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the commission, and it is pertinent to note that such cities take pride in stating that their water conforms to the treasury department standard.

The commission formulating the standard had in mind that it was to be applied primarily to water taken directly from cars or vessels. Realizing that in such cases the water might have been stored for some time, and that such storage would undoubtedly cause marked changes in the bacterial flora, they set the maximum permissible number of bacteria which would develop on agar at 37 degrees at 100 per cubic centimeter. The commission stated that they would have considerably reduced this number if the standard was to be applied to water at its source.

As regards bacteria of the bacillus coli group, however, they considered that inasmuch as these bacteria do not multiply in water, but, on the other hand, die out rather rapidly, the permissible number could be set within very definite limits. It has been this part of the standard which requires that there shall be not more than 2 B. coli. per 100 c.c., that has received the most criticism. It is not believed, however, that this criticism has been well taken for reasons which will be enumerated.

While the standard under discussion applies to lake and river carriers, as well as railroads, it is in the latter connection that it has a direct bearing on public water supplies since, in the majority of cases these carriers obtain their drinking water from such sources. The question of drinking water on lake vessels has been previously discussed before this association and will not be dwelt upon at this time.

In order to ascertain whether it was feasible to utilize this standard in the manner presupposed by the commission, several hundred samples were collected from railroad cars within the sanitary district of the Great Lakes. At the time the samples were collected information was Sathered regarding the point or points where the water was originally obtained, as well as the length of time that had elapsed since the coolers were filled. In few cases could information of any reliability be obtained. The analyses of the water also gave little of value, inasmuch as certain samples, supposedly from the same source of supply, taken on different days, gave widely divergent results. Moreover, in case a sample failed to meet the requirement of the standard, there was no way of knowing whether the impurities were present in the source of supply or were introduced in the process of filling the coolers. As a result of these analyses, it was plainly evident that, in order to bring about any permanent and beneficial results from the enforcement of the standard, reliable and accurate data regarding the source of supply must be obtained.

Inasmuch as this would require a sanitary survey of each source, and since analyses of shipped samples are not as reliable as those examined immediately after collection, it was deemed advisable to carry a laboratory into the field. A portable laboratory was therefore devised and used for about two months. The results of the field work indicated that it was the proper method of handling the situation, but because of certain difficulties with the Portable laboratory, its use was discontinued and a laboratory car designed. This car, which was built by the Pullman Company, has now been on the road for about two months, and has demonstrated its usefulness in handling the problem.

After having made some thirty sanitary surveys of water supplies used by railroads, it became more and more evident that such surveys were absolutely necessary to correlate the analyses, in order that an opinion could be formed as to the safety of any given water. In order to make the surveys mandatory, the interstate Quarantine regulations were amended on February 12, 1917, so that they now require that the water shall not only conform to the bacteriological standard, but shall not be from a supply that is exposed to contamination.

Formerly, if a sample of water taken from a source which was obviously contaminated, happened to contain not more than 2 B. coli per 100 cubic centimeters, the source of supply would have been approved. Under the present regulation, however, no matter what the bacteriological analysis indicates, the use of water from such a supply would not be permitted.

The matter of enforcing these regulations in the sanitary district of the Great Lakes has been from the start carried on with the idea of not only benefitting directly the passengers on railroad trains, but benefitting, indirectly, the much greater number of people using the same supplies in towns.

When the sanitary survey and analysis show that a supply is contaminated or is exposed to contamination, a letter is prepared to the municipality or private water company, as the case may be, in which the conditions are outlined and suggestions made for betterments. In many cases these recommendations have been adopted, usually because the municipalities are aware that unless corrective measures are adopted, the railroads will not be permitted to use the supply.

To return to the question of the B. coli requirements of the standard; over 100 investigations have been made of water supplies used by railroads in Illinois and Michigan. These supplies have been of all types, shallow wells, deep wells, and surface water, treated and untreated. The filtration plants, ranging in size from 15,000,000 gallons per day to 1,000,000 gallons per day, all produced a water well within the bacteriological requirements. All the disinfection plants, most of which used liquid chlorine, produced a satisfactory water. The only supplies failing to meet the standard were untreated supplies and a few ground water supplies. In every one of the latter cases, however, the sanitary survey had shown some point of possible contamination.

Only two supplies failed to meet the total count requirement, and in each of these instances the water had been stored in large reservoirs which had not been cleaned for a considerable period. The agar count, as a general rule, was less than 10 per c.c. The fact that most of these analyses were made during the winter months undoubtedly had some influence on the low counts. These data are sufficient to convince the writer that it is possible for any public water supply to meet the requirements of the treasury department standard without undue expense.

Several investigators have recently brought out data affecting the significance of the B. coli test, by differentiating the organisms into fecal and non-fecal strains. Their observations, however, have not yet been generally accepted and until they are and the technique is standardized, the presence of any of the B. coli group in a water must be considered as evidence of contamination. If sufficiently intensive investigations are made of water supplies containing B. coli, in practically every instance a possible entrance for the organisms will be discovered.

From the foregoing statements the following conclusions can be derived :---

(1) The requirement of the standard regarding total count is very lenient. It could be reduced more than half without eliminating any but an extremely small percentage of supplies that would otherwise pass the requirements.