CONVERSATION PIECE:

What's a Sanitary Engineer?

A conversation with George W. Reid, professor in charge of O.U.'s sanitary engineering program, develops a picture of a relatively new profession on the Public Health scene.

If the sanitary engineer were to stop going about his business, people would begin to die in large numbers.

Most of the time the public probably doesn't consider sanitary engineering in a dramatic light. "A sewer engineer?" they say. "Why, there isn't any drama connected with his job, not as there is with the medical doctor's, at any rate." But, again, if this engineer ceased operations and sudden death converged upon entire cities, then one might realize how many lives are saved because of his work.

The thing is, the sanitary engineer can never know just how many lives he guards. Because he's doing a pretty good job, you see. However, he does remember that back around the turn of the century the death rate due to typhoid was terrific. A regular visitor, this disease often wiped out a quarter of a city's population. And even during the first World War it was commonly found that more soldiers would be on their backs—suffering from typhoid, cholera, dysentery—than would be on the field.

Today the sanitary engineer is putting a stop to such occurrences. He is a member of a public health team which includes the medical doctor, health educator, medical entomologist, parasitologist, and others. Actually the engineer does a great deal of the work, because public health isn't concerned with curative or clinical medicine, but with preventive medicine. And when you think in terms of prevention of disease, you must think of correction of *environment*. A good deal of such correction is strictly an engineering problem.

Such engineers are trained at O. U., and the emphasis isn't only on research but on professional development. The University offers a program leading toward a master's degree in sanitary science as a more specialized follow-up to the civil engineering curriculum.

Students and professors here handle real projects while they learn. For example, they recently concerned themselves with filtration of water. In the ordinary filter used in most U. S. cities only two gallons of water can be handled per minute by each square foot of the filter. This is because, due to the hydraulic characteristics of filters, fine impurities stay at the top of the water being processed, while heavy particles collect at the bottom. Engineers know that if a way could be discovered to reverse these particles—so that the fine would be at the bottom and the coarse on top—then 20 gallons of water could be handled per minute. A plant one-tenth the size could be used, or operations speeded up. Engineers at O. U. are working on an idea which may make this a reality.

At the University's newly-established Bureau of Water Resources, workers are attempting to help with the scheme to bring water from the Kiamichi area up to Central Oklahoma where it is needed so badly. Also, studies are underway to find what causes sewer odors and to cut them down. Someday, it is hoped, we will be able to remove brines from water, thereby purifying sea water and putting it to use, and to manage weather, which, if ever achieved, would allow us to move large amounts of water to areas where it is in demand.

A city like Oklahoma City throws literally tons of liquid fertilizer down the North Canadian River every day. This is in the form of liquid sewage effluent. We've found that we can recoup it and grow algae on it, and O. U. is doing just that. If we succeed in harvesting the algae without destroying the food values in it, then it can be used for cattle food; Oklahoma A&M has already discovered this. So in this area we're trying to breach a gap.

Milk produced by two local companies is investigated at the school—at the companies' request, of course. And contracts are held with a pipe company and the National Institute of Health.

O. U. holds another contract with General Electric for the composting of its industrial trash. Such trash generally is made up of one element; in this case it's sawdust. The company became tired of burning it and burying it, and, too, both of those systems are negative. Now sewage sludge is added to the sawdust, and because the sludge contains balancing nutrients, bacteria can take the resulting product and do the rest of the work. Humus is the result. A holder of moisture in the soil, its value in this country is high.

Why, you're asking yourself now, did we have to add sewage sludge to the sawdust before the bacteria would work on it? Well, bacteria have to have a well-balanced dinner just as you and I, and, remember, G. E. gave us only sawdust.

In sewage digestion work, constant studies are made to see just what must be added to materials to speed up the process, allow production of more gases from the sewage, and so on. Because the process is generally a slow one, bacterial "slimes" are cultivated for specific uses, then stored so that they'll be immediately available when needed.

The department where all this is happening is only seven years old.

Students begin, of course, by training as engineers. Then they go into the latter phase, a well-rounded program which requires them to study in fields such as bacteriology, entomology, health education, medicine. This means that the department needs—and gets—strong support from other departments. Infirmary personnel who qualify as instructors step in and teach the students, and help comes from plant sciences and zoology professors, and many others.

The only place in which such a program can be found is a full university. There are very few schools which can manage this. The Universities of California, Michigan and Minnesota are perhaps the only ones which boast such a strongly unified set-up as that of O. U.'s sanitation curriculum. Other schools teach it, but they fail to bring in all the various subjects needed to be known by the really well-trained sanitary engineer.

And there is no other school in the U. S. which attempts what O. U. is doing—emphasizing environmental sanitation. What does this mean? Well, it would be easier to say what it does *not* mean. For instance, it doesn't mean simply specializing in the treatment of water, or of sewage, or of something else. Rather, it means learning to work at all these things, everything in the environment which makes a man uncomfortable or threatens his health while he works or relaxes.

An article of this length couldn't possibly cover the entire task of the sanitary engineer, but perhaps a few examples will give you an idea of its constantly broadening scope.

The disposing of garbage has become not so much a health problem as an economic one. Americans are very wasteful, and there's no reason why cows or hogs couldn't consume the food we throw away. But what do you find when you look in a garbage dump? Everything. A hog isn't going to eat a tin can or rubber tire, so sorting devices are needed to prepare the wasted food for him. Even then, the hog has shown in the past that he's not willing to eat all—only about half, in fact. He wouldn't eat rinds. But it was found that if the rinds were cooked and pulverized he loves them. So now processing devices are needed.

Rats cause tremendous spoilage, and in some areas they are particularly active. What to do? Find what breed of rat is doing the bad work, study his habits, and then get busy wiping him out.

In certain spots along the Mediterranean many people are afflicted with trachoma, an inflamed condition of the eyes. Not having adequate water supplies, they wash out of the same bowls, and there's where they contract the disease. The engineer found that one of the places where trachoma was most often transmitted was in the mosque, or temple; the mosque offers washing areas for visitors. Where possible, running water replaced the bowls, and the disease was cut down sharply. We refer to this as "basic sanitation."

Other basic sanitation could improve the health of Egyptians. About 80 per cent of that country's population is infected with schistosomiosis, and this is how it has happened:

Egypt features an agrarian culture, based on the Nile River. The people who work there have an annual income of about $120. They cannot afford to buy privies, so they relieve themselves in the area where they work. The fecal material is picked up by the snail. A fluke, or worm, lives on the snail, and this fluke departs from the snail, comes up out of the mud and works its way through the bare feet of the fieldhands. So there is a round-robin process.

Now, when you have a population which is 80 per cent infected, you have an engineering problem. There are too many people to treat properly. The snails could be killed with copper sulfate but this, too, is a negative method. All that needs to be done is to build privies for these people. It's a basic method. Not long ago it was just as basic in our own South when hookworm ran riot.

When radioactive wastes first began appearing, we treated them. And in the beginning all we knew to do was put them in a pond and hold them there. Today there are several ways of disposing of them. If the waste is combustible, we burn it, discharge it, dilute it in the air. If non-combustible, it can be buried; however, in this case one must select burial sites which won't pollute ground waters. If the waste is gaseous, then there are filters to absorb it. If liquid, it can be absorbed by a special ceramic, baked, and thus imprisoned for good; it's buried then.

All these methods are a far cry from the handling of the first wastes, which were simply mixed with concrete and dumped into the ocean. Along with such tasks come others: the engineer must sample the atmosphere for high radiation content, decontaminate the air and surface, build structures to prevent radioactive penetration.

The engineer gets into the agricultural field when, say, he tries to find how to prevent evaporation, thereby retaining our precious imponded waters. And, as indicated earlier, he helps develop water resources for both farm and city. Incidentally, there has been a shift in recent years from getting water out of the ground to getting it from surface runoff; cities cannot seem to dig enough wells to supply themselves. As for the purification of water, this was what caused the engineer to enter public health in the first place; the civil engineer had traditionally worked with water, and when it was found that it is one of the major vectors of disease, he began to take an interest in sanitation by larger and larger degrees.

But don't think that we treat the *water* to purify it. It's cheaper to treat the wastes or sew-

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age which get into it. Actually our streams got so fouled up that it became almost a necessity to treat the wastes. This process is economically feasible, for usually no chemicals have to be added to badly polluted waters; sewage matter carries a heavy load of organic matter, and these organisms may be utilized in treatment.

The engineer deals with transportation. He looks for ways to keep disease from spreading from trains, the lavatories of which often discharge wastes on the tracks. And when ships are inclined to do the same in a harbor, he's concerned with what we call "shellfish sanitation." The shellfish in a harbor mustn't be contaminated, for they constitute a food. Therefore, either the wastes or the shellfish must be treated.

During World War II we found that troops journeying to the Far East ran into some major problems which were not waterborne, but carried by such vectors as the mosquito or the louse. Naturally the control of malaria is an engineering problem, either from the standpoint of preventing it or wiping it out. And this control is basically brought about by land drainage. Here we have the perfect example of how closely the sanitary engineer must work with those in other professions if he is to get the job done. In the opening stages of the war on malaria, an entomologist had to identify the type of mosquito which carries malaria before the engineer could go to work.

In parts of South America malaria still is found, just as cholera is in India, and plague in China. Sanitary engineers know these diseases may be controlled by environmental techniques, so they visit such areas, show the people how to build proper wells, avoid pollution of streams, etc.

But in most of the world malaria is just about whipped, as is yellow fever and some other sicknesses. Yet we still run into those like typhus fever, which is carried by fleas. These fleas live on rats, and rats live in garbage. So we find ourselves in the business of eradicating rats. The way to do it is through proper disposal of garbage, and through correct building of homes and other structures in order to keep rats out.

Industry has presented some fascinating, if not pleasant, problems. Industry pollutes both our streams and the air as well. If smoke is to be mixed into the air, then stacks have to be properly designed to do it. If it is to be taken out of the air, collecting devices are needed. Think about California's smog! We've a terrific problem there.

Inside some plants the workers are exposed to a number of things which cause disease. A traditional disease of the workman is silicosis. For a long time we didn't even have a technical name for it, called it "grinder's rot" because a fellow who worked on granite literally began to rot away after a time of breathing stone dust into his lungs. Men who welded came down with what was termed "galvo," because after working with galvanized stock they got sick; they were inhaling zinc fumes.

Proper ventilation and other preventions check such diseases, remove the hazards. Call this field "industrial hygiene" if you will, but it's a part of sanitary engineering.

So is the problem of "cason's disease." A man sometimes comes down with this after working as a sandhog in a cason, or under the ocean as a diver. Emerging from the compressed air, he falls sick. Doctors found they could analyze the trouble, but the engineer had to see what could be done to stop it.

What caused the diver to have the "bends"? His bloodstream had picked up a lot of nitrogen where he worked, and nitrogen comes back out of the blood at a slow rate—too slow a rate—after a man leaves the ocean floor. Bubbles form in the veins, and this results in blockage. But if we substitute helium for some of the nitrogen in the air supply, it comes out faster and the diver doesn't get sick.

(A similar problem appeared in high altitude flying. Here, too, additional oxygen must be supplied the pilot because of reduced pressure, and now we're confronted with the problem of a man getting bends while going *up* rather than down!)

The iron lung was invented by a sanitary engineer, Philip Drinker of Harvard, in following such a problem.

Terrible noises, intense heat, bad lighting and other factors keep us working in the industrial field.

But anything in man's environment which tends to affect him adversely is the sanitary engineer's business. When he sees slums smothering a multitude, 20 people using the same sink, atomic tests in progress, drouth gnawing at the land, garbage standing exposed in an alleyway, insects winging a deadly mission in the night, a deep sea diver writhing in agony—when he sees all these things and more than you can imagine, he goes into action.

There are about 25 graduate students in O. U.'s Department of Sanitary Science, more than in the graduate department of any other part of the School of Engineering. They have come from many parts of the world to learn how to correct the environment of man. They'll be working quietly in future years, hardly dramatic figures, and scarcely noticed by the innumerable lives they'll be saving.