

TYPHOID FEVER EPIDEMIC AT WINONA LAKE DURING THE SUMMER OF 1925.

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There has been considerable typhoid fever at Winona Lake since the Assembly was started 30 years ago, six well-defined epidemics having occurred.

Only the summers of 1923 and 1924 were entirely free from the disease. While most of the epidemics have been water-borne, usually from polluted springs or wells, the epidemic of 1922 was due to milk, infected by a carrier at one of the dairies.

As Winona Lake has many thousands of visitors each season besides the 12 weeks' summer school for teachers, with an attendance of 500, and the Indiana University Biological Station, an epidemic is likely to prove very disastrous and spread the disease over a large territory.

The epidemic of 1925 began with three cases on June 22 and three more on June 24. By July 8, 20 cases had occurred among people living or working at Winona Lake, and by July 23, the number had risen to 30, including two or three in Warsaw, though Warsaw generally had little typhoid. Only one case developed after July 23.

Early in July, reports began to come in of cases in various parts of the country among people who had been at Winona Lake earlier in the summer.

The Indiana State Board of Health made an investigation, sending Dr. T. B. Rice on July 1 to study the situation.

It became evident at once that the infection was probably water-carried. All milk used in Winona Lake is pasteurized and many of the patients did not use milk. Flies were not unusually numerous. No one boarding place seemed to have more cases than another. Indeed, many of those sick lived and ate at home. The bathing beach was somewhat polluted but probably not more so than during the two previous summers when no typhoid occurred and many of those taken sick had not been in the lake at all.

The National Conference of the "Church of the Brethren" was held at Winona Lake June 2 to 12, and it is said over 30,000 persons visited the grounds during Sunday, June 7. This is a much larger number than could be efficiently cared for with the facilities available. Indeed, the water supply was insufficient and on June 6 was reinforced by an auxiliary supply which had not been used for some months. These visitors maintained a cafeteria on the banks of the canal near the Inn and the possibility of this being the source from which the typhoid spread was considered. In spite of reports of unsanitary conditions, investigation failed to reveal that conditions were any worse than many which were constantly present on the assembly grounds. Nor does there seem to have been more illness among those in charge of the cafeteria than among others. Indeed, the help was reported to be unusually free from sickness at the time. While there was much typhoid among those who had attended the conference, the percentage of sickness was

no greater and perhaps even less than among others who were on the grounds at the time or soon afterwards and who had not eaten at this cafeteria. This would seem to argue against the possibility of a specific carrier in connection with the cafeteria.

Early in June, generally reported as about Sunday, June 7, much gastro-intestinal disturbance occurred among the residents and visitors at Winona Lake. Indeed, it seemed as if a large percentage of the population was ill with this malady for a few hours or a few days and it became a matter of current remark that visitors to the grounds were taken sick within a few days after their arrival. This trouble continued throughout most or all of June, gradually abating toward the end of the month.

Everything pointed to the general water supply as the source of the infection as no localized supply could have produced such widespread illness.

The Winona Lake water supply is furnished by the Interstate Public Service Company of Warsaw, but is distinct from the Warsaw supply. Most of it comes from deep wells near the gravel pits north of the Pennsylvania Railroad tracks. It is apparently pure and free from pollution. Most of it is pumped directly into the mains without treatment. At certain times during the day water is pumped from a deep well on the hill east of the Mount Memorial building into twin tanks which serve as a reserve for use during those portions of the 24 hours when the demands are heaviest.

A few years ago another water system was installed, taking water from the canal, to be used only for sprinkling and flushing the public toilets.

There was supposed to be no connection whatever between these two systems as the canal was known to be grossly polluted from many private sewers which empty into it.

When the water supply became insufficient on June 6, an old cistern which had formerly been a part of the supply, but had been abandoned some months before, was again connected with the system. This "cistern" is really a large well, supposedly fed by springs, and was not known to receive surface water from any source. Indeed, tests with fluorescein and other dyes failed to show any connection with surface water or sewers. The water company claims that before this connection was made the water which had been standing in this well was pumped out and allowed to run into the sewer. Thus only fresh water was pumped into the mains. There are some who deny that the well was pumped out before being connected.

The water from this well was pumped into the mains for three days, being disconnected June 8 or 9. When examined by Doctor Rice July 1, it was slightly turbid, with a barely noticeable odor and stale taste. A bacteriological analysis of a sample of the water, while not entirely satisfactory, failed to show sufficient pollution to account for an epidemic. A sample of water taken at the same time from the town supply at the home of John O. Motto on Administration Boulevard, showed an unexpected high degree of pollution which could not be accounted for by contamination with the old well water.

The Interstate Public Service Company while hunting evidence for some source of pollution other than the old well, discovered on July 8 that the hands of the master meter at the corner of Parkway and Administration Boulevard were turning backward. An examination of previous readings revealed the following record: June 8, 365,000 gallons; June 26, 465,000 gallons; July 7, 4 P. M., 331,970 gallons; July 8, 7:30 A. M., 328,700 gallons. Evidently the meter had been running backwards which would only be accounted for by a back flow of water.

An immediate search was made for the cause. Underneath the public toilets, two cross connections were found, one under each toilet, joining the sprinkling and flushing system for the toilets with the public drinking water. Inquiry disclosed the fact that these connections had been made in March though the law prohibits all such connections and the State Board of Health forbids them. The valves separating the two systems were closed at the time of the discovery and it is claimed that they had been opened only on one occasion. This was when the pump at the canal broke down, perhaps on June 5, and the city water was then on only two hours. The connection from the sprinkling system, it is claimed, was broken before the valve to the town supply was opened and this valve was carefully closed again before the connection with the sprinkling system was re-established. No very definite statement, however, could be obtained and the workmen seemed somewhat confused in regard to the valves, one of them actually declaring a certain valve to belong to the town system which was later found to belong to the sprinkling system. Both valves were easily accessible and might have been opened by anyone at any time. As the pump at the canal when operating developed 60 pounds pressure and the fire hydrant on the water mains at Parkway and Administration Boulevards showed only 40 pounds, it is easily seen that if the valves were open when the pump was operating, there would be a back flow into the town mains and cause the meter to reverse. It is quite significant that a number of people spoke of the disagreeable taste and odor which the water had early in June. "It tasted and smelled just like canal water." The barber said it was not fit to put on a man's face, it had such a disagreeable odor when hot.

A study of the distribution of the typhoid cases in Winona Lake is also interesting. Of the 24 cases which occurred on the Assembly Grounds, 19 were on Parkway or Administration Boulevards, mostly grouped near the point at which the branch line for the toilets was taken from the water mains. This is exactly what would be expected if water from the sprinkling system backed up into the town mains as the water in this section would naturally be the most highly polluted. It would also explain the highly polluted sample taken at the home of Mr. Motto. It was in this part of town that the disagreeable taste and odor was most often mentioned.

In order to supply the crowds of the conference, a row of drinking fountains was put up along Parkway in front of the barber shop just at the point where the branch line to the toilets was taken off from the mains. Undoubtedly, many of the visitors were infected from

drinking at these fountains as it was here the largest crowds collected.

After the line to the toilets had been disconnected, flourescein was put into the canal and the pump started in order to determine if there were any other connections between the two systems. Though the water in the sprinkling system was very green, no trace of the dye could be found in the town mains, showing that no other connections existed. The sprinkling system was then ordered abandoned and the pump dismantled. It is quite significant that both the Winona Hotel and the Westminster Hotel have their own water supply and only one case of typhoid occurred in them. One of the girls at the Winona Hotel went home with the disease August 2. These hotels also were almost entirely free from the gastro-intestinal disorder that was so prevalent in other parts of the grounds.

While the total number of cases occurring in Winona Lake and Warsaw was about 30, "The Gospel Messenger", the official organ of the Church of the Brethren, on August 22, listed 140 cases which had been officially reported to them among people who had visited the grounds in June. Of these cases, 22 were fatal, making a mortality of over 15 per cent, which is high even for typhoid fever. Undoubtedly, there were many cases not reported or listed.

That the epidemic was wide-spread is shown from the following towns given in a list of 13 cases published in "The Messenger" August 8: Leon, Iowa; Mt. Sidney, Va.; Irricana, Alberta; Sebring, Fla.; Hemet, Calif.; the disease being scattered from the Atlantic to the Pacific, from Canada to the Gulf.

To prevent future trouble, a chlorinating plant has been installed at the Winona pumping system and a new sewer is contemplated.

Exactly how the infection found its way into the town supply will probably never be known but it seems safe to assert that it was undoubtedly canal water from the sprinkling system which came by way of the physical connections underneath the public toilets. Probably this water was flowing into the mains for a number of days whenever the pump at the canal was in operation.