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MAY, 1955—VOL. 27, No. 5

sludge treatment plants using diffused air, has indicated that B.O.D. removal per 24 hr. per 1,000 cu. ft. of aeration capacity varied from 15 to 50 lb., and the air required per pound of B.O.D. removal ranged from 500 to 1,600 cu. ft. Activated sludge treatment units for domestic sewage are now being designed, using such mechanical aeration equipment, on the basis of 300 lb. of B.O.D. removal per 24 hr. per 1,000 cu. ft. of aeration volume, at a removal efficiency of 90 per cent or more. Sufficient field data have been accumulated to permit such design figures to be used safely.

It is hoped that the foregoing comments and the citation of data will help to answer some of the questions raised by Mr. King, and permit proper interpretation of the material presented in the paper.

References

8. Buswell, A. M. *Eng. News-Rec.*, **90**, 835 (1923).
9. Mohlman, F. W., and Wheeler, C. E., "Activated Sludge Experiments at Calumet Sewage Treatment Works." *Sewage Works Jour.*, **2**, 4, 529 (Oct., 1930).
10. Metcalf and Eddy, "American Sewerage Practice." Vol. III, p. 583. McGraw-Hill Book Co., New York, N. Y. (1935).
11. Mohlman, F. W., "Twenty Five Years of Activated Sludge." In "Modern Sewage Disposal," p. 68. Federation of Sewage Works Associations (1938).
12. Gehm, H. W., "Aerobic Treatment of Wastes High in B.O.D. Concentration." Proc. 8th Indus. Waste Conf., Purdue Univ., p. 346 (1953).
13. Stanley, W. E., "Factors Affecting the Efficiency of Activated Sludge Plants." *Sewage Works Jour.*, **21**, 4, 625 (July, 1949).

WHAT IS A SANITARY ENGINEER?

On December 14, 1954, the Committee on Sanitary Engineering and Environment, Division of Medical Sciences, National Academy of Sciences—National Research Council, approved the following definition of the term "Sanitary Engineer":

"The practice of sanitary engineering includes the following activities:

"1. Surveys, reports, designs, reviews, direction, management, operation and investigation of works or programs for:

(a) Water supply, treatment, and distribution.
(b) The collection, treatment, and disposal of community wastes; *viz.*, sanitary sewage, industrial wastes, and refuse, including salvage and reclamation of useful components of such wastes.
(c) The control of pollution of surface waterways and ground waters, and of surface and subsurface soils.
(d) Milk and food sanitation.
(e) Housing and institutional sanitation.
(f) Insect and vermin control or eradication.
(g) Rural, camp, and recreation place sanitation.
(h) The control of atmospheric pollution and air quality, and of light, noise, vibration, and toxic materials, including application to work spaces in industrial establishments (industrial hygiene engineering).
(i) The prevention of radiation exposure.
(j) Other fields that have as their major objective the control of environmental factors affecting health.

"2. Professional research and development work supporting the activities listed in 1.

"3. Responsible teaching of sanitary engineering subjects in educational institutions of recognized standing."

Industrial Wastes

1954 INDUSTRIAL WASTES FORUM *

KENNETH S. WATSON, *Leader*

Coordinator of Waste Treatment, General Electric Realty Corp., Schenectady, N. Y.

Chairman Watson:—In this forum it is proposed to deal with some of the fundamental considerations in the handling of industrial wastes. Because the initial consideration in the handling of industrial wastes perhaps is the matter of their approved disposal, the bulk of this discussion will be concerned with this facet of the subject.

The disposal of industrial wastes for most practical purposes means their discharge by one of two alternate methods: passing them into a municipal sewer system either with or without pretreatment, or conducting them to the nearest stream either without or after treatment.

Even though this subject is supposed to be simple, the more one thinks about it and works on it, the more complicated it becomes and the more facets it seems to have.

The discharge of industrial waste into a municipal sewer system means that the industry in question must be accountable to the city, to protect the sewer system and the sewage treatment plant. The provisions of the permit from the city to the industry, or the provisions of an agreement which might exist or be negotiated between the city and industry, fall within the general framework of the municipal ordinance which is in effect in that city.

In connection with the discharge into a municipal system, there are two particular points to be considered with reference to the industrial waste ordinance. First, should industrial waste concentrations be listed in a municipal ordinance in general terms, or should they be spelled out in detail? The second point for consideration is should industrial waste specifications apply to the individual plant effluents, or should they apply to the composite effluent at the sewage treatment plant?

The final topic for consideration is: Where an industry has a choice, what is the soundest approach—discharge into the municipal sewer system, or into the stream?

Of the six discussion leaders, one considers the affirmative viewpoint, another the negative, of each of the particular points mentioned. In fairness to the panel it is pointed out that the views expressed by any member do not necessarily represent those of all members of the panel. The point should, perhaps, also be made that the views expressed are personal and do not necessarily represent those of the organization with which the discussor is associated.

Industrial Waste Specifications in Municipal Ordinances

Fenton H. Dobb, Senior Engineer, Sewage Disposal Section, City of Cincinnati, Ohio:—In the past 75 to 100 years billions of dollars have been lit-

* From transcript, 27th Annual Meeting, Federation of Sewage and Industrial Wastes Assns.; Cincinnati, Ohio; October 11–14, 1954.

erally buried beneath the ground in the form of vast systems of sewers and waste carrying conduits, which provide a cleaner, healthier environment. The term "buried" is used because it seems to express adequately the attitude of the layman taxpayer who, after demanding and financing a costly sewer system, promptly forgets its existence as soon as the connections are made and the trenches are backfilled and leveled. The old adage "out of sight, out of mind," seems to fit the situation perfectly.

As a result of this attitude, sewage collection systems are probably the most misused and abused of all public facilities. The taxpayer demands proper use and maintenance of publicly owned facilities (such as buildings and roads) which are built on the ground surface, but ignores the sewer which is buried and out of sight. Thus arises the general misconception that sewers will carry away any unwanted wastes, regardless of physical of chemical characteristics, with no damage to the conduit.

To protect the investment of its citizens, every political subdivision served by a sewer system, regardless of its size, should adopt a complete, suitable, and workable ordinance for the control and regulation of the uses of the system and for the protection of existing and proposed sewage treatment works.

The drafting of such an ordinance should be a cooperative endeavor, with adequate representation of all interested and involved factions. Municipal officials, representatives of industry, consulting engineers, and legal talent, all properly qualified, should be brought together to contribute their professional knowledge and experience to the formation of the ordinance. The result should be a workable legislation wrapping up in a single package the machinery for regulation and control of the system and tailored to the requirements of the community and the wastes being contributed. Waste contributors to a typical sewer system can be classified roughly into two specific groups, as follows:

1. The domestic contributors. This group is composed of occupants of private homes, operators of hotels, restaurants, and other businesses who rarely discharge wastes of greater strengths than "normal." However, through ignorance or carelessness, this group occasionally discharges small quantities of deleterious substances.

2. The industrial and commercial contributors. Large quantities of wastes of greatly varying characteristics and high strengths from a large variety of industrial processes are discharged by plants and factories in the average industrial community. These wastes, unless regulated and controlled by legislation, can be responsible for untold damages to sewer systems and can reduce the efficiency or even incapacitate sewage treatment works. The expense of expanding existing treatment works to adequately treat uncontrolled industrial waste loads places an additional tax burden on the citizens of the community.

Special limiting specifications in an ordinance are therefore directed primarily toward the regulation of industrial wastes. Since these wastes vary so widely in volume, constituents and concentrations, the limitations should be spelled out, either directly in the ordinance or in the rules and regulations authorized by the ordinance. Advantages of defining specifications and limitations in the ordinance can be listed as follows:

1. Simplification of administration. If each industry had to be considered individually with regard to allowable or chargeable concentrations of waste constituents, as would be necessary if specifications were not clearly defined, the administration and field work involved would be cumbersome and costly.

2. Equity amongst industry. With specifications clearly spelled out, there is no basis for one industry to believe another is being favored or no opportunity for a municipality to favor one industry over another. Standards are set down which must be conformed with regardless of size or type of industry.

3. What industry can expect. All industry, including new companies coming into the city, will know exactly what concentrations of wastes are objectionable and can take action to comply with the regulations.

4. Equity of charge. All companies subjected to sewer charges based on strengths of wastes which are spelled out in an ordinance are assured that each company is bearing its share of the load with no favoritism being shown.

5. Enabling industry to plan ahead. In most cases, the expense to industry created by the ordinance cannot be recovered. Clearly spelling out in the ordinance the limitations and bases of charge will enable industries to adjust their budgets and methods of production to absorb these expenditures in the most favorable fashion.

To define each limitation of waste strengths and constituent concentrations directly in an ordinance alone would, in most cases, result in an unwieldy and inflexible legislation. To provide flexibility, the ordinance should authorize a set of rules and regulations in which limitations and bases of charge are spelled out. These could be amended to fit the program as it progresses, without the necessity of time-consuming council action or the enactment of new legislation.

In conclusion, it has been the experience of the City of Cincinnati that its service charge and industrial wastes ordinances and rules and regulations, which were drafted with the cooperation of industry and other interested parties and in which the limits of waste strength concentrations and bases of service charge and surcharge are clearly defined, have all resulted in a workable program in which citizens and industry are striving toward a common end—that of cleaner and healthier living.

A. J. Steffen, Sanitary Engineer, Wilson & Co., Chicago, Ill.:—Waste treatment and disposal is a part of production and industry's interest does not end when the waste enters the floor drain. In other words, industry recognizes fully its responsibility to the agencies handling its liquid wastes. Industrial sanitary engineers are continually developing new ways to prevent and utilize wastes which might become problems when discharged into the sewer.

There are at present more than 20 active committees in industry, organized specifically for the promotion of waste treatment and waste prevention and for conducting research and developing information in this field. A tremendous volume of information is disseminated by these groups through pamphlets, talks and motion pictures. Since most of this material is aimed at people in the industries involved, little knowledge of these activities filters through to sewage treatment plant operators and sanitary engineers not in industry. This is unfortunate, but steps to correct the situation are being taken by the National Technical Task Committee organized by the United States Public Health Service. It is hoped that through this agency more of this information will become available to workers in the sewage treatment field.

Just as industry recognizes its responsibilities to sewage treatment agencies, so too, the sewage treatment works manager will recognize his responsibilities to help promote healthy industrial development and encourage normal community growth by guard-

ing against unnecessary restrictions for industrial waste discharges.

Here are some questions which should be answered before any industrial waste clause is written into a sewer ordinance:

1. Is the waste in question a safety hazard when dumped into the sewers? If so, it should, without question, be eliminated from the sewers.

2. Is the public health affected by the discharge of this waste into the sewers? Can the public health be affected by conditions resulting from efforts on the part of the industry involved to comply with the proposed restrictions? For example, a real public health hazard may develop from collecting and hauling a waste which might be handled in the city sewers without damage.

3. What does it cost the sewer authority to handle the problem of extra labor, extra equipment, or—in the case of accelerated wear or corrosion—, in replacement of sewers or equipment at increased frequency? Perhaps the clogging of the sewer in question can be prevented by semi-annual cleaning instead of annual cleaning. This would represent an extra cost. Perhaps a different type of jointing material in a short length of local sewer will prevent damage from corrosive wastes.

4. What will it cost industry to conform to the proposed restrictions? Will a holding tank do the job? Will hauling and dumping be necessary? What will it cost per year? Each waste should be handled at the lowest ultimate cost, no matter which agency actually performs the operation.

5. How much of the waste, in concentration and in volume, can be tolerated in the sewers from the existing industries? Is the restriction going to work an undue hardship on any existing industry, just to protect the sewers or treatment plant against industries yet unborn? Restrictions should be based on actual existing conditions, not on theoretical extreme conditions that may never happen and that in the end can be prevented by the simple expedient of a permit system for new sewer connections.

Maximum quantities or concentrations of deleterious materials should not be spelled out in an ordinance. Such restrictions can cause unintended hardship for an industry that may discharge insignificant quantities of the waste in question into a relatively large sewer flow. For example, a bottling plant may be prevented from discharging caustic from a bottle washer if a maximum pH is spelled out, even though the volume of this waste may be insignificant.

What would a realistic industrial waste section of a sewer ordinance look like? First, the discharge of explosive gases; liquids, solids or semi-solids capable of clogging the sewers; corrosive materials capable of damage to the sewers; or toxic, poisonous or noxious materials, should be prohibited. Questions of temperature limits, grease and solids concentrations, and similar characteristics can be covered by a statement as follows: "No waste shall be discharged, without pretreatment, into the sewers which, because of temperature, solids concentrations, grease content or other characteristics, will cause, either directly or indirectly, special difficulties or extra expense in the maintenance and operation of the sewers and sewage treatment works unless special contractual arrangements are made with the industry to defray the cost involved."

This type of industrial waste clause is sufficiently restrictive to prevent abuses and is still broad enough to avoid unrealistic limitations which may ultimately restrict the normal industrial growth of the community.

Where sewer service charges are based on volume, surcharges for B.O.D. concentration over and above

a set limit are sometimes prescribed, as pointed out by the previous speaker. In all cases, however, any problems encountered in handling industrial effluents should be solved by a committee of technical people representing the city and industry. This committee would be familiar with the limitations of the public sewer system and the treatment plant and the characteristics of the industries and their effluents. This committee can determine whether pretreatment is necessary and, if so, to what degree; it can determine whether treatment at the municipal sewage treatment plant is more economical; and it can determine the limits within which the industry must operate its waste control program.

I do not agree with all the restrictions in the model sewer ordinance which appears in the Federation's Manual of Practice No. 3,* but I do agree with the guiding principle stated on page 7 of the manual: "A soundly conceived sewer ordinance is beneficial to industry as well as to the municipality, for it makes possible maximum use of the public facilities for all wastes that can be handled effectively."

Don E. Bloodgood, Professor of Sanitary Engineering, Purdue University, Lafayette, Ind.:—As a member of the committee that worked on M.O.P. No. 3, I would like to point out that a great deal of effort was spent in trying to establish in the model ordinance what were believed to be sound limits. At that time it seemed reasonable to establish some kind of ordinance based on the experience recorded in the literature, rather than completely on the ideas of the committee. Mr. Steffen may be right, however, because some of the ordinances adopted since publication of the manual, and one in particular, have no limit on grease.

Mr. Steffen advocates a committee of industry and city government management to establish wastes concentration limits. That is a fine idea, but implementation of the decisions of such a committee would present grave practical problems.

Mr. Steffen:—The limitations, as previously mentioned, can best be determined for each individual case, preferably by a committee of technical people, and the organization and the power of a technical committee of that type should be spelled out in the sewer ordinance.

Adequate grease recovery at the local plant is, again, something that the technical committee can determine as needed in each individual case. There are good, efficient grease recovery facilities available to industry, so there should be no question about that. However, as to whether limits should be included in the ordinance, that is something else again. There may be some small operator, even a restaurant let's say, that perhaps has a conventional grease recovery system but discharges more than the 100 p.p.m. specified in the ordinance. If the discharge is to a large sewer, that contributor may not be creating a problem that would require action by the municipality, requiring him, perhaps, to build an expensive and elaborate grease recovery system.

Dean M. Taylor, USPHS, Cincinnati, Ohio:—I'd like to ask Mr. Dobb to expand a point be brought up in regard to the placing of most of these definitions. Should these limits be outlined in the rules and regulations rather than in the ordinance itself? Also, can flexibility and change be made appropriately? If a system of charges as set up proves to be inadequate, what can be done to develop that program to meet the situation?

Mr. Dobb:—In the formation of an ordinance there should be some defi-

* "Municipal Sewer Ordinances." Man. of Pract. No. 3, Federation of Sewage and Industrial Wastes Assns., Champaign, Ill. (1949).

nite provision for periodic review of the ordinance, the rules and regulations, the prohibitions, etc. If the concentrations and strengths gathered by experience can be lowered or raised, if the charges are too great, or if operation expenses go up or down, in the course of review each should be raised or lowered to fit the existing conditions.

H. H. Black, USPHS, Cincinnati, Ohio:—Someone has used the expression "damages could result from uncontrolled discharge." I'd prefer to have it put in the positive sense and find out how to get positive control of the uncontrolled discharge, whether it be to a sewage treatment plant or a stream.

Mr. Dobb:—In speaking strictly from the point of view of the City of Cincinnati—and it can be applied to all municipalities, large or small—the point of control lies with the authority created by the ordinance. Cincinnati is working out a point of control, although that goal has not been fully realized as yet.

Through primary, secondary and tertiary questionnaires directed to industry, and returned by them in a very cooperative spirit, the industrial effluent strengths have been determined. The city also has developed a gaging and sampling program for checking the effluent from industry, and through the cooperation of industry—by their own gaging and sampling and spot-check by the City of Cincinnati in its gaging and sampling program—a very good control has been established and a positive knowledge of the industrial wastes of this city has been gained.

N. S. Bubbis, General Manager, Greater Winnipeg Sanitary District, Winnipeg, Man.: It is not desirable, nor does it always work out in practice, to deal with each industrial wastes case specifically. In Winnipeg, for example, nine packing plants had to be dealt with. Dealing with them individually did not get us very far; but when they realized that a definite standard was going to apply to all of them, large and small, we got results. It is necessary to have a definite standard for a given industry, so that all plants of that industry are dealt with in the same manner and are placed on more or less competitive basis.

Our legal counsel had considerable to do with the drafting of the industrial waste ordinance of the Greater Winnipeg Sanitary District. Perhaps that is why it was arranged and phrased as it is. We certainly feel that it is a realistic approach to the problem and we have proven that it can be applied in practice. The ordinance starts with all the prohibitions; it states that this particular substance or certain substances over certain strengths shall not be discharged to the sewers. After listing the exclusions it goes on to state that notwithstanding specific exclusions, wastes of concentrations greater than those specified may be discharged by special license. That provision was included to take care of those small industries or small plants that discharge negligible quantities of high-strength waste which in the total result does not create problems to either the collection system or the treatment plant.

It is necessary to include in the ordinance a provision which enables the municipal authority to insist that industry provide a sampling and/or measuring manhole so located that it is accessible at all times. In making prosecution it must be established in the courts that the particular waste being objected to actually came from the particular industry being prosecuted. If that can't be done, the charges cannot be pressed home.

Mr. Steffen:—That escape clause is a handy device, but it does weaken whatever effort was made to require a limitation. It also brings out the thought that perhaps it might be just as well not to have that limitation,

and let the limitation be spelled out by a committee made up of technical people. However, it is possible to see the advantages of an arrangement of that character. It certainly does permit the small user of the sewers, who normally is not causing any damage, to exceed the limitation that the ordinance spells out.

I don't think any industrial representative would want to use the sewers to the damage of the public or use the sewers beyond the limits for which he is paying. Generally he wants to pay for what he is getting, and it is not intended to indicate in any way that industry wants a free ride. However, it is not fair to penalize one industry for the misfortune of another. If an industry is large enough, and has the type of waste that causes a problem in the municipal sewers or the municipal sewage treatment plant, whereas another one is lucky enough to be small and doesn't cause that problem, I don't see why the small one should be penalized along with the large one.

In the same instance, if one is discharging into a large sewer flow where the dilution effect is such that a corrosive element in the waste would not create difficulties, and another is discharging perhaps the same amount into a small sewer, but is causing corrosion because of the relative proportion of sewage flow against the discharge, the latter, of course, will have to pay for the condition. But why penalize the first plant because of the misfortune of the other for having selected a place on a sewer where such trouble arises?

H. Heukelekian, Research Specialist, N. J. Agricultural Experiment Station, New Brunswick, N. J.:—There are some general guiding principles that are pertinent to this discussion. First, any industrial waste should be accepted into the sewers unless actual damage can be shown. Then, when prohibitions are to be placed, they should not be placed on the basis of concentration of specific constituents in the effluent, but on the concentration in the sewer. In other words, the dilution factor should be taken into account.

There are too many existing ordinances which sound more or less arbitrary in the light of the present state of knowledge. They are too detailed to be enforced, even though they are on the books as valid statues; therefore, they are just never enforced. Why not reduce prohibitions and concentration limits to the minimum necessary, and then actually enforce them?

Mr. Dobb:—Actually, to enforce an ordinance, particularly one with many rules, regulations, and prohibitions and where the burden of proof is on the city, requires a staff larger than most cities can consider.

Suppose harmful concentrations of deleterious materials arrive at the sewage treatment plant in a fairly large municipality. How does one trace the origin of those materials? In a city with 800 or 900 mi. of sewers, a complete survey of the whole sewer system would be required unless the investigators are lucky enough to find that contributor within the first few miles. Such a process is time consuming and expensive.

Chairman Watson:—The discussion has begun to touch on the second phase of this subject. Therefore, it seems appropriate to present it and discuss both the first and second phases together.

Waste Specifications—Applied at Source or at Treatment Plant?

F. B. Milligan, Sanitary Engineer, Pennsylvania Department of Health, Harrisburg, Pa.:—There are a number of good reasons why industrial waste specifications should apply to the discharge as it leaves the mill or factory where it is produced, rather than to the general mixture of sanitary sew-

age from the town and industrial wastes from assorted industries as this combined flow enters the municipal treatment plant. Before discussing these reasons, a few remarks seem to be in order.

It should be recognized that the requirements necessary for an existing municipal sewage treatment plant are pretty rigidly dictated by the type of plant and its capacity as to the volume, nature and concentration of the influent which it can handle successfully. No matter what the surcharge or rental which the townspeople or the industrial establishments concerned might be willing to pay, certain physical limits hold, beyond which no more industrial waste or sewage can be received.

A new plant, on the other hand, can be designed to handle any combination of sewage and industrial wastes which is treatable in the present state of the art. In most cases the best solution for a given degree of treatment will be that which is the most economical in the long run for all concerned.

For any municipality, the decision as to how large a new or enlarged municipal plant is to be, and of what type, should be made only after a careful study, preferably by an experienced engineer who can evaluate the many factors which always must be considered, and make sound recommendations.

A great deal depends, of course, on the size of the town as compared with the industrial load—that is, on the amount of dilution which can be expected, as well as on the degree of flow-equalization, neutralization of acid by alkaline wastes, and similar factors.

In most cases, municipal ordinances should impose maximum limits for suspended solids and B.O.D. in industrial wastes, beyond which these characteristics should be subject to surcharges. It is essential that a sound basis be established for such surcharges, perhaps on population equivalents; one for the B.O.D., another for suspended solids, another for volume.

There can be little question that certain requirements, at least, should apply to all industrial wastes (and sanitary sewage as well) as they leave the industrial establishment which produces them, if they are to be admitted to the municipal sewers and treatment works. Some substances must usually be excluded from the municipal system except in very small amounts. These include the following:

1. Volatile oils such as gasoline, tar, and other wastes produced by garages, oil refineries, and chemical industries, and causing fire and explosion hazards and disturbance at sewage treatment works.

2. Acid wastes from metal pickling and oil refineries; also caustic wastes, such as kier liquor from textile mills or rag digester wastes from paper mills. Wastes of these types damage sewer structures and equipment, and interfere with biological treatment processes.

3. Highly toxic substances, especially cyanides or compounds of selenium, chromium, etc., from metallurgical and other industrial processes, phenols from gas works, arsenic and lead from chemical and other plants. These wastes endanger human life, disrupt biological sewage treatment, and must be collected and disposed of safely without discharge, or must be treated for practically complete removal of poisonous qualities before discharge either to sewers or streams unless they are negligible in amount.

Wastes with other objectionable characteristics also must be excluded or pretreated before admission to the municipal sewer system. These may be grouped about as follows:

1. Excessive inorganic solids, including coal ash, foundry sand, sawdust, and straw.

2. Suspended solids such as brewery and distillery mash, fibers and solids from abattoirs, leather tanneries, vegetable canneries, and wool scouring. (Spent grain, blood and paunch manure can be collected and sold.)

3. Suspended solids found in paper mill wastes, whole slop from breweries and distilleries, screened wastes from vegetable canneries, etc. (Paper mill wastes are generally excluded from sewer systems.)

4. In addition, neither extremely hot water nor excessive volumes of any kind of waste should be tolerated in the sewer system.

Objectionable substances or characteristics in industrial wastes often can be considerably reduced by good housekeeping or modified plant processes or both. If this is not enough, pretreatment usually improves a waste sufficiently for admission to the public sewers.

Each municipality should establish ordinances with specifications setting maximum limits for the salient characteristics of industrial wastes ordinarily encountered, with equitable surcharges (for example, for B.O.D. and suspended solids loadings beyond the established limits), which should be determined on the basis of the relative volume and nature of the sewage and the various types of industrial wastes at present existing or anticipated during the expected life of the municipal plant, and on the size of that plant and its treatment capacity.

These specifications should be applied at the point of origin of the wastes—that is, at the point of discharge from the establishment producing the wastes—for such reasons as the following:

1. The only way in which the municipal requirements can be entirely equitable as between the load placed on the municipal treatment plant by the domestic sewage from the town, and that placed by any given industry, or between one industry and another, is to require that all wastes and sewage meet standard specifications requiring elimination of toxic, explosive, and other harmful characteristics, and fixing proper surcharge rates for types of wastes which are treatable but would impose an additional load on the plant.

The total surcharge for each mill or factory should be the sum of surcharges for the waste volume and for each kind of pollution load. Charges could be computed on the basis of sewage population equivalents for volume, B.O.D. and suspended solids. If the wastes also contain grease, iron, etc., charges for these would have to be determined differently.

2. It is only possible to determine equitable service charges if all industries in a municipality must do comparable jobs of pretreating or conditioning their wastes before discharge.

3. Without standard specifications or requirements for all industrial effluents, difficulties caused at a sewage treatment plant by industrial wastes would entail a tremendous amount of work to determine the establishment whose wastes were responsible and the amount of pretreatment necesary to correct such difficulties.

If municipal ordinances are written to apply to the industrial effluent at the factory, then it would be feasible to require a regular program of effluent sampling and analysis at each factory, with occasional checks by the city. This would provide a solid basis for service charges, would make management aware of its industrial waste problem, and would provide data on the effectiveness of any pretreatment required.

It is certainly true that limiting values must be placed on the volume and characteristics of the influent to

a municipal treatment plant at the plant. These will be dictated by its size and type (and, therefore, its treating capacity).

The problem is to establish specifications which, when they are applied to the factory effluent at the factory, will produce an acceptable influent to the municipal treatment plant. These specifications could be determined by the following procedure. Suppose that the municipality has adopted a limiting requirement of .5 p.p.m. iron in the incoming combined wastes to the municipal treatment works. The total volume of combined wastes must be measured or estimated in any case. Then, the number of pounds of iron which may be received per day into the treatment works can be determined, and this amount can be prorated among existing industries, with a suitable allowance for anticipated future requirements. Then, knowing the volume of discharge from a given industrial establishment, the amount of iron which its wastes may carry without exceeding the allowable amount at the municipal treatment works can be determined, in p.p.m. if desired. Similarly, all other waste specifications can be determined or allocated for each industrial plant served by a given treatment works.

Volume and waste characteristics must be determined by a survey of the town and of each industrial discharge, followed by suitable contracts between the municipality and the waste-producing establishments. The ordinance then could contain a requirement that the wastes from any factory may not exceed in daily volume the amount specified in the contract for the admission of these wastes into the municipal system.

Fred C. Olds, Plant Engineer, Procter & Gamble, Cincinnati, Ohio:—The fundamental objective of a waste disposal project is to get the required job done at the least over-all cost to the community, the community being composed of individual homes, business establishments and industries. The philosophy behind the project should be that of creating a favorable waste disposal climate which will attract new industry to the area.

The City has many responsibilities in the matter of waste disposal. Three of these bear directly on the question under discussion.

First, it is necessary for the city to determine the size and nature of the plant required, based on the existing wastes in the sewers at the time of a survey. Then, of course, there must be due allowance for an anticipated growth in the area. Second, when this is done, the city in some way has to provide revenue for the construction and operation of the plant. Third, when the plant is constructed, the city has to protect the sewers, and protect the operation of its plant.

These things bring up the necessity for industrial waste specifications, which do three things: First, they provide surcharge revenue; second, they protect the sewers; and third, they protect the operation of the plant.

Of all these specifications, only two need apply at the source. The first of these is one specification which sets up the definition of a normal sewage in terms of, say, B.O.D. and suspended solids, and provides for the payment of a surcharge where the effluent from the industry exceeds this definition of normal.

The second specification is one which protects the sewers. This excludes the harmful materials mentioned by Mr. Milligan, and they are selected for obvious reasons. This, again, is a single specification.

The two specifications just mentioned are the only two that need apply at the source.

The rest of the industrial waste specifications are written for the purpose of insuring that the treatment plant can operate satisfactorily on the influent which it receives; therefore, it seems logical that these specifications should apply to the influent at the plant. Provision can be made to restrict at the source when some concentration exceeds its specified limit at the waste plant.

If all this group of specifications applied at the source, the dilution factor would be ignored. For instance, there might occur in the sewer at an industry concentrations of oils, or metals, which at the same strength would give trouble in the treatment plant. However, these may very shortly be reduced to harmless concentrations by the larger volumes of diluting sewage in the intercepting sewer.

More specifically in this connection, the specification at the source can severely penalize a small contributor of concentrated sewage who actually is adding only a minute increment to the strength of the influent as it arrives at the plant, whereas a large contributor of a somewhat smaller and acceptable concentration is, perhaps, creating a much more severe problem.

Finally, the city has geared its service and surcharges to the strength and volume of the contribution of each industry. The industry, therefore, pays its fair share of the cost of construction and operation of the plant. Once it has eliminated the objectionable materials from the sewer, it has a right to expect the city to accept its effluent up to a point where the loading is such that the influent at the treatment plant exceeds the maximum allowable concentration of some specified material and begins to cause difficulty at the plant.

Chairman Watson:—In discussions between industry and municipalities, it quite often is possible that the two groups may be talking about different specifications. For example, the industry may be talking about specifications at the sewage treatment plant and the municipality may be talking about specifications at the industrial effluent. Sometimes an understanding of the basis for mutual agreement is slow in coming. In having dealt with a number of cities on that subject, I think sanitary engineering and professional industrial waste people need to give a lot of clear thought to trying to arrive at a pattern which makes sense.

Arthur D. Caster, Sewage Disposal Engineer, City of Cincinnati, Ohio:—Messrs. Steffen and Olds both brought out the point that they are trying to set up stream standards for the sizing of sewers. I think municipal sewers are entirely different from streams, and if industry is to be asked to remove certain prohibited substances sewer discharges, the requirement must be city-wide.

Any charges that municipalities place upon industries are part of the industries' production costs. If there are two industries of the same type side by side, but with one discharging into a small sewer and one into a large sewer, and there are different standards for the two types of sewers, the industry on the large sewer gets a benefit and, other things being equal, has lower production costs than the plant on the small sewer.

Mr. Olds:—In that connection, the city should have the attitude that the size of its sewers and the size of its treatment plant are not sacred, and should be expanded or enlarged as required. This is but another factor in creating a favorable atmosphere for the waste disposal situation in the area.

Mr. Steffen:—My comment on this question of relative dilution related only to what possible damage there might be to the sewer in question.

Of course, if a waste causes a problem at the treatment plant, it should be charged for, but if the sewer in question is not harmed, it is not fair to charge the small industry just because the large industry is causing the problem that requires a special

charge. It isn't fair to ask one industry to throw money away just because another industry has the misfortune of being improperly—or let's say unfortunately—located.

William S. Wise, Director, Connecticut State Water Commission, Hartford, Conn.:—Three questions are prompted by this discussion; first, suppose conditions in the sewage system of a municipality are entirely satisfactory as far as the discharge of industrial wastes into the system is concerned during 1954. However, a new industrial concern locates on the system in 1955 and discharges a substantial volume of toxic industrial wastes similar in character to those now discharged by some of the existing industries. Should the new industry be required to bear the whole burden of pre-treatment or should the city go to the existing industries and ask them to bear a portion of the cost of reducing the combined concentration down to the accepted limits?

The second question deals with determination of concentrations of toxic industrial wastes. Are the samples used for the determination collected over a 24-hr. composite period or are they collected over shorter periods of time? During boom times many industries operate around the clock and the concentration of toxic substances during the low night sewage flows would be much greater than during the high day sewage flows. The reverse would also be true in cases where industries operated only during an 8-hr. period. In this case the concentration during the night flows would be zero, whereas it might be quite heavy during the day.

The third question concerns cyanide concentrations and pH. If the concentrations of these substances are determined only at the treatment plant it may be found that they are entirely within safe limits. However, an industry may be located on one of the branch sewers and may be discharging substantial volumes of cyanide-bearing wastes into a sewer into which a substantial amount of acid wastes had been discharged. Under such conditions the discharge of these wastes would prove to be a great hazard, not only to the sewer system itself, but also to the personnel engaged in the maintenance of the sewer system because of the possible evolution of hydrocyanic acid gas. Would it not be well to set concentration standards for the discharges into the sewer system from industrial plants?

Mr. Steffen:—The first question sounds like a stream standards question; whether the new user should have to bear the full brunt of the situation he is causing when existing users have been getting along in pretty good shape. That goes back to stream philosophy, too, where perhaps one party is using the capacity of the stream for self recovery and then another user comes along and upsets the apple cart. Which one pays the bill? Wiser heads than mine have tried to answer that one.

A situation of that character should be answered, however, by the committee previously suggested, the committee being empowered by legislation to take whatever action is necessary. Leaving it up to a committee takes away the onus of a requirement by an individual.

The model ordinance suggests that the requirements be set up by the superintendent of the sewage treatment plant. That is too much of a burden to ask one man to shoulder. Where a new industry comes in and causes a problem, after existing industries of the same type and discharging the same type of wastes have been getting along with the existing treatment plant, the committee should determine an equitable solution.

As regards the question of sampling, composites should be taken over the normal operating period of the industry, which is not necessarily a

24-hr. period. Although an industry may operate 24 hr., the actual load of processing may run 8 or 10 hr., the remainder perhaps being clean-up, cooling water, etc. Therefore, the day should be broken up into sections, depending on the operating characteristics of the particular industry.

As regards the question of cyanide, certainly any hazardous, damaging, toxic or noxious materials should be prohibited from entering the sewers.

Mr. Olds:—The question of who bears the cost when a new industry comes in has been rather neatly handled by the new Cincinnati ordinance. Under this ordinance existing industries are paying service charges and surcharges, which are going towards the amortization of plant facilities not yet built. The plant is being built, however, in anticipation of future growth, so existing industries are building capacity for industries and householders not yet located in the area. Some time in the future, the capacity of that plant will be reached due to growth in the area, and a new plant must be built. Presumably on the same basis as now holds, those in the contributing area at that time will be faced with financing construction of a new plant.

The question of operating cost when a new industry comes in has likewise been resolved. The new industry will contribute materials to the sewer which will cost the city money to remove or to handle. The ordinance specifies that the city shall examine its operation and determine the cost of handling a pound of B.O.D., or a pound of suspended solids. When the new industry comes into the picture, it is charged proportionately for its contribution. In other words, it pays its way as far as the operation of the plant goes.

George Rhame, Sanitary Engineer, Division of Water Pollution Control, State Board of Health, Columbia, S. C.:—South Carolina has stream standards. But whether called stream standards or industrial waste specifications of an ordinance, the same fundamental engineering problems have to be solved. There is one big advantage, however, in municipal waste disposal: When wastes increase, another sewage treatment plant can be built, but it's impossible to put in another stream. There is no simple solution to the problem of waste disposal; it is inherently complicated.

James Crane, Cincinnati Chemical Works, Inc., Cincinnati, Ohio:—There seems to be a confusion of two problems—the policy problem and the factual problem.

Engineers and technicians, in general, follow the policy that is set down by city councils or other governing bodies. These governing bodies decide, based on engineering facts and recommendations, what the general policies will be. As an example, in Cincinnati it was decided that all citizens, both corporate and individual, will make advance contributions for sewage plants to be built large enough to take care of the industrial loads and future loads. There was quite a bit of controversy between the sewage people and the industries, but it was finally resolved by the City Council, which is as it should be. It is very necessary that the governing bodies have full technical advice before acting.

Chairman Watson:—Is the necessary experience and the know-how of technical people always properly called upon and used by the regulatory bodies in developing ordinances?

Frank Woodbury Jones, Consulting Engineer, Cleveland, Ohio:—A previous speaker has, perhaps, overstressed one point a bit. As I interpret his remarks, he implied that a city should take into its sewer system any amount and kind of waste, provided the industry paid for it. This is not always practicable. Again, one of the panel stated that if a treatment plant

became overloaded it s a simple matter to expand the works. This, also, is not as easy as it sounds.

There should be limitations on both quantity and quality of process wastes in order to avoid undue burden on a municipality or on its sewage treatment works. As a case in point, a small municipality built a sewage plant some years ago, designed to serve for about 20 years. It was a fine plant and produced an excellent effluent for two years. At that time the local Chamber of Commerce in an endeavor to bring industry to the town, raised about $1,500, purchased a site, and presented it to the industry. The town fathers, as is often the case, gave no thought to the industrial wastes, particularly in respect to a possible hazard to results at the treatment plant. The industry referred to produces a waste of very high pollution characteristics. In fact, it contributes 20 per cent of the total flow, and 75 per cent of the total B.O.D. arriving at the plant. In other words, the industrial load is one-fifth the total in volume, and three times the organic load, contained in all of the domestic sewage.

That happened years ago, and although the plant has been seriously overloaded and under a stigma because of poor results, it is only recently that definite progress has been made toward improvement.

In general, there should be some means, not necessarily by ordinance, but preferably by agreement, so that, in the event a sudden wastes load is imposed by industry, such load could be modified to prevent an undue burden on the municipal treatment plant.

In respect to control of admissions to the sewer system, in at least one city it is specified that in no hour must the concentration of waste be more than three times the average. Control should also be imposed on wastes which interact with each other, when mixed, to create a hazard.

A large industry is inclined to the viewpoint that it should not have restrictions which are not imposed on a smaller industry with similar wastes, and this point appears well taken. Consequently, where all industries of the same type are treated alike, much better cooperation can be expected.

Oftentime one hears: "If we get such and such an imposition, we shall have to move out of town." This is fraught with difficulty too, because no matter where the industry goes, the waste problem goes along also.

In all my experience, I have never found that a city or municipal government wanted to penalize industry. By the same token, it is certainly a pleasure to find that today industry is actively cooperating in solving mutual pollution problems.

Mr. Dobb:—In Cincinnati the technical know-how got through to Council for various reasons: Consulting engineers were first called in, and then there were meetings between city and industry representatives over a period of weeks; in fact, the consultations with industry continued for more than three years. As a result, all the technical know-how that was available from the consultants who were familiar with the sewage field, and from the technicians in industry, was thoroughly and pretty well brought together. The fruits of this labor are contained in the Cincinnati ordinance.

Mr. Wise:—Sometimes it is questionable whether these problems should be solved largely on a technical level or on a management level. A series of instances in Connecticut will illustrate the point:

For several years meetings had been held with a group of similar industries in an effort to set up a program of waste treatment for the industries as a whole. These meetings were held with technical representatives from the various industries. No substantial progress for setting up a program was made because the representatives felt that one of their duties was to keep the cost of operations down in their individual plants and that waste treatment would increase the over-all cost of plant operation. A conference was arranged with the managements of the various industries and progressive action was obtained because management gave the green light.

Mr. Jones:—It should be noted that in Cincinnati, for example, the normal sewage, above which the surcharge is made, is more than reasonably strong. In other words, 300 p.p.m. of suspended solids, and 240 p.p.m. of B.O.D. is a strong sewage that at once permits a number of small industries, and contributors of various kinds, to get in under the normal rates. It is only after that level is reached that the surcharge becomes effective. Therefore, industrial or commercial contributions, get a break of perhaps 20 to 25 per cent before even the surcharge is brought into play.

Mr. Olds:—For Procter and Gamble the surcharge exceeds the service charge by considerable, and that, we feel, is a right and equitable thing; if we are contributing that strength, we should pay our correct proportion of the charge.

William H. Higgins, Superintendent, Ewing-Lawrence Sewage Treatment Works, Trenton, N. J.:—Two widely divergent approaches by industry can be seen in our communities. One industry, originally producing a waste containing 30 p.p.m. of cyanide, has in a year's time improved its effluent until it now contains less than 1 p.p.m., and efforts are being continued to reduce it even more.

Another industry produces cooked rubber wastes which clogs the sewer system and clogs the treatment facilities. Although negotiations have been carried on for more than a year, this industry refuses to make satisfactory progress. Therefore, because that waste raises the suspended solids in the municipal plant effluent to 7,000 p.p.m., the authority will have to refuse the waste until it is pretreated.

E. S. Chase, Consulting Engineer, Boston, Mass.:—Like the poor, the industrial wastes problem is with us always. It is a topic which has been discussed at great length.

The question has been raised as to how to treat the small industry as against the big industry. I'd like to call attention to criminal law where there is a differentiation between petit larceny and grand larceny.

Another point that has been touched upon is the action of Chambers of Commerce in trying to bring new industry into small communities. In one small community with which I am familiar, the Chamber of Commerce attempted to get a wool scouring plant to move in. Fortunately, the industry had sense enough to ask for advice as to the degree of treatment which might be required before their wastes could be put into the city sewers. The city had a nice, relatively new sewage treatment plant, which would have been badly overloaded had that industry's wastes been permitted in the sewer system. Therefore, the industry decided not to locate in that particular community.

This experience indicates the responsibility of industry to investigate the problems it faces before locating in a new section of the country, or even in a new community in the same section.

Chairman Watson:—In the interest of objectivity, a member of the Forum audience has been asked to briefly summarize the two phases of this subject that have thus far been discussed—Mr. Palmer.

Clyde L. Palmer, Assistant City Engineer, Detroit, Michigan:—This whole subject was aptly summarized by the gentleman who made the statement that there are two phases to it—the policy phase and the engineering phase.

Engineers are interested in both

phases. Certainly the engineer should be on the policy making board. There are, however, things that this policy board will have to consider, that are not entirely engineering. The local conditions that have to be met in the matter of financing is an important factor in determining how the ordinance should read; whether the use of surcharges is to be resorted to as part of the financing picture, or whether the financing is such that the entire benefit of the plant can be turned over for the free use of all, two different but entirely valid viewpoints depending entirely on the viewpoint of the policy making body of the community in which the problem arises.

For the engineer however, there are some more definite limitations that will have to be met. Basically, of course, the whole problem will go back to the receiving waters. Some of the limitations that will have to be placed upon the use of the public sewer system will be the result of conditions created in the receiving waters. Other limitations will be as a result of the sewage process in use, and others as a result of using the sewer structure as a means of transportation to the point of final disposal.

Industry, or any of the users of a public sewer system and a sewage disposal system, cannot escape these limitations. It is a question only of how they are to be administered. The fact remains, however, that there are definite quality limitations imposed on sewage and industrial wastes by virtue of their effect on the receiving waters, the sewage treatment process, the equipment, and the structures of the sewer system itself.

In about the year 1945 the City of Detroit started working on its standards and regulations. Previous to that time, there were no regulations and reliance was placed on the ordinance, which said in effect that industry or any user could not discharge any deleterious material into the sewer system.

Several industries created serious damage in the sewer system. In compliance with the ordinance they paid sizable sums of money, but as usual there was the cry: "Why doesn't somebody tell us these things?" Therefore, in an attempt to keep people out of trouble, and to protect the city's interest, the standards and regulations for controlling the use of the sewers were formulated.

In the present discussions, there does not seem to be a great difference between the viewpoints of municipal agencies and industry. Industry agrees that certain substances should be entirely prohibited in the sewer system, but it contends that other things should not be limited to too great an extent. On the other side, municipalities, of course, believe that certain things must be prohibited, and other restrictions should be put on to protect the use and maintenance of the system and the treatment plant.

Actually the viewpoints are not too far apart. There are some problems, but they are not insurmountable. The answer probably lies somewhere between both of the different viewpoints.

Mr. Dobb claims that industrial waste concentrations should be spelled out. It should be pointed out, however, that there are plenty of unknowns and uncertainties still remaining. There are hundreds of thousands of chemicals that are known, and by tomorrow we will have more. Therefore, any attempt to spell out concentrations of acceptable material in the sewer system is almost impossible.

On the other hand, Mr. Steffen contends that the specifications should be general, and the concentrations should be left to technical people. That is an excellent concept, but general standards do not provide practical design limits. The limits that are set up shouldn't be so vague or so general that there is very little to go on when a decision is necessary as to the kind or the amount of treatment required. No industry should be expected to spend important money on vague generalities.

As between those two viewpoints, the answer must be general because of uncertainties; but where the information is fairly well established, it should be definitely stated in any ordinance or set of regulations.

Mr. Milligan contends that waste specifications should apply to the industrial effluent. This involves certain questions of policy. The public sewer system and sewage treatment plant stands between the receiving waters and the individual user. If the industry or user were on his own, he would be directly responsible for the conditions in the stream, but when connected to a public sewer system, the governmental agency stands between the user's outlet and the stream. In almost all cases, such an arrangement is greatly to the advantage of the user.

Although the standards should apply to the industrial effluent, where the industry is connected to the public sewer system, the requirements should be based on protecting the receiving waters and giving the user the benefit of the dilutional effect of the sewer system.

Mr. Olds takes the position that the specifications should be based on one level of concentration at the treatment plant.

It should be pointed out, however, that some types of effluent can't be considered at the treatment plant; the deleterious effect of that discharge is right at the point where it enters the sewer system. Therefore, whether it should be excluded or included, and to what degree, must be determined at the point of entry and not farther down the system at the treatment plant.

The answers to the problem seem to lie somewhere between the points of view taken by Messrs. Milligan and Olds. For certain types of wastes the standard must be based on the level at the plant; for certain other wastes the standard must be based on the level at the point of entry to the municipal system.

Detroit has been interested in its waste standards and regulations since 1946 and has accomplished considerable in this line. Because of the multiplicity of metalworking industries in the city, ferrous iron caused a lot of trouble, concentrations at the plant frequently running in the range of 30 or 40 p.p.m., and at one time going up to 400 p.p.m. Such concentrations in effect put the treatment plant out of service, so something had to be done to bring them back within a range where treatment was possible at the plant. Whereas the Detroit plant had been suffering from this condition about 10 or 20 per cent of the time, application of the standards has reduced the plant difficulties from ferrous iron to about 1 per cent of the time.

Disposal to Public Sewers *vs.* Separate Treatment

Chairman Watson:—There is still one further area for discussion; that is, where there is a choice, should an industry discharge its wastes into the municipal sewer system with or without treatment, or should it discharge into the stream with or without treatment?

The first speaker considers discharge of industrial wastes to public sewers; the next, treatment of the wastes and direct stream discharge.

N. E. Damron, Sanitary Engineer, Lederle Laboratory Division, American Cyanamid Co., Pearl River, N. Y.:—Sometimes the efficient disposal of an industrial waste can be accomplished by discharging it to a municipal sewer; at other times it is necessary to provide treatment at a company plant prior to direct dis-

charge to a stream. Obviously, if public sewers are not readily accessible, an industrial waste treatment plant is required. Although less apparent, separate treatment of an industrial waste is also necessary if the nature of the waste is such that it can not be treated economically at a municipal works. This might be true if a waste had little B.O.D. but contained pollutants which were not removable by the conventional processes used at domestic sewage plants. Another example is that of an industrial waste which would meet stream standards without the degree of treatment sometimes required on municipal sewage.

Fortunately for consultants and industrial waste engineers, the decision of whether to discharge into a stream or into a public sewer is usually complex: elaborate, lengthy, and expensive studies are often necessary to obtain an intelligent answer. This outline lists a number of the benefits to be derived from discharging industrial wastes into a public sewer. The other side of the question—treatment and direct stream discharge—is to be discussed by another panel member.

As is true of most industrial considerations, cost is of prime importance. Which is the least expensive method of discharge? Which will give industry the most for its money? Usually the combined treatment of industrial and municipal wastes is more economical than separate treatment in a number of small plants. The trend is toward supermarkets and super sewage plants which can handle a large amount of business at a low unit cost.

These joint plants eliminate the need for industry to provide complete treatment. In many instances, where the wastes are not oily, toxic, caustic, or strongly acid, they can be discharged to the public sewer without pretreatment. This is particularly true of small industries whose waste flow is only a small percentage of the total sewage. Where pretreatment is required, the waste facilities can often be kept simple and small in size, thus minimizing capital investment and operating cost. If an industry is located in a city, there may be no room for an extensive treatment works. Even if land is available, it may be quite costly and better used for manufacturing. In contrast, there is usually no problem in obtaining low-cost land for a municipal plant. Discharge into a public sewer eliminates the need for an industry to build expensive outfall sewers.

Industries are usually reluctant to make large investments in waste disposal. This natural reluctance is due to management's desire to obtain a tangible, monetary return on its capital outlays. Money for waste treatment must compete with money for the manufacture of profit-making items. Under these circumstances, management may be inclined to buy its waste treatment on an annual basis instead of making a large capital investment. By sending its wastes to a municipal plant, industry can take advantage of the very favorable interest rates on non-taxable sewer bonds.

Of those industries which are connected to public sewers many pay on the basis of flow, B.O.D., and solids. Should production fall off, or manufacturing processes change so the volume of wastes is reduced, the annual treatment bill should be substantially less. Industry will not be stuck with a "white elephant." Such a cost arrangement provides an excellent incentive in an industrial plant for the conservation of water, re-use and recovery of waste materials, and the elimination of pollutants at the source.

The big sewage treatment plant usually has better supervision and control than a small industrial waste plant, which may not have a full-time superintendent, a chemist, or adequate operating personnel. In some industries, waste treatment is a part of production and, due to certain union agreements, the operating engineer has no direct authority over the men who work at his waste plant. Almost as detrimental to satisfactory operations is the high rate of turnover among plant personnel—it is hard to retain well-trained and experienced men.

The joint sewage works is usually economical, due not only to its large size but also to the increased treatability of its combined wastes. The classic example of this is the neutralization of an acid waste with an alkaline one, although this has probably occurred in the classroom much more frequently than it has in practice. However, there are other synergetic waste combinations which aid in the settling of solids, the removal of colloids, and the breakdown of organic matter.

Treatability of industrial wastes is often helped by the dilution and nutrition values of domestic sewage. Some wastes, such as those from pharmaceutical plants, have a B.O.D. of 2,000 p.p.m. and stronger. This type of waste can be readily treated on trickling filters, but unless the strong liquids are diluted, heavy growths will build up on the filters, causing many operating problems and perhaps creating very obnoxious odors. Other industrial wastes, such as those from cotton kiering and brewing, are deficient in nitrogen and phosphorus. These important nutrients can frequently be supplied by mixing the industrial waste with domestic sewage. Furthermore, when an industrial waste is mixed with larger quantities of sewage, fluctuations in the composition, strength, and rate of flow are not as important as when the industrial waste is being treated separately.

A number of industries, particularly those concerned with food processing, have a seasonal waste disposal problem. Where municipal plants are available or can be built, food processing wastes can often be treated with year-round sewage. Chemical treatment during the processing season will help to remove excessive suspended solids and B.O.D. Thus, the industry can avoid construction of a waste plant which would be idle much of the year.

Although the discharge to a city system must be carefully controlled, such control is not as critical as direct stream discharge. No matter how careful and conscientious employees try to be, sooner or later an operator will turn the wrong valve—usually at 2 AM—and send a heavy load of industrial chemicals down the sewer. With direct stream discharge this could result in a nightmare of dead fish, outraged sportsmen, and very bad publicity. However, if this inadvertent discharge were sent to the municipal plant, complete disaster would be avoided although the municipal superintendent would be faced with a difficult period of operation and would probably require tighter control at the industrial plant.

Another disadvantage of direct stream discharge is the difficulties encountered in attempting to set up fair effluent standards for a number of industries and cities located on the same stream. After standards have been set, it may be even harder for the industry to meet them as new products are made and old ones discarded. There is also a feeling in industry that water pollution control authorities take a more lenient view in handling municipal disposal problems than they do in the case of industries. Whether or not this is true, there are advantages in handing over to a municipal authority the responsibility and problem of meeting stream standards.

Even when the cost and difficulties of individual treatment appear to be less, combined treatment may still make good sense. By connecting into a city system an industry is aiding

the community to bear the cost of an areawide improvement program. In some smaller towns and sparsely populated districts a public sewer system would not be possible without industry's backing. Under these conditions management obtains the benefits of good will, excellent advertising, and better living conditions for its employees.

In most cases there will be a number of reasons for an industry to discharge into a public sewer. For example, at Lederle Laboratories in Pearl River, N. Y., management was influenced by its desire to be a good neighbor, as well as by the savings involved. Both Lederle and Pearl River are located on the watershed of a public water supply and, as they grew in size, it became desirable in 1939 to build a municipal plant which would handle their combined wastes. Some of the capital was provided by a water company, part by Lederle, and the remainder by WPA funds and municipal bonds. Operating costs were shared by the industry and the town on a flow basis. Due to industry's participation the sewer tax was quite low, only half as much as it would have been otherwise.

When penicillin, and later Aureomycin,* was discovered and the production of these antibiotics was begun at Lederle, the plant's industrial wastes were increased tremendously. To meet this new waste problem, the treatment facilities at the town plant and at Lederle were increased and the contract with the town was revised so that payment was calculated according to B.O.D. strength and volume of flow. During this period of expansion and waste disposal difficulties, Lederle was fortunate to be connected with the town plant. Thus, the public water supply downstream did not receive unmanageable quantities of waste. By 1950 it was obvious that building new treatment units would not provide a permanent solution to the area's waste problem. The best bet was to remove the wastes from the present watershed and transfer them to the Hudson River, the lower part of which is too salty to be used for potable water.

At this point management had the option of going it alone or again joining forces with the town. In either case, Lederle would have to pay the full cost of the project. The initial cost of each method would be about the same; a company trunkline would be smaller, but could not take advantage of existing sewers. Direct discharge to the river would mean losing an investment in the municipal plant and the construction of additional treatment facilities at Lederle. A joint effort by the town and Lederle appeared to be best from engineering, legal and public relations standpoints.

In 1952 a new outfall was built which utilized portions of a former Army camp outfall to the Hudson River. Construction of this outfall not only aided in solving Lederle's immediate waste disposal problem, but also helped to open up large areas for industrial and residential use.

In summary, the main advantages of discharge to a public sewer are:

1. Lower cost due to the large size and better supervision of a single plant.
2. Availability of capital in the form of non-taxable sewer bonds.
3. No duplication of waste disposal facilities.
4. Improved treatability of combined industrial and domestic wastes.
5. Less critical control requirements for sewered wastes as compared with treatment and direct stream discharge.
6. Better community relations.

The objective of getting the job of waste disposal done at the least overall cost to industry and the community usually can best be attained through combined treatment of industrial and domestic wastes.

H. W. McElhaney, General Foreman, Finishing Division, Talon, Inc., Meadville, Pa.:—Whether or not industrial wastes are treated prior to discharge into streams is purely a matter of local practice or ordinance; but the fact remains that nine times out of ten they ultimately wind up in a stream or river, even when first discharged into a sanitary sewer.

Therefore, the problem appears to be simplified into two phases.

The first is a question of treatment or no treatment prior to discharge; and second is the manner and location of treatment prior to discharge on the basis of eventual discharge to some stream or river, either directly to the stream or indirectly through a sewer to a city sewage treatment plant and then to the stream. Only one question appears to remain for discussion—the most practical and economical means of pretreatment before discharge, because certainly it must be conceded that some pretreatment is necessary, even if it be only controlled discharge, dilution, or partial treatment rather than complete treatment.

The benefits of direct discharge to a stream by industry may be summarized as follows:

1. In direct discharge only one set of requirements (those of the state where the discharge occurs) must be met. If the city sewer is used, a double standard exists. On the primary one of the city ordinance, usually different in every city and subject to change as the city management grows and changes, is superimposed the secondary one of state requirements.

2. Usually a city requires some pretreatment prior to discharge to the public sewers. With a little more treatment, an effluent suitable for direct stream discharge could be produced, thus eliminating city charges, possible damage to the stream if the city treatment plant fails, and the question of responsibility in case of a spill or slug getting through from one of several industries using the same sewer.

3. No assessment or sewer charge is levied when direct stream discharge is used.

4. Better community relations will exist between the citizens of a city and industry if the population as a whole does not feel that they are paying the bill for disposal of the industries' wastes. Construction costs, too, are higher for a city plant where both domestic and industrial sewages are to be treated in combination.

5. Industry often will have to pay more than the actual cost if the city sewer is used, because methods of determining and apportioning the cost are often crude or unreliable, with only two workable methods—flat rate or quality-quantity basis—generally recognized. Either method can become a burden to industry due to production process changes, production fluctuations, or changed city management personnel.

In conclusion, it would appear that an industry should treat to the extent necessary to meet local stream requirements. As a result the industry would have complete control of the treatment process; would be able to fix responsibility for such treatment within its own organization; would be able to control and forecast costs; and would be responsible to only one master, not two.

John H. McClintock, Humble Oil and Refining Co., Baytown, Tex.:—Although my company's problem is somewhat different from the typical industrial waste problem under discussion here, we would like very much to turn our effluent over to the city. On the other hand, we don't believe that is practical because our effluent

* The American Cyanamid Company's trade mark for the antibiotic, chlortetracycline.

amounts to about 25 m.g.d. and the city's sewage only amounts to about 5 m.g.d.

Actually, we have done a pretty good job with pretreatment, but, as with most cities, the municipal program is lagging a bit. This particular city has several plants, one of which is a primary plant which dumps into the industry's outfall. Perhaps much of the problem could be boiled down to the relative size of the industry and the municipal plant concerned. It makes a lot of difference whether it is the dog or the tail that is being wagged.

Mr. Damron:—I haven't had any experience with discharge of municipal wastes into an industrial system, but it sounds like a wonderful idea. In other words, the municipality pays the industry and the industry enjoys the advantage of running its own plant and getting paid for it.

Royal E. Rostenbach, Chemical Engineer, Hanford Atomic Production Operation, General Electric Co., Richland, Wash.:—Where industry is in a position to make a choice of going into a stream or into a sewer, it should be remembered that in expanding communities and expanding metropolitan areas, to pass up the opportunity of connecting to the sewer may be to lose that opportunity forever, or at least for a long time.

Ralph H. Holtje, Sanitary Engineer, State Board of Health, Indianapolis, Ind.:—Each discussor's viewpoint is influenced by his own experience. The people in industry who have had unhappy experiences with a community will naturally wish to carry out their own treatment; those industries that have had good relations will naturally go that way. So it all boils down to the primary factor of public relations. If there is a choice, certainly those who have had good experience with the community will lean toward municipal treatment, whereas those who haven't will lean the other way. The trend seems to be for industry to go in with the community, particularly if the industry isn't too large.

Chairman Watson:—That brings up some good questions. Of course, most cities hope to grow and to get new industries. By what procedure can they insure that their sewer system will be adequate to take in the industrial wastes that may be discharged at a later date?

Mr. Dobb:—To take in all future wastes is to be too inclusive, but sewage works should be planned to provide capacity for at least 25 or 50 years. Although they may be financed through service charges and surcharges, additional sewer systems are not the responsibility of the sewage disposal (treatment) section, but of the sewer department in the community or communities affected.

Communities expand only because of business being brought into the picture. Therefore, it is a function of the city to provide the main trunk sewers, and the function of the local community to provide the laterals to get into the main trunk sewers.

Linn H. Enslow, Editor, Water and Sewage Works, New York, N. Y.:—Many of us know communities where the sewage treatment plant is really an industrial waste treatment plant, whatever it may be called. In fact, a case has been known where one type of industry contributed about 90 per cent of the loading on the local sewage treatment plant. Instead of a sewage treatment plant, this installation should be run as an industrial waste treatment plant, with the city paying the industry for the cost of treating its sewage.

Harvey G. Rogers, Director, Division of Water Pollution Control, State Board of Health, Minneapolis, Minn.:—It seems that we are likely to oversimplify the situation with respect to these industries. There are industries that on the basis of the size of the community and the characteristics of their waste have no choice as to whether or not they must have separate treatment. The wide variety of industries encountered through the range of size of the communities throughout a state means that in each case the large installation must be considered strictly on its own merits.

In Minnesota it has been found that since the institution of service charges the majority of the industries do feel that they know where they stand. It is easier for them to determine their costs on a calendar basis and to pay a service charge. Controlled provision of waste treatment is a function that can be provided by the municipality at a more economical level than can be provided by the industry.

Mr. Milligan:—In Pennsylvania where industry has a choice of treating its own waste or of discharging it to the city sewers for treatment in the municipal plant, it is often necessary to provide primary treatment or other pretreatment which is almost equivalent to primary.

The margin of difference in cost between pretreatment and so-called primary treatment is very slight. But when it comes to a higher degree of treatment, many industries seem to be finding that it is cheaper to treat their own wastes initially, then enter the city sewers for further treatment. In that range they have a lower surcharge.

Mr. Olds:—In that connection at our plant we were faced with two almost insurmountable problems in connection with trying to fully treat our own waste to go into a stream.

In the first place, for the volume to be handled there was not space available anywhere for a treatment plant of sufficient size. In the second place, the consultants were unable to assure construction of a plant which would adequately treat the waste because it was primarily industrial. On the basis that there must be sufficient dilution with domestic waste to make it adequately treatable, rather extensive pretreatment is performed and the rest is put into the city sewer because we of necessity have to.

W. W. Bergerson, Assistant Engineer, Washington Pollution Control Commission, Seattle, Wash.:—What is waste? In the entire discussion so far waste has been accepted per se. Actually, waste is only what isn't immediately usable. Probably the biggest challenge of all is the matter of utilization of wastes and prevention of wastes. In the State of Washington there is particular cognizance of this problem in the pulp industry, which is doing something about it in the form of wastes recovery and reuse.

Chairman Watson:—That is a very pertinent point; the fact that it is obvious to industry that any recovery which has application is certainly a sounder approach than treatment. And recovery is intended to include the circulation and re-use of water.

L. L. Falk, Engineering Service Division, Engineering Department, E. I. du Pont de Nemours and Co., Wilmington, Del.:—There are several practical considerations that an industrial plant must take into account in the matter of direct stream *vs.* sewer discharge. The factors involved will, of course, vary considerably from plant to plant. Accordingly, the relative costs will vary also.

Most industrial plants do not have the choice to make; they do not have both disposal methods available. This is particularly true of many newer plants that are locating away from sewered municipalities. It is also true for many older plants in large cities where the sewer is the only way for discharging waste. It should be pointed out also that some industrial wastes do not discharge either to a sewer or a stream. Such wastes may be disposed of by incineration, solar evaporation, dumping in abandoned mines or quarries, and by under-

ground disposal in suitable geological formations.

As pollution abatement and rehabilitation of the streams of this country progress, industrial plants will be faced increasingly with the alternatives of stream discharge with adequate treatment, or municipal sewer discharge. The choice will depend on many factors. A few of these are as follows:

1. Changes required in plant sewer system to connect to a city sewer. Here might be mentioned the experience of a du Pont plant in a large city that is proceeding with plans to treat its municipal sewage. It will be necessary for the plant either to connect to the city system or to treat its waste for river discharge. Studies were made within the plant to determine the wastes that could be sent to the river, those that could be sent directly to the city sewer, and those that would require some degree of treatment for discharge either to the sewer or the river. These studies clearly indicated that it was most economical to discharge to the city sewer, even when pretreatment was necessary. Several alternate systems for sewer changes within the plant are now being studied in preparation for connection to the future municipal system.

2. Segregation of waste sources. Much of a plant's total sewer flow may be from sources that contribute little or no pollution. Here separation of such sources will benefit waste treatment for either stream or sewer discharge. In the former case, size of treatment facilities and operation are reduced. In the latter case, the sewer charges will be less because of lower waste volume.

An example here is a du Pont plant in a small town now connected to a county sewer system. The plant is separating industrial wastes and sanitary sewage for delivery to the sewer from those that can still be discharged directly to the river, with the approval of the state water pollution authorities. This plant also provides an example showing that the in-plant cost to deliver waste to a municipal sewer may be more than the charges for the use of the sewer. The sanitary sewage is pumped through a force main to the county sewer. It is estimated that the power, maintenance and depreciation costs are about $0.50 per 1,000 gal., compared to $0.06 per 1,000 gal. charged for use of the county sewer. The estimated cost of operating a separate du Pont sewage treatment plant is $0.80 to $1.00 per 1,000 gal.

3. Acceptability of wastes for sewer discharge. Often certain constituents of wastes cannot be discharged to municipal sewers for such reasons as damage to sewer structure, creation of a hazardous sewer atmosphere, or inability of the sewage treatment plant to handle them. In such cases, segregation or pretreatment of wastes (for example, neutralization of acids or precipitation of metals) may be required. The possibility that a treated waste could be discharged either way should be considered.

4. Comparative operation costs. Normally, sewer discharge will show the lower operating cost over treatment for direct stream discharge. Labor, maintenance, insurance, and depreciation costs are lower. Some examples of cost figures in the literature and within our experience can be cited. Zack[1] indicated that municipal sewer charges for milk wastes in several small Pennsylvania towns ranged from $0.10 to $1.00 per 1,000 gal. of waste. Beebe[2] showed the cost to treat a soluble oil waste by pressure flotation

[1] Zack, S. I., "Treatment and Disposal of Milk Wastes." THIS JOURNAL, 25, 2, 177 (Feb., 1953).

[2] Beebe, A. H., "Soluble Oil Waste Treatment by Pressure Flotation." THIS JOURNAL, 25, 11, 1314 (Nov., 1953).

was $0.42 per 1,000 gal., including chemicals, labor, and power, but no depreciation. Liontas[3] gave a cost of $1.10 per 1,000 gal. to treat organic and fermentation wastes on high-rate filters. This included labor, maintenance, depreciation, insurance and overhead. Watson[4] indicated the cost for treating metal-finishing wastes was $0.91 per 1,000 gal. without, and $2.85 per 1,000 gal. with depreciation included.

In constructing a large office building in a suburban location, the du Pont Company chose discharge of sanitary waste to a county sewer over separate sewage treatment for discharge to a nearby stream. A portion of the cost to extend a trunk sewer more than 2 mi. to do this could be justified on the basis of lower operating costs in using the sewer. For example, it costs $0.06 per 1,000 gal. of sewage discharged to the sewer. It would probably have cost at least $0.85 per 1,000 gal., including depreciation, to treat the sewage adequately for stream discharge.

At a new du Pont plant in a remote location, sewage treatment costs will amount to about $0.70 per 1,000 gal. This will include labor, power, maintenance, depreciation and supervision. Here no municipal sewers are available. However, if they had been, in all likelihood, they would have been used.

In conclusion, where municipal sewers are available industries will usually find it advantageous to use them rather than to treat separately for river discharge. In fact, the lower treatment costs and, often, lower initial investment for facilities offered by using municipal systems, is a definite attraction to industrial plants. Industrial plants should expect to pay the full cost involved in treating their wastes after discharge to the city sewer. It should be pointed out that municipalities, because of the lower unit investment cost of large treatment plants and the lower interest rates they pay on their bonds, are in a position to do this more cheaply than industry, which must bring in a higher return on its investment because of the risks involved in competitive enterprises. Also, because of the dilution of industrial wastes in municipal sewers, treatment by the municipal plant is rendered easier in many cases than it would be in the connected industrial plants.

[3] Liontas, J. A., "High-Rate Filters Treat Mixed Wastes at Sharp and Dohme." THIS JOURNAL, 26, 3, 310 (1954).

[4] Watson, K. S., "Treatment of Complex Metal-Finishing Wastes." THIS JOURNAL, 26, 2, 182 (Feb., 1954).

FEDERATION HEADQUARTERS OFFICE MOVED

At the end of April 1955, the Federation headquarters and publication office was moved from its former location in Champaign, Ill., to new quarters in Washington, D. C. The new address is:

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