Dynamic Impact of Advancing Technology on Environment and Health

By MARK D. HOLLIS

WITHIN the short period of 50 years, Western civilization has compressed more major technological changes than had occurred in all its previous 2,000 years. Since 1900 we have witnessed the birth of the automotive age, of aviation, and of mass production techniques. Developments in electronics, chemotherapy, and jet propulsion have appeared since 1930. Synthetics—apart from celluloid and bakelite, almost unknown in 1930—are now commonplace. More than a half million synthetic compounds are in production and use—in construction, in household products, in clothing, and in foods. We often speak of the 900-percent increase in industrial production since 1900 without noting that more than half of this increase has occurred since 1940. And now, to all of this, is added nuclear energy—the atomic age with its fantastic potential for good and for evil.

But by all signs, this is only the beginning. Already on the horizon are such techniques as irradiation of foods, rocket transportation, electrification of solar energy (now operating a telephone circuit in Georgia), and a host of other potentials.

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Attitudes Concerning Change

One thing is clear: In your life span there will be an avalanche of change such as we have never known.

Much of the world is unaware of what is in its grasp. I returned last month from a trip through several of the areas of the world which have been barely touched by technical advances, if at all. To me the striking characteristic in these countries was not their primitive sanitation but their inertia toward change. One senses a hopeless resignation to the open sewers and open sores, to the appalling rates of infant mortality, to decrepit old age at 40, to acceptance of drudgery, disease, and despair. We in the United States, always a Nation of restless pioneers, generation by generation, have displayed no vested interest or ingrained habits that compel us to do things in old ways, if new ways are better. Oscar Wilde said: "The longer I live the more keenly I feel that whatever was good enough for our fathers is not good enough for us."

It is this heritage that makes possible new developments so swiftly achieved that we have little time to adjust our minds to the changes and to understand their full significance. The tenor of the times is reflected in our increased living pace—at home, at work, and at play.

Scarcely a new product brought on the market today can expect to make the grade unless it can be advertised as doing something faster. Detergents wash clothes faster. Household equipment bakes pies, roasts meat, washes dishes, and cools houses—faster. Industrial and business machines accomplish all sorts of tasks—faster. Communication and transportation—all work and get there faster.

Yet all this timesaving has not added even a split-second to our 24-hour day. Instead, the individual is pushed at a faster and faster pace, an endless response to alarm clocks, television, and superpowered automobiles. All this leaves him little opportunity—and less time—to think, to understand himself, his fellow human beings, and the complex environment in which he lives. Yet how much we need this understanding, not only as individual men and women but also as members of families and communities, of our place among all peoples in a shrinking world. Because only through understanding can we make wise decisions as to constructive use of our unprecedented technology. And if ever we needed wise decisions this is the hour.

Science and Technology

So let us pause to recall a distinction between basic science and technology. The scientific foundations of our understanding of physical laws have been laid slowly by the world's great thinkers through many ages. Modern technology, the prompt and effective application of basic science to practical use, is a product of this era, developed largely since we were born.

Until fairly recent years there was little direct association between the basic scientist and the technologist. G. K. Chesterton, who died in 1936, wrote of this wide gap between the scientific mind and the consequences of the knowledge produced by scientific thought:

"When a man splits a grain of sand," he said, "and the universe is turned upside down in consequence, it is difficult to realize that, to the man who did it, the splitting of the grain is the great affair, and capsizing of the cosmos quite a small one."

There now exists much closer collaboration between the scientist and the technologist, and even more significant, between both these experts and society. As a result, each scientific discovery, promptly flashed to our network of research institutions, sets off a chain reaction emitting dozens of new discoveries.

Modern industries are ready, willing, and equipped to transform the scientific report or the laboratory demonstration into new or improved products. For example, you are familiar with the rapid development of the frozen-juice concentrate industry in Florida. I never cease to be amazed at the production reports on this industry. One producer said, "We expected much, and got much more."

What Is Environmental Health?

There exists a close interplay between technology and environmental health. And this interplay becomes closer and more involved as technology moves ahead.

Some of you may ask, "What is environmental health?" This term has come into use in recent years, and no precise definition has been accepted even by the professional groups who use it most frequently. In 1948, the World Health Organization defined human health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." Paraphrasing this statement, we might say that environmental health is a state in which man's environment contributes to his physical, mental, and social well-being and is not merely the absence of environmental hazards to personal health.

We may well accept such a proposition, for man and his environment are indivisible. Ordinarily we think of man as master of his environment, molding it to meet his needs. But it is more realistic to think of the environment and man as molding and changing each other simultaneously.

Environment is a broad term and each facet has its impact on public health. For instance, many people associate alcoholism with the social environment; accidents with the psychological environment. However, let us consider environmental health as it refers to the physical environment—to air, water, food, and shelter. Of these basic essentials, air and water in particular gain importance as our changing

technology shapes our Nation more and more into a complex of metropolitan centers.

Water Resources

Concentrations of people in a technological environment are bound to create all sorts of wastes which pollute and deteriorate the air and water resources. In nature, both air and water have an unusual capacity for absorbing and purifying man-made pollution—up to a point. So long as human activity does not overtax nature, air and water resources remain essentially clean and safe. In our accelerating technology, we do overtax these resources. Corrective practices to preserve a balance acceptable to all interests are not always easy.

Across the Nation, our water resource is becoming a problem of top priority. Available supplies are being increasingly taxed. In many areas, shortages already threaten to halt further expansion. The water problem is one of increasing demands, seasonal shortages, floods, and pollution.

The average urban dweller uses 150 gallons of water per day. Thirty years ago, one person used only 20 gallons per day. There were then few if any laundromats, dishwashers, and air conditioners. The water that goes into production of things you eat and wear and use raises the national per capita requirement to 1,500 gallons per day. By 1975, these water demands will double—expressed on an annual basis, a million gallons per capita for a population of about 200 million.

Industries that need large amounts of water, and that is most of them, will go where it is. And by and large the population will go where industry goes. It is just as simple as that and at the same time just as complicated from the standpoint of future economic, social, and environmental adjustments.

Water Conservation

The mere availability of water represents only half the picture. As water use increases, pollution increases. What we face, therefore, is a vicious cycle—more water needed, to support more activity, to produce more wastes, to pollute more water. The answer involves a variety of water conservation measures. Of these, pollution abatement is essential to permit re-use of the water as streams flow from city to city. And remember that 80 million people depend on surface streams for their drinking water.

When I was a boy, three expressions often used were: "cheap as dirt"; "free as water"; and "easy as breathing." The zooming prices of real estate knocked out the first. Water shortage is taking care of the second. And now even the third may have to be qualified. In some areas, the air is not so easy to breathe.

Air Pollution

Twenty years ago, community air pollution was quite localized and was primarily a problem of smoke abatement. Then in 1948, 5 smoggy days at Donora, Pa., made thousands ill and caused at least 20 deaths. In London, England, in 1952, 7 days of smog implicated air pollution in 4,000 deaths. These episodes should not be dismissed entirely as freak situations.

Less dramatic smog episodes build up from time to time in most of our metropolitan areas. The reality is that the community air supply, like water supply, has limitations. Florida has her water problems, but California leads in the smog problem department. Los Angeles is the best example of a city in our changing technology that is overtaxing its air supply.

In highly developed areas we simply cannot go on forever spewing more and more complex contaminants into the atmosphere without inevitable consequences to public health and community well-being.

We must expect some deterioration of community air resources in this age of ours. The job, as with water, is to limit depreciation in keeping with the entire development of the area.

You may ask, "Why this sudden concern about community wastes reaching air and water?" A popular belief is that it should be simple and easy to purify such wastes before discharge. On the contrary, proper control is both complex and expensive. Water pollution abatement alone will cost a billion dollars a year of somebody's money.

In earlier years, wastes were piped to the edge of town and given only superficial treatment—often no treatment at all. Factories too were located on the edge of town with stack discharges to the atmosphere. In those days water and air resources were able to absorb community contaminants without undue harmful effects. At worst, factories produced merely local nuisances.

Changing Character of Wastes

Today, in our metropolitan and industrial complexes, the situation is vastly different. Not only is technology advancing but metropolitan population is increasing—already up 35 percent since 1940. Now a hundred million people live in metropolitan areas of the United States. And for the most part, there is no longer an edge of town. The city blends into the suburban areas, also thickly populated and industrialized; the suburbs into ex-urbia areas, where people use the same water resources and experience the same smog; and vice versa to the next city. In addition, there is the ever-increasing volume of waste. And, most troublesome of all, an increasing complexity in the character of wastes.

Modern cities, with all their diverse activities, discharge thousands of tons of contaminants to air and water every hour. In the chemical complex involving countless new compounds, the resulting actions and reactions, continually occurring in air and water, produce situations extremely difficult to measure and even more difficult to understand. The atomic age introduces an entirely new set of terms, equations, and factors. Radioactive contamination does not follow our set patterns and established formulas of dispersion, dilution, and biochemical actions. Man's ability to control this impact of waste on the physical environment will be a significant factor in future metropolitan growth and development.

By all of this I do not mean to imply that we can quantitate the effects on personal health of contaminants in our physical environment. There is much we have to learn on this score. However, in many areas, these contaminants are causing physical discomfort, economic blight, and agricultural damage. But remember we are talking about accelerating technology. When we project present trends over the next two decades, the concentrations of contaminants in air and water do have a sobering implication—not only with respect to personal health but even more so to mental and social well-being. We must develop the understanding and remedial practices now to minimize these future difficulties.

What we need most is a better understanding of behavior and effects of contaminants in air and water. To produce this knowledge will require a much broader research effort. Universities and other research institutions should assume leadership in this effort.

On the industrial side, industry officials have an understandable reluctance to accept blame for all the atmospheric and water pollution. Actually, the responsibility is about evenly divided between industrial operations, per se, and public use of the fruits of industrial technology. Air is contaminated by the family car, home fuels, rubbish burning, and the like. Water is contaminated by home laundries, dishwashers, garbage grinders, and so on. From my experience, I am convinced that responsible industry is willing to use its research facilities to adjust its processes in line with a sound control plan. A prerequisite, however, is to know specifically what contaminants from industrial processes are hazardous and at what concentrations. And in our changing situation this is quite a task.

It is obvious that technology has created many problems in environmental health. It has, on the other hand, contributed much to the improvement in our well-being and comfort. It has given us the highest average standard of living the world has ever known.

It has been of direct assistance in providing the United States with remarkably safe public water supplies, by far the best in the world. It has improved food processing and packaging, housing, insect control, and a host of other environmental health measures.

Indirectly, the potential of cheap power from nuclear sources will place in the hands of the engineer a much wider range of possibilities. Reclamation of sea water, talked about for ages, is moving toward practical reality with such developments as the permionic membrane.

Weather modification, although still in the exploratory stage, has intriguing possibilities. Automation, too, will find increasing application in the environmental health field.

Now to shift gears for a moment. The engineering and technical aspects of pollution control likely will be less difficult in the long run than the related political, economic, and legal considerations. Pollution of air and water more and more influences the patterns of metropolitan growth and land use. The degree of regulatory control, how it is applied, and especially where it is centered, raises important and fundamental questions.

Effects of pollution are seldom limited to one political jurisdiction. Always difficult is the question of financing necessary remedial measures. Even more difficult is the process of obtaining agreement among various interests for the best use of environmental resources. There is real need for public awareness and for public understanding. The situation cannot be corrected by merely opening a window or turning a valve.

If the pollution problems of the future are to be met and managed, coordinated city and regional planning must be the basis. This must integrate the social, political, legal, and economic factors with the technical ones. Each State needs to appraise its problems realistically and to develop a framework which will foster a partnership participation by other public and private interests. This will require a degree of effort much better organized and much better understood by the public than are our present practices.

Research in Hospital Facilities Field

Grants for research projects to develop new knowledge about hospitals, health services, and health facilities were awarded in February 1956 by the Public Health Service to Yale University, Sinai Hospital, Baltimore, St. Mary's Hospital, Evansville, Ind., Health Insurance Plan of Greater New York, and the American Hospital Association. The grants were awarded, upon recommendation of the Federal Hospital Council, from the recent appropriations under the Hospital Survey and Construction Act for research in the hospital facilities. Eleven grants were also awarded in December 1955.

Yale University will study factors which can be used to achieve maximum functional efficiency in hospital architectural design.

The Sinai Hospital project will demonstrate the extent to which the shortage of professional nurses can be alleviated by employing and training floor managers and general aides for nonprofessional hospital duties.

St. Mary's Hospital will evaluate its new plan to provide more individual care for patients and will demonstrate the reorganization and education necessary to success of the plan.

HIP will analyze available statistical information to determine the influence of a comprehensive medical care insurance program on hospital admissions, patients' length of stay, quality of service given, and hospital costs.

The American Hospital Association study will be a basic analysis of accomplishments over the past decade in planning and building hospitals and health facilities, including the effect of the Hill-Burton program, for the purpose of establishing new scientific guides to planning for future hospitals, nursing homes, rehabilitation centers, and diagnostic and treatment centers.