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# COMMUNICATION

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## CAN WE AFFORD POLLUTION CONTROL?

We hear a great deal these days about not being able to afford to pay for pollution control. We hear that we cannot have both jobs and capital spending for growth and clean air and water at the same time. Developing countries hearing these cries of oppressed industries eagerly use the same tact to avoid any environmental control. Are the developed nations setting a proper example? Can we expect undeveloped countries to burden themselves with the costs of environmental pollution control while trying so desperately to supr their economy? The main problem here revolves about the question of who can afford environmental protection? I maintain we all can — developed and undeveloped alike.

I prefer to restate the question as a statement that no modern society can afford not to protect its environment. For if we have an impure environment, life will be no life at all; at least one not worth living in. Now the ardent unilateral industrialist — and even many politicians — will argue that life without industrial jobs can get pretty trying as well. What good is breathing clear and clean air or drinking and recreating in sparkling pure water if one hasn't a job from which to obtain the money to buy food, clothing, and shelter. On the surface that sounds like good reasoning. But it should be exposed for what it really is. It is only a smokescreen — a defense mechanism wisely perpetuated by single minded and motivated industrialists of all countries of the world. Unfortunately the politically minded persons in governments have accepted this subterfuge as the gospel. It is not difficult to guess why. They conclude that a booming economy — without constraining pollution control costs — is vital assurance of their political future. This conclusion as well as industry's smokescreen is nonsense and should be exposed once and for all time as simply untrue and invalid.

Let's first clear the air about costs and then proceed to other matters which determine whether any price at all is worth paying to protect environmental quality. Water pollution control in many "wet" industries costs about one to two percent of their production costs. This is not a ficticious figure but one I have derived myself from numerous industrial plants in the United States. The percentage would be even less for developing countries. Air pollution control costs may run two to five percent of production costs. Innovative practices can lower these percentages even further. I am not convinced that industry's argument that $1.01 or even $1.05 to produce important goods for society rather than $1.00 would represent an "unbearable", burdensome cost to industry or the consumer. In fact I am assured that this meager increase in production costs is not only well within economic limits but also is a small price to pay for a clean environment. Industrialists are prone to quote costs not in percentages but in dollars which may seem exhorbitant to most sideline observers. The environmentalists are still shying away from quantifying the benefits

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of clean environment. And with good reason, for it is not an easy task, but can be done by expending sufficient time and effort. One attempt has been made by the American E.P.A. to include new jobs in environmental construction as one of the benefits of abatement. But the price tag still appears excessive and unrealistic. It may be helpful to provide an answer to the question of who can pay these costs.

I am not one to propose that industry absorb the costs. On the contrary these costs should be passed on to the consumer whoever he is and wherever he resides. An industrialist within any given western country may reply that if he raises the price, his sales will be reduced. The market will not "stand still" for any more price rises — no matter how small, he explains. The same industrialist in an eastern European country may plead that he is not permitted by governmental regulations to raise the price of his product to include these costs. Both industrialists have valid arguments for not raising product costs. Perhaps it is governments and consumers who are to blame for not accepting these costs. Once they understand that, first, the true costs of environmental protection are relatively small and, second, the costs will ensure that all people will be able to live — not just exist — and enjoy clean air and water and all of its amenities, I am convinced they will accept them.

But, in case they do not they can show their refusal to accept the costs by abstaining from the purchase of the products. If products remain unsold, they may not be as vital to society as their manufacturers had assumed. If, on the other hand, they were truly vital but too high priced, governments may decide to defray part of the production costs as a societal benefit. In all cases, moreover, industry should not be expected — and rightfully — to absorb pollution abatement costs entirely.

Another question often arises during industrial production decisions. Should industry be located in developed nations where superior technology exists or in developing nations where economic stimuli and balancing of world industrial production is needed? Worldwide agencies such as the United Nations are inclined to favour the latter while strong nationalists and ardent industrialists generally favour the former. Unfortunately neither viewpoint takes proper consideration of the matter of pollution control. Some consider the environmental problem as insignificant when related to other production concerns; while others treat it as a costly burden either to be avoided completely or as weighing excessively in its decision of where to locate new production facilities. What is required is a progressive viewpoint that pollution control costs be treated as a normal part of production costs. When that is an accepted procedure, industrial location becomes a production decision. In effect, it is my opinion that production should take place wherever and whenever it is profitable for industry to do so. If waste treatment costs at a particular country site are excessive so as to make production costs sufficiently high and worlwide competition impossible, another site in that country or another country should be selected. The world consumer is entitled to the lowest possible product cost. However, this should not be achieved at the expense of a contaminated environment.

Another ploy used by industry is that they lack the technology suitable for solving pollution abatement requirements. Are they justified in making this claim? They advance this defense based primarily on two facts: (1) new abatement equipment is untried and costly and (2) the environmental quality levels are much too stringent to allow use of more conventional, tried, and less expensive equipment. These arguments also appear reasonable on the surface. Data and efficiencies are available for all new treatment equipment. Otherwise it could not be sold at all. Reliable equipment manufacturers invest considerable sums of money in pilot plant testing in order to facilitate their sales and to guarantee operational efficiencies. Some large equipment units such as scrubbers, filters, and coolers are expensive — but hardly so when related once again to total plant costs. Industry still needs to think of this equipment as necessary for production not as a burdensome and wasteful added cost to satisfy some bureaucrat. If an industrial plant has been gradually improving its production efficiency related to pollution control, the new effluent guidelines need not be considered too stringent. These guidelines should represent only another step in the direction of a clean environment. Unfortunately some industries have neglected pollution control in the past and these guidelines do represent to them a gigantic leap towards bankruptcy. It is useless to chastise them for their past omissions, but it is useful to guide them firmly and patiently into making proper amends for the past. The environmental quality requirements are not too stringent but the gap in remedial action is too wide for them now. It must be bridged nevertheless; and at a faster pace than in the past.

All of this leads us to the most important issue of where we are headed in water pollution control. Will we proceed to strengthen and enforce our laws in an endeavour to achieve a cleaner environemnt? Or have we reached the point where any further expenditure of money by industry for pollution control will be resisted for "economic" reasons? I believe, in fact, that we have reached a plateau in the level of environmental quality in developed nations. Any movement upward from that plateau will occur as a result of either a booming rise in the industrial economy or from a series of environmental disasters brought about by the unabated discharge of toxic chemicals. Not all municipal and industrial plants have reached the plateau proposed for the United States' Environmental Protection Agency's effluent guidelines. These laggards will continue to improve their treatment facilities until safely at the plateau. That level roughly coincides with the conventional secondary treatment — or removal of 80 to 90 percent of settleable suspended matter and five day B.O.D. In the United States of America the plateau of secondary treatment commonly has been referred to erroneously as "complete treatment". The originators of this expression must have been short-visioned when they derived it. As populations grow and industry expands to meet world needs more surface and ground waters must be used and often reused. Even as we embark upon the use of tertiary treatment in some plants we must not be misguided into thinking of this as complete treatment. I would like to mention some of the contaminants which must also be removed from wastewater effluents — if not immediately then at some time in the near future. I propose that we begin thinking, planning, and instigating treatment systems capable of removing these additional contaminants.

## 1. AMMONIA NITROGEN

When $NH_3-N$ is present in effluents (or may be produced from the reduction of other nitrogenous compounds), it will exert an oxygen demand upon the receiving water — above and beyond that measured and expected by the conventional five day BOD. It usually is a slow oxygen demand but a significant one and certainly one to be considered in maintaining stream water quality. Ammonia also exerts a toxic effect on fish which are becoming more and more vital in view of our world food shortage and increased emphasis on recreational fishing. The removal of ammonia nitrogen or their precursors from wastewaters is accomplished mainly by stripping, absorption, and anaerobic biological treatment followed by stripping. Proper selection of a process for denitrification depends primarily on the amount and forms of nitrogen compounds. The degree of removal efficiency required depends upon the characteristics of the receiving waters including its uses and time of flow before reaching its ultimate destination.

## 2. TOXIC CHEMICALS

Recent experiences with PCB, ketone, mercury, and other complex organic and inorganic compounds have demonstrated that many chemicals persist in receiving waters. Most are unaffected by conventional means of waste treatment. Many concentrate in the flora and fauna of the watercourse. As a result of this they may be reconsumed by humans. The concentration in fishes and subsequent eating by people has resulted in some catastrophies and other potential ones. Because of this imminent danger a number of watercourses have been designated as "out of bounds" for fishing. In addition real fears have developed in communities which derive their drinking water from these resources. Obviously the most certain way of overcoming or avoiding the problem of toxic metals is to curtail the use or the discharge of any chemicals found to be toxic to humans when ingested either in water or in fish or livestock. This is not so easily accomplished; first because of the inherent, prescriptive right of industry to produce whatever products are beneficial to society, and second because only trace amounts often appear in their effluents. These small quantities were unmeasurable analytically until recently and have tended to build up in algae and fish life in streams, lakes, and seas. Industry must find ways to eliminate wastage of any of these toxic chemicals or revert to using other chemicals as substitutes. If neither solution is feasible, industrial waste treatment — generally either chemical precipitation or absorption — may be possible.

## 3. INORGANIC COMPOUNDS

Raw water supplies are becoming increasingly more contaminated with salts such as sodium chloride or sulfate. These salts are not removed by any conventionally used process of waste treatment; hence they are passed back to the watercourse. Each successive pass results in a higher concentration of salt. Usually these salts have not proved harmful except to other consumers — generally other industries downstream who find the salts interfere with their production. Municipal officials are beginning to consider the possibility of having to soften waters because of the increase in calcium and magnesium salts in them. However, softening as generally practiced will not remove the cations and hence a build-up alkalinity ensues. Complete demineralization treatment techniques such as evaporation and reverse osmosis can be used to lower the mineral salts to almost any degree required.

## 4. ADDITIONAL BOD AND SUSPENDED SOLIDS

Watercourses are being dammed up and waters reused and slowed down in their passage to adequate diluting waters — generally oceans or seas. Because of this all of the BOD will be exerted during the wastewater travel. Consequently greater percentages of it need to be removed by treatment facilities before discharge. Likewise suspended matter now will settle out at some point during the long and interrupted flow to the oceans. Additional treatment for these solids as well as BOD must be designed to remove a total of at least 95 percent of them. Some type of fine-media absorption or ultra filtration can be used to remove these contaminants with this efficiency.

## 5. COLOUR

In the 1950's and 1960's we became aware of the fact that coloured matter in streams was a form of pollutant to be concerned with from both psychological and physical standpoints. The appearance of colour in watercourses denotes in the minds of viewers a polluted state and is therefore objectionable. It also interferes with the transfer of sunlight and hence the growth of normal habitants of receiving waters. Most coloured compounds are difficult to remove with conventional treatment methods. This is one of the reasons why engineers of the 50's and 60's were reluctant to press the matter of its removal. However, in the 70's with the advent of both advanced treatment methods and a greater public concern of this form of contamination, more progress can be expected in this area. Chemical precipitation, oxidation-reduction, and ultrafiltration treatment methods appear most promising for removing significant quantities of coloured matter from wastewaters. These colour-removing treatment systems should be applied following the units for removing other contaminants. This allows for some removal by conventional units and also ensures that the colour-removing units will operate with a minimum of interference.

## 6. COD

In industrial wastes an average generally-accepted ratio of COD to $BOD_5$ is 2.5. This means to the water resource manager that part of the organic matter is non-biodegradable, although some of the COD may degrade given sufficient time and proper stream environment conditions. The harm caused by this slowly or non-biodegradable organic matter is largely to the downstream user. It will persist and be contained in the water whatever its use; drinking or industrial water supply being most affected. Although this type of organic matter may not be toxic nor exert a significant oxygen demand, it may not be desirable in the water supply. It may exert an undesirable long term effect on humans who are compelled to drink the water. Seldom are these forms of organic matter removed during the course of municipal water treatment. An example of this may be various lignous compounds discharged by pulp mills. Some organic chemical compounds which are discharged by industry include starch and carbon methyl cellulose from textile mills and non-biodegradable detergents from chemical plants. They cause a foam, turbidity, or taste or may even be unnoticed when present in low enough concentrations in drinking waters. Removal techniques utilized to some degree so far or potentially possible include (1) chemical substitution by the industry (2) fine media filtration and (3) ultrafiltration.

If we are successful in removing these additional and – thus far – persistent contaminants from industrial and municipal wastewaters, what does this mean to society? First, and most naturally, this means that our receiving waters will have less contaminants and therefore be of higher water quality. But, second, the quality of the treated effluents may be so high as to make them directly reusable. It may even be considered wasteful to send such relatively clean wastewaters to rivers already more contaminated. At the very least we can expect these well-treated effluents to be reused directly for industrial plant process waters and for certain secondary municipal water needs. In fact, I can see on the horizon a new concept in our water engineering resource system in which the wastewater treatment plant becomes also the water supply facility. This concept provides an interesting challenge to our design engineers – especially if we consider the water distribution system required. In any event we should look forward to some revolutionary changes in the late 70's and early 80's.

In summary, we all can and must afford industrial waste treatment for its cost approximates only one to five percent of production costs. These can be paid for mostly by the product purchasers and should not presented any significant deterent for plant location in a given country. We have and are continuing to test and develop the treatment techniques needed to remove important industrial contaminants of (1) inorganic contaminants, (2) ammonia nitrogen oxygen demand, (3) toxic chemicals, (4) additional $BOD_5$ and suspended solids, (5) colour, and (6) COD. Some increase in direct reuse of wastewaters will result from these forms of advanced treatment.