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C. Procedure

1. Pipette 10 ml. of the clarified sample into a 50-ml. Nessler tube. Add potassium permanganate solution dropwise until a pink color persists for a minute. Allow the mixture to stand until this color disappears, then make up to the mark with the test reagent. Mix thoroughly by inverting several times.

2. Prepare standards by pipetting varying amounts of the standard iron solution, not exceeding 10 ml., into Nessler tubes, together with enough of the dilute hydrochloric acid to make a total of 10 ml. Each milliliter of the standard iron solution used corresponds to 2 p.p.m. of iron in the unknown. Add potassium permanganate solution and test reagent as in the treatment of the unknown.

3. The unknown may be compared with the standards at once, as the color develops promptly. The colors fade upon standing, more slowly than when methoxy-ethanol is not used, but fast enough so that there should not be a time difference of more than 15 minutes in preparation of unknown and standards. The fading is largely photochemical; hence the tubes should not be exposed unnecessarily to strong illumination.*

If the unknown contains more than 20 p.p.m. of iron, use a smaller amount than 10 ml., making up to 10 ml. with the dilute hydrochloric acid, and multiplying the final reading by the appropriate factor.

The author made several hundred iron determinations in sewage when he served as Research Chemist for the Los Angeles County Sanitation Districts, and found the foregoing procedure much more satisfactory than the simple thiocyanate method which was used formerly.

Summary

The Winsor method for determining iron, which is a methoxy-ethanol modification of the thiocyanate method, is more satisfactory than the simple thiocyanate method for sewage analyses. A detailed procedure is given.

References

1. Winsor, *Ind. Eng. Chem., Anal. Ed.*, 9, 453 (Oct., 1937).
2. Peters, McMasters and French, *Ind. Eng. Chem., Anal. Ed.*, 11, 502 (Sept., 1939).

* The recommendation of Peters, McMasters and French (2) as to the use of hydrogen peroxide for oxidizing the iron, as a means to forestall fading, has not been investigated by the author, but the use of methoxy-ethanol provides sufficient protection against fading, and it would seem that the variable amount of organic matter present in sewage would be oxidized with more certainty with permanganate than with peroxide, without the use of an undue excess of oxidant.

Industrial Wastes

INDUSTRIAL WASTES, THE LAW AND POLLUTION CONTROL PROGRAMS *

By Milton P. Adams

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The present era of accelerating national defense production brings to a close a period of unprecedented building in our field. Tremendous advances have been made in providing facilities for the control of sewage pollution during the past seven years. Judging from our Michigan experience, however, it will still take time to develop complete and dependable, day in and day out pollution control with the facilities heretofore provided.

The problems of many industries and commercial establishments are also being solved. This is particularly true where their wastes through direct connection or after pre-treatment are susceptible of connection to the municipal system.

For the most part, much less has been accomplished in that field frequently mentioned as the "wet" industries. These are dependent for their existence upon relatively large quantities of process water. Most of this used water supply becomes, in turn, a source of industrial waste. The daily operation of these industries creates the largest and most difficult group of problems that remains to be solved. The pollution created is generally responsible for the depletion of normal oxygen in the receiving waters. Adverse effects on private and public rights, on fish and aquatic life and on wild life are one result. This waste occasionally fills in ship channels as well, or taints public water supplies or imparts to them chemical constituents, difficult if not impossible to remove by known and practical methods of water treatment. In any chain of industries along a particular watercourse, the complaint of a downstream operator is frequently lodged against upstream users.

In Michigan, and I believe the same condition exists in other states, some outstanding industrial accomplishments can be mentioned. Others await the completion of experimental and research work now in progress and the passing of the current national defense emergency. But the total problem confronting us is tremendous and goes far beyond the date of anticipated internal industrial plant changes or new waste disposal installations.

A greatly enlarged and continued supervisory and administrative function is introduced if real pollution control is to result in either the municipal or industrial field.

* Presented before the Second Annual Convention, Federation of Sewage Works Association, New York City, October 10, 1941.

I doubt whether any state represented here is today adequately supervising the results of its greatly increased number of operating sewage and waste disposal plants. Nor have we gone sled-length as yet toward getting all the sewage or other wastes to these established plants. And it doesn't take very much marginal pollution to offset the public health value of an operating sewage plant.

It has been our experience that major industrial problems diminish or disappear in proportion to the supervisory staff effort that we can devote to the task. This starts with informal contacts or a Commission notice of failure to control pollution, followed by general plant surveys. Their purpose is to locate, analyze and determine the character and amounts of waste produced. Generally the staff opinion as to waste waters requiring treatment and those which may be separated for direct discharge is accepted by the management and our Commission. If research or experimental pilot plant operation is required at this point, an increasing number of agencies or engineers is available for this purpose. The Engineering Experiment Station of Michigan State College at East Lansing has been called upon most frequently for assistance in the industrial waste field in our state.

The most difficult stage is now reached—how to finance the necessary changes? While this is not the responsibility of the state, a knot can easily be tied by overlooking this factor that may take years to undo. "Piecemeal approach" to the completed solution is frequently necessary, with generally satisfactory although delayed results. Action of our Commission is employed to officially establish pollution restrictions, where necessary, set time limits or officially adjust other matters of difference that may arise. At both official and informal hearings before our Commission, it sits in judgment on our findings and recommendations, as well as the position taken by the polluting agency. Its order or other determinations are then made.

Members of the Commission have been willing as a rule to "take a stand" against pollution when convincing proof of injury has been established. The making of summary orders and their attempted enforcement, however, where ways and means of correction are unknown or currently unattainable, is not sound public policy. Neither is such action likely to be sustained in the courts. Michigan's legislative committees in recent years have viewed more restrictive statutes against pollution with the greatest skepticism. They say we already have enough power. With a few exceptions, I presume state legislative experience with new pollution laws is similar to our own.

Couple this state experience with that of the last six years at Washington in attempting the enactment of federal pollution legislation and I am convinced that more restrictive state or federal statutes are unlikely within the coming decade. Should we not ask ourselves in any event—Are we making the best use of the law which we already possess? Does new legislation necessarily *insure* accelerated progress down the road of improved pollution control? Is the answer to be found in state-

instituted litigation to awaken the laggard polluter where he is found? Should such action be coupled with more of the qualified type of technical personnel for contact and field supervisory purposes? Is more research information needed? Are more funds (industrial or federal or both) necessary to accomplish and maintain the changes in waste disposal practice? In the correct answers to these questions lies the solution of our problems.

Currently we appear to have the prospect of operating under one or the other of two federal laws, depending upon which type of bill is enacted. These are H. R. 1110 by Mr. Spence and H. R. 3778 by Mr. Mundt. Both are lodged in the Committee on Rivers and Harbors of the 77th Congress. Neither bill seems likely of consideration at the present time, due to the exigencies of national defense. Yet because these bills represent two divergent conceptions of pollution control administration that have been prevalent for the past several years, they are important.

Unless more progress is made by the states in solving their unyielding industrial problems, we must be prepared to accept federal administration of pollution control in some form. Maybe we will have it anyway.

There is unquestioned need for improvement in statutory law covering procedure and financing and as an aid to the solution of certain state and interstate problems. But these various federal bill drafters hope to make uniform the pollution statutes of all the states, following some national pattern. Have they overlooked the uniformity and protection against pollution and other water abuses, already available? This is inherent in the so-called common or court-made law of the United States and of the several states.

We must take at the outset a broad perspective of the entire matter of water use and controls. Pollution abatement is only one part of a larger problem. The National Resources Planning Board and its predecessor agencies have been attempting to foster this concept for several years past.

Detrimental water pollution to me, is evidence of the abuse of an otherwise perfectly legal use of a state resource. I use the term "state resource" advisedly, since with the exception of navigation and certain power installations, our natural waters and their problem are primarily a function of state rather than federal interest and control. Of the fresh water streams and lakes of the United States, only a portion are apparently navigable by either state or federal definition. In addition to the now existing legal and illegal use of public waters for waste disposal purposes, surface waters must provide the means of navigation, power development, public, private and industrial water supplies and irrigation, as well as the medium in which fish and aquatic life live and upon which wildlife depends. Correlated problems created by precipitation and the resultant flow of water are found in flood and soil erosion control.

If we are to make the most of our water resources for the good of unborn generations as well as ourselves, artificial and natural abuses must be checked and corrected. Only in this way can the beneficial uses of this resource be fully developed and utilized. Wise use without abuse is one of the accepted definitions of good conservation. It is also a fair statement of principle to be drawn from the common or court-made law itself. No one use of a water resource can be permitted to prevail at the expense of others without causing trouble and conflict.

If we would but familiarize ourselves with and utilize this declared policy of the so-called common law of waters, we will find sound administrative guides to practically every situation that can conceivably arise. On the other hand, statutes defining rights and establishing limitation on use are strictly construed. Their enactment always trails the problem created. They are frequently inadequate to meet new needs as they arise. They depend upon a sufficiently crystallized majority of legislative opinion for their enactment.

Yet here lies, little used and apparently less appreciated, this potentially valuable implement to our work—the common law of waters of all the states. It presents through its so-called "reasonable use doctrine" uniformity of policy for all users of our water resources to follow.

What then is this common law as it relates to waters? It is an ever increasing compendium of the decisions of the state and federal appellate courts, classified to bear upon definite subjects with related facts. Its original foundation was the English common law. This was accepted conditionally or in its entirety by the states of the Union as they were organized. It also serves as the foundation of jurisprudence of the United States courts. Only to the extent that subsequent statutory enactments have come and gone, and court decisions modified it, has the common law been changed. Hence for any present lack of statutory enactments, the aggrieved party is rarely without a remedy.

To make a geological comparison—it is the sedimentary rock bed ever increasing in thickness and strength as more deposits in the way of current court decisions are laid down. The upper layers of this deposit consisting of the more recent decisions would be given the most judicial consideration presumably, when questions arise for determination. If the facts of a given case are found to fit and the litigation is otherwise properly instituted and free of fatal technicalities or prejudice, the answer will be satisfactory.

Ever changing and generally inadequate statutory law, on the other hand, may be compared to the earth, trees or vegetation which may be found overlaying this rock bed of the common law. It may be brushed off, or completely changed, as time goes on, whereas the rate of change in common law doctrine is exceedingly gradual. It comes about as the result of changing judicial opinion and its weighing of the facts and equities involved. It is this integration of separate but related cases into a stable policy of the law which appeals to me as the only sure

foundation upon which pollution control of the future should be based. This is especially the case where existing rights to the use of water are to be curbed. Substantial sums of money must be expended to compensate for the curtailed use of that resource for future waste disposal purposes.

How do we invoke the common law? In Michigan, generally by filing a bill to enjoin detrimental pollution. What we seek is restriction to a "reasonable use" by the polluter obtained through the court's decision. It is heard in a court of equity or chancery as distinguished from a court of law. Equity jurisprudence, so-called, is always open to the complainant, where relief through the law courts is neither adequate nor available.

Relief may be sought by the injured individual as well as by the downstream municipality, if a riparian, or by the state, acting under its police power. The same process by which the pollution offender is compelled to observe the law of the land may be employed by him to obtain his rights to the legal use of the water to which he is entitled. Only the court can define and delineate the limit of reasonable use, beyond which pollution or other abuses are unlawful. But a category of court recognized pollution injuries already exists. They have been heretofore declared as evidences of *unreasonable* use and such practices enjoined. The engineer or pollution control administrator has a good cue, therefore, to the limit to which he may safely go in approving or enforcing pollution control facilities. Those of you in charge of municipal plant operation, and designing engineers as well, will derive much benefit from your attorney's explanation of the relation of the doctrine of the common law to your respective pursuits.

We have tried to follow the declared policy of "reasonable use" in our contacts with industry and municipalities in Michigan. We believe the policy has not only yielded results but has generally meant more effective cooperation toward control in a spirit of good will. The importance of this factor to successful pollution control cannot be overestimated. No state or the federal government can ever employ enough pollution policemen to know about or guard against every occurrence, municipal or industrial, which will cause pollution. Most managements, if convinced that you are fair and reasonable, will respond in like manner. It is obvious one is going to get farther to acknowledge at the outset that the polluter is entitled to a reasonable use of the stream or water for disposal purposes, than to damn him as an outlaw and issue an order for a complete clean-up of *all* pollution from and after a certain day. Moreover, it is my opinion that irrespective of the statutory authority under which one is entitled to proceed, whether state or federal, present or future, "the law" will support you if a reasonable use is conceded, while it may defeat you if it is shown that your requirements are unreasonable or arbitrary or not susceptible of accomplishment.

Through your attorney's counsel is the only way to ascertain the value of seeking a common law solution of your stubborn and resistant

pollution problems. Prepare your facts, interpret the test results, list the nature of injuries created and place them in his hands for advice. Armed with his opinion you should be able to prevail upon the head of your department or pollution control board to institute the appropriate litigation.

With your permission, I shall read a few excerpts from paragraphs on the so-called Law of Waters. They are taken from Vol. 67, Corpus Juris, omitting references to the citations to supporting cases. Other authorities, such as "Cyc" (Cyclopedia of Law and Procedure), L. R. A. (Law Reports Annotated) and R. C. L. (Ruling Case Law), are equally available and of interest.

On the subject of the Rights of Riparian Owners to Use of Water (page 690), the following statement of the law is found:

> Subject to any paramount right to the use of the water existing under the general law in some other person, a riparian owner has the right to make any use of the water, beneficial to himself, on the riparian land, which his situation makes possible, so long as he does not inflict any substantial or material injury on those below him, and he may facilitate his use of it by any appropriate means; but all the riparian proprietors have an equal or common right to use the water, and each must exercise his rights in a reasonable manner and to a reasonable extent, so as not to interfere unnecessarily with the corresponding rights of others, . . .

On the subject of Reasonableness of Use, commencing on page 694:

> A riparian owner's rights are not measured by the necessities of his own business, but by the rule that his use of the water must be reasonable when considered with reference to the needs or rights of other riparian proprietors on the stream, and any malicious or wanton use or abuse of his water privileges by a riparian owner is unreasonable and actionable. There is no fixed rule of law for determining what will constitute a reasonable use, but each case depends on its own particular facts, and the reasonableness of a particular use is generally a question of fact for the jury, although the use of the water may be so plainly excessive as to be unreasonable as a matter of law. In determining the reasonableness of a particular use it is proper to consider the character and size of the stream, its location, the nature and condition of the improvements thereon, the uses to which it is subservient, the state of civilization, climatic conditions, the custom and usage of the people in the vicinity and elsewhere in regard to the management of business, the hours of labor, and the use of the water of such streams, the nature of the banks, the volume of water, its fall and velocity, the subject matter of the use, its object and extent, the necessity for it, and the previous usage.

On the subject of Pollution with Respect to the Right to Pure Water, commencing on page 767:

> It is the right of every riparian owner to have the stream continue to flow through or by his premises in its natural condition of purity, and free from any contamination or pollution, such as would render it unfit for domestic purposes, or for manufacturing purposes, or for agricultural purposes, such as irrigation or the watering of stock, or for swimming and bathing purposes, or which would be destructive to the fish therein, or cause it to give off noxious and unhealthful odors. Thus an upper riparian proprietor ordinarily has no right to pollute a stream. If he does so it is wrongful, unless he has some prior or special right to some exclusive or particular enjoyment which permits such pollution. A statute prohibiting the pollution of watercourses occasioned by the inflow of salt water, of oil, and of other substances is a proper exercise of legislative power. . . .

Relative to the Nature of the Right to Pure Water, we find the following:

> The right of a riparian owner to have the water flow pure and undefiled is what is termed a natural easement; it is annexed to the soil and is parcel of the land itself, and inheres in the estate entitled ex jure naturae independent of grant or prescription. Such right is not conditioned upon the beneficial user of it, nor can its owner be deprived of it by legislation. An injury to the purity or quality of the water, to the detriment of other riparian owners, constitutes, in legal effect, a wrong and an invasion of private right.

Under Principles Governing Subjection of the Right to Pure Water to the Right of Reasonable Use:

> The right to purity of water is subject to the right of each riparian proprietor to use the stream to a reasonable extent, and whether or not a pollution of the waters of a stream is an actionable injury to a lower riparian proprietor depends upon whether it is the result of such a reasonable use of the stream as the upper owner is entitled to make or of an unreasonable use in excess of his rights. The right to purity of water is not one of absolute immunity from all pollution. The upper owner is entitled to use the stream in such a manner as to make it useful to himself even if it somewhat impairs the quality of the water; and so if his use of the stream is a reasonable use, the fact that it incidentally impairs the purity of the water gives no cause of action to a lower riparian owner. However, a riparian owner must not use the water of the stream so that the water is so corrupted and polluted as practically to destroy or greatly impair its value to the lower riparian owners. What is a reasonable use is primarily a question of fact, but whether the undisputed facts, and the necessary inferences therefrom, establish an unreasonable use is a question of law. It is to be determined in view of all the facts and circumstances of the particular case. Every use of a stream which decreases the purity of its waters is not unreasonable. There must be a fair participation in the use of the water between the upper and the lower riparian owners. The reasonableness of the use depends upon the extent of detriment to the riparian proprietors below. If it essentially impairs the use below then it is unreasonable and unlawful unless it is a thing altogether indispensable to any beneficial use at every point of the stream. In some jurisdictions the rule is stricter where the use is for manufacturing or industrial purposes than where it is for ordinary farm or domestic purposes, it being held that the use of the water of a stream for ordinary farm and domestic purposes does not render an upper riparian owner liable to a lower owner even though such use renders the water materially less pure to the lower owner's substantial damage; but the use of the water of a stream for industrial or manufacturing purposes by which it is polluted is quite another matter, and the riparian owner's right is limited to the extent that such use must not materially pollute the water to the substantial damage of the lower riparian owner, and such use and pollution of the water renders the user liable to a lower riparian owner whenever the damage is of a substantial nature.

On the subject of Pollution from Other Sources:

> Ordinarily it is no justification or excuse for one who pollutes a watercourse that the stream is already contaminated or that various other persons are contributing to its pollution, or that an extraordinary flood was a contributing cause. The fact that the damage would have been less had the stream been pure when it reached defendant does not reduce his liability for all damages occasioned by his pollution of the stream, nor does the fact that the stream is already partially polluted from other sources permit a riparian owner to increase the pollution thereof to the damage of a lower riparian owner.

Relative to the Necessity to Mitigate or Prevent Injury, the following:

In some jurisdictions if the lower riparian owner by the exercise of ordinary care and at reasonable cost, can minimize the damages it is his duty to do so. In other jurisdictions he is under no duty to mitigate his damages, for although he is bound to exercise reasonable care to protect himself from any damage that he has cause to anticipate, he is not bound to expect that an upper riparian owner will inflict wrongful injuries upon him in the use of the stream, and it is not his duty to take steps to protect himself from unexpected unlawful acts. Thus he is under no duty to protect himself from injury through pollution at his own cost, even though he could protect himself at less expense than would have to be incurred by the wrongdoer causing the pollution for the prevention thereof.

With respect to Refuse from Mills and Factories, commencing on page 774:

A riparian owner has a right to make a reasonable use of the stream for the operation of a mill or factory, and may even cast waste material therein if he does not thereby cause material injury to public or private rights. However, he has no right, by unreasonable use, seriously to impair the rights of a lower riparian owner, . . . It is no excuse or justification for such pollution that the use of the water in the mill or factory is a lawful riparian use; that the business of the mill or factory is conducted skillfully and according to the best modern methods and without malice or negligence . . . or that complainant knew defendant was building large and expensive works and made no objection thereto; or that an act of God in the form of a drought caused the stream to fail to carry off the refuse as it did in normal times. There is no public policy in favor of industrial development which will justify for the sake of a factory or mill the destruction of the rights of other riparian owners by the pollution of the stream. No supposed rule of necessity in order to carry on a business, or on account of its usefulness or necessity, or on account of the amount involved, will authorize the pollution of the waters of a stream. A manufacturer who uses the water from a stream in his plant and returns it into the stream in a condition no more polluted than when he took it out of the stream is not liable for the pollution of the stream.

Under the Effect of Custom, the following:

A long-continued uniform custom of mill owners and manufacturers along a particular stream may make it a reasonable use for them to discharge their waste and refuse into the stream.

Under the subject Occasional Pollution of Stream:

If the riparian owner has employed every means known to the business to prevent a discharge of noxious matters into the stream he is not chargeable with negligence for an occasional unavoidable discharge of such matters with a consequent temporary pollution of the waters of the stream.

Under the subject of Acquisition of the Right to Pollute, as obtained by prescription, we find on page 776:

Although in some jurisdictions the right to pollute a fresh water stream cannot be acquired by prescription or any lapse of time, as a general rule, if the pollution of a watercourse does not constitute a public nuisance, the right to use the water of a stream in such manner as to pollute it to the prejudice of lower riparian proprietors may be acquired by prescription. Such a right cannot arise, however, where it would be injurious to public health, or constitute a public nuisance, or be in opposition to intermediate legislative enactments against it. To acquire a prescriptive right to pollute a stream a riparian proprietor's use of the waters thereof must be injurious to lower riparian proprietors, uninterrupted, adverse, under claim of right, and with the knowledge of the lower riparian proprietors, or with such acts that knowledge will be presumed, and must have continued for the full prescriptive period. Such a prescriptive right can be exercised only in the manner and to the extent to which the pollution was begun and continued in order to acquire the right, but cannot warrant any further or greater pollution.

Relative to Persons Entitled to Relief, the following:

Since he has a right to have the stream flow by or through his place in a pure and undefiled condition, a riparian owner has a cause of action for the pollution of the stream, and a person in possession of reality is, for this purpose, classified as an owner. This right, except where the pollution constitutes a public nuisance or injures the water for a purpose under the regulatory power of the state, is ordinarily confined to the riparian owners below the point on the stream where the pollution takes place; and a nonriparian owner, unless he can show that the pollution of the stream creates a condition which constitutes a nuisance, injurious to him other than the condition of the water itself, has no cause of action therefor. . . .

Other pertinent sections of the law such as that relating to Trial and Relief in Equity, commence on page 789:

Injunction is a proper remedy to prevent a threatened pollution of a watercourse, or to stop the further continuance of a nuisance consisting in such pollution, and this remedy is available, although redress might be had by abatement of the nuisance or an indictment, or by action at law. The granting or refusing of an injunction rests in each case on the sound discretion of the court, exercised according to the recognized principles of equity, and plaintiff must not only show the pollution of the stream, but he must further establish facts entitling him to such relief under the equitable principles generally applicable to injunctions. As a general rule, the use of a stream in such a manner as materially to foul and adulterate its water will be enjoined, provided the injury is a recurring and continuing one, and the stopping of the acts complained of will restore or tend to restore plaintiff to the enjoyment of his rights, and particularly where defendant, before building his plant, gave explicit assurance to plaintiff that he would avoid polluting the stream, or, in the case of pollution by mine water diverted from its natural outlet and by artificial means discharged into a stream which does not form the natural drainage of the mine, where it does not clearly appear that the natural conditions make it impracticable to discharge the water in any other way, or that the expense of doing so would be so great as substantially to deprive the mine owner of the use of his property. Isolated acts of pollution do not constitute a ground for injunction, nor do past acts or resulting injuries unless it appears that the acts or injuries shown will probably continue or recur. Thus an injunction will be denied where, at the time of the suit, defendant has taken steps whereby the pollution is prevented. If a riparian owner's use of the stream is reasonable and does not pollute it to such a degree as to render it unfit for manufacturing, mechanical, or domestic purposes, he will not be enjoined. The court will not, at the instance of the attorney-general, restrain a mill or factory from a use which pollutes a stream somewhat where the lower riparian owners do not complain of such use and most of them are dependent on the operation of the mill or factory for their support.

On the subject of Relative Injury, note the following:

In some jurisdictions the court, in deciding whether to grant or refuse an injunction, cannot consider the balance of convenience, or of advantage or disadvantage, to plaintiff and defendant and the public at large of defendant's use of the stream. In others, in considering whether to enjoin a business enterprise from polluting a stream the courts recognize the importance of business enterprises. They will not overlook the needs of important manufacturing interests nor hamper them for trifling causes. Thus, where such enterprises are established at the only place where it is practicable to operate them, and they are conducted in the only practical manner, their right to operate will not be destroyed for trivial causes or for slight damage resulting to others, and if the damage which will result to defendant from an injunction is much greater than any injury to plaintiff from the pollution such state of facts will warrant a refusal of the application for injunction. However, substantial injury to lower riparian property will not be permitted for the purpose of enabling a new and great industry to flourish. Oil fields will not be abolished and annihilated by an injunction against the pollution of streams by oil wells, it being impossible to abate the pollution and at the same time operate the oil wells.

The subject of Defenses to Action of Abatement is of interest (page 792):

> It is no defense to a suit to enjoin the pollution of a stream that the business engaged in by defendant is a lawful and useful one which is being conducted in a proper and customary manner, or that plaintiff bought the property with knowledge of the existing conditions as to the pollution of the stream. . . . Also, plaintiff's right to an injunction is not affected by the difficulties of complying with it on the part of defendants, provided it is within the limits of physical possibility; nor, it has been held, does the fact that to enjoin the continued discharge of sewage into a stream will cause hardship on the persons enjoined and menace their health and that of others, operate to prevent the issuance of the injunction, but in this connection the right which the courts ordinarily have to refuse an injunction because of the disproportionate injury which would result to the parties must be considered.

You have just heard quoted statements of portions of the court-made law on waters. If unfamiliar with it, are you not impressed by its complete applicability to our work? In all probability you can bring this to bear upon the solution of your delinquent problems. If so, what further need have we for more restrictive statutes against pollution?

It will be noted that the common law of waters is built primarily on riparian owner relationship. State or federal agencies for the control of pollution must therefore establish their eligibility to complain. Where acting in behalf of public health protection, the state's inherent police power would presumably establish this eligibility. Some legislatures have broadened, beyond the limits of public health, the authority of the state to combat pollution. Our attorney general and I presume most state's attorneys, have power to abate public nuisances, however caused.

The purpose of the controversial Section 10 of the Mundt Bill is an attempt to establish the eligibility of complaints by the federal government against pollution. Where the pollution is of a local nature, even though found in navigable waters, it remains to be demonstrated whether or not this bill in Congress, should it become law, will place another unit of government still farther removed than the state in a position to control local pollution. The question is particularly pertinent if, in doing so, state jurisdiction is automatically ousted, as many believe will be the case.

In conclusion then, it would seem entirely unnecessary that any of us in the state pollution control field should be awaiting the enactment of any federal law with the idea that this is necessary to establish uniform national policy. The doctrine and principles of the common law already provide this uniformity. The only safe criterion of water quality in the crossfire of interests in which we find ourselves is that of "reasonable use," interpreted in the light of each differing set of facts and circumstances. Moreover, "reasonable use" will be the criterion where pollution abatement is sought by injunctive process in either state or federal courts. The tests of injury, however, may be expected to be more strict and difficult to prove in federal than in state courts, according to my understanding. All of us cannot wear the same size hat or shoes neither can all pollution problems be equitably solved with the same remedies nor the same degree of treatment.

For those sewage or waste disposal problems that impede or prevent the realization of sound pollution control programs under cooperative compliance policies, we should be getting our facts together, enlisting rather than discouraging the interest and aid of the injured riparian proprietor and giving our own state's attorney the opportunity to help us. By proper steps, the uniformity and fairness of the common law can be brought to bear, with beneficial results.

If such steps are supplemented by inviting Waltonians and other critics of our past methods to give heed to our obstacles as well as the examples of failure of pollution control we will not be constantly "in the middle." We should presently have not only the facilities and plant changes to permit compliance but the staff assistance necessary to the maintenance of satisfactory pollution control for future years.

Acknowledgment

The writer wishes to acknowledge the aid of Mr. Harry W. Jackson, Assistant Attorney General of Michigan, for advice and counsel given in connection with the preparation and review of this paper.

Discussion

By C. R. Hoover

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Mr. Adams has given us an invigorating, practical and legal justication for the extension and improvement of the control of industrial waste pollution. I agree that further Federal restrictive legislation does not appear likely under present conditions of the National Defense effort, but I am not too confident of continued restraint. Some feel that social and economic changes, not necessary in the present emergency, may be extended as a matter of consistent general policy. I agree that the control of water resources is primarily a State function but unless individual states or groups of states are active in preventing inequalities and injustices across state lines, local as well as Federal pressure for broader control is likely to develop. There has been too much smoke of rumor regarding factory migrations to avoid waste treatment expense to make us confident that there is not some accompanying fire. The military strategy, dictating the wide distribution of defense plants, cannot but locate new sources of pollution in some states which have not been seriously faced with industrial waste problems in the past. These plants become potential competitors of factories required to treat their wastes.

It would appear that if Federal authorities are interested in requiring wide-spread pollution control that they should make provision for

industrial waste treatment in plants financed by the National treasury. Moreover, a manufacturer should not be asked to expand his production capacity or sell his product to the Federal Government at a price that will not permit of meeting the cost of waste treatment.

From the stand-point of the manufacturer there are reasons why pre-treatment and waste elimination should be considered at the present time. Full time operation indicates the possibilities of reasonable profits before tax deductions. Sterner competition is certain to be expected in the post-war period. Now is the time to prepare to avoid future expense.

Mr. Adams is undoubtedly correct in his statement that we cannot now expect a continuation of the past extensive public works program, but we can hold our gains. In this connection I feel that one of the basic requirements of the Connecticut State Law, which established the Connecticut State Water Commission, is a good guide at this and all times. This basic requirement is in substance that no objectionable pollution of State waters, by a new industrial source, shall be permitted provided a reasonably feasible and economic method of preventing or eliminating the pollution is known. This law and its justifiable interpretation, would appear to accord with the requirements of the basic common law and the reasonable control policy of Michigan as explained by Mr. Adams.

Technically trained State officials can now, as always, do much to educate and assist industries in understanding their pollution problems. Industrial chemists and engineers need to have more appreciation of sanitary engineering, and the effect of small amounts of toxic substances on biological processes. As one manufacturer once said to me "You want us to reduce our impurities in our waste water to 100 p.p.m.; that is, ten times as pure as the purest product we sell and we think we are doing pretty well to get our impurities down to one-tenth of a per cent or a thousand parts per million."

This is a time when cooperative engineering surveys of industries can be carried out by State and Municipal authorities. Segregation of objectionable wastes and equalization and effective dilution can be encouraged. Economies can be pointed out and recoveries, especially those of strategic materials, emphasized. For example, additional standing rinse tanks in plating rooms, recovery of cutting oils, making cattle feed and fertilizer from food factory wastes, save-alls and closed white water circulation in paper plants. The giving of sound engineering advice, recommendation of well trained outside consultants and the warning to avoid the pitfalls of makeshift treatment expedients are especially needed in these times of peak production.

I would like to emphasize one of the points Mr. Adams mentioned briefly. This is an appropriate time to investigate the full utilization of the large number of new municipal treatment works in connection with industrial wastes that can be admitted to sewerage systems. Proper regulation of the discharge of industrial wastes to sewers,

closer pH control, addition of small amounts of regulating chemicals, and many other expedients which modify, but do not seriously alter the operation of a sewage plant, are in order. We have been especially interested in eliminating the effect of copper in separate sludge digestion and hope to report some simple measures to be used in sewages receiving metallurgical wastes. A number of factors affect the amount of copper that can be accepted in a sewage, but owing to the large segregation of copper compounds in settled sludge, we are inclined to agree with Mohlman's original estimate at New Haven that 1 p.p.m. may have retarding effects on sludge digestion. In this connection we are much interested and we feel that all those connected with sludge digestion and all biological processes should also be interested in the proposals being considered by the group of experts preparing to revise the Federal standards for drinking water. Dr. J. K. Hoskins, of the United States Public Health Service, told the American Chemical Society at Atlantic City, on September 8, that the standards being considered involved raising the maximum allowable copper content from .2 p.p.m. to 2. p.p.m. and invited comments from those interested. We find that many so-called potable waters contain more than .2 p.p.m. but we have yet to find one which contains as much as 1. p.p.m.. I am not an authority on the physiological effects of small amounts of copper on humans, but I think I can claim that 2. p.p.m. will be detrimental to other important forms of life of interest to the sanitary engineer.

This situation may be clarified by later proposals but it may serve to indicate my closing point. Cooperation is needed in solving technical problems. Cooperation of Governmental authorities, public health officials, sewage workers, water resource conservators, industrialists, and their varied technical staffs is indicated if the complex problems of water supply and liquid waste disposal are to be solved. By such cooperation we can benefit not only the health of the public but the health of industry as well.