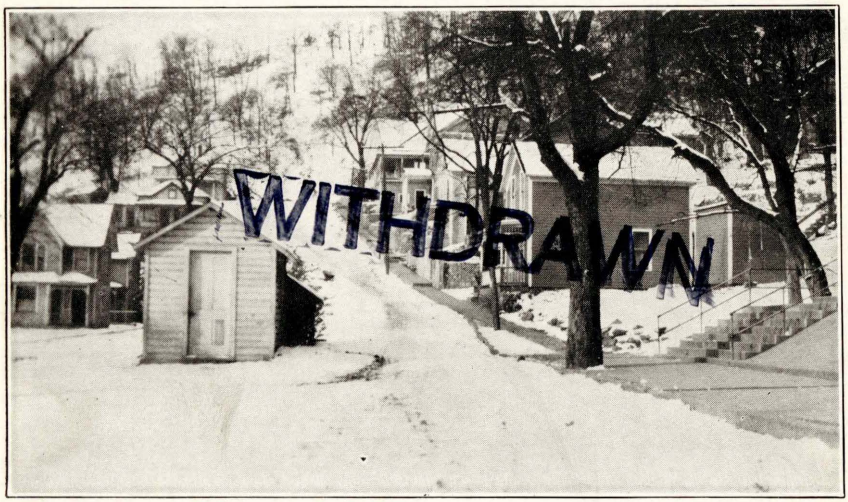
IOWA STATE COLLEGE
OF AGRICULTURE AND MECHANIC ARTS
OFFICIAL PUBLICATION

Vol. XXIII October 29, 1924 No. 22

SANITATION SURVEYS

By W. H. LARKIN

Presented at the Sixth Conference on Sewage Treatment at Ames, Iowa, October 28, 29 and 30, 1924



Bulletin 70

ENGINEERING EXTENSION DEPARTMENT
IOWA STATE COLLEGE
AMES, IOWA

Published weekly by Iowa State College of Agriculture and Mechanic Arts. Ames, Iowa. Entered as Second-class matter and accepted for mailing at the special rate of postage provided for in Section 429, P. L. & R., Act of August 24, 1912, authorized April 12, 1920.

CONFERENCES on sewage treatment are held annually at Iowa State College, under the auspices of the Engineering Extension Department. These meetings are of a practical nature and are arranged for municipal officials and all others directly or indirectly responsible for the operation of sewage-treatment plants.

This publication is one of the more general papers which were presented at the 1924 conference. Several others from this meeting are to be published. In addition to the more formal papers, considerable time on the program was devoted to the consideration of sewage-treatment plant construction and operation, as well as to the individual problems of those in attendance.

SANITATION SURVEYS

By W. H. Larkin

Assistant Engineer, Iowa State Department of Health.

According to Webster, "sanitation" means "a rendering sanitary", "science of sanitary conditions", and "use of sanitary measures". Since in each of these definitions the word "sanitary" is used, we ascertain from the same authority that this word means, "of or pertaining to health; relating to the preservation or restoration of health".

"Survey", Webster also tells us, means "an examination of all parts or particulars of a thing to ascertain its condition, quantity, or quality". Therefore, a discussion or paper on "Sanitation Surveys" should cover examinations of all the parts and particulars of things relating to the preservation or restoration of health, to estimate their conditions, quantity, or quality. It hardly needs to be stated that this is a broad subject.

Factors Affecting Public Health

Our health is dependent upon many things. It is dependent upon the food which we take into our bodies, upon the air we breathe and its comparative freedom from disease-carrying organisms, upon the water in which we wash or bathe; and so on down the line we find that at every turn the things with which we come in contact have either a beneficial or a detrimental influence upon our health.

One of the greatest constant dangers to our health is the possibility that animal waste may gain admittance to the body through some tract, carrying with it disease germs which the body is unable to overcome. One of our objects in building and maintaining sewer systems and sewage-treatment plants is the destroying of the harmful organisms before they are released into any stream, dry run, or water-bearing stratum where they may endanger the health.

To understand clearly the decomposition of wastes and the treatment of sewage, we should go into the mechanism of the processes by which organic matter is formed and then destroyed or decomposed. We have, to start with, an abundance of mineral matter from which, with the aid of solar energy, green plants build themselves up and thus form vegetable or organic matter. From this organic matter animals derive the energy necessary for their life processes, and in so doing they break it up into the materials from which it was derived.

The requirements of animals for life are water, oxygen and organic matter; and their wastes are water, carbon dioxide and organic matter. Organic wastes are mainly dead organic matter,

which by oxidation becomes stabilized and mineralized. This is where the sewage-treatment plant plays its role, the work being done primarily by bacteria.

The Purpose of a Sanitary Survey

If a resident of a small Iowa town, or a man living on an Iowa farm, were to be questioned as to the purpose of a sanitary survey, he would probably say that it was to determine how far the well supplying drinking water was from the privy vault into which the wastes of the family were discharged. There is no doubt but that he would have made a start in the right direction, but ordinarily he does not go far. In one instance a farmer, whose well was located a short distance from and at a lower elevation than his privy, contended that if any liquid filtered for a distance of one rod through the ground it was purified. At the same time there are many people living in cities who believe that all is well if the sewer outlet is down-stream from the water intake.

Change of Conditions

Only a few generations ago our forefathers when in need of water would make a hole in the ground. If they got any water, this water was good; or they would drink the water from almost any spring or clear stream and consider it perfectly safe. At that time there were such small amounts of impurities discharged into the streams that, with the great dilution, the streams could easily care for these wastes. Likewise, the soil was in a state of virgin purity; hence the filtering capacity was usually such that, unless a source of pollution was very near to a well, the impurities would be so thoroughly filtered out as to be of little danger to the water in the well.

Time has gone on; sewage has been discharged into the streams and often into water-bearing strata. Garbage has been dumped on the surface of the ground where it has provided an excellent place for the harboring and breeding of rats, mosquitos and flies, or has been washed away into the streams. The water resources have been used without any thought of conservation, and more and more we have to resort to surface waters for our drinking water, often taking water from the same stream and in close proximity to the point where sewage is discharged. Where our forefathers depended upon nature to purify their wastes, we have to resort to artificial means or some installation for hastening natural means of purification.

Sanitary Surveys in Small Towns

In making sanitary surveys in small towns, which are similar to rural districts and shall be so classed, the first information wanted is concerning the water supply. It is the general thing to find that most of the water is secured from wells of less than one hundred

feet in depth and often as shallow as fifteen feet. Upon investigation as to the construction of these wells, it is usually found that they are walled up with brick or are of the "bored" type lined with open-joint tile. In any event the coverings are usually poor, and the wells so located as to allow the admission of surface drainage—this often coming from a filthy back yard or chicken lot. The prevalent opinion is that each individual or community has the best water in the state; if it has never killed anyone it is considered "perfectly safe".

As to the means employed for sewage disposal in the rural communities, it is found that the most common device is the "outdoor" toilet with open or boarded-up vaults. Here the rat has free access and runs almost at will from the barns to the privy vault and then to the pantry. Some of the more modern homes are equipped with cesspools or septic tanks—the cesspools often allowing the sewage to seep into the nearby soil, and the septic tanks frequently discharging their effluent, which contains a great percentage of the impurities of the influent, into some nearby dry run.

The garbage is usually fed to the chickens or hogs, while the barnyard is allowed to become filthy and thus to make ample provision for the breeding of millions of flies.

In case the community is supplied with water from a common source, the chances are that this source is a well, probably of the "dug" type. It is apt to be located at the foot of a hill at the end of the main street, where the wash from the streets is carried right past it, and where the well is fed from the hill on which there are located a number of privy vaults, cesspools and barnyards.

Some of our small towns are supplied with sanitary sewer systems and sewage-treatment plants. If such is the case, it will be likely that about thirty per cent of the houses are connected to the sewer system, while the remaining seventy per cent are still using cesspools or outdoor toilets. If the sewage-treatment plant is an old one, it is apt to be a Cameron-type tank with a concrete-slab covering. The tank, in all probability, will have never been cleaned (at least not during the administration of the last two or three councils), and the last man that visited the plant is apt to have opened the by-pass valve. If the plant is more modern, it will probably consist of an Imhoff tank with sand or stone filters. The flowing-through chambers of the tank are apt to have scum on the surface caused by the clogging of the bottom slot. The sand bed may be found supporting a fair crop of corn, with the effluent of the tank being by-passed directly into the creek.

As an example of this, a representative of the State Health Department asked the mayor of a county-seat town in the northern part of the state what they had in the way of a sewage-treatment plant. He said he didn't know exactly, but guessed they had one of those "antiseptic" tanks. When asked if he cared to go out to inspect

it, he said he didn't mind going, as he hadn't been out for about a year. When the plant was located, it was found to consist of a small lift-station, an Imhoff tank, a dosing chamber and a sand filter. The operator was there caring for the plant in his own way. The centrifugal pump had clogged, allowing quite an amount of sewage to accumulate in the pit. A scum had gathered on the surface of the liquid in the flowing-through chamber of the Imhoff tank, caused by the stoppage of the bottom slot, thus making a septic tank out of this chamber. The operator did not know that there should be no scum in this chamber. When we arrived, he had just gotten the pump started, and it was lifting the sewage out of the pit into the flowing-through chamber at the rate of from 150 to 175 g.p.m. In addition to this, he had a big wooden hoe affair with which he was agitating the scum on this chamber and washing the whole thing on through to the dosing chamber. He admitted that this was a regular practice, and then asked why he had so much trouble with the sand beds.

Since the greater part of the waste material and filth of the rural community eventually finds its way into the small creek which drains the community, let us pass on down this creek to the river, then down the river to the first city, and see what we find there.

Sanitary Surveys in Cities

The river supplies the water for the city, but this water is passed through a water-purification plant. It is drawn from the river and mixed with a coagulant, either lime or alum, or both, and then passed into a sedimentation tank where the suspended matter is supposed to settle out. From there it is passed through filters, dosed with liquid chlorine and pumped into the distribution system of the city. The plant operator is able to turn out a water which will give a very good test most of the time, but often has trouble coping with the seasonal changes or the algae growth.

The city is apt to be practically covered with a sewer system, into which the domestic wastes are passed and are carried to several points along the river where they are discharged. It is possible that one sewer line serving a small portion of the city discharges into the river above the inlet to the water-purification plant.

The garbage from the main part of the city is probably collected and disposed of by the city. After being stored in metallic cans, it is loaded into wagons and taken to the incinerator, where it is burned. If the city does not have an incinerator, it is possible that it is taken to some remote place and buried, or it may be fed to hogs. There is not so much objection to the methods of garbage disposal used by the cities as there is to the number of cities which have no systems of disposal at all, but which allow the individuals to dump it in small ravines or along the roads and in alleys.

In making further investigations, we find a public swimming pool, maintained by the city or some amusement company. It is probable that the water is from the public supply, but that no attempt is made to keep track of the bathing load and to refill the tank or to filter the water accordingly. Instead, it is allowed to be used until it becomes very dirty, when the tank is cleaned and refilled. It is a general practice that the swimmers are forced to take a shower bath before entering the pool, which is one redeeming feature.

Industrial Wastes

Our next investigation is concerning the industrial wastes. Possibly we find a corn-canning factory which passes its great bulk of waste through a very simple and inadequate septic tank and then on into the sewer system. We find a packing plant which passes great quantities of its sewage into the river with no treatment whatever. A gas plant is passing its wastes, in the form of tar water, into the river—and so on.

At the request of an engineer for an Iowa town, an investigation of the condition of a sewage-treatment plant was made about a year ago by a representative of the State Board of Health. It seemed that about two weeks prior to this investigation, the filter beds of the sewage-treatment plant had become matted, causing the water to be impounded thereon, and that the conditions about the plant had been such as to cause a very decided nuisance. The plant had recently been entirely renovated, including cleaning the tank, removing the old sand from the beds and replacing it with new. It was concluded, after some investigation, that this condition was caused by the waste coming from the local corn-canning factory. It was found that this canning company had constructed a small septic tank for the treatment of its wastes before they were passed on into the sanitary sewer system. This simple treatment plant was, however, inadequate for the nature and quantity of wastes passed through it, and the City Council was advised to cause the canning factory to discontinue the use of the sanitary sewer system for the disposal of its industrial wastes.

Sanitation Inspections

These conditions, the sort usually found in the rural communities and cities of Iowa, are the conditions learned by simply visiting the community, observing the lay of the land, the location of the well, the construction of the well, the amount of collected filth, the sewage-treatment plant, the water-purification plant, and so on. As no determinations as to the quality of the water or the efficiency of the sewage-treatment plant are ordinarily made under such conditions, these inspections could not rightfully be termed "sanitation sur-

veys", but rather "sanitation observations". However, by these observations it can be seen that a proper survey of a water-supply could not be made which would neglect the method and location of sewage disposal; a proper survey of a swimming pool cannot be made without knowing the source of water-supply; and so, as one portion of a sanitary survey is dependent upon another, the sanitation of one community is more or less dependent upon that of another community. A proper sanitary survey is thus the determination of the conditions of an intricate system of variable factors, and they should all be worked out together. The fact that these different elements are variables shows that proper sanitation surveys are not simply making determinations of these conditions at any certain time, but studying their changes, continuous and seasonal.

Suggested Survey Procedure

It is the opinion of the writer that, since this system of elements determining the general sanitation of the community or state starts with the water-supply, surface or underground, and ends in our streams as the effluent from sewage-treatment plants, the proper sequence would be to start with our streams and work up stream and inland.

Complete surveys of our streams would consist of making gagings to determine the high and low-water marks and the amount of flow at different points and over an extended period. Chemical and bacteriological analyses should be made of the water at the same time, together with the determination of the dissolved-oxygen content and the oxygen demand. Along with this work a complete study should be made of the sanitary sewage and industrial wastes which are being discharged into the streams, as to the amounts, and the true contents—chemical and bacteriological.

Observation should be made as to stream life in comparison with the nature of the water in various locations. Possibly some experimental work on the various types of wastes should be done to determine upon a satisfactory treatment.

In connection with our water-purification plants, a complete study should be made to determine the effect of various industrial wastes and to gather data on the actual efficiency of the plants under different conditions. Numerous bacteriological and chemical analyses would have to be made in this phase of the work. A close watch should be kept on municipal sewage-treatment plants, and the relative stability test be given their effluent periodically.

The sanitary surveys should proceed inland. Detailed investigations should be made of all well water-supplies, and the purification power of the different kinds of Iowa soils. Thus the work should continue, taking in swimming pools, tourist camps, private water-

supplies and the like. Surveys of our bordering streams could be made in cooperation with our neighboring states.

If such surveys could be made covering the state of Iowa for a period of a few years, we would have some real data. On these data we could then base some intelligent legislation on the conservation of our water, both underground and surface, and on other phases of sanitation, which legislation would serve to better the general health conditions of our state.

THE COLLEGE

The Iowa State College of Agriculture and Mechanic Arts conducts work along five major lines:

AGRICULTURE

ENGINEERING

HOME ECONOMICS

INDUSTRIAL SCIENCE

VETERINARY MEDICINE

The Graduate College conducts advanced research and instruction in all these five lines.

Four, five and six-year collegiate courses are offered in different divisions of the College. Non-collegiate courses are offered in agriculture, home economics and trades and industries. Summer sessions include graduate, collegiate and non-collegiate work. Short courses are offered in the winter.

Extension courses are conducted at various points throughout the state.

Research work is conducted in the Agricultural and Engineering Experiment Stations and in the Veterinary Research Laboratory.

Special announcements of the different branches of the work are supplied, free of charge, on application. The general bulletin will be sent on request.

Address, The Rigistrar,

IOWA STATE COLLEGE,

Ames, Iowa.