PLAGUE—Continued

Place	Date	Cases	Deaths	Remarks
Union of South Africa—Con.				
Transvaal—				
Boshof	Dec. 7-13	1	1	On farm.
Wolmaransstad district	Nov. 22-29	1	1	On Farm Wolverspruit, Vaal River. Native.
On vessel:				
S. S. Conde				At Marseille, France, Nov. 6, 1924. Plague rat found. Vessel left for Tamatave, Madagascar, Nov. 12, 1924.

SMALLPOX

Place	Date	Cases	Deaths	Remarks
Bolivia				
La Paz	Nov. 1-30	12	7	
Brazil:				
Pernambuco	Nov. 9-Dec. 20	73	16	
British South Africa:				
Northern Rhodesia	Oct. 28-Dec. 8	55	2	
Canada:				
British Columbia—				
Vancouver	Dec. 14-Jan. 3	32		
Do	Jan. 4-17	35		
Victoria	Jan. 18-24	1		
Manitoba—				
Winnipeg	Dec. 7-Jan. 3	14		
Do	Jan. 4-24	21		
Ontario				Nov. 30-Dec. 27, 1924: Cases, 33.
Hamilton	Jan. 24-30	1		
China:				
Amoy	Nov. 9-Jan. 3			Present.
Antung	Nov. 17-Dec. 28	5		
Foochow	Nov. 2-Dec. 13			Do.
Hongkong	Nov. 9-Dec. 6	5	1	
Shanghai	Dec. 7-27	1	2	
Czechoslovakia				Apr.-June, 1924: Case, 1, occurring in Province of Moravia.
Ecuador:				
Guayaquil	Nov. 16-Dec. 15	4		
Egypt:				
Alexandria	Nov. 12-Dec. 23	9		
France				July-Oct., 1924: Cases, 61.
Germany				June 29-Nov. 8, 1924: Cases, 7.
Gibraltar	Dec. 8-14	1		
Gold Coast				July-Sept., 1924: Cases, 82; deaths, 1.
Great Britain:				
England and Wales	Nov. 23-Jan. 3	472		
Do	Jan. 4-10	91		
Greece				Jan.-June, 1924: Cases, 170; deaths, 27.
Do				July-Oct., 1924: Cases, 34; deaths, 25.
India				Oct. 19-Dec. 6, 1924: Cases, 6,422; deaths, 1,433.
Bombay	Nov. 2-Dec. 20	19	12	
Calcutta	Oct. 26-Dec. 20	194	106	
Karachi	Nov. 16-Dec. 27	12	2	
Madras	Nov. 16-Dec. 20	69	30	
Rangoon	Oct. 26-Dec. 6	41	12	
Indo-China				Aug. 1-Sept. 30, 1924: Cases, 223; deaths, 76.
Province—				
Anam	Aug. 1-Sept. 30	49	11	
Cambodia	do	40	9	
Cochin-China	do	115	49	
Saigon	Nov. 16-29	3	2	Including 100 sq. km. of surrounding country.
Tonkin	Aug. 1-Sept. 30	19	7	
Iraq:				
Bagdad	Nov. 9-15	1	1	
Italy				June 29-Nov. 8, 1924: Cases, 57.
Jamaica				Nov. 30-Dec. 27, 1924: Cases, 33. Reported as alastrim
Kingston	Nov. 30-Dec. 27	4		Reported as alastrim

CHOLERA, PLAGUE, SMALLPOX, AND TYPHUS FEVER—Continued

Reports Received from December 27, 1924, to February 13, 1925—Continued

SMALLPOX—Continued

Place	Date	Cases	Deaths	Remarks
Java:				
East Java—				
Pasoeroean	Oct. 26-Nov. 1	9	1	
Do	Nov. 12-19			Epidemic in two native villages.
Soerabaya	Oct. 19-Nov. 29	484	159	
West Java—				
Batam	Oct. 14-20	2		
Batavia	Oct. 21-Nov. 14	2		
Do	Dec. 20-26	10	1	
Cheribon	Oct. 14-Nov. 3	14		
Pekalongan	Oct. 14-Nov. 3	20		
Latvia				Oct. 1-Nov. 30, 1924: Cases, 5.
Mexico:				
Durango	Dec. 1-31		5	
Guadalajara	Dec. 23-29		1	
Do	Jan. 6-12		1	
Mexico City	Nov. 23-Dec. 27	5		
Monterey				Jan. 24, 1925: Outbreak.
Salina Cruz	Dec. 1-31	1	1	
Tampico	Dec. 11-31	5	4	
Do	Jan. 1-20	11	5	
Vera Cruz	Dec. 1-Jan. 3		10	
Do	Jan. 5-18		9	
Villa Hermosa	Dec. 28-Jan. 10			Present. Locality, capital, State of Tabasco.
Nigeria				Jan.-June, 1924: Cases, 357; deaths, 87.
Do				July-September, 1924: Cases 6; deaths, 1.
Peru:				
Arequipa	Nov. 24-30		1	
Portugal:				
Lisbon	Dec. 7-20	19		
Oporto	Nov. 30-Dec. 27	3	2	
Russia				Jan. 1-June 30, 1924: Cases, 9,683.
Spain:				
Barcelona	Nov. 27-Dec. 31		5	
Cadiz	Nov. 1-Dec. 31		51	
Madrid	Year 1924		40	
Malaga	Nov. 23-Jan. 3		97	
Do	Jan. 4-17		26	
Valencia	Nov. 30-Dec. 6	2		
Switzerland:				
Lucerne	Nov. 1-Dec. 31	19		
Syria:				
Aleppo	Nov. 23-Dec. 27	13		
Do	Jan. 4-10	12	3	
Tunis:				
Tunis	Nov. 25-Dec. 29	42	35	
Do	Jan. 1-14	23	29	
Turkey:				
Constantinople	Dec. 13-19	5		
Union of South Africa:				
Cape Province	Nov. 9-29			Outbreaks.
Orange Free State	Nov. 2-8			Do.
Transvaal	Nov. 9-15			Do.
Uruguay				Jan.-June, 1924: Cases, 101; deaths, 2.
Do				July, 1924: Cases, 25; deaths, 3.

TYPHUS FEVER

Place	Date	Cases	Deaths	Remarks
Algeria:				
Algiers	Nov. 1-Dec. 31	5	1	
Bolivia:				
La Paz	do	2		
Bulgaria				Jan.-June, 1924: Cases, 191; deaths, 28.
Do				July-Aug., 1924: Cases, 4.
Chile:				
Concepcion	Nov. 25-Dec. 1		1	
Iquique	Nov. 30-Dec. 1		2	
Talcahuano	Nov. 16-Dec. 20		5	
Valparaiso	Nov. 25-Dec. 7		4	

CHOLERA, PLAGUE, SMALLPOX, AND TYPHUS FEVER—Continued

Reports Received from December 27, 1924, to February 13, 1925—Continued

TYPHUS FEVER—Continued

Place	Date	Cases	Deaths	Remarks
Chosen:				
Seoul	Nov. 1-30	1	1	
Czechoslovakia				Apr.-June, 1924: Cases 3, occurring in Province of Russinia
Egypt:				
Alexandria	Dec. 3-9	1	1	
Cairo	Oct. 1-Nov. 18	10	7	
France				July-Oct., 1924: Cases, 7.
Greece				May-June, 1924: Cases, 116; deaths, 8.
Do				July-Oct., 1924: Cases, 30; deaths, 4.
Latvia				Oct.-Nov., 1924: Cases, 16.
Lithuania				Aug.-Oct., 1924: Cases, 15; deaths, 1.
Mexico:				
Durango	Dec. 1-31		1	
Guadalajara	Dec. 23-29		1	
Mexico City	Nov. 9-Jan. 3	80		Including municipalities in Federal district.
Palestine				Nov. 12-Dec. 8, 1924: Cases, 7.
Ekron	Dec. 23-29	1		
Jerusalem	do	2		
Peru:				
Arequipa	Nov. 24-30		1	
Poland				Sept. 28-Nov. 1, 1924: Cases, 137; deaths, 7.
Portugal:				
Oporto	Jan. 4-10	1		
Rumania				Jan.-June, 1924: Cases, 2,906; deaths, 328.
Do				July, 1924: Cases, 69; deaths, 10.
Constanza	Dec. 1-10	1		
Russia				Jan. 1-June, 30, 1924: Cases, 92,000.
Leningrad	June 29-Oct. 25	11		
Spain:				
Madrid	Year 1924		3	
Malaga	Dec. 21-27		1	
Tunis				July 1-Nov. 20, 1924: Cases, 39.
Turkey:				
Constantinople	Nov. 15-Dec. 19	6	1	
Do	Jan. 2-8	1		
Union of South Africa:				
Cape Province	Nov. 9-29			Outbreaks.
East London	Nov. 16-22	1		
Orange Free State	Nov. 9-Dec. 13			Do.
Transvaal	Nov. 9-15			Do.
Yugoslavia				Aug. 3-Oct. 18, 1924: Cases, 17; deaths, 2.
Belgrade	Nov. 24-Dec. 7	4		

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