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Proceedings of a Symposium: Pollution Control of Industrial Wastewaters

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Pollution Control of Industrial Wastewaters

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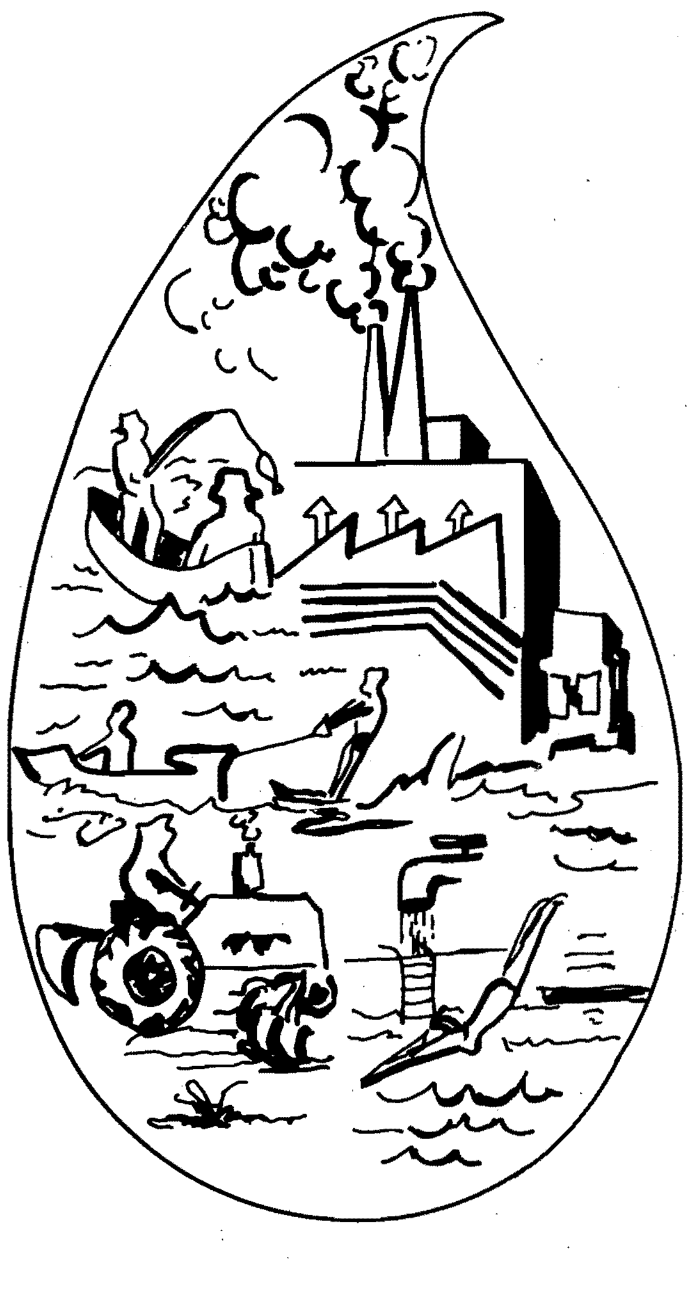

Proceedings of a Symposium

POLLUTION CONTROL OF INDUSTRIAL WASTEWATERS

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INDUSTRIAL WASTEWATER PROBLEM IN UTAH

by

Calvin K. Sudweeks*

Introduction

General. It is indeed a pleasure for me to be with you this morning to discuss the problem of industrial wastewater in Utah. We do have industrial wastewater problems in our state as do all other states in the nation, and as do all other industrialized cities and countries throughout the world. But before discussing specific problems in Utah let us first consider the field in general and briefly discuss what industrial wastewaters are, where they come from, and the problems they create.

Sources of industrial wastewater. Industrial plants produce a variety of waste products that can in general be categorized as follows: (a) solid materials left over from the product, (b) gaseous wastes which pass into the atmosphere, and (c) liquid wastes which are discharged into the various water courses. Industrial wastewaters obviously fall into the last category, that of liquid wastes which are discharged from the industrial plants.

Most industrial wastewaters are derived from cooling, washing, extracting, flushing, impregnating, chemical treatment, and other similar operations. They are as varied in nature and quantity as the products and the processes of the plants from which they drain. They range from discharge of great quantities of cooling water that is contaminated only with heat, to the emptying of relatively small, but concentrated baths that are heavily loaded with organic and inorganic substances. They range from large steel mills and sugar refineries discharges to discharges of small laundromats and car wash operations.

Problems resulting. It has been said that industrial wastes are the penalty paid by an industrial nation and are one of the inevitable problems connected with industrialization. They are the outcome of

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civilization and its demand for a high standard of living.

Only the so-called civilized nations suffer from such wastes. Prior to our own industrial revolution, there were essentially no industrial wastewater problems to cope with. However, I feel confident that very few of us would be willing to revert back to the preindustrialization era in order to eliminate the industrial wastewater problems which have resulted from our current level of civilization.

Problem

Approach (general). Recognizing these facts, there is only one alternative available to us today. That alternative is to develop and utilize adequate wastewater treatment measures to eliminate the remaining industrial wastewater pollution problems which have resulted and to thus insure an adequate and useable water supply for the present and future generations. My reference to "the remaining pollution problems" is entirely intentional because, as you will see later, considerable progress has been made in the field of industrial wastewater treatment in Utah and we must not deny credit where credit is due.

Because industrial wastewaters are so varied in both nature and quantity, there are no "cut and dried" treatment processes which can be applied. It is usually found that each problem must be studied individually and a waste treatment procedure developed on a "tailor made" basis to suit the specific conditions and needs of that particular industry.

Types of wastes and effects. All industrial wastewaters affect, in some way, the normal life of a stream and, as we are all aware, the discharge of wastewaters from certain industries into a given stream can be disastrous. Certain industries produce and discharge wastewaters which cause far more difficulties than the discharge or treatment of domestic sewage from the community in which the industries are situated. Toxic metals and chemicals may destroy the biological activity of the streams, even in municipal sewage treatment works, and thus may render the receiving waters unfit for further use. In the manufacture of organic chemicals, for example, the wastes produced may impart taste and odor problems to the receiving streams that are essentially impossible to remove in standard water purification plants. Strong acids and alkalis may render receiving waters corrosive and expensive to purify for further use. Suspended solids may settle in receiving waters and smother aquatic life. Excessive concentrations of organic matter may rapidly exhaust the natural purifying capacity of the receiving waters. Oils, dyes, and floating solids may render receiving waters and their banks unsightly and interfere with the rights of other water users. The following table presents a list of materials that can cause pollution.

Table 1. Materials in Industrial Wastewaters That Can Cause Pollution.

Inorganic Salts (Minerals)
Acids and/or Alkalis
Organic Matter
Suspended Solids
Floating Solids (Lighter than Water)
Heated Water
Color
Toxic Chemicals
Microorganisms
Radioactive Materials
Foam-Producing Matter

Effects on Streams and Need for Standards. Streams can assimilate a certain quantity of most any waste before reaching what we refer to as a polluted state. Some streams are large and some are small, some are swift moving, while others are very slow moving. Each of these conditions has a bearing on the amount of assimilative capacity of a specific stream. To insure that a stream's assimilative capacity is not overtaxed and the rights of all downstream water users will not be unduly interfered with, it is necessary to assign water quality standards to the various streams which take into account the downstream uses. Such standards of necessity contain limits for the various pollutants, and thus serve as effective guidelines to insure that the assimilative capacity is not overtaxed and that the downstream water users rights are protected.

Tests and test limitations. The tests used to determine strength and characteristics of domestic sewage obviously cannot be applied to the analysis of industrial wastewaters, unless it is done with the understanding of the limitations and, unless they are supplemented by tests that evaluate more specific properties of the wastewaters. Toxic wastes, for example, may have a high chemical demand for oxygen (COD), but may exert a biochemical oxygen demand (BOD) that is quite low, although much organic matter is present. When such a waste is discharged to a stream then the toxic constituents may be diluted below threshold limits, and thus permit the biological activity to establish itself. The total oxygen demand may then increase with increasing dilution of the waste. Other similar examples could be cited which would only further stress the fact that industrial wastewater treatment is not a cut and dried procedure and each problem must be considered individually.

Factors relating to water use and wastewater discharge. The volume of water used by industries varies widely, not only with the type of industrial operation, but also with one or more of the following factors.

1. Availability and cost of water.
2. Difficulty of wastewater disposal.
3. Nature of the processes and equipment employed.
4. Attention given by management and public authorities to water conservation.

Industries on large rivers are more apt to use large amounts of water and discharge large amounts of wastewater than are similar industries located on small rivers or in areas where a very limited water supply exists.

Approach

Treatment and disposal. The treatment and disposal of industrial wastewater can be handled either (a) through discharge to municipal sewerage systems or (b) by means of separate treatment and disposal facilities provided by the industries.

Oftentimes considerable savings in industrial waste treatment can be affected by such means as (1) altering manufacturing processes to decrease the volume and concentration of wastewater, (2) developing means for the recovery of useful by-products from the wastewater, (3) treatment and reuse of process waters within the plant. In fact, each of these possibilities should be exhausted before any wastewater is allowed to leave the plant for subsequent disposal.

There are many industrial wastewaters that are amenable to treatment in municipal sewerage systems, and wherever this can be accomplished to the benefit of both the industry and municipality involved, it provides a splendid solution to the problem. However, beforea municipality accepts wastes discharged from an industry, it should first learn the facts and characteristics of the wastes, the sewage systems ability to handle them, and the effects of the wastes on the system.

To remove pollution from industrial wastewaters, a municipal sewage treatment plant must have sufficient capacity of the proper type. Theoretically, a sewage treatment plant could be designed to handle any type of industrial wastes, but the present plants fall shy of this ideal.

Pollutional characteristics of wastes having readily definable effects on sewers and treatment plants are roughly classed as follows:

1. Biochemical oxygen demand (BOD)
2. Suspended solids
3. Floating and colored material
4. Volume
5. Other harmful constituents

In Utah there are numerous industries which are discharging their wastes to municipal-type sewer systems with no apparent ill effect. As indicated previously, I feel that this provides an excellent means of handling certain amenable industrial wastes.

Types of industrial wastewaters. To this point we have discussed in general terms the variety and complexities of the wastewater problems associated with industry. Now let's attempt some logical categorization of industries with respect to characteristics of wastewaters produced. (See Table 2.)

Status of Wastewater Treatment and Disposal in Utah

To determine the status of the industrial wastewater problem in Utah, the Utah State Division of Health has attempted to contact all of the industries in the state and obtain sufficient pertinent information to define the problems relating to each individual industry. The information thus

Table 2. Types of Industrial Wastewaters

Wastewaters Containing Organic Impurities
Food Processing
Sugar Refining
Slaughter and Packing House
Animal By-products
Bottling (Soft Drinks)
Canning
Milk Processing
Milling (Grain)
Baking and Frozen Goods
Brewing
Wastewaters Containing Both Organic and Mineral Impurities
Textile and Wool Scouring
Tannery
Laundry
Wastewaters Containing Mineral Impurities
Mining and Milling
Chemical
Oil Field and Petroleum Refining
Coal and Coal By-products
Cyanide and Plating
Sand and Gravel

obtained was tabulated in inventory form in 1965 in the publication titled, "Industrial Wastewater Facilities in Utah," and the following table is essentially a summary of the information contained in this inventory. In Table 3, I have attempted to list industries on the basis of the types of wastewaters produced (essentially on the basis of the listing contained in Table 2).

You will note a grand total of 300 industries listed in Table 3. They cover the spectrum both in size of industry and in quantity and quality of wastewater produced. Of this total, 222 produce wastewater containing organic impurities, 44 of which also contain mineral impurities. Seventy-eight (78) produce wastes containing essentially only mineral impurities.

Of those wastewaters containing organic impurities (from 222 industries) there is a potential BOD production of approximately 261,000 pounds per day which, in terms of people (or population equivalent - P. E.), is equivalent to approximately 1,500,000. One hundred thirty-five (135) of these industries discharge their wastewaters to municipal sewer systems (the organic load is approximately 67,000 pounds of BOD per day, representing a P. E. of approximately 396,000) and some provide their own facilities for wastewater treatment and disposal. This leaves only about 35 percent of the organic material produced (in terms of BOD) that finds its way into waters of the state from these industries directly. Thus, approximately 65 percent of the organic matter (BOD) is being effectively and satisfactorily disposed of by the industries.

Evaluation of the remaining problems relating to the industrial wastewater, which contain essentially mineral impurities, is not as easily accomplished. However, we know there are major difficulties with these 42 industries and with the approximately 19 mgd of wastewater flow being discharged to waters of the state without adequate treatment. Considerably more detailed study is needed in order to define the magnitude and extent of these problems.

One major task thus facing us at this point in time, is with the approximately 100 industries which presently discharge their wastewaters to waters of the state without adequate treatment. In this category are many "difficult to treat" wastes, which contain both organic and mineral substances. Another major task will be to hold the line on all new industries locating in Utah to insure that adequate wastewater treatment and disposal means are provided at the beginning of each new industrial operation.

UTAH STATE DIVISION OF HEALTH

SUMMARY OF INDUSTRIAL WASTEWATER TREATMENT AND DISPOSAL IN UTAH

August 7, 1967

Type of Industries	No.	Est. BOD Produced # /Day	Est. Flow MGD	Discharge to Municipal Sewers No.	BOD #/Day	Flow MGD	Discharge to Other Facilities With Adeq. Tr. No.	BOD #/Day	Flow MGD	Without Adeq. Tr. No.	BOD #/Day	Flow MGD	Discharge Without Adequate Treatmen BOD # /Day	Flow MGD
A. WASTEWATERS CONTAINING ORGANIC IMPURITIES														
Food Processing														
Sugar Refining	3	149,000	5.670	0			0			3	149,000	5.670	61,550	5.670
Slaughter & Packing H.	66	34,233	2.589	22	18,535	1.911	20	10,705	0.332	24	4,993	0.346	4,993	0.346
Animal By-Products	12	8,808	0.263	2	5,920	0.171	5	2,623	0.072	5	265	0.020	265	0.020
Bottling-(Soft Drinks)	14	21,875	0.204	14	21,875	0.204								
Canning	14	17,950	3.961	9	6,124	1.405	2	198	0.013	3	11,628	2.543	11,628	2.543
Milk Processing	44	5,386	1.608	25	3,520	0.978	2	306	0.217	17	1,560	0.413	725	0.413
Milling (Grain)	6	2,335	0.223	6	2,335	0.223								
Bakery & Frozen Foods	6	450	0.705	6	450	0.705								
Brewing	2	1,322	0.396	2	1,322	0.396								
Others	11	12,040	1.303	6	63	0.112	0			5	11,977	1.191	11,977	1.191
B. WASTEWATERS CONTAINING BOTH ORGANIC & MINERAL IMPURITIES														
Textiles & Wool Scouring	3	1,490	0.305	2	1,090	0.209				1	400	0.096	400	0.096
Tannery	1	27	0.005	1	27	0.005								
Laundry	40	6,070	0.624	40	6,070	0.624								
C. WASTEWATERS CONTAINING MINERAL IMPURITIES														
Mining & Milling	16		34.880	0			5		22.318	11		12.562		12.562
Chemical	8		0.469	0			2		0.154	6		0.315		0.315
Oil Field & Refining	7		4.429	0			1		0.360	6		4.069		4.069
Coal & Coal Products	6		0.996	1		0.029	1		0.317	4		0.650		0.650
Cyanide & Plating	5		0.034	4		0.033	1		0.001					
Sand & Gravel	10		1.087				5		0.412	5		0.675		0.675
Others	26		9.320	8		7.019	8		1.826	10		0.475		0.475
A + B + C	300		69.071	148		14.024	52		26.022	100		29.025		29.025
A + B	222	260,986	17.856	135	67,331	6.943	29	13,832	0.634	58	179,823	10.279	91,538	10.279
		(1,535,000)*			(396,000)*			(81,000)*			(1,058,000)*		(538,500)*	

A REVIEW OF UTAH'S NEW WATER QUALITY STANDARDS

by

Lynn M. Thatcher*

General

Utah's "new" standards are not entirely new, as a review of the standards history in Utah will show. The one thing about them which is different relates to the impact of the Federal Water Quality Act of 1965, which called for assignment of water quality standards to all interstate waters. The Federal legislation resulted in considerably increased demands on the State staff because efforts were diverted from the established program to the specific activities needed for formal standard adoption. One desirable outcome of this situation was the stimulation of all states to develop standards which would be compatible throughout the entire river basin areas.

A brief review of Federal water pollution control legislation is desirable to place the recent actions in focus.

Federal Water Pollution Control Legislation

The basic Federal Water Pollution Control Act was passed in 1956. It was known as Public Law 84-660. Amendments were made to the Act in 1961, as delineated in Public Law 87-88. Further amendments were made in 1965, in the Act now known as the Water Quality Act of 1965, and otherwise referred to as Public Law 89-234. The most recent amendments were completed in 1966, in the act known as the Clean Water Restoration Act of 1966, otherwise referred to as Public Law 89-753.

Space will not permit delineation of the various provisions of the Act and its amendments, but some enlargement on the Water Quality Act of 1965 is necessary since it is the basis of today's discussion.

Federal Requirements for Water Quality Standards

The Water Quality Act of 1965 was adopted on October 2, 1965. The

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Act originally provided for establishment of a Federal Water Pollution Control Administration within the Department of Health, Education and Welfare, but this administration was later transferred to the Department of the Interior by reorganization plan No. 2 of 1966, effective May 10, 1966. Thus, the Department of Interior became the agency to deal with the States in establishment of water quality standards, except for some exclusions relating to public health aspects of pollution, which were left in the Department of Health, Education and Welfare.

Section 10 of the Act specified that a state could avoid Federal enforcement action on its interstate waters by

(1) Submitting by October 2, 1966 a letter of intent that such state, after public hearings, would before June 30, 1967, adopt water quality criteria applicable to interstate waters or portions thereof within such state, and

(2) Adopting a plan for the implementation and enforcement of the water quality criteria adopted.

The Act was followed in due course by a set of guidelines prepared by the Department of interior, designed to interpret the Act in such a way that states could proceed to develop the standards and plan of implementation with some degree of assurance of acceptance. While some apprehension was caused by certain of the guidelines, various public and private discussions of them offered considerable assurance that a reasonable attitude would be used in their application, and that any standards and implementation plan based on sound policies would very likely be accepted, unless it called for too long a delay in the quality improvement procedure.

Utah Water Pollution Control Legislation and Regulations

Two Utah legislative enactments of 1953 had significance with respect to water pollution control in Utah. These were (1) the Utah Water Pollution Control Act (Chapter 14, Title 73, Utah Code Annotated, 1953) and (2) Section 26-15-4, Utah Code Annotated, 1953, specifying powers and duties of the State Department of Health in relation to water quality.

Standards were adopted under these Acts as follows:

1. Wastewater treatment plant design standards were adopted in 1953, by the Water Pollution Control Board. These were

based primarily on the so-called "Ten-State Standards," and covered features of design used by the engineering staff in review of plans for wastewater treatment plants.

2. Two years later, in 1955, water quality standards were adopted by the Water Pollution Control Board.

3. In the same year a set of standards covering individual waste disposal units was adopted by the State Board of Health, in connection with the State Plumbing Code. These were important from the standpoint of water pollution potential of individual waste sources which cannot be handled by a public sewer system. Wherever possible, the control of individual waste disposal systems was delegated to local health departments, but in areas where such departments were not functioning, the state still assumed what obligations it could in exercising suitable controls.

The voluntary action of many municipalities toward development of suitable wastewater treatment works following enactment of the Water Pollution Control Act resulted in a flood of plans to the engineering staff for approval. Thus, for the following several years plan approval became a major activity. Obviously, cities could not be discouraged from moving ahead to implement the philosophies of the Water Pollution Control Act. At the same time, it was unthinkable to risk construction of facilities which through design omissions or for other reasons would not provide a good guarantee of effluent quality which would fit the overall State plan for water pollution control.

Simultaneously with assumption of the work load of approving municipal waste treatment plans, consideration was given by the Board to classification of streams as provided by the standards adopted in 1955. It is necessary to explain the classification procedure in Utah to allow a full understanding of its application.

Classifications describing water uses and setting the limits on various pollutants for each use are established in the basic "standards." Six different classifications are described, each for application to different circumstances. The number of classifications has been kept to a minimum to avoid the administrative complications which obviously would result otherwise. After a specific classification has been formally assigned to a given stream or other water resource, the standards of that classification are legally established, but not before.

Classes "A" and "B" are directed toward the groundwater resources which are so important in Utah. The quality prescribed by them is achievable in natural waters which have filtered through soil under specific conditions which cause a high degree of purification, but is not likely to be achieved in any surface watershed, even where identifiable waste discharges to stream channels are prohibited.

Class "C" carries quality specifications insuring useability of the water for all established purposes, acknowledging that the user in some instances should share cost of control, as in the case of a municipality which must provide complete treatment for Class "C" water to make it safe for domestic purposes.

It is important to point out that in Utah the classification process is not necessary to the accomplishment of pollution control. While there are cases where the State would be reluctant to begin an enforcement action without prior classification, much has been done to clean up pollution of both water resources and land resources without any formal classification action.

The philosophy of the Division of Health in bringing about control of water pollution is that court action should be avoided rather than sought. Thus considerable effort has gone into informal contacts with polluters with the object of explaining the philosophy of the Boards in an attempt to convince responsible people that pollution should be controlled before rather than because of any threat of legal involvement. This does not mean that legal processes are impossible or that the Boards will avoid them; but it is intended to imply that avoiding legal processes often accomplishes much more with less expenditure of time and energy than the alternative.

Possibly the best evidence of this circumstance is the achievement to date of modern sewage treatment of over 90 percent of the population of the State, and achievement of suitable industrial waste treatment for over 60 percent of the total industrial waste load.

Action Taken Under Water Quality Act of 1965

To get back to the specific action stimulated by the Federal Water Quality Act of 1965, it is obvious that Utah was well into a water pollution control program by the time the Act passed. There was no hesitation on the part of either of the Utah Boards involved in this activity with respect to submitting a letter of intent to the Department of Interior. It did turn out that the letter was sent barely before the deadline for its receipt (October 2, 1966) but this had no significance other than the desire to include in the letter the results of progress being made with Colorado River states toward adoption of compatible standards for the entire Colorado River Basin.

It is now common knowledge that much effort was put into meetings with the seven Colorado River states toward development of an agreement which would form the basis for preparation of standards by each state.

Another interstate stream to be involved in all actions on interstate waters in Utah is the Bear River and its tributaries. This stream would have been included along with all others in the recent interstate action except for litigation which has placed the classification process in jurisdiction of First District Court. It is believed that the classification procedure can go forward following termination of the Court action without jeopardizing or being incompatible with other state actions being taken at the present time.

Interstate Standards Adopted

As already mentioned, the water quality standards, adopted in 1955 by the Water Pollution Control Board, have been in use in Utah since that time. Obviously, these could have been used for submission to the Federal Government under the terms of the Water Quality Act of 1965. They were not submitted because of the desire of the Board of Health and the Water Pollution Control Board, as well as other water resource interests in Utah, to insure complete basin harmony in any action taken. Instead, after the Colorado River agreement was achieved, its terms were incorporated into the 1955 standards, and minor changes were made in the standards to insure compatibility.

One important feature of the agreement is the statement of several parameters in qualitative terms rather than in specific terms. Some examples are total dissolved solids, chlorides, and sulphates. It is acknowledged that limits for these parameters must eventually be set, and the process of developing enough information to do this is continuing. This feature was not in conflict with the original Utah standards.

The revised Utah water quality standards, as adopted officially by the June 30, 1967, deadline date stated in the Act, cover all the different classes mentioned previously in relation to the original 1955 standards. The simultaneous classification action needed to satisfy the Federal Act specified Class "C" for official application to the interstate waters of the State. The nature of the revisions to Utah's standards is best described briefly by a listing of the principle changes in the Class "C" standards. Most of these resulted from the Colorado River Agreement. They are as follows:

1. A new paragraph was added to insure compatibility of standards with the Colorado River Agreement on water quality. This essentially made the Colorado River Agreement part of the standards.

2. A new paragraph was added to provide more explicit reference to the necessity of considering cumulative effects of pollutants in relation to control of waste discharges and maintenance of stream quality. This idea was included in the original standards but not spelled out explicity.

3. Previously-included standards for irrigation water quality have been eliminated. This was brought about as a result of opinions by experts that the standards were essentially meaningless and that there presently are no suitable substitites. This is not considered a disadvantage because there is still a general statement in the standards requiring consideration for quality for irrigation uses. When meaningful standards for irrigation quality are developed they can be adopted.

4. Specific standards for radioactive substances, as delineated by the National Bureau of Standards, were added.

5. The upper limit for pH range in waters of the state was lowered from 9.0 to 8.5 as a result of a request by various Fish and Game Departments.

6. A standard of 5.5mg/l. for dissolved oxygen was included.

7. A footnote was added under the quality requirements to acknowledge existence of natural purification forces which

may improve water quality in some instances to the point where recreational use would be permitted.

8. The subscript "1" for use in assigning classifications where standards are exceeded from natural causes was eliminated. This will not alter the effect of the standards, because the accomplishment planned by use of the subscript will be achieved in the new standards through addition of the word "controllable" to modify the word "pollution."

9. The word "heat" has been added to the list of specific pollutants mentioned.

Copies of the standards as presently in use are available for distribution from the State Division of Health. They appear as Part II of the Code of Waste Disposal Regulations. The Class "C" standards, which have been applied to interstate waters, can be described in brief form as follows:

The interstate waters are to be protected for the following uses:

Domestic water supplies (after complete treatment)
Source for industrial water supplies
Irrigation
Stock watering
Fish and wildlife
Recreation

Pollutants identified for control in general terms are:

Heat
Oil and other substances producing slicks
Floating and suspended solids
Toxic materials
Other substances interfering with specified uses

Pollutants identified for control in specific terms are:

Chemical substances
Radioactive substances
Acidity and alkalinity (pH)
Bacteria
Biochemical oxygen demand
Oxygen consuming substances

Not specifically mentioned, but implicit in the language of the standards are controls on color, odor, and substances which would produce off-flavor in the flesh of fish.

Plan of Implementation

As previously mentioned, one of the Federal requirements was the submission of a plan implementation which would delineate the procedures by which the State would accomplish improvement and protection of stream water quality in accordance with the adopted standards. This required specific identification of interstate waters and a delineation of waste sources and compliance status. Fortunately, Utah had already completed inventories of both municipal and industrial waste sources, so that identification of sources was not too difficult. Defining compliance status was not quite so simple.

Time does not permit a complete description of all waste sources and their probable effect on receiving waters, but it can be stated that a compliance date June 30, 1970, was established. This means that any waste treatment facilities found necessary to insure compliance with the standards must be in operation by June 30, 1970.

Inherent in the Utah law is the philosophy that no new source of contamination can be created unless it complies in every respect with treatment and control requirements. This is obviously to prevent build-up of a new backlog while the old one is being eliminated.

This will require constant vigilance, notwithstanding a provision of the law which makes it illegal for anyone to discharge wastes without a permit from the Boards. Monitoring of stream water quality will be of some benefit in this respect, but it will not be adequate to control all actions which might result in water pollution, particularly from the standpoint of preventing rather than correcting pollution.

Part of the plan of implementation includes, of course, a description of monitoring necessary to insure a proper operation of existing plants as well as disclosure of any deterioration of quality of stream waters from unknown or uncontrollable causes. Obviously, monitoring needs will increase greatly in the years to come, and it seems obvious that improvements in technique will be necessary to achieve the level of monitoring ultimately thought to be essential.

Some Basic Principles of Application

Obviously, it now becomes necessary to plan application of the adopted standards to the entire state, including intrastate waters, as well as groundwaters, even though the latter are not covered under the Federal Act.

Controls over small waste disposal units must continue and very likely must be intensified in some areas, particularly in view of current trends toward development of isolated subdivisions, commercial developments, and recreational areas. Lack of rigid control here can result in high levels of pollution in headwaters of many streams where pollution obviously should be at extremely low levels.

It must be acknowledged that normal use of a river basin's supply of water will result in some residual pollution, regardless of treatment methods employed. Hopefully, future research will develop new treatment processes which will help mitigate this problem, but equally obvious, the principle of increasing degradation of quality in both time and distance must be kept in mind.

It must be recognized that classifications must be applied to finite stretches of stream. The assignment of Class "C" to a given segment of stream flow will not, as mistakenly interpreted in some instances, result in uniform Class "C" quality at all points in the channel. This is obviously impossible when it is realized that all pollutants are cumulative in some degree. Thus, a higher water quality is guaranteed in the upper reaches of the classified waters, in order to insure against lower than Class "C" quality at the lowest downstream point identified with the classification. In other words, assignment of Class "C" means application of Class "C" parameter limits at a single point in the stream. Upper reaches of Class "C" streams will approach Class "B" quality or better for some parameters.

Section II-3 of the new standards recognizes this principle and establishes authority to insure needed control. In practice, specific control is achieved through the permit system. The State staff, acting under policy of the two Boards, reviews specific plans, takes into account all other existing or potential sources of pollution, and makes a judgment on treatment needs to avoid exceeding the Class "C" limits at the lowest downstream point.

It should be pointed out that while the standards described apply generally to receiving stream flow they can and must become effluent standards as required by lack of dilution water. Furthermore, because of the public health ramifications of the standard for coliform bacteria, it is presently an effluent standard by reason of the requirements stated in Section 1 of the Code of Waste Disposal Regulations, where a limit is placed on coliforms at 5,000 per 100 milliliters in any discharges not isolated from the public. This requirement is given additional force in Section 3 of the Code, which recognizes the limited ability of chemical disinfectants, especially chlorine, to kill bacteria which are protected by layers of organic substance, through a requirement for certain biological oxidation treatment prior to final disinfection.

Some Special Problems

It is recognized that certain special problems will need constant attention in the future, both from the standpoint of continuing controls found necessary as well as need for research to develop better solutions.

Fortunately for Utah, two of the problems of a serious nature found in other areas do not exist here. These are the problems of combined sewers and mine drainage. Combined sewers have not been allowed in Utah at any time, and mine drainage has not to date been found to contain serious polluting substances. A problem related to that of combined sewers is found in Utah where groundwater infiltration is evident. A number of municipalities have greatly increased sewage flows resulting from this situation, and some attention will need to be given the matter in the future. If practical methods of excluding groundwater are not found, the inevitable result will be greater expenditures for larger treatment facilities.

Marinas and vessels on the greatly increased areas of recreational water in the state could constitute a significant source of pollution in the absence of adequate control. Fortunately, legislation adopted in 1967 will permit necessary controls to avoid negating the other benefits achieved through actions already described. It should be noted that the logical approach to this problem is to follow the National Park Service lead and require that all wastes on boats be contained in tanks for dockside servicing. It is our understanding that the State Park and Recreation Division is already giving consideration to dockside facilities to handle this problem. Rules and regulations under the new statute will be prepared by the Park and Recreation Division with concurrence of the Board of Health.

Special consideration will need to be given to wastes from agricultural pursuits, including animal wastes, milking parlor and small dairy wash-up wastes, and irrigation return flow. We are already in touch with some of the farm organizations in connection with these problems, and have discussed certain aspects of them with Utah State University personnel. More time will need to be spent in the near future.

Land erosion generally will need to be given greater attention in the future. Both the U. S. Forest Service and the Bureau of Land Management are increasingly active in control of lands under their jurisdiction to minimize erosion, but more needs to be done with agricultural lands.

Nutrient removal could become a major problem in connection with some of Utah's impoundments. Stimulation of biological growth as a result of nutrients in water has been a minor problem in Utah to date, but there is no reason to believe that we will escape the major problems encountered in other areas.

Oil brines as well as brines from other commercial developments are known to have the potential of contributing salinity to the Colorado River System but a detailed study will be necessary for full evaluation. These sources could be a factor in increasing salinity which is already recognized to be high. Positive control measures for oil brines have been achieved in some cases and will need to be developed generally. A look to the future of oil shale development is also important because of possible dangers of salinity discharges if controls are inadequate.

Some significant sources of natural salinity occur in the state of Utah, such as LaVerkin Springs. While there is no current evidence of practical methods for control of natural sources, some continuing attention should be given this problem, particularly when it is recognized that the single source mentioned contributes some 300 tons of salinity to the receiving stream each day.

Recreational use of waters of the state is recognized as posing a particular problem. Increasing pressures for use of waters of the state for swimming will require special study in the future, because the "C" classification applied to most surface waters does not provide a bacterial standard low enough to insure adequate safety of swimmers. Studies now in progress indicate the possibility that some natural improvement of the bacterial quality of some waters, particularly impoundments, might permit development of swimming facilities in some areas, but this is by no means an automatic possibility and each situation will need special study on its own merits. One task yet to be accomplished is establishment of a positive limit for bacteria for areas devoted to swimming purposes.

It is anticipated that additional actions will be taken in the future to assign specific classifications from the newly modified standards to specific waters of the state. In the meantime, all ongoing pollution control actions as described, will be continued.

Continued cooperation, as in the past, of universities, water resource agencies, industries,and municipalities will be essential to success of the program.

POLLUTION-- ITS CONTROL AND PREVENTION

by

Elmo Morgan*

It is a pleasure to be on this campus again where I spent five years as a student, and in this State, where I spent 13 years of my professional career. The first 17 years of my life were spent just over the "hill" in the Bear Lake country. So, truly, this is coming back home for me. There have been a few changes, but it is still home.

Pollution -- its control and prevention -- are lively subjects for the industrial community today. I want to report that they are also lively subjects of considerable positive activity in the Department of the Interior.

I am glad to highlight the program as I see it now and to identify the areas which I believe you can aid us in our understanding of pollution and its elimination.

Many of you have been involved in waste management and water quality for a considerable time. For my part, I do not pretend to be as familiar as I would like to be with all the sophistications, and subtleties of the water quality business. Much of what I want to learn can come from the industrial community, and thus I am especially pleased to be with you at this Conference.

What is obvious to me at this stage is that we have a serious water pollution problem on our hands. And it takes its toll in varied ways. Every day the front pages of our newspapers carry accounts of degradation and destruction to our waters and shores and the natural life they support.

Here are just a few of the headlines that have startled me lately:

From the Washington Post, "Ash Pollutes Clinch River--Fish, Animals Wiped out"

From the Portland (Maine) Telegram, "Atlantic Salmon Faces Extinction"

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*Elmo Morgan is Deputy Assistant Secretary for Water Pollution Control, Department of the Interior.

"Feedlot Sludge Kills Again" reports the Kansas City (Missouri) Star.

The Sunday Tribune in Oakland, California, relates "Pollution Hurts Land Values"

The New Haven (Connecticut) Register tells of "Raw Sewage Reported on Streets, Beach"

And in the Rochester (New York) Times Union, "State Keeps Ban on Ontario Beach"

From the Philadelphia Inquirer, "Sulfuric Acid Pollutes Creek" and, "Mine Drainage, Oil Wastes Soil Allegheny River."

Many questions occur to me as I read these news accounts and see their results:

"Is it not better business to capture and use the sulphuric acid now dumped in our streams?"

"Does feedlot sludge have to go into the streams?"

"What causes the fishkills?"

"How did coal ash get into the streams or oil and sewage on the beaches?"

"By accident" you say.

Many of these incidents are not accidents, and nearly all of the remainder are preventable accidents.

The ecological horrors recounted by headlines, as many as there are, are only a part of the total damage from water pollution.

Subtle, but devastating, damage to the ecology--the steady filling in of estuaries, the breaking of the food chain, the poisoning and choking of Lake Erie and even Lake Tahoe--occurs not as a single, newsworthy incident. But the many steady and often unnoticed events are taking a very heavy toll on our society, on our economy now, and for future generations.

Who, then, is responsible for these ecological disasters? The cities tell me industry.

Industry says agriculture. Agriculture says mining, and the mining industry tells me power plants.

Pollution --A Definition

Before we can assess responsibility for the damage and sustain a proper clean-up, we must, in my judgment, first define pollution.

As with many of our present day problems that involve a wide spectrum of society, there are equally wide variations in what people think pollution is.

Pollution defined by those of the "Cold Trout Stream" school of thought is any addition that in any way changes waters from a pristine form. This school wants trout streams at any cost and even where none exist in nature.

At the other end of the spectrum is the "Open Sewer" school of thought. This school admits there is water pollution only when children contract hepatitis, or great masses of fish are wiped out and the pollution is so thick you can see it on the water. This group holds that nature is herself a polluter -- lakes age, streams silt up -- so what is wrong with expediting the process.

Both schools are unacceptable. All streams cannot be pristine, cold trout streams, nor can we condone their use as open and free sewers or sinks for disposal of any wastes.

I believe we should define our term "Pollution" as would a rational man, with no bias, or perhaps with every bias. Pollution so defined and abated should reflect the many demands a society places on its waters, providing the uses most beneficial to all, including recreation, agriculture, industrial and municipal water supply, transportation, fishing, and many more. Water should be of manageable quality today and be left to posterity in reasonable amounts and clean at a reasonable cost.

If all water interests of society are properly represented, a balance should be struck between our two extreme schools of thought--

between industry and fishing; between profits and perch. This balance should permit all activities to coexist and flourish.

It is the intention of the Department of the Interior that this balance of the many water demands of society should be represented by the water quality standards.

Water Quality Standards

Water quality standards are the heart of the national effort now under way to restore a damaged water environment and prevent damage in the future, thereby expanding the uses of our waters, and allowing future economic growth and well-being of our Nation. The Nation faces an enormous task in reversing the deterioration of its lakes, rivers, estuaries, and streams. It is a job which is essential to the future well-being of our country, and fortunately the President, the Congress, all levels of government and the American Public have shown an awareness and determination that this job be done.

The job will be neither easy nor cheap. All levels of government and industry will spend much more on pollution control in the years ahead to meet the standards currently being established under the Water Quality Act of 1965.

Since our resources will never be unlimited, we therefore have an obligation to obtain the most clean-up per expenditure of our resources--of funds, manpower, time, and facilities.

The water pollution control program is now at the stage where many goals for water quality have already been set through the states' establishment of water quality standards which determine whether a particular water resource will be used for purposes of industry, agriculture, municipal water supply, fish and wildlife, or outdoor recreation.

Water quality standards for all interstate waters were authorized by the Water Quality Act of 1965. Each state has now submitted water quality standards and a plan to implement and enforce the standards to the Secretary of the Interior as required by the law. Only the territory of Guam has not set such standards.

In formulating these water standards, the states were required to perform three enormous tasks:

1. Determine the uses of their water resources now and uses desired for the future. These had to be all uses--recreational, agricultural, industrial, and municipal.

2. Assess the present water quality and that needed to support each future desired use, and

3. Develop plans to achieve the quality of water necessary to support each use, including specific steps for municipalities and industry, a timetable of action, required enforcement provisions and financing arrangements.

Submitted standards are reviewed in our Federal Water Pollution Control Administration regional offices and in Washington and finally approved by the Secretary of the Interior as federal standards.

On July 14 the Secretary of the Interior approved complete standards for two states (Georgia and Indiana), partial standards for another two states (New York and Oregon) and found standards substantially satisfactory for three states (another part of New York, and all of South Dakota and Alabama).

The remainder of the states' standards are still under review. The process is a weighty one in terms of volume and importance of the work, for the standards, once set, will be the guidelines and goals of water quality.

The standards will vary from area to area, from river basin to river and even within a river, depending on uses; but if the job is done correctly, there will be a consistency, a compatibility and rationality to such variations.

No segment of industry should have an advantage over another segment because of its location on a river. We seek standards that will apply to all members of a particular industry equally, so that no longer will a company move its plant upstream or down, or from one state to another to avoid its responsibilities for clean waters. And no longer will one company be disadvantaged in the market place because it treats its wastes and prevents pollution.

The cleaner waters resulting from enforced water quality standards will benefit all of us.

Industry's Stake in Clean Water

Pollution control pays. It pays the fisherman in increased and better tasting harvests. It pays the city resident in lowered water costs and greater recreational opportunities. It pays the farmer in better crops and healthier animals.

But, I want to make it clear--from the standpoint of my long association with various segments of industry, and from my new vantage point in the Interior Department program--pollution control pays the industrialist, too.

Industry's stake in clean water is tremendous. The prosperity and expansion of industry depends on ever growing quantities of clean water. Indeed, water is the lifeblood of industry.

I am told it takes 18 barrels of water to refine a barrel of oil; 300 gallons of water to make a barrel of beer; 600 to 1,000 tons of water for each ton of coal burned in a steam-power plant; and 250 tons of water to produce a ton of paper. A large paper mill will need more water than a city of 50,000 people.

Our industries are expanding. Paperboard and paper production, for instance, has doubled in the past two decades and is now about 40 million tons a year.

And some of your processes are today requiring more water. It now takes 50 gallons of water to wash a case of canned fruit or vegetables, where it took half that much 20 years ago, before the advent of pesticides and insecticides.

Industry will require more and more clean water each year. But this water is a borrowed resource--borrowed from the store of rivers and lakes that belong to all of the people.

Very little of this water is actually consumed in the absolute sense. It is borrowed from a lake or river, and most of it is returned to that lake or river. But in what condition? That is the question.

All too often the returned volumes are polluted to one degree or another, thus in a sense, consuming water, in that the water becomes unfit for certain purposes--drinking, swimming, fishing, sometimes everything else, except navigation, perhaps. Some of our bodies of water are even judged "too thick to navigate and too thin to cultivate."

Industry is a substantial contributor to these conditions, along with cities, farms, mines, and run-offs. Just as industrial demands for clean water are growing, so is the industrial output of wastes, such as meat packing offal, sugar beet wastes, creameries whey, fruit and vegetable wastes and pesticides from canneries, oil from refineries, pulp sulfite liquors, and dyes and chemicals from textile mills, chemical residues, fatty and oily wastes from processes of bleaching cotton, flax, hemp and jute, acid, lime, oil and grease from steel companies, and heat from power plants, just to mention a few.

The municipal sewage problem is severe, but that of industrial organic wastes is becoming worse. Five years ago the Public Health Service reports, industrial plants were pouring out pollution at a rate equivalent to the domestic sewage from 160 million population. By 1970 this organic waste from manufacturing and processing plants is estimated to equal the domestic sewage from the entire U. S. population of 210 million.

Based on present growth, a seven-fold increase is predicted by 2000 in purely industrial wastes produced by large water-using industries. Residues are predicted to become even more variable in character and will contain oxygen-consuming ingredients as well as the complete range of industrial chemicals and heat.

The increasing demands for clean water are on a collision course with the projections for a decreasing supply of clean water. This is where water pollution control comes into the picture, for water quality is the other side of the coin of water supply. You cannot separate the two, for pollution and supply are both parts of the same water problem.

So while there are those among us who say that water pollution control is trying to put industry out of business, in fact, the real aim is to provide a climate of increased industrial options, where further expansion and prosperity are possible.

A Three-Step Policy for Water Quality

The national water quality program does not intend that America should become fatalistic about the projected increases in wastes, or about the projected increases in demands for water, for if realized, these projections may well outstrip our capacity to cope with them.

There are three basic principles, as I see it, that we would like to see industry and all other segments of society adopt. I do not pretend to have all the answers as to specific ways to implement these principles in various industries. This information you can supply and the Department of the Interior hopes to work with you.

The three-step policy I recommend to you for water quality is:

1. Minimize withdrawals of waters from our watercourses,

2. Maximize use of withdrawn water, and

3. Minimize discharge of polluting effluents back into those waterways.

Reduced water withdrawals keep concentrations of pollutants lower in our lakes and rivers. Just as industry should try to keep down withdrawals, so should agriculture and municipalities. We must also combine with your efforts to minimize withdrawals, techniques to augment supply--evaporation--control on waterways and reservoirs, and weather modifications, low-flow augmentation and desalting.

Maxium use by industry of its waters means reuse--the more effective treatment and imaginative use of waste waters. This increases the available supply of water to industry and offsets the cost of the waste treatment. More and more industries are intensively using their waters, and municipalities are finding uses for treated waste waters.

The minimized discharge contaminated effluents requires the treatment of wastes before they leave the plant and enter the common resources of the Nation's waters.

There are several techniques to implement this three-step policy --you will know and be exploring many more:

---Redesign industrial systems to reduce production of pollutants, such as chemical residues and heat, and reduce the amount of water required in the system.

---Modify industrial processes to treat wastes in each stage in the process and to recover valuable elements, found profitable with pulp and paper sulfites, for instance.

---Test more thoroughly the long-range effects of exotic new chemicals and control their use and disposal.

---Investigate and use non-polluting substances in your processes and products. For example, the soap and detergent industry, an industry with a responsible attitude toward clean water, has just established with the Department of the Interior a task force to study the whole problem to eutrophication, and possible replacements of phosphates in detergents, as one solution.

---Design and operate construction sites to prevent soil erosion.

The ideal of this three-step policy in action is the industrial closed-cycle, where waters once are used, treated and reused again and again. All industries do not lend themselves to this ideal, but each can work toward it as a goal.

The thread which runs through each step of this policy is the concept that prevention of wastes is better than treatment of wastes once they have reached the waterways.

In the national water pollution control effort, we are emphasizing the added advantages of preventive rather than treatment techniques for two basic reasons--economics and equity.

The Nation's economy, if it is going to expand and grow, as I have said before and wish to reiterate, must not be fatalistic about the predictions of waste increases. Waters with the predicted 208 billion gallons in them daily of industrial wastes alone in the year 2000 cannot support a healthy, water-demanding economy. An economy based, at least in part, on clean waters, cannot also be an economy of polluters.

It is more difficult, sometimes impossible to treat wastes once they get into the streams and lakes. Certainly it is more costly to the national economy to cleanse every gallon of polluted water than to prevent its addition in the first place.

Then, too, some effects of water pollution are irreversible--such as fishkills.

It is an economy of resources to capture valuable materials in industrial effluents, before they are emptied into our waters.

I might add that industry's best source of public relations can be to prevent its own contribution to water pollution, for Americans have become very sensitive--indeed, hostile --to polluted lakes and rivers.

Prevention rather than treatment of wastes is also a matter of equity. Wastes prevention places the cost of clean waters on the polluter. Clean water is not free, but in the past the cost has been borne by the public in the form of water treatment and closed beaches and fishing grounds.

In the past, polluters have been free to use, for their own benefit, the common resources of water--borrowed from the public's supply, as if those waters had no economic or aesthetic value for others in society. This is just the opposite of the more general rule of our economy--that users of resources must pay a price for their use which represents the value of those resources if they would be used elsewhere. By paying this price the user economizes on his use of the resources to the point that their value to him always equals or exceeds their value for other purposes.

This brings us to another argument for prevention. The technique of placing the cost of clean water on the polluter, also provides a very real incentive to effective and efficient water quality controls.

The prevention of wastes which contaminate the commonly held water resources should, we would hope, be a regular cost of doing business, just as using other resources are regular costs of business.

To reach the goal of making the greatest and highest use of our water resources, the Department of the Interior will aid industries in every way available to it.

The Federal Water Pollution Control Administration administers programs of grants to industry - totaling $20 million a year - to aid in finding improved ways to treat and prevent industrial wastes. The maximum federal share is 70 percent of project costs.

The Administration operates a research program of direct, contract and grant research, to develop more efficient and economic techniques and technology for water quality.

For those wastes which cannot be prevented by industry and must, therefore, be treated, joint treatment between industry and cities are a reasonable solution, often lowering the cost to each party.

The Federal Water Pollution Control Administration has a program of grants to municipalities for the construction of waste treatment plants. The program is authorized for $3.5 billion for a four-year period. The federal government can pay, without dollar ceilings and after approval by the state pollution control agencies, 30 to 55 percent of project costs.

Another program, of comprehensive planning for each river basin, is underway in the Federal Water Pollution Control Administration. The idea is to bring all affected parties in a river basin - both private and public - into the planning and control of pollution. We hope that industry will take an active role in this program and the solutions it will develop.

I want to encourage dialog between various industries and the Department of the Interior. Much of this has begun and I believe it proves beneficial to all parties. Let us know how our research, grants, and other programs may supplement your work for clean water, for this is a subject of interest to all of us. I can assure you that it is to the Department of the Interior--the department of natural resources--and certainly it should be to industry. For water is the lifeblood of industry.

STEPS IN SOLVING AN INDUSTRIAL WASTEWATER DISPOSAL PROBLEM

by

Franklin J. Agardy*

Introduction

The spectrum of industrial wastes is extremely broad. In the liquid waste field alone it is possible to range from a molasses waste, very high in carbohydrates, to acid mine drainage, high in sulfuric acid, to a metal finishing waste, high in cyanide, to an oil refinery waste, high in emulsified oil. Similarly, it is possible to be faced with a waste producer discharging continuously, such as with an oil refinery, to the extreme of a cannery waste where the discharge may vary by hour, day, week, and season.

The moral here is that each industrial discharger presents the engineer with an almost unique situation. Couple this with a need to consider the nature and condition of the receiving water, be it stream, lake, bay, or municipal sewer; the specific local, regional, and state water quality criteria; economic condition of the industry and local community, and one begins to realize the magnitude of even so simple an undertaking as the study of a single industrial discharger in a small community!

A final point deserves comment. This paper deals with the steps involved in solving an industrial wastewater problem, but as shown in Fig. 1, the entire waste generation capacity of the industry must be considered. A solution to the liquid waste problem is no solution at all, if it merely shifts the waste to the solid or gaseous phase.

Industry Evaluation

The first step in the solution of the problem must deal with a complete analysis of the type and source (s) of the waste. This "Characterization Profile" is outlined in Table 1. It must be recognized that the characterization includes a consideration of the receiving water as well as state, regional, and local water quality standards.

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Table 1. Characterization Profile.

CHARACTERIZATION
A. Industrial Waste Discharge (Individual Streams and Combined Effluent)
1. Volume/Time Variation
2. Physical Characteristics
3. Chemical Characteristics
4. Biological Characteristics
B. Receiving Water
1. Municipal Waste System
See "A" above
2. Lake, Stream, Bay, etc.
State, regional, and local water quality standards

The plant waste composition can take many forms as shown in Fig. 2. It is possible that only a small percentage of the total plant effluent carries a large portion of the plant waste. A detailed study of the in-plant liquid lines often leads to more efficient plant operation with the net result being both a monetary saving and a reduction in waste generation.

Similarly, it is necessary to determine the water flow profile and compare this to the domestic waste flow regimen. Examples of flow profiles are shown in Figs. 3 and 4. While these profiles are reported as normalized flow over a 24-hour period, it is also possible to plot variation in Biochemical Oxygen Demand, suspended solids, pH, etc.,

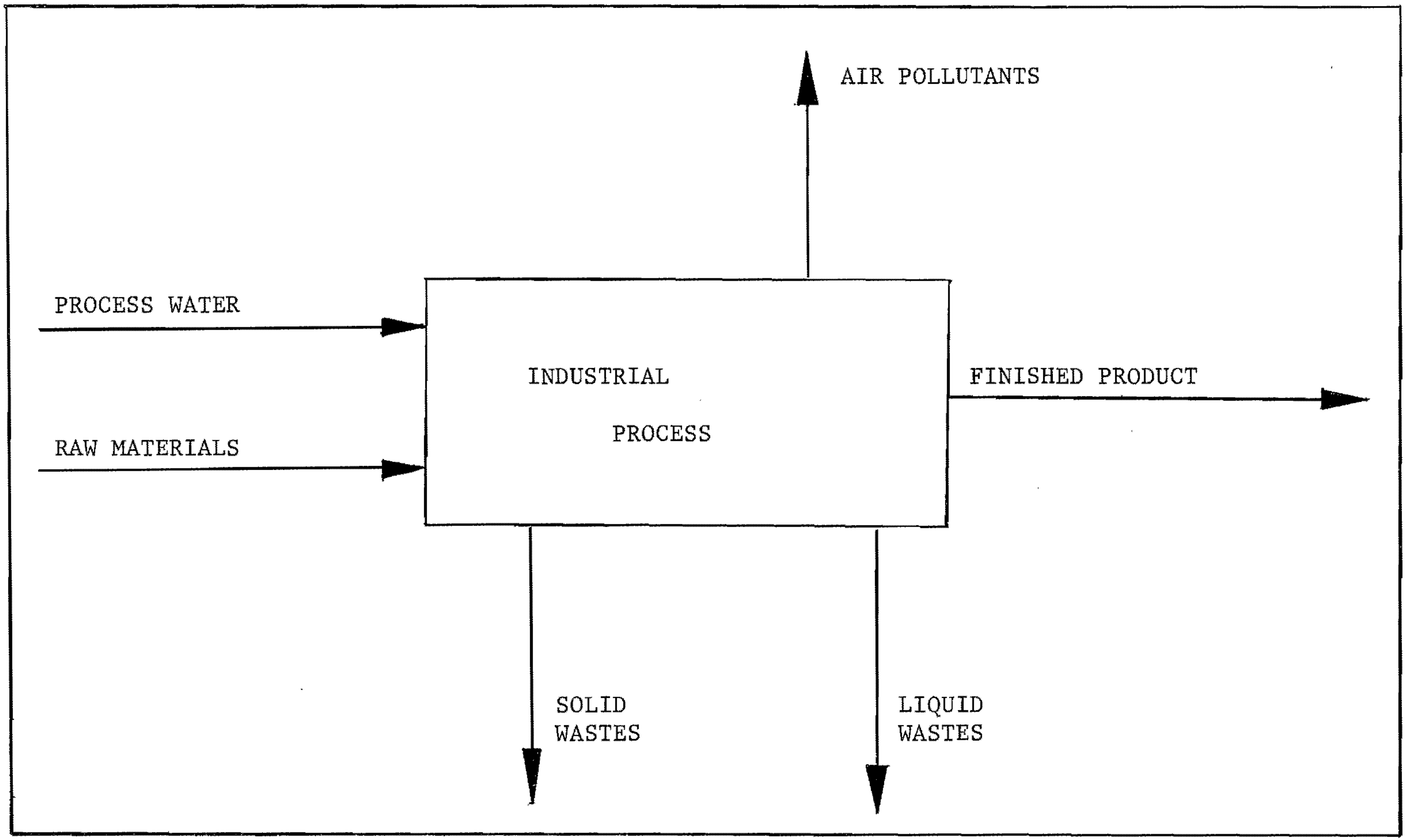

Fig. 1. Industrial process input-output model.

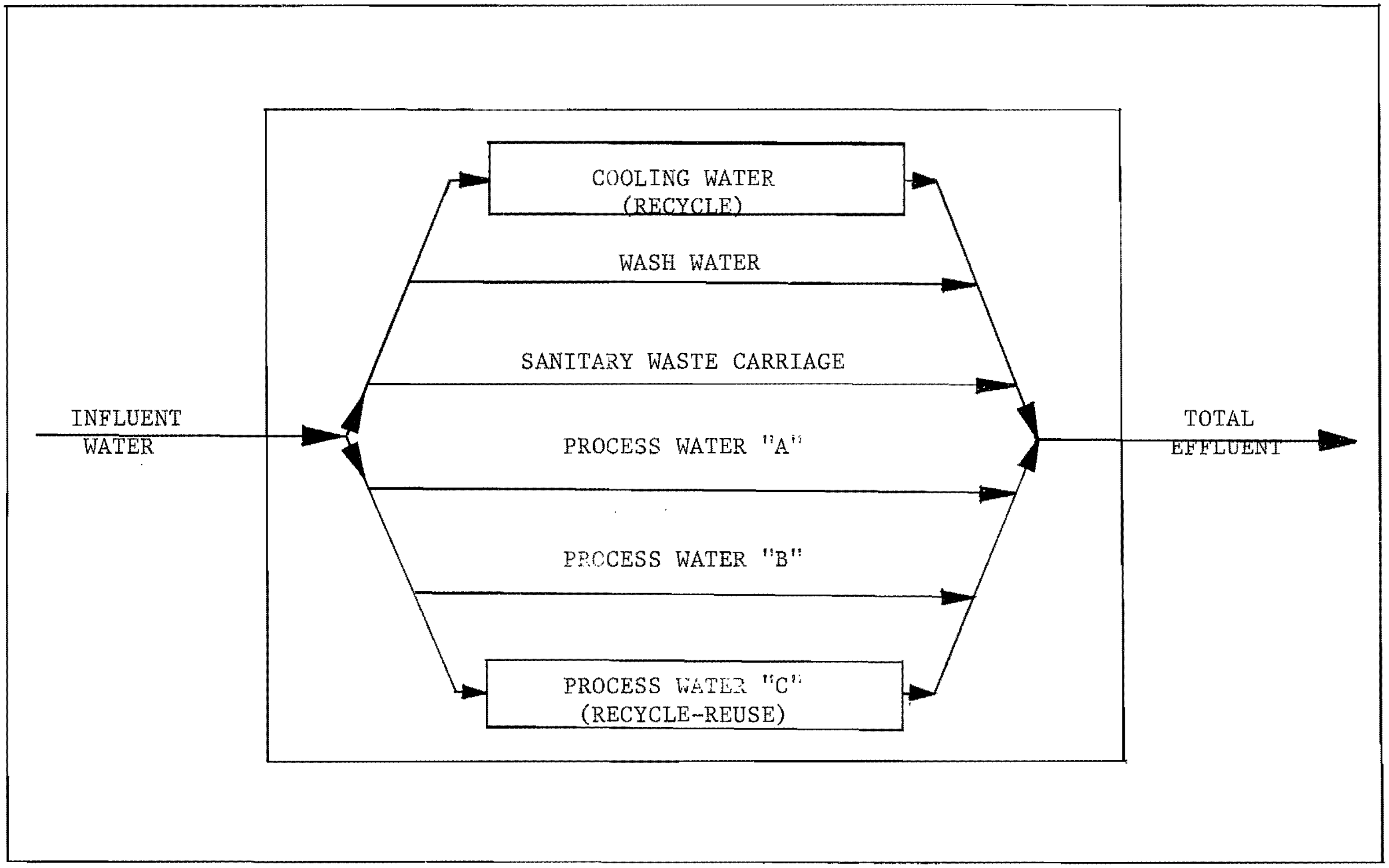

Fig. 2. In-plant liquid lines.

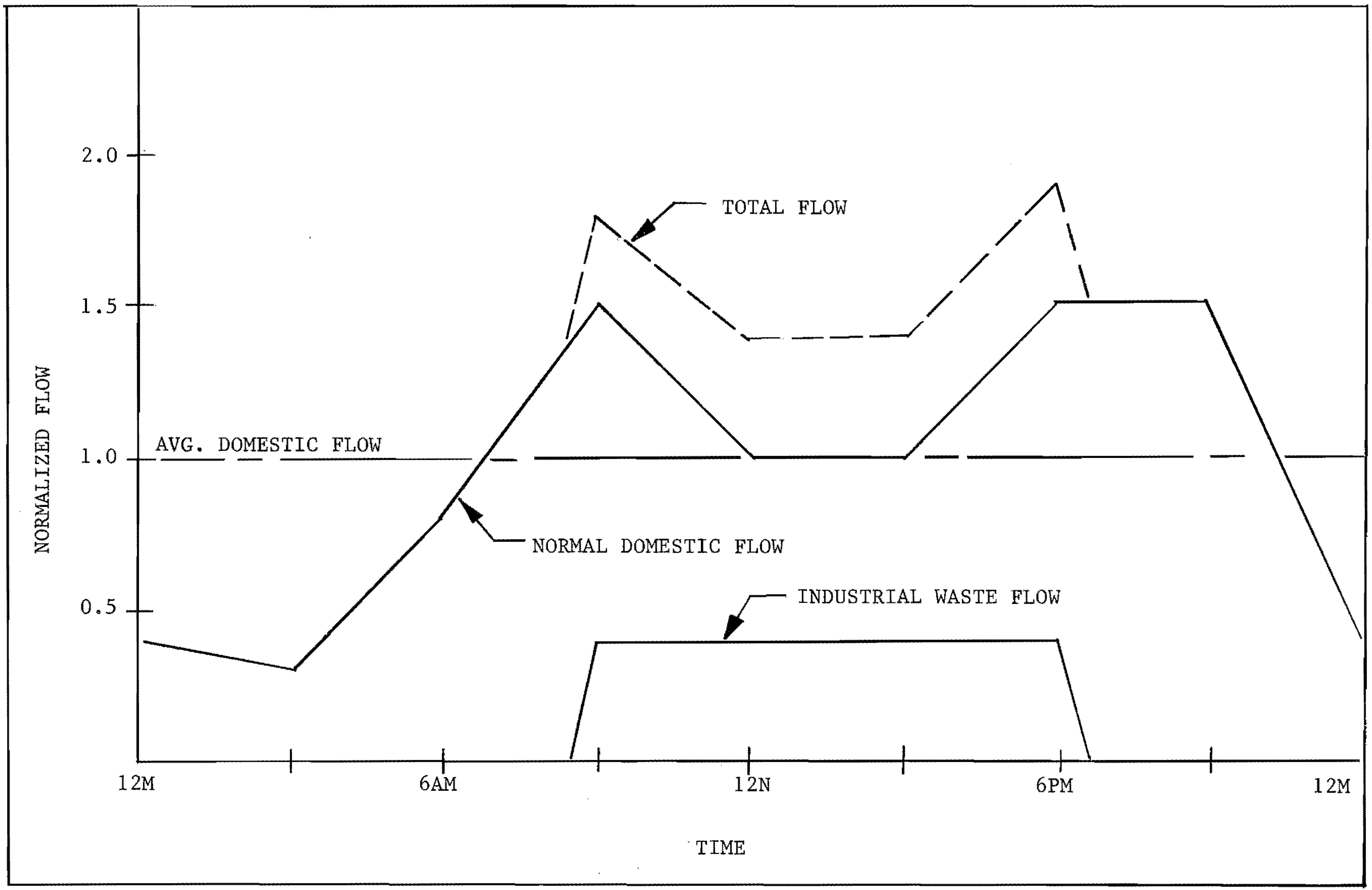

Fig. 3. Domestic waste/industrial waste flow profile.

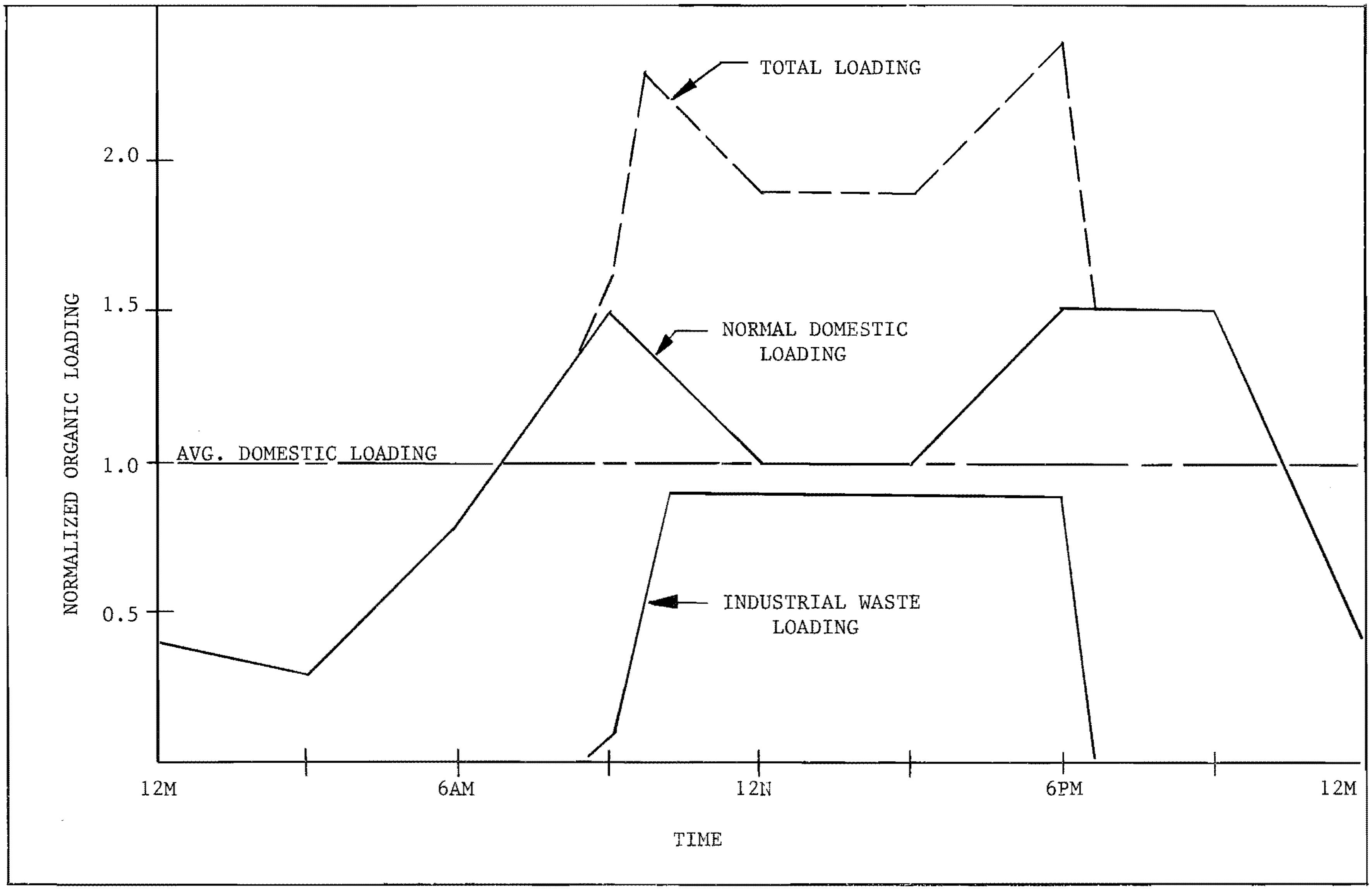

Fig. 4. Domestic waste/industrial waste organic loading profile.

against time variation in hours, days, weeks, or months. In the case of a cannery, these profiles would be critical both during the 24-hour period and during the months of canning operation.

Treatment Methods

An inventory of waste treatment methods is shown in Table 2.

Table 2. Inventory of Waste Treatment Methods.

TREATMENT METHODS

A. Industrial Waste Treatment

1. Inplant Water Reuse and Byproduct Recovery

2. Physical Methods
   - (a) Screening
   - (b) Sedimentation
   - (c) Floatation

3. Chemical Methods
   - (a) Coagulation and precipitation
   - (b) Chemical oxidation
   - (c) Neutralization

4. Biological Methods
   - (a) Aerobic biological contact
   - (b) Anaerobic biological contact

5. Combinations of 1 through 4

B. Industrial Waste and Municipal Waste

1. At Industry Site

2. At Municipal Plant

It should be stressed that the specific nature of the waste coupled with the character of the receiving water will often limit the selection of waste treatment methods. A waste containing primarily organic matter in suspension might require only sedimentation or chemical precipitation to satisfy a discharge requirement, while a waste high in phenol might best be treated by biological oxidation or adsorption by activated carbon. A non-specific waste containing many pollutional constituents will usually require treatment by several operations and processes. Fig. 5 summarizes many series of operations which might be employed in waste treatment.

Study Development

Having a knowledge of the character of the waste and the receiving water requirements, it is possible to view the steps comprising the study development. These are shown in Table 3.

Table 3. Outline of a Comprehensive Industrial Waste Investigation.

STUDY DEVELOPMENT	
I.	Industrial Waste Characteristics
II.	Municipal Waste/Receiving Water Characteristics
III.	Water Quality Standards
IV.	Bench Scale (Laboratory) Alternate Treatment Scheme Studies
V.	Pilot Scale (Field) Evaluation of One or More Treatment Schemes
VI.	Cost/Efficiency Relationships
VII.	Prototype Facility

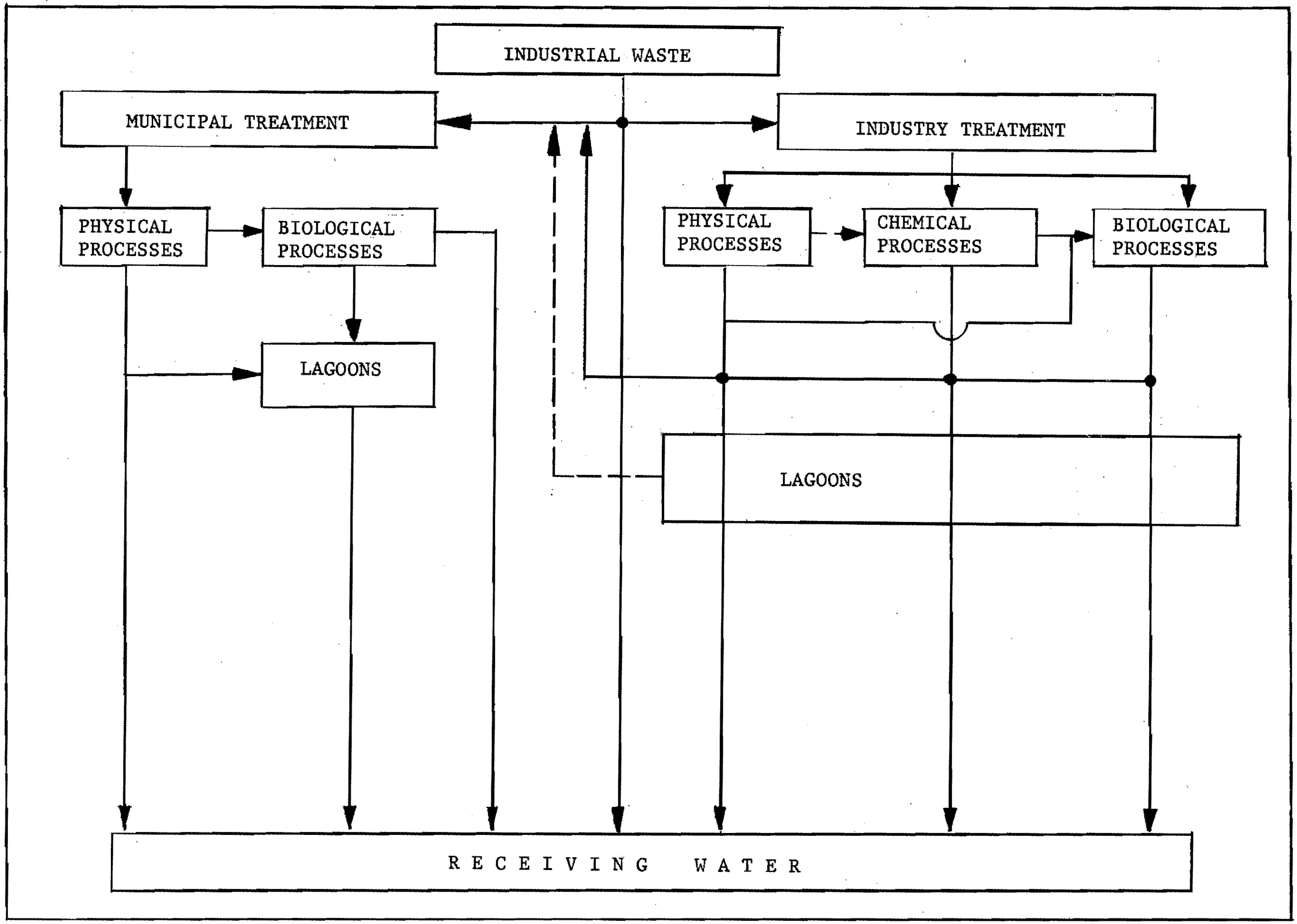

Fig. 5. Industrial waste treatment/disposal.

Generally, the more complete the in-plant characterization is, the more easily one can decide on specific bench scale or field scale studies. Comprehensive biodegradability studies cannot be overstressed. The oxygen utilization rate of both acclimatized and unacclimatized bacteria will point the way to the most efficient biological treatment schemes if the waste is primarily organic in nature.

Cost/Efficiency Relationships

The final step consists of evaluating the waste treatment scheme(s) in terms of least cost-maximum benefit. Table 4 lists alternates such as on-site treatment, proportional discharge and combined treatment. The selection of a final scheme should take into account (a) capital cost, (b) operating cost (s), (c) change in sewer service charges if any, and (d) flexibility of facility to adapt to changing codes.

Table 4. Cost/Efficiency Relationships for Alternate Treatment Schemes.

COST / EFFICIENCY RELATIONSHIPS

A. On-Site Treatment

1. Specific Waste Streams
2. Total Effluent
3. Pretreatment Only
4. Mix with Municipal Waste and Treat

B. On-Site Holding With Proportional Flow Discharge

C. Discharge to Municipal Sewer for Combined Treatment by Municipality

Summary

The steps in the solution of an industrial waste problem have been detailed in the previous sections. It is clear that the engineer must possess or avail himself of the following capabilities:

(a) Knowledge of the industry and the specifics of the processes.

(b) Appreciation of the physics, chemistry, biochemistry, and hydraulics of waste analysis and treatment.

(c) Knowledge of water quality criteria both static and dynamic.

(d) Ability to economically analyze alternate schemes of treatment.

(e) A keen appreciation of the flexibility which a good treatment scheme must possess.

JOINT TREATMENT OF INDUSTRIAL AND MUNICIPAL WASTES

by

R. E. Pailthorp*

Introduction

Joint treatment refers to a collection and treatment system which will serve industrial, domestic, and commercial users in a community; which will be paid for by those users; and that is constructed and operated by a public body. Joint treatment systems have the potential for providing the most economical treatment for an entire community and can therefore result in the least demand on the national economy for pollution control. Recent increases in State and Federal aid for the construction of publicly-owned treatment systems and the demand for added waste treatment will result in a great increase in the use of joint treatment facilities by industry.

Joint treatment requires that a group of users with differing interests work together. Essential componets for the success of the joint treatment approach are:

Incentive
Cooperation
Understanding (knowledge)
A plan for treatment which will meet the users requirements
A logical rate structure
A sewer use ordinance (with flexibility)
Agreement
Time

This paper presents the factors which at present favor and limit joint treatment, a logical approach to a rate structure, and the reasons for a sewer use ordinance.

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Factors Favoring Joint Treatment

Most of the considerations which favor joint treatment have been discussed in detail in the articles which are referenced at the end of this paper. These considerations may be favorable to both industry and the public in some cases, and in other cases will be favorable to only one of these segments of the community.

An outline of these considerations follows:

A. Technical Considerations

1. Nutrients required for some industrial wastes. Excess phosphorous and nitrogen are available in domestic sewage.

2. Reduced effects of slug discharges of wastes.

3. Dilution of toxic compounds to below threshold concentrations.

4. Biological systems maintained in operation at all times and are ready to accept instantaneous loads.

5. Well qualified operators can be provided.

B. Financial Considerations

1. Federal aid--30 percent to 55 percent

2. State aid--0 percent to 25 percent.

3. Industry would pay property tax on privately owned system.

4. Lower cost of money--3 1/2 to 4 1/2 percent interest rates for a 20 to 25 year period available to public bodies.

5. Lower operating costs.

6. Usually no capital investment required by industry.

7. Unit cost for construction of larger systems less than for smaller individual systems.

C. General Considerations

1. Industry does not have to maintain a person trained in waste treatment on their staff.

2. Minimum of administrative time required by industry.

3. Regulatory agency looks to public body for planning, construction, financing, and operation.

4. Space not required on industrial site.

5. Possible public realtions problems resulting from waste treatment are averted.

6. Remote treatment makes additional industrial locations available within the City.

7. The availability of industrial treatment facilities can be used to attract industry to a community.

Limits of Joint Treatment

Limited Treatment Capabilities. Municipal collection and treatment systems are most often designed to treat primarily domestic wastes. These plants can accept only wastes which are compatible to the processes used in these normal treatment systems. If it is possible to plan for specific industrial wastes and if the industries take part in planning for a joint treatment system, the capabilities of a treatment system can be expanded and specific limitations minimized.

Product Recovery. It is normally not possible to recover a saleable product at the municipal sewage treatment plant because of contamination with biological organisms and with suspended and dissolved solids of the municipal sewage. Product recovery for financial return must normally be done by the industry. It would, however, be possible for a public agency to provide a pretreatment plant which could recover and market a product. This would have an advantage to the industry if the income from the by-product sale did not result in a favorable investment for the industry.

System Damage. Industrial wastes may cause problems in sewers, sewage treatment plant, or stream. Such items as oil, foam, flammable compounds, and toxic wastes can normally not be tolerated in a municipal system.

Treatment Methods Limited. Extremely economical systems can often be provided for specific types of industrial wastes because of their particular characteristics. These, in most cases, can only be practiced in separate systems and cannot be used if several wastes are combined. It is possible for a public body to provide specific types of treatment plants for several industrial wastes separate from the domestic and commercial waste treatment facility. Examples of specific treatment methods used by industries are anaerobic treatment of meat packing wastes, deep well injection for salts or toxic wastes, and irrigation for organic wastes such as cannery and paper mill effluents.

Pretreatment. Industrial wastes must usually be pretreated to remove large solids, grit, oil, grease, and toxic wastes.

Location. The industry must be in the vicinity or inside the boundaries of a public body.

Expansion Limited. A public treatment system can usually not be expanded fast enough to meet the increasing needs of a dynamic industry. Advance planning by industry and the public body are extremely important to overcome this limitation..

Possible Treatment Systems

Joint treatment is normally construed to mean the physical combination of all wastes and common treatment units at one site. However, joint treatment can also apply to a publicly owned and operated treatment facility which would treat only the waste from several industries in common units or a series of separate units which were separately and specifically designed to treat industrial wastes. Public bodies such as municipalities, port districts, sanitary districts, and counties, could provide such a service.

A facility could be specifically designed so that little or no pretreatment by industry would be required. In a plant designed to treat specific industrial wastes, all types of wastes could be accepted including wastes from chemical plants, metal processing plants, petroleum plants, and canneries. The extent to which this approach is carried would be largely dependent upon the request of industry and the willingness of the public body to provide service.

Treatment units can be designed to fit widely variable situations. Industries that have a chance to take part in the planning for a treatment system should attempt to influence the design so that it will be favorable to their requirements. This does not mean to imply that the industry must become involved in the intimate details of design, but they should make the public agency aware of their specific needs.

Rate Structure

Joint treatment implies joint financing. A logical and equitable rate structure must be used to distribute the capital costs and operating and maintenance costs to the users if joint financing is to be successful.

Nearly everyone agrees that service should be paid for in proportion to benefit. After agreement is obtained on this simple approach, the hard work begins and judgment must be applied. Both capital costs and operating and maintenance cost can be distributed to several users based on measurements of flow, BOD, and suspended solids, since these three characteristics of sewage and industrial wastes determine the size of individual units within the treatment plant. By applying the necessary mathematics to the waste loads discharged from each industry and to the cost for providing the treatment units and operating them, a logical and equitable rate can be calculated for each user. This system of charging is outlined in great detail in the joint report published in the Ohio State Law Journal, which is referenced at the end of this paper. This approach is not perfect. It is, however, logical and approaches equity. The method is being used, with suitable modifications, in several cities in the West.

To demonstrate how this approach can be used, the following example is presented. To make the example simple, several assumptions must be made. These are as follows:

1. A conventional trickling filter, secondary treatment plant used.

2. Domestic, commercial, and industrial users are connected to the system.

3. Characteristics of the plant load are as follows:

Characteristic	% Industrial	% Domestic and Commercial
Flow, mgd	50	50
BOD, lbs/day	75	25
Suspended Solids, lbs/day	30	70

4. The plant is designed for the exact load which it received. That is, there is no reserve capacity and no overload.

5. Industry discharges the same quantity and quality of waste all year, each day.

6. All wastes receive equal treatment in each treatment unit.

7. No storm flow or infiltration enters the treatment plant.

Fig. 1 is a schematic diagram of a conventional treatment plant which can be used for reference. The required steps for arriving at a final cost are to (1) separate the plant into distinct units, (2) determine which component of the waste the unit is designed for, (3) determine the total cost of each unit, and (4) determine the portion of the unit which industry should pay for based on their flow, BOD, or suspended solids discharge.

Table 1 shows a cost distribution for a plant. In this example the load from all industrial users is treated as though it were from a single industry. The division to each industrial user can be made by simply dividing the industrial load into individual components. Table 1 also presents the effect of 75 percent and 30 percent aid programs. Determining the individual industrial loads is much more difficult than applying the resultant numbers to the treatment unit cost to determine service charges. Anyone who has had experience in sampling and testing industrial wastes can envision some of the difficulties which would

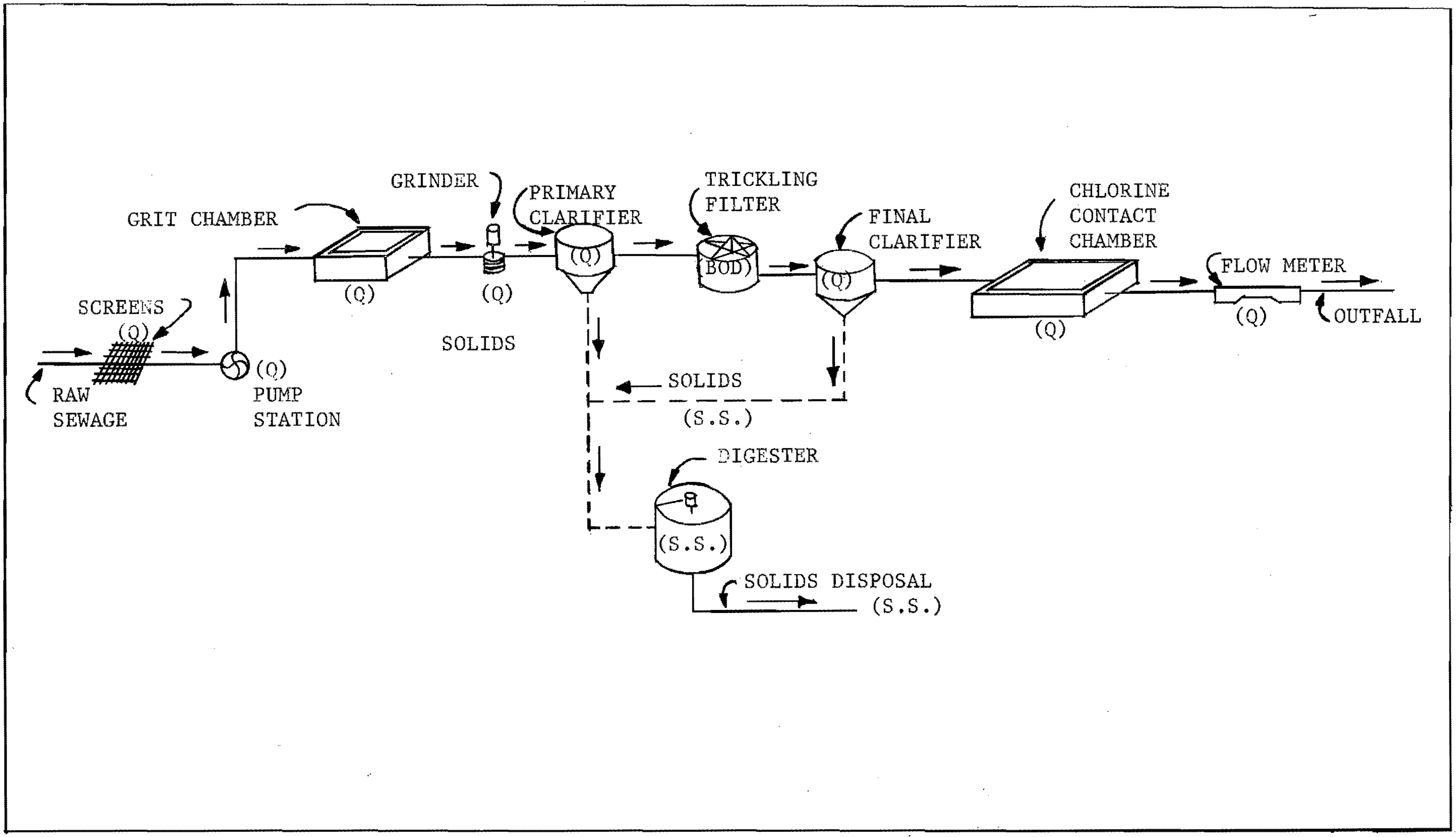

Fig. 1. Treatment plant.

TABLE 1. COST DISTRIBUTION

Unit	Principal sewage for which designed	Total cost of unit	Cost for Flow	Cost for BOD	Cost for S.S.
Bar Screen	Flow	$ 20,000	$ 20,000		
Pump Station	Flow	60,000	60,000		
Grit Chamber	Flow	20,000	20,000		
Grinders	Flow	20,000	20,000		
Primary Clarifier	Flow	100,000	100,000		
Trickling Filter	BOD	200,000		$200,000	
Secondary Clarifier	Flow	100,000	100,000		
Chlorine Contact Chamber	Flow	40,000	40,000		
Sewage Piping	Flow	20,000	20,000		
Sludge Piping	Suspended solids	20,000			$ 20,000
Digesters	S. S.	100,000			100,000
Sludge Disposal System	S. S.	60,000			60,000
TOTAL		$760,000			
TOTAL			$380,000	$200,000	$180,000
% to Industry			50%	75%	30%
Capital Investment for Industry			$190,000	$150,000	$ 54,000
SUBTOTAL			$394,000		
Less 75% Aid			$295,500	less 30% aid	$118,200
City Cost Applied to Industrial Rates			$ 98,500		$275,800
25 Year Bond at 4% Annual Amortization Cost			$ 6,300		$ 17,680

arise in determining a single number which can be used to represent the industrial load.

In addition to capital costs, operating and maintenance costs must be proportioned to each user. Table 2 is a hypothetical case which demonstrates a method for distributing these costs to each classification of user.

From the totals in Table 1 it can be computed that 50 percent of the total plant costs were attributable to units for flow, 25 percent attributable to units for BOD, and 24 percent attributable to units for suspended solids. These proportions can be used in allocating operation and maintenance costs for such items as labor, equipment repair, and supplies. Some of the plant costs are, of course, directly attributable to a single component of the sewage flow. A detailed knowledge of the plant and its operation is necessary to make a logical allocation of these costs. The plant personnel must keep accurate records of their costs and separate them into divisions which can be used for proportionment.

In this example, the annual operation and maintenance costs attributed to industry would be $26,500.

The total annual cost to industry would then be as follows:

With 30 percent aid	O & M Cost	$26,500
	Capital Cost	17,680
	Annual Cost	$44,180
With 75 percent aid	O & M Cost	$26,500
	Capital Cost	6,300
	Annual Cost	$32,800

Discussion of Rate Structure

The example presented was approached from the standpoint of computing the industrial portion of the charges. The charges not paid for by industry would be supported by charges to domestic and commercial users.

TABLE 2. O. AND M. COSTS

Item	Cost	Flow %	Flow $	BOD %	BOD $	Suspended Solids %	Suspended Solids $
Labor	$29,000	50	$14,500	26	$ 7,500	24	$7,000
Equipment Repair	3,000	50	1,500	26	780	24	720
Chlorine	4,000	100	4,000				
Power	10,000	45	4,500	50	5,000	5	500
Supplies	3,000	50	1,500	26	780	24	720
Sludge disposal	1,000					100	1,000
TOTAL	$50,000		$26,000		$14,060		$9,940
		50%	$13,000	75%	$10,500	30%	$3,000
Industry's Portion →					$26,500		

The operating costs may be a large portion of the total yearly cost, as they are in this example. This points out that the way to minimize sewer service charges may be to design a plant for minimum maintenance, perhaps even at the expense of greater first cost. Federal and State taxes would have to increase, of course, to support the increased cost of aid programs. The overall best solution from a national point of view may not be served by an economic comparison which includes the effects of State and Federal aid; however, from the standpoint of a public body, at the local level it is difficult to assess the actual effect of aid programs on the individual taxpayer. Therefore, the decision for a particular waste treatment approach is based on the least yearly cost to the public body without considering the side effects of increased taxes to support Federal and State aid programs.

It is important that the industrial rates reflect the actual cost for service so that each industry can weigh the economics of providing separate treatment and so that income to the public body will be adequate to provide the necessary facilities. A user may discover or provide a loophole in the rate structure which would make it possible for the user to obtain additional service without equitable payment. The eventual result will be that the facility will fail to provide adequate treatment.

The assumptions which were made at the beginning of the example simplify the presentation considerably compared to actual practice. The following is a list of actual factors which must be considered. These will not be discussed in detail; however, they have been considered in actual situations and suitable answers have been applied in particular situations which make the rate distribution acceptable and equitable.

1. Reserve capacity will be provided in most treatment facilities and it must be financed by some or all users.

2. The rate structure must be adjusted when the plant treats waste beyond its design capacity.

3. The rate must be applied to industries which operate for only a few weeks each year.

4. An industry discontinues use of the system after the City has invested capital for providing treatment.

5. Industry wants to expand beyond the treatment plant capacity.

6. The bonds have been retired for the initial investment.

7. Additional units must be constructed to treat the waste before the bonds for the original construction have been retired.

8. The sum of the individual measured loads is greater or less than the total load measured at the sewage treatment plant.

9. Some costs are not directly the result of flow, BOD, or suspended solids. These would be such costs as for fence, lawn, roads, office, furniture, repair shop, tools, etc.

10. It must be decided who will own and operate flow measurement and sampling stations at individual industries.

11. A portion of the plant units may be provided for infiltration flows caused by irrigation or storm water.

12. A definition must be established which defines an industrial waste discharge.

13. All wastes are not treated equally in individual treatment units.

Sewer Ordinance

A public body must adopt a sewer ordinance to control unusual wastes which may injure workmen, damage sewers, cause unusual maintenance, interfere with treatment, or cause problems in a receiving stream.

Most ordinances are more restrictive than actually necessary because of the need to cover all situations. A "flexibility" clause is normally contained in an ordinance which would allow it to be changed to relax for specific cases. Even if the ordinance does not include this flexibility, it is often available by specific requests to the public agency.

General Discussion

Joint treatment is becoming more common. This is true because of inherent economies, financial aid from government for publicly-owned systems, and increased requirements for treatment of industrial wastes. Joint treatment may offer advantages to all classes of users. Industry and public bodies should be ready to consider the joint treatment approach and should be aware of the necessary elements for success.

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FEDERAL INCENTIVES FOR THE CONSTRUCTION OF INDUSTRIAL WASTE-WATER TREATMENT FACILITIES AND PROGRAMS FOR INDUSTRIAL WASTE-WATER TREATMENT RESEARCH AND DEMONSTRATION GRANTS

by

John C. Merrell, Jr.*

To a prairie farm boy from the Midwest, Utah State University in beautiful Cache Valley, with its surrounding mountains, enjoys an idyllic setting. I saw it as such in my previous visits and it still looks that way to me today. In 1963, I attended an Interagency meeting in this same location and am today reminded of a picnic up Logan Canyon with several members of that group. One member is now Director of Cornell University's Water Research Laboratory in the State of New York. Recently he made an interesting presentation of all of the changes in the Federal water pollution control acts and laws in the Journal of the American Water Works Association. In it he shows the increasing Federal interest in the control of both municipal and industrial waste pollution. Water quality degradation by industrial wastes can certainly be reversed or diminished by several new aspects of the Federal program.

This discussion will follow closely my assigned topic and will thus be divided basically into two parts. First, the Federal incentives, and second, programs for waste-water treatment research and grants as related to industry's water pollution control effort.

Many of us currently note a changing attitude in industry tending to overcome its previous over-reaction against any control of industrial waste to a more cooperative attitude that we should continue to encourage. One sees this change in such things as industry's sponsorship on TV of attractive clean-water programs and in many public statements by industry representatives.

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Twenty-three years ago at the first Purdue Industrial Waste Conference, William Rudolfs said, "The production of waste should be considered an integral part of the manufacturing processes and the cost of treatment of industrial wastes must, therefore, be charged against the product." In 1946, again at the Purdue Conference, George E. Symons said, "Industry must also accept waste treatment as a legitimate production cost in order that the natural resources of this country may be handed on to posterity undamaged and undestroyed. In the long run the future wealth of the country's natural resources depends on what we do with industrial wastes today and tomorrow."

The Federal Water Pollution Control Administration's Assistant Commissioner for Research and Development reminded the latest Purdue Industrial Waste Conference of these quotations. How many of these statements, he asked, are we still making today? A lot of water has been cycled through our environment since Rudolfs and Symons documented their views; yet the flow of wastes to our waterways has increased steadily in quantity and potency to the detriment of the nation's water quality.

Today, we find industry saying, "To those who say they cannot afford to take effective anti-pollution measures, I can only respond that they can't afford not to." This is a quote from M. A. Wright, President of the U. S. Chamber of Commerce, before the Houston Chamber on December 6, 1966. In his address "Air and Water: A Time for Decision" Mr. Wright went on to say, "The best solution to the problem of restoring and maintaining the quality of our air and water lies in a well-coordinated, community-wide effort. No single segment of society is capable of accomplishing the job that lies ahead," and further, "If the pollution problem is to be solved, and it must be, it is imperative that more state and local governments play an active role. In most cases, the problem is a local responsibility, and we should see that it remains such."

We could interpret Mr. Wright's remarks to mean we have to treat all of our wastes from both industry and municipality; that this problem can best be accomplished by joint action at the local level. The entire Federal water pollution control program is committed to doing this by helping all segments of society in a do-it-yourself local responsibility approach. Congress has authorized various research, demonstration, and construction grants, and created a period for the setting of interstate water quality standards by the States. Hopefully, this will encourage standards setting for all state waters as well. The commitments for Federal grants are to be expanded, again with local control. The intent appears to be to let the water quality standards and other state programs create a demand for the grant dollars and other incentives available through the Federal program.

The Federal incentives are both direct and indirect as they affect industry's installation of water pollution control facilities. The direct category includes a 7 percent investment tax credit which industry can claim for certain water pollution control facilities. During a recent period when P. L. 89-800 suspended this investment tax credit generally, investment in water and air pollution control facilities was exempted. Additional direct Federal incentives may be voted for industrial pollution abatement, since there is continued interest in Congress in this direction. During the 20 years following 1945 an average of three bills a year were introduced into Congress proposing various forms of tax incentives for industrial pollution abatement. During the first session of the 89th Congress (1965) there were 19 such bills; in the first six months of the second session (1966), 24 bills.

Many industries discharge their wastes to municipal sewerage systems. Thus they benefit indirectly from the Federal program which provides construction grants to municipalities for waste treatment facilities. The use of the municipal system by industry is certainly in accord with the philosophy of cooperative State and local action. This program of construction grants is available now and is being expanded. The indirect benefits to industry can be further increased by State participation in construction programs. Benefits are such that many industries would do well to discharge their wastes to municipal systems rather than delay constructing their own waste treatment facilities pending further tax or depreciation advantages.

P. L. 89-800 places some limitations on the water pollution control facilities that were exempted from the 7 percent investment suspension placed on certain other real properties. Although newer legislation has since restored the investment credit, the suspension period included Oct. 10, 1966, through March 9, 1967. The pertinent language of P. L. 89-800 under Water and Air Pollution Control Facilities, in subparagraph (A) states:

> "Any water pollution control facility or air pollution control facility shall be treated as property which is not suspension period property."

For purposes of subparagraph (A), the term 'water pollution control facility' means any property which (1) is used primarily to control water pollution by removing, altering, or disposing of wastes, including the necessary intercepting sewers, outfall sewers, pumping, power, and other equipment, and their appurtenances; and (2) is certified by the State water pollution control agency (as defined in section 13(a)of the Federal Water Pollution Control Act) as conforming to the State program or requirements for control of water pollution, and is certified by the Secretary of the Interior as being in compliance with the applicable regulations of Federal agencies and the general policies of the United States for cooperation with the States in the prevention and abatement of water pollution under the Federal Water Pollution Control Act. Under Standards for Facility, subparagraph (A) shall apply in the case of any facility only if the taxpayer constructs, reconstructs, erects, or acquires such facility in furtherance of Federal, State, or local standards for the control of water pollution or atmospheric pollution or contaminants.

It is apparent that the Federal program is designed to help the State program and State or local water quality standards. Notice of proposed rule-making pursuant to this provision of the law as applied to water pollution control facilities was published in the Federal Register of February 1, 1967. The proposed regulations require certification by the Secretary of the Interior that a facility is in compliance with the appropriate regulations of Federal agencies and the general policies of the United States for cooperation with the States in the prevention and abatement of water pollution under the Federal Water Pollution Control Act. In determining such compliance, the Secretary is to consider "whether such facility is consistent with and meets the requirements of:

(1) Water quality standards and plan of implementation and enforcement establishment pursuant to section 10(c) of the Federal Act;

(2) Recommendations issued pursuant to section 10 (e) and (f) of the Federal Act;

(3) State water pollution control programs established pursuant to section 7 of the Federal Act and regulations under Subpart A, Part 601 of this chapter;

(4) Comprehensive water pollution control programs established pursuant to section 3 of the Federal Act;

(5) Guidelines for Establishing Water Quality Standards for Interstate Waters issued by the Federal Water Pollution Control Administration of the Department of the Interior, May 1966;

(6) General Standards applicable to Federal facilities as set forth in section 4, Executive Order 11288;

(7) State, interstate, and local standards and requirements for the prevention, control, and abatement of water pollution."

It is easy to understand that the intent of tax incentives is to improve and enhance water quality in accord with the water quality standards program. It should not be hard to realize that the establishment of a lax water quality standard will not give much incentive to provide treatment or to gain tax advantages therefrom. Whereas, a uniform water quality standard, established on interstate water in accord with the guidelines and intent of the Federal program, will provide these advantages. This indirect water quality standards approach should be an incentive to States as well as industrial waste dischargers to utilize good, high quality standards for intrastate waters to take advantage of these tax incentives.

While Congress has accepted the philosophy of using investment tax credit, it has not gone along with giving other tax incentives by the use of accelerated depreciation or so-called "fast tax write-offs." There is obvious resistance to such programs by those concerned with the Federal budget processes, although the investment tax credit is usually harder on Federal revenues than the fast tax write-off. Also, certain industries which have, through the years supplied their own treatment or closed-cycle systems to reduce water pollution, would not be likely to favor these special advantages for their sister industries. Tax preferences discriminate in favor of prosperous companies, discourage efficient water management, and work an injustice on companies that faced up to their waste disposal problem without waiting for financial aid.

The same restrictions on Federal help would likely apply to accelerated depreciation because bills proposed in Congress generally carry the following two limitations: (1) They disallow incentive tax credit and accelerated depreciation on any equipment which contributes or adds to a company's profits. Such exclusions presented few problems when treatment plants were the total consideration. With present emphasis on in-plant changes and closed systems, it will be more difficult to recognize whether "any facility, structure, or equipment which is constructed, erected, installed, or acquired primarily to control water pollution" contributes to profits. (2) The proposals require certification that the water pollution control facility is in conformity with the State program or State requirements for control of water pollution and is in compliance with the applicable regulations of Federal agencies. Some proposals require certification only by the State water pollution control agency. Other bills call also for certification by a Federal agency or certifying authority (usually the Secretary of the Interior).

Fortune magazine recently discussed and analyzed industry's control of both air and water pollution control. This magazine takes the view that industry should supply its own controls and supply them now, without question and without asking for special tax advantages. The reasoning is that applying these controls out of the cost of the product is less difficult and more generally fair between industries than utilizing tax incentives or fast tax write-offs.

In evaluating industrial incentives for water pollution control, the Secretary of the Interior is required by Section 18 of the Federal Water Pollution Control Act to conduct a study of methods for providing incentives to assist industry in the construction of water pollution control facilities. The study is to include, but not be limited to, possible use of tax incentives as well as other financial assistance. The Secretary is to consult with the Secretary of the Treasury and other appropriate Federal officers and report results to the Congress, with recommendations, by January 30, 1968.

In light of the developing viewpoints, one cannot predict the changes that will come, but the Federal construction grant is now available indirectly for industries whose wastes are amenable to treatment in municipal waste systems designed to accept industrial waste. This is a currently active program for sewage treatment plant construction grants to municipalities. During 1966 the Federal Water Pollution Control Administration awarded $125,000,000 to 791 communities to help finance $623,000,000 worth of waste treatment facilities. This program give grants of 30 percent up to $1,200,000 until July 1, 1967. On and after July 1, the dollar limitations were removed and the Federal grant now may be 40 percent if the State also contributes at least 30 percent, and 50 percent if the State also contributes 25 percent and the project is in conformity with enforceable water quality standards. In metropolitan areas the grant may be increased by another 10 percent, If the project is in conformity with a comprehensive metropolitan plan. Grantees are required to pay all costs not covered by the Federal grant and to assure proper and efficient operation of the treatment works after completion.

The Act authorizes grants to any State, municipality, or intermunicipal or interstate agency for the construction of necessary waste treatment works. A municipality is defined in the Act to mean any city, town, borough, county, parish, district, or other public body created by or pursuant to State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes, and an Indian tribe or an authorized Indian tribal organization.

The construction grants program is administered in cooperation with the State water pollution control agencies. Application forms are obtained from the State agencies which review the completed applications for conformance with State water pollution control plans and establish a priority for grants. Following State action, the applications are sent to the appropriate Federal Water Pollution Control Administration Regional Office for processing.

During fiscal 1968, this construction grant program will contain $203,000,000 although the Clean Water Restoration Act of 1966 authorized $450,000,000.

The programs for research and development grants, which include industry under certain categories, are covered in Sections 5 and 6 of the Federal Water Pollution Control Act. Under these sections, grants and contracts are awarded to support and promote the coordination of research, development, and demonstration projects (including basic and applied research studies, investigations and experiments) relating to the causes, control and prevention of water pollution. In addition to this general authorization, the Federal Water Pollution Control Act, as amended, authorizes grants and contracts in the following specific areas:

(1) Practicable means of treating municipal sewage or other water-borne wastes to remove the maximum possible amounts of physical, chemical, and biological pollutants to restore water quality for repeated reuse.

(2) Improved methods and procedures to identify and measure the effects of pollutants on water uses, including those pollutants created by new technological developments.

(3) Methods and procedures to evaluate the effects on water quality and uses of augmented streamflows to control water pollution not susceptible to other means of abatement.

(4) Assisting the development of projects to demonstrate new or improved methods of controlling discharge into any waters of untreated or inadequately treated sewage or other wastes from storm sewers or combined storm-sanitary sewers.

(5) Assisting the development of projects to demonstrate advanced waste treatment or water purification methods or new or improved methods of joint treatment systems for municipal and industrial wastes.

(6) Research and demonstration projects for preventing pollution of waters by industry, including, but not limited to, treatment of industrial waste.

Section 5 of the Federal Water Pollution Control Act, as amended, authorized a sum not to exceed $60,000,000 for fiscal year 1968 and $65,000,000 for fiscal year 1969 to carry out, in addition to a number of other activities, the research areas described in (1), (2), and (3) above. Section 6 authorizes the following: $20,000,000 annually for fiscal years 1966 through 1969 for grants and contracts in areas (4), (5), and (6) above; $20,000,000 annually for fiscal years 1967 through 1969 for projects in area (5) above; and $20,000,000 annually for fiscal years 1967 through 1969 for grants in area (6) above.

Secretary Udall recently announced that 10 grants totaling $2,500,000 have already been awarded to companies proposing the development of new ways to treat their own industrial wastes. These affect such industries as meat packing, pulp and paper, beet sugar refining, and potatoe processing. Other industries currently operating in this region could certainly utilize some of the benefits of this program.

Grants for storm and combined sewers and for joint municipal and industrial waste treatment systems can equal as much as 75 percent of the estimated reasonable cost of the projects. Grants for the prevention of pollution by industry may not exceed $1, 000, 000 or 70 percent of the project cost. There are no matching requirements for contracts which can be made to public or private agencies, institutions, or to individuals. The grants for general research and development may be made to public or private agencies, institutions, or individuals. Grants in the areas of combined sewers, advanced waste treatment, or new and improved methods of joint treatment systems may be awarded only to states, municipalities, intermunicipal or interstate agencies concerned with water pollution control. Applications for these grants should be made to the Office of the Assistant Commissioner for Research and Development, Federal Water Pollution Control Administration, Department of the Interior, Washington, D. C. 20242.

Summary

The states have now completed their extensive effort in establishing water quality standards for their interstate waters, subject to Federal review and approval. They are also modifying their state program plans for utilization of Federal assistance. The present program of assistance to industry includes an investment tax credit but, more importantly, support for a state and local operated program when a municipality uses Federal construction grant funds for municipal waste treatment facilities designed to treat local industrial waste. If the utilization of present water quality standards, state programs, and Federal grants cannot accomplish the degree of industrial waste pollution control that Congress intended, changes could be forthcoming with increased Federal incentives and control for those incentives.

The research and development program of the Federal Water Pollution Control Administration does support contracts and grants for research and demonstration of new and useful industrial waste treatment.