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Status of Stream Pollution in Iowa

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Under the Iowa Stream Pollution Law, adopted in 1923, the State Department of Health is charged with the administration of antipollution measures. The law requires specifically that the State Department shall investigate conditions of alleged pollution and may issue orders for the remedying of such pollution. If the work contemplated under any such order exceeds $5,000 in cost, the State Executive Council must approve such order.

The destruction of fish and other aquatic life and the rendering of a stream unsafe as a source of water supply for domestic consumption are the two bases mentioned in the law, upon which an order may be issued. I presume the reason that the nuisance was not specifically mentioned was because ample authority over nuisances is given the local and state authorities elsewhere in the Code.

Acting under the provisions of this law the Division of Sanitary Engineering has since July 1, 1925, been studying the conditions of pollution of Lime creek, Shell Rock river, and Cedar river. In these studies stress has been laid on the oxygen determinations, namely, dissolved oxygen and biochemical oxygen demand and bacteriological determinations, particularly quantitative determinations of bact. coli. In the later work such determinations as ph. nitrates, chlorides, alkalinity, settleable solids and total solids have been made on some of the wastes.

In addition to the bacteriological and chemical determinations, it has been necessary to make the quantitative determinations of sewage and trade wastes in most instances and in one instance it has been necessary to make stream discharge observations because of the lack of such data.

The oxygen determinations were emphasized because it is believed that these determinations give more reliable information as to the condition of pollution in a stream than any other determination or set of determinations which could be made in the field laboratory, which is the only one available and with the very limited personnel and equipment available for this work. Secondly,

trade wastes that are being discharged into the streams that have so far been studied are of such nature that the fish destruction as well as nuisances result from oxygen depletion rather than from any toxic substance discharged into the stream.

It certainly would be very desirable to make more extensive examinations, both on the river samples and on the trade wastes, if funds were available. We have had two instances where it has been necessary to vary this procedure and have had additional chemical determinations. Cyanide from an electro-plating plant, which resulted in the death of 18 dairy cows and thousands of fish, in the one case, and phenol wastes from a gas plant in the other case were the substances in question.

Total bacteriological counts are made largely for interest yet the average results appear to indicate that such results are a fair indication of gross pollution, particularly where domestic sewage is the polluting material.

Quantitative b. coli determinations are the only means, from present knowledge, to determine the maximum stream loading consistent with safe use of the water for drinking and domestic purposes, even after very adequate treatment of the water. Bacterium coli has been adopted as an index for safe loadings of filter plants and therefore where a polluted stream is used as a source of domestic water supply this is a very important determination.

In the work that has so far been done, the need for extensive studies on each stream has been very definitely brought out. So many factors affect the self-purification of streams that from the knowledge now available there is no formula by which one might accurately predict the effect upon a stream of a certain amount of sewage or trade waste.

Municipal sewage is rather constant in its chemical composition and the amount of oxygen-consuming material from a certain population can easily be calculated. Likewise a chemist can easily determine by means of a series of analyses the average composition of a trade waste and this can be converted to a population basis. The stream discharge is easily measured and the quantity of available oxygen can be easily computed from the laboratory and stream flow data. However, in practice the problem is not so simple as there are so many factors affecting the rate of deoxygenation of the stream as well as the rate of reaëration. For instance, temperature of the water in the stream apparently has a marked effect upon the oxygen demand. While the determination of five

day B.O.D. when the sample is incubated at 20 deg. C. gives a fairly reliable index of potential oxygen demand, lower temperature of the water in the stream has such a marked effect in deferring biological action that the potential demand is not so soon exerted as under incubating temperatures. Thus the effects of pollution are at the worst considerably farther from the source of pollution in winter than they are in summer. This would prove advantageous in that the polluting material would be more widely diffused and the dilution afforded would be greater were it not for the fact that when the water temperatures are lowest, ice formation is the heaviest and most extensive, thereby cutting off the opportunity for reaëration of the water. All existing formulas for computing reaëration fail when the stream is completely or almost completely frozen. Theriault, Levine and others have conducted some experiments to determine the temperature effect on deoxygenation but these experiments have not yet reached the stage where they are of much value in forecasting the effect of certain wastes on a stream under varying temperature conditions.

Character of wastes also certainly influences the rate of deoxygenation in that the optimum temperature and other stream conditions vary for different wastes.

Therefore it is evident that each stream with a set of conditions peculiar to itself constitutes an individual problem and must be studied as such if any definite conclusion is to be reached.

After the degree of pollution has been determined and the degree of purification needed has been decided upon comes the problem of determining by experiment in the case of many trade wastes a method of treatment that is economically feasible. All trade wastes are not amenable to treatment by the methods now in vogue although most new methods are modifications of the existing methods. The problem is twofold; first, finding a method of treatment which is successful, and second, applying this method so that the costs will not be prohibitive.

The problems confronting the department are not confined to technical consideration alone. There is also the problem of administration. One group of citizens demands that the streams be returned to their original condition of pristine purity. Another group does not deem that the expense to communities and industries of properly treating their wastes is justified by the results thereby obtained.

It is economically unfeasible to meet the demands of the first

group and certainly the majority of our people do not agree with the view of the last group. Almost every one will agree that where public health is menaced, such as a case where a city is dependent upon a stream as a source of water supply, treatment of wastes to a degree that the water can be rendered safe must be required regardless of costs. It is also obvious that where a nuisance exists or where fish are killed, steps should be taken to remedy the situation. Progress has been made in correction of stream pollution in Iowa during the past few years.

The Engineering Experiment Station at Ames has devised experimentally a method for successfully treating creamery wastes. While no working plants are as yet in operation it appears to be assured that at least one will be constructed this summer (1928).

This same station is just completing studies on treatment of packing house wastes, which studies will be used as a basis for the design of a complete treatment works for one of the large packing plants in the state. This construction will be completed this year. Several of the gas plants are installing tar and oil removal plants, and in one instance, the wastes are being completely eliminated from a lake.

The National Canners Association and the Iowa Canners Association have agreed to begin investigations for developing a method of treatment of cannery wastes. Experimental work on beet sugar wastes by an Iowa sugar factory has reached a point where the problem of one of the worst pollution conditions in Iowa seems to be nearing solution. Popular sentiment for cleaner streams is becoming aroused to the point where the larger cities in Iowa are beginning to think seriously of their waste problems. Much remains to be done, however.

Iowa has a goodly number of municipal sewage treatment plants. According to our latest records there are two hundred cities and towns in the state that have some kind of sewage treatment plants. These cities and towns have an aggregate population of three hundred and fifty thousand. Many of these plants are not giving satisfactory results, due to faulty design or operation. These figures indicate at once that the treatment plants are for the most part in the small cities and towns, the average population of the towns served with sewage treatment works being 1750.

Of the sixteen first-class cities in the state with an aggregate population of 635,493 only one has a treatment plant and at this place only one-third of the sewage passes through the plant. This

condition, however, is now being remedied so that by the end of the year all of the sewage will be treated. Of 305 communities in Iowa having public water supply, with a population aggregating 1,125,000, one hundred-five, with a total population of 775,000, are discharging untreated sewage into the streams of the state.

Of the major industries in the state which produce objectional wastes only one has a waste treatment plant, and this plant is being replaced this year by an entirely new plant, due to unsatisfactory results from the old plant.

Industries and municipalities, however, are coöperating and taking cognizance of their deficiencies in this matter and it appears that Iowa is entering into a new era as far as stream pollution is concerned.

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