The Quality of Our Environment and Its Planning and Management

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— We need determined, rigorous and effective actions guided by bold, thorough and comprehensive plans —

The quality of an environment must meet a set of criteria to protect public health, to preserve and maintain public welfare, and to radiate aesthetic "waves" which would stimulate and strike a sense of enjoyment and relaxation. The set of criteria is a spontaneous response of human feelings, a subtle expression of appreciation, justice, self-respect and responsibility intertwined. In order to manage the environment, the criteria are necessarily translated into quantitative terms of a host of parameters for conveniences, which are evidently a poor substitute for the genuine response.

The mode of environmental management in Taiwan is at a developing stage. The following are some examples:

(1) The wastewater works of Taipei

The wastewater collection system of Taipei is basically of the combined type which was installed many decades ago, for relieving the storm water as well as receiving the effluent flows from a myriad of septic tanks. A unique feature of the septic tanks is that they are used only for the settling and

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retaining of toilet solids. The other sources of domestic wastewaters, including kitchen and bathing all directly discharge to the combined sewers. The sewers are rectangular in cross section with a flat bottom. They were originally open ditches, but since the last decade have been covered with heavy concrete slabs with the provision of inlets. At present, the sewers are filled with sludges, a part of which is flushed out from dwellings and other buildings and could contain hazardous and toxic materials from a variety of scattered small factories throughout the city. However, the major portion of the sludges is the muds, garbage and rubbish, entering through the inlets during storms or being swept in during street-cleaning. It is most probably that if replaced with the Western separate sewer systems , the existing combined sewer system which may have to be kept as storm drains would not be reduced in its accumulation of sludges. The installation of a 4×10^5 MTD (metric tons per day) primary wastewater treatment plant was completed for the Greater City of Taipei in 1981, which at present, is operated at about 10% of its capacity, because only two new developments of a little over 100,000 people connected to the plant provide the small flow. Yet, somehow grits from the streets in a concentration of more than 1000 mg/l reach the plant during storms, a situation which could overcome the capacity of the grit chambers and damage pumps and other treatment equipment of the plant.

With all the cities and towns there are only six municipal wastewater treatment plants in Taiwan, serving less than 5% of

the total population. The ironic facts are that at the present time municipal wastewater treatment plants are not really needed in Taiwan. A municipal wastewater treatment plant is installed to receive and treat municipal wastewaters collected via sewer systems. The street ditch systems in the cities of Taiwan, including the City of Taipei, are laid not so that the wastewaters are discharged directly to streams through scattered outlets and are not, as yet, intercepted and delivered to designated sites for treatment. Since there is no municipal wastewater collected for treatment, why should any one need a treatment plant?

(2) Industrial wastes

Another major source of water pollution is industrial wastes. There are about fifty (50) industrial parks located throughout the Island, more than half of which are provided with industrial waste treatment plants. The other half discharge their wastes including toxic chemicals directly to streams. In addition, many manufacturing factories are situated outside the Industrial Parks, some of which are generating toxic chemical wastes, but providing practically no treatment.

(3) Water shortages

Due to deforestation, highway and other massive constructions, development of residential areas, industries and other forms of land use, small streams are destroyed, and the larger ones are badly silted. Such practices not only deteriorate the water quality, but also, more seriously rush the mud-laden water to either storage reservoirs or the coastal waters. Consequently

even with an average rainfull of about 250 cm per year (about 2.5 times the annual rainfall of U.S.) there are often periods of water shortages in Taiwan. Because the rivers are short and silted and the land is bare, during raining seasons only a small percentage of the water can be retained on land for utilization while a much larger portion quickly concentrates in flat or low areas, causing damaging inundation as well as siltation before meandering into the sea.

(4) Air pollution

As to the quality of air, especially in large cities, air pollution due to automobiles in Taipei, and from stationary sources in Kao-hsiung are rather serious. There is no need of any instrumentation to detect the high concentrations of particulates, residual hydrocarbons, and irritating sulfur oxides. With all the technology applied to control or mitigate the pollution at both mobile and stationary sources, the results are discouraging. The key reasons probably are: the senses of responsibility and obligation, as citizens of the land, do not prevail among the polluters, and the infrastructure of the regulatory agencies is yet to be strengthened for effective enforcement. Besides the human factors, the effectiveness of air-pollution controlling facilities could be hampered by unfavorable topographical setting and/or prevailing atmospheric condition, as well as by the overcrowding of automobiles or factories. It must also be realized that at best the installation of controlling facilities can only mitigate, not eliminate the pollution even with the rigor of proper operation and maintenance.

For example, a current issue of installing a gigantic cement-manufacturing factory just outside the boundary line of Taiwan's famous Taroko-Gorge National Park is being considered because of the argument that the installation of air-pollution control facilities can eliminate all the pollutants and avoid damages to the nearby National Park, a rare and priceless national asset.

(5) Garbage and rubbish

The most urgent matter which demands immediate attention is the disposal of rubbish and garbage which is of course, a problem of global scale. The only method of disposal used in Taiwan has been open dumping. The solid wastes nowadays are overflowing and spreading. For large cities, because of the increase and concentration of population and the skyrocketing of land value, it has been very difficult to find a site for disposal. Small communities and industries dump their wastes at one's discretion. The piles of wastes can be found on river banks, in watersheds, one's backyard, blind alleys and empty lots.

(6) Odors

The open-dumped garbage, accumulated sludges in the street ditches and septic stream waters, "spiked" with the air pollutants emitted from automobiles and factories, create a peculiar odor which is often sensed by tourists from abroad.

Of all aspects, the ones having long and deep effects on Taiwan's Environment are water supply, hazardous wastes, and pollution of coastal areas.

(1) Water supply. Taiwan's water supply is jeopardized both in quantity and quality. The main source of water supply in Taiwan is the reservoirs, about thirty (30) in number. For some of the reservoirs, the storage capacity is accelerating in reduction by silting, a result of years' damage of watersheds due to deforestation, mismanaged cultivation and uncontrolled development of residential, recreational and even industrial activities. Some reservoirs are not only eutrophic with excessive growth of water-quality spoiling algae, but also suspected of being contaminated by pesticides and other undesirable organics. The creation of reservoirs by damming has also resulted in a secondary undesired effect, due to the Taiwan practice of requiring no minimum flow downstream of the dam. A casual train passenger observes the dry river beds along the way with exposed bottom of gravels and boulders and wonders why. If the passenger ever steps off the train for an investigation out of curiosity, he would find that the rivulets trickling along the bottom are the discharges from industries and towns along the river, or the leachate of the garbage piles on the river bank.

The groundwater supply is mostly utilized by fisheries, and industries. Some commercial establishments, such as hotels, use it as supplementary sources. Little, if any, information is known regarding the changes of water quality due to pollution and sea-water intrusion. Because of the massive withdrawal of groundwater in the past, the water table has excessively receded and the land subsided. The need of recharge is evidently great

and urgent, but a little attention has been given in this respect.

Some unfortunate communities, located beyond the access to reservoir water are using nearby river water as their sources of water supply, which are, more than often, polluted by unidentified industrial and/or agricultural (pesticides, organics from duck and swine farms) wastes. The only defense available for these communities is the conventional sand filtration, an ineffective method of water treatment, even with proper operation, to safeguard against the chemicals and other sinuous pollutants.

(2) Hazardous Wastes.

The second most serious concern is the accelerating generation of hazardous wastes in solid, liquid and gaseous forms. So far there are not effective regulations to manage such wastes in detection, collection, treatment and ultimate disposal. Because the Island is small and the population is dense, it would be extremely dangerous, if the hazardous wastes are not quickly brought under control.

(3) Pollution of coastal Areas

The third most serious concern is the protection of the coastal areas. Because the polluted rivers and estuaries discharge a wide range of organic and inorganic chemicals into the coastal waters, the ecology of which have been adversely changed. Taiwan is an island with a large ratio of coast-line to land area. The national economy is heavily dependent

upon how the coastal areas can be utilized. These areas must be protected to preserve their natural values while utilized for developing national economy.

The matter concerning an environment is often ramifying and complex. The following is a list of suggested subjects in different aspects related to the planning, upgrading and management of our environment. For convenience, the subjects are presented in three catagories: Long-term planning, Bold conception and Immediate actions.

(1) Long-term planning.

The long-term development of Taiwan's economy must have been planned, in which the reciprocal relation with the environment, essentially the water, air and land use, must have been considered. What is suggested hereupon is the long-term plans with the emphasis centered on the quality of our environment.

(a) Is there a desired maximum population for Taiwan? If there is one, what is it? —— Ecologically any habitat has a maximum capacity for its dwellers. When the maximum capacity is exceeded either by increasing the dwellers in number or by boosting the affluence of each dweller, the environment must be modified to accommodate the new demands, otherwise it would undergo degradation in quality. It would then gradually lose its ability to keep the resulted pollution in check even with continuous effort to improve the skills and facilities in managing the environment. Finally it becomes a problem of balancing the availability of energy against the supply of natural resources. The smaller the habitat, the faster and

keener the pinch.

(b) Should Taiwan be more industrial or more agricultural? —— A land of favorable rainfall and temperature, and fertile soil for agriculture, while lacking of natural resources, probably should build its economy, essentially on agricultural developments supplemented by specific types of industries which have low demand on supply of energy and raw materials. A well-planned balance of industries versus farms would impose less strain on the environment. The population density would then be reduced, the pollution lessened, and the living more pleasant.

(c) A comprehensive plan and management program for upgrading the environmental quality for the Province of Taiwan —— such a plan should deal with all factors influencing the environmental quality, such as water supply and wastewater disposal, control of mobile and stationary air-pollution sources, handling and disposal of rubbish and garbage, transportation, industrialization, land utilization, recreation, soil conservation, highway and dam construction, and development of residential districts. The master plans for the Greater Cities of Taipei and Kaohsiung could be the two major portions of the grand plan for the Province. The plans must be in details, taking into consideration of the current status on one hand, and integrating far-sighted views for years to come on the other. It may need the joint effort of many factions of experts selected from local circles as well as from abroad.

(2) Bold conception

Some of the bold endeavors are often viewed as not plausible

at their early stage of conception. However, who would have believed in early 1960's the landing of man on the moon ten years later.

(a) Fresh-water reservoir by the sea —— an idea imported from Holland to save our bare-bottomed rivers while quenching our thirst.

Professor Yang of NTU, upon his return from Holland, mentioned the success of Holland's water resources conservation programs which include the construction of fresh-water reservoirs outside the estuarine outlets. He also suggested the possibility of applying the scheme in Taiwan. This writer believes that for a island with short and rapid rivers, and wide and shallow estuaries, this idea of fresh-water reservoirs by the sea could be well adapted. A dike with adequate spillway capacity is provided outside the estuary outlet, which keeps the sea water out while "ropes" off a sufficient area of coastal water for the storage of fresh water. The fresh water from the upstream rivers is stored in the seaside reservoirs and backed up in the original estuary-channels, thus raising the water level in the dried rivers. However, it must be emphasized that the pollution along the river and estuary must be cleaned up, and the soil conservation of the watershed must be observed so that the seaside reservoir can be free of siltation with minimum maintenance, and the quality can fit for water supply with conventional processes of water purification. Probably the key to the feasibility of this concept is how to control the nonpoint

pollution sources, including the storm water from streets which would be laden with pollutants accumulated in the storm drains between storms.

(b) Submerged interceptors

Most of the cities and industrial developments in Taiwan are located near rivers and within about 20 kilometers from the coast. It would be feasible to build a pipeline under the river bed to intercept the industrial wastes and municipal wastewaters of towns and cities, and deliver the wastes flow to the coast where it is then connected to ocean outfalls. If the wastewaters intercepted are required to have some of the pollutants removed before ocean dischage, the necessary treatment facilities should be provided at the coastal area before the connection with ocean outfalls. Such a scheme will keep the river clean and can go hand-in-hand with the installation of a "fresh-water reservoir by the sea".

(3) Immediate action. This topic is discussed under the following subtitles: (a) The most urgent, (b) Municipal water distribution systems, (c) Public sewer systems, (d) Drastic measures for air pollution control and (e) Facts-of-life factors.

(a) The most urgent.

There are three pollution sources most urgently needed for actions: solid wastes, polluters of water-supply sources and hazardous wastes.

At top of the list is the handling of solid wastes which include rubbish and garbage, sludges from septic tanks and wastewater treatment plants, sediments from public sewers and

residues generated by air pollution control processes. The present practice of discarding these solid wastes contaminates both air and water, as well as threatens the public health and degrades the living surroundings. There is no magic to make solid wastes disappear. They must ultimately be buried either on land or under water. Before burial it is often to reduce their bulky volume and stabilize their putrefying characteristics by means of incineration. As to find the optimum operation of landfill in combination with incineration for a locale, such as Taipei, a comprehensive environmental and economical analysis will be needed. Because of the land limitations prevailing in Taiwan, for the final solution of solid wastes disposal, the method of "coast-fill", that is, filling of solid wastes in a drained enclosure between the coast and a ocean dike, may have to be adopted, with which incineration can be advantageously incorporated. There are precedents in other countries that useful new land can be thus added to coastal areas.

With a same degree of urgency, the pollution of water-supply sources should be outlawed. The regulations of soil and water conservation must be absolutely enforced so that the erosion is prevented and the groundwater is recharged.

As for the hazardous wastes, an inventory must be made immediately. How much are being produced and where are they stored? Regulatious must be promulgated to require the proper handling of such wastes, including transport, storage, and ultimate disposal. The facilities for transport and temporary

storage must be provided, and the scheme for ultimate disposal must be prepared.

(b) Municipal water distribution systems

Municipal water supplies in Taiwan are often recontaminated via poor joints of distribution systems because of low water pressures (about 1.5 kg/cm^2 in Taiwan vs about 4.5 kg/cm^2 in U.S.) and cross connections. As reported, portions of the water distribution pipelines in many cities of Taiwan are in poor conditions and leaky at excessive rates. If their pressure is raised as high as the ones required in U.S., there would be at least a leakage of 50%, that is, about half of the water from a water purification plant is lost through leakage. At the prevailing low pressures, the water pressure is further reduced to lower than atmospheric pressure during peak water-demand periods, a situation which results in the seepage of contaminated water into the pipes through the joints, causing recontamination. Furthermore, due to the low water pressure a unique house connection through a pumping-and-storage arrangement, a serious cross connection, is used. To have potable tap water by eliminating recontamination via leakage and cross connections, the water distribution pressure must be increased to at least 4 kg/cm^2.

(c) Public sewer systems

The public sewer systems for the cities of Taiwan were installed many decades ago and of the combined-sewer type. The combined sewer systems are still being used in other countries such as Boston, in the Northeastern region of U.S. and in Tokyo

of Japan, and are not completely written off. About 14 years ago, an engineering report was prepared by a U.S. consulting firm on the Taipei sewer system, and recommended separate systems mainly because the project had a low funding so that the firm could not afford to make a detailed study on the feasibility of utilizing the existing open-ditch system. The firm also failed to illustrate fully either the effectiveness and advantages to install a separate system for the city of Taipei, or the uselessness of the existing open ditches as combined sewers. Ever since, the option of separate systems for Taipei has persisted. In the last decade the open ditches have been covered with concrete slabs and almost forgotten, while the septic tanks, an integrated component of the public sewer system for retaining the toilet solids, are hardly functioning because of inadequate installation and poor maintenance. The negligence in maintenance of the existing public sewer systems may be due to the persistence of the notion that they would soon be replaced by separate systems. However, it must be realized that the cost of changing combined system to separate systems is prohibitively high, and such a change could be practically impossible due to local conditions. It is, therefore, urged that an engineering study be made to find how the existing facilities, including the ditches and the septic tanks can be rendered to function properly.

(d) Drastic measures for air pollution control

The air quality in Taiwan, particularly in cities is less than desired. One may be comforted by optimistic statements

occasionally coming through the news media, proclaiming the air is getting cleaner. However, logistically more cars join the street jam everyday, and the increase of factories continues. Why should any one expect to find that the air quality is getting better? Unless drastic measures are applied to control the air pollution, such as limiting the use of automobiles and probibitting the operation of air-pollution intensive industries, most probably it would be lucky if the air quality does not become worse.

(e) Facts-of-life factors

Besides the major components of this ramified complex and yet integrated system of environmental quality —— water and wastewaters, air and its pollutants, and rubbish and garbage as delineated before there are still other factors involved, such as noise, insects and rodents, public-safety problems, occupational hazards and poor sanitation. Many of those factors are familiar to every one and encountered in daily life. They are taken for granted as facts of life. Because of this very fact, although it is obvious to every one that those factors are degrading the quality of life, there are difficulties in seeking ways to make a change for better.

The objective of this presentation is to highlight the quality of Taiwan's Environment and suggest possible approaches for its improvement. Each of the subjects delineated could be elaborated, or even documented in details through R & D effort.