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RECYCLING: PROBLEMS AND PROPOSALS

by

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> ...Every day of continued exponential growth brings the world system closer to the ultimate limits to that growth. A decision to do nothing is a decision to increase the risk of collapse. We cannot say with certainty how much longer mankind can postpone initiating deliberate control of his growth before he will have lost the chance for control. We suspect on the basis of present knowledge of the physical constraints of the planet that the growth phase cannot continue for another one hundred years. Again, because of the delays in the system, if the global society waits until those constraints are unmistakably apparent, it will have waited too long.[1]

Introduction

This article is multifaceted. Its primary goal is to clearly present the nature and extent of the problem of the exhaustion of non-renewable natural resources in the perspective of environmental problems in general. A second major objective is the presentation and discussion of a variety of suggestions for surmounting the resource depletion problem. To satisfy these goals, this article will present some of the more accurate statistical information available today, define certain relevant terminology, and discuss the methods of solid waste management currently in use, pointing out their advantages and disadvantages. Hopefully, the reader will come to appreciate the great sense of urgency that the authors feel about the environmental problems treated herein and to understand some of the positive courses of action available to society to cope with these problems.

The authors extend their appreciation to Donald Maziaz for his assistance in gathering technical information.

1. D. L. Meadows, D. H. Meadows, J. Randers and W. Behrens, *The Limits to Growth* (New York: Universe Books, 1972), p. 183.

> And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth.... So God created man in his own image, in the image of God created he him; male and female created he them. ...God said unto them, Be *fruitful,* and *multiply,* and *replenish* the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing....
>
> Genesis 1:26-28

How Long Can We Go On?

Many years ago a chemical axiom known as the *Law of the Minimum* was postulated. This natural law states that under ideal circumstances a reaction will continue until restrained by exhaustion of whatever essential ingredient is present in least supply. Applying the *Law of the Minimum* to the environment raises many questions. In man's ongoing reaction with his environment, which ingredients are essential? Which are in least supply? Although all of the Earth's resources are finite, the exhaustion of some of the essential ones in shorter supply makes moot questions regarding the finiteness of others.

It is abundantly clear that man has followed the directive stated in Genesis--to be fruitful and multiply. Man has shown no hesitancy in exercising his dominion over the inhabitants of all three major components of the ecosphere--air, land and water. It is equally clear that, in his rush to propagate his species and to exercise dominion over all others, man has ignored the directive to replenish his environment. Instead, he has proceeded systematically to rape his environment by polluting, extracting, and moving on. Only a growing awareness that

there will soon be no unpolluted places to move on to has led an appreciable number of people to take cognizance of the environmental problems facing the Earth. Unfortunately, few of these individuals appreciate fully the gravity of the problem.

"Ecology is not only more complex than we think, it may be more complex than we *can* think."[2] Poul Anderson has stated the same thing in more general terms: "I have yet to see any problem, however complicated, which, when you looked at it the right way, did not become still more complicated."[3] This thought may be quite disconcerting to many ecology activists who think that they understand the environmental problem and have the answers for it. It certainly is disconcerting to the authors of this article who, like everyone else, would like to "solve" the problems of the environment.

Notwithstanding the seemingly infinite complexities of the ecosphere and its stability, it seems safe to say that if man were to devote sufficient resources to the problem, he could cope with it. The complexity of the problem is probably comparable to that of putting a man on the moon, though of much higher magnitude. The United States committed an estimated $40 billion to solving the highly complex problem of placing a man on the moon in a relatively short peiord of time. The object there was to win the "space race." A similar, though larger, commitment will be necessary to develop a sufficiently sophisticated

2. H.D. Johnson, ed., *No Deposit-No Return, Man and His Environment: A View Toward Survival* (Reading, Mass.: Adison-Wesley Publishing Co, 1970) p. 32[1]

3. Kaiser News, *Ecology: The Man-Made Planet* 4 (1970).

understanding of the socio-economic factors influencing the complex physical relationships that constitute the environmental crisis. The object here is to win the "survival race."

Some significant steps have been taken to achieve this understanding. Under the auspices of the Club of Rome Project on the Predicament of Mankind, a System Dynamics team at M.I.T. headed by Professor Dennis L. Meadows has taken one such step. Dr. Meadows describes the Club of Rome as "a group of approximately seventy invividuals united by a deep concern about the future of the world and the looming problems which threaten human society."[4] The Club is a nonpolitical, multinational group whose members include economists, educators, scientists, humanists, and businessmen. Through the medium of a sophisticated System Dynamics model, the team has attempted to analyze the global limits to growth. The results to day of the ongoing study have been published in a highly readable and fascinating book, *The Limits to Growth*.[5] This book should be regarded as essential reading by anyone who is concerned about the quality of life on this planet beyond the next decade or two. Because this study is the most sophisiticated effort to date to quantify environmental problems and because the conclusions reached by the M.I.T. team, though they have been espoused by others, are supported by reasonably reliable statistical information, this article quotes extensively from

4. D. L. Meadows, *M.I.T. - Club of Rome Project on the Predicament of Mankind* 2 (1972).

5. D. L. Meadows, D. H. Meadows, J. Randers and W. Behrens, *The Limits to Growth* (New York: Universe Books, 1972).

this new book.

Should the reader desire to learn more about the field of System Dynamics in general or the foundations of the global model used in this study, he should look to *Principles of Systems*[6] and *World Dynamics*,[7] respectively. However, a brief explanation of the techniques of the M.I.T. study and some of the terminology used by the book in reporting the results of that study will aid the reader in understanding the following materials. The global model used in the study is the result of an attempt to select major variables (in this case, population, pollution, industrial capital, food production, and nonrenewable natural resources) and quantify not only their growth patterns but also their interrelationships. This results in a very complex pattern of interrelationships which is then programmed to be handled by a computer. With this program, the computer is able to make projections of the trends of these major variables into the future. Of course, the validity of these projections depends upon the accuracy of the program's spelling out the quantification of the interrelated growth patterns and the accuracy of the raw data fed to the computer as a starting point. Notwithstanding the lack of perfection in both of these inputs, the M.I.T. team feels that the results are basically sound and that improved input information and further refinements of the program will not change the

6. J. W. Forrester, *Principles of Systems* (Cambridge, Mass.: Wright-Allen Press, 1968).

7. J. W. Forrester, *World Dynamics* (Cambridge, Mass.: Wright-Allen Press, 1971).

basic conclusions of the study.

To define briefly some of the important terms, let us look at a single variable: population. There are two basic feedback loops that affect population. The average fertility--the fraction of the population giving birth each year--is a positive feedback loop adding to the population; that is, the larger the population, the larger the annual number of births will be. The average mortality--the fraction of the population dying each year--is a negative feedback loop tending to decrease the population. Many factors such as family income, education, health services, food, etc. affect the two feedback loops. An equilibrium state is said to exist when the rates of input and output of the two feedback loops are equal; that is, when the population is neither growing nor declining.

Looking at the population growth pattern of the now famous jar of fruit flies simply as an example of the behavior of a simple variable in a closed system, the population continues to grow very rapidly until the food supply in the jar is exhausted. At this point, the population begins to decline very rapidly. This pattern is termed "overshoot and collapse" by the authors of *The Limits to Growth*.

Given the above background information, some of the basic conclusions reached by the M.I.T. team using the global model are presented:

1. In most contemporary societies, the dominant force in socio-economic change is exponential growth of population and capital.

2. Current growth rates of population and material output will exceed critical physical limits if continued for another fifty to one hundred years. Moreover, the longer uncontrolled exponential growth

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is permitted to continue, the fewer options will be available to achieve the equilibrium state. For example, with the resources available, X number of people could have a Y standard of living or 2X number of people could have 1/2 Y standard of living. By waiting until the population of the Earth has doubled from its present level--a point estimated to be reached in about 28 years, the mean standard of living possible for the Earth's population will be only one-half of that attainable at current population levels. In any case, that is substantially below the standard currently enjoyed by the United States.

3. Growth may be halted by self-imposed limitations (a transition to equilibrium) or by nature-imposed limitations (overshoot and collapse). While the latter will come about with no effort on anyone's part, the achievement of an equilibrium state, in terms of both population and investment capital, will only be achieved through great effort and major social change.

4. "Because of the delays in the many feedback loops which govern growth in material output and population, the most probable result of current global growth trends is overshoot and collapse."[8]

5. The book warns against technological optimism and concludes that though technological solutions may ease some of the growth-caused pressures, they will only postpone the ultimate collapse unless they are accompanied by radical changes reducing the political and socio-economic factors causing growth.

8. D. L. Meadows, *supra* note 4, at 16.

6. To preserve mankind's advances toward a civilized society, a state of global equilibrium, where population and capital or material output are essentially stable and in balance with the finite resources of the Earth, must be achieved. The study determines that the minimum requirements for equilibrium are: (1) capital plant and population must be constant in size, (2) all input and output rates (births, deaths, investment, and depreciation) must be kept to a minimum, and (3) the levels of population and capital and the ratio of the two must be set in accordance with the values of society.[9]

7. "A society released from struggling with the many problems caused by growth may have more energy and ingenuity available for solving other problems.... The evolution of a society that favors innovation and technological development, a society based on equality and justice, is far more likely to evolve in a state of global equilibrium that it is in the state of growth we are experiencing today."[10]

8. "There is no unique, optimal long-term population level. Rather, there is an entire set of tradeoffs among personal freedom, material and social standard of living, and the population level. Given the finite and diminishing stock of resources on this globe, we are inevitable faced with the necessity of recognizing that a larger population implies a lower material standard of living over the long term."[11]

9. D. L. Meadows, *supra* note 5, at 173.

10. Id. at 174.

11. D. L. Meadows, *supra* note 4, at 16.

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9. Each day of continued exponential growth brings the world system closer to its ultimate limits and decreases the long-term options of society as well as the probability of making an orderly transition to equilibrium. Because of the delays in the responses of the world system, transition to equilibrium will take a long time. Accordingly, steps must be taken immediately to begin planning and implementing the transition to equilibrium.

From the above conclusions, it is obvious that recycling is not a panacea for the world's environmental problems. In fact, unless broad-scale recycling is coupled with deliberate controls aimed at halting growth, it could exacerbate the environmental problems by providing more raw materials which would permit exponential growth of industrial production to continue for a longer period creating, in turn, much more pollution resulting in higher mortality rates and decreased capacity of the plant to produce food. Nevertheless, we must assume that the leaders of the world's nations will see the handwriting on the wall and become sufficiently apoliticial in time to deal with the limitations on growth in time to preserve a habitable ecosphere. To maintain a reasonably high standard of living for increased numbers of people, increased amounts of raw materials are necessary. It is axiomatic that we cannot continue to bury our natural resources in landfill projects and expect to maintain our present standard of living into the next century or even until the end of the present one.

The table presented below is condensed from one published in *The*

Limits to Growth. A brief explanation of the original and condensed versions will make the statistics more understandable. The original table contained 10 columns with the following headings: Resource, Known Reserves, Static Index (known reserves divided by the present rate of consumption), Projected Rate of Growth (of rate of consumption), Exponential Index (the number of years the known reserves would last taking into consideration the projected increases in rates of consumption), Exponential Index Calculated Using 5 x Known Reserves, Countries with Highest Reserves, Prime Producers, Prime Consumers, and U.S. Consumption as % of World Total.

RESOURCE	STATIC INDEX (years)	EXPONENTIAL INDEX (years)	U.S. CONSUMPTION AS % OF WORLD TOTAL
Aluminum	100	31	42
Chromium	420	95	19
Coal	2300	111	44
Coblat	110	60	32
Copper	36	21	33
Gold	11	9	26
Iron	240	93	28
Lead	26	21	25
Manganese	97	46	14
Mercury	13	13	24
Molybdenum	79	34	40
Natural Gas	38	22	63
Nickel	150	53	38
Petroleum	31	20	33
Platinum Group	130	47	31
Silver	16	13	26
Tin	17	15	24
Tungsten	40	28	22
Zinc	23	18	26

Many readers who label environmentalists as "doom peddlers" will attempt to disparage the above statistical information. However, the

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Static Index was derived directly from a U.S. Bureau of Mines publication. It is apparent that, without recycling, many of the above resources will be exhausted before the end of the present century. With our blind faith in the free enterprise system, we could simply wait for this to happen and expect industry to then mine landfill sites. However, parks, lakes, housing developments, industrial parks, etc. are built on sanitary landfill sites. It could prove very costly to attempt to extract minerals from a completed and improved site. Moreover, the concentration of the elements would make conventional practices extremely costly.

What is Recycling?

It is generally acknowledged that the "recycling problem" is really an interaction of several phenomena. The original extraction of raw material from the Earth creates by-products and waste. The purification and conversion into a useful form produces even more waste. Finally, the manufacturing process also produces waste and pollutants. The marketing function, in the form of packaging and paperwork, adds to the waste. And all of these processes consume great amounts of energy. The production of this energy entails extraction, waste and pollutants, whether the source be coal, petroleum or nuclear fission.

Any attempt at total recycling must involve more than merely taking the goods the consumer rejects and reinserting them into the cycle. Some materials are easily reinserted and others impose such a cost in waste, pollutants and energy that it would be foolish to force society to reuse them with present technology. For example, in Los Angeles, a

salvage plant de-inks newsprint from which it makes newsprint for direct use. The firm processes 300 tons of old paper per day but unfortunately recovers only 260 tons of the new product. The remaining 40 tons of material--along with three million gallons of waste water--is discharged daily into the local sewerage system. The water consumed in the process is equivalent to that used by a city of 30,000 people. The solid waste is a load on the sewage treatment plant equivalent to a city of 250,000![12]

Whether this recycling of newsprint has a net beneficial or a net detrimental effect on the environment is an open question. To answer it, one would need to assign values to many resources in ways that are not presently done. To make the proper decision about whether to recycle newsprint, and if so, how much and where, requires a sophisticated System Dynamics model like that used for the Club of Rome Project coupled with a sophisticated, long-range economic valuation of the various resources used in the process balanced against the value of the output. It may well be that it is more desirable, from a long-range ecological standpoint, to let the sun provide the energy for recycling newsprint by returning the minerals to the ground and growing new trees. These trees are an essential link in the natural cycle of oxygen generation upon which all animal life is dependent. The important point is that there are no simple answers. We are dealing with incredibly complex relationships. To make the right or optimal decisions, we must develop an equally complex information evaluation system upon which to base our

12. American Public Works Association, *Proceedings: National Conference on Solid Waste Disposal Sites* (1971).

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decisions and supply it with accurate data.

In any total scheme, there must be great emphasis in channeling the consumption of materials by both industry and the consumer to those modes which are economically reusable. Ideally, the price of any item would reflect the costs to the environment caused by its extraction plus the net costs of recycling the raw materials in the product to the extent they exceed the original extraction cost. The purchaser would base his decision to buy solely on cost and utility. It would be ideal if that would occur. Instead, it will be necessary to use regulation, taxation and public education to accomplish this result.

Envelopes and paper bearing statements to the effect that they are made from recycled paper abound these days. But are they really recycled? For purposes of public relations, a loose definition of recycling has been adopted. Most of this paper is made from paper scraps--trimmings from earlier envelope manufacture or other cuttings of new paper made from virgin fibers. This scrap is kept separate from other scrap and is reprocessed in its rather pure from without ever leaving the paper company's hands. The correct term for this operation would be "salvage," because the material, paper in this case, has never been used and hence cannot be "reused" or "recycled."

Recycling is limited in its present application to those areas where separation is relatively simple and where a ready market exists for the salvaged materials. Because of separation costs, the bulk of items that are presently "recycled" or salvaged never enter the refuse stream, but are sorted and separated at the source and funneled back

into the manufacturing stream. In addition to the above example of paper trimmings, other examples are metal turnings and scrap from slaughter houses and butchers that are collected separately and sold to renderers. Many manufacturing processes produce a concentrated waste that, if there were a market, could easily be sold and recycled.

In another public relations effort offering a placebo to public demands for recycling, the public has been told via a large advertising campaign that steel cans are the ideal container because of the ease with which they can be electromagnetically separated from other waste. Similarly, some bottling companies and brewers are accepting returned cans and no deposit bottles for "recycling," and, in some cases, are paying for them. To the extent that the no deposit bottles are cleaned and refilled, they are being recycled. However, at least in the Western states, most of the returned cans are used in precipitating copper near the large mines in Arizona, Utah and Nevada. In the East, the steel producers are offering to recycle all cans returned to them, but are not paying for them. (There are almost no steel producers in the West.) The furnaces are limited in the amount of scrap steel that can be accommodated and severely limited in the amount of tin cans that can be used. The furnaces in the steel-making process are currently recycling the maximum amount of scrap, and the newer steel-making furnaces can absorb even less. Any additional cans will have to be used in the blast furnace process.[13]

13. Address by E. J. Ostrowski, "Recycling of Tin Free Steel Cans, Tin Cans, and Scrap from Municipal Incinerator Residue," 79th General Meeting of American Iron and Steel Institute, New York, 1971.

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The major obstacles to recycling cans are ignored in these advertising campaigns. All steel or all aluminum cans are readily recyclable but few of today's cans are either all steel or all aluminum. Moreover, the cans are mixed with a large mass of solid waste. Most of the cans are not even bi-metal cans but, in fact, are three or four metal cans. Most of the can's in which our canned goods are purchased are made from tin-plated steel with a soldered seam. Removing the solder and the tin plating to make this can acceptable for recycling is an expensive process to the extent it is possible at all. To the extent that blast furnaces are accepting a portion of these cans for recycling, the lead and tin are not being recovered. When an aluminum pop-top for a beverage container is added to this problem, it creates a can that is simply not recyclable with existing technology.

It was originally thought that the recent development of the tin-free steel can (where the tin coating is replaced with chromium alloy and a resin film and the soldered side seam is replaced with a weld) would provide a boost to the recycling of cans, allowing their unlimited use in the steel furnaces. But because almost all of these cans have aluminum tops, the new development provides no relief at all. However, Continental Can Company (and probably others) is developing a steel pop-top. When it is introduced and in general use, perhaps a real breakthrough in the recycling of steel cans can occur. Then cans will be of real value to the steel companies, and, hopefully, a price will be offered for them that will cover the cost of separation and transportation. However, legislation should be enacted

immediately to curb the use of multi-metal cans. Aluminum-topped steel cans are inexcusable when an all aluminum can will do the same job and can be easily recycled. Soldered seams are intolerable when welded seams will result in a more readily recyclable can, saving lead at the same time. Even tin plating should probably be done away with in favor of a resin coating to prevent rusting or corrosion.

What is Solid Waste Management?

The term "garbageman" has long been used to describe the person who picks up the garbage from individual residences and hauls it away to a disposal site. Recently, the term "sanitation engineer" has come into vogue. Some of those in the field are, in fact, engineers in the technical sense of education and experience. However, it is doubtful if any of those persons engaged in the picking up of solid waste are engineers. The above example is cited, not because of an objection to calling a garbageman a sanitation engineer, but because of the close analogy between the above nomenclature and the phrase *solid waste management*. Solid waste *management* is the term that the industry now applies to garbage collection and disposal. In its literal sense, solid waste *management* probably does not exist in this country today. Solid waste *disposal* is engaged in by nearly every municipality in the country.

The problems of managing solid wastes, i.e., placing controls on the composition, quantities, and disposition of material currently labeled as "solid waste," cannot effectively be dealt with on the local level. Local governments that have tried to regulate the use of undesirable (from a recycling standpoint) methods of packaging have encountered

strong industry resistence, court battles, and have had their efforts held unconstitutional in some cases. However, an article by Stanley C. Ruchelman entitled "Municipal Regulation of Non-Returnable Containers"[14] concludes that such regulation can be drafted and enforced in such a way as to avoid problems of unconstitutionality.

A case history typifying the myopic, insular attitude of at least one garbageman was published in the trade publication *Solid Wastes Management* under the title "Despite Environmentalists' Claims, San Francisco Trash Analysis Indicates That Most Items Are Not Recyclable."[15] Notwithstanding this astounding title, the actual conclusion of the article is that in San Francisco there exists a ready market for only about one-third (by weight) of the urban refuse collected in the three samples of one ton each. Instead of concluding that a problem exists in the form of a need to create markets for the materials found in the solid waste collected, the article concludes that "the beverage bottlers and canners have created a Frankenstein of their own imagination. Apparently we are not being overwhelmed by these containers, but rather by the collection depots and buy-back campaigns. Glass and aluminum suppliers have created the impression of an engulfing tide of bottles and cans that does not exist. Instead of deterring a rush of regulatory and tax restrictions by their campaigns, they may be the victims of their own destruction."[16] This conclusion is based upon the finding

14. S. Ruchelman, *Municipal Regulation of Non-Returnable Containers*, 1 Environmental Law 257 (1971).

15. 14:4 *Solid Wastes Management* 16 (April, 1971).

16. Id. at 24.

that beverage containers constituted about 7% by weight of the total collections, though food containers, both metal and glass, constituted nearly 22% of the total.

The garbageman who wrote the article presents, in his opening paragraph, what is probably a rather typical view of environmentalists in the eyes of his industry:

> Frenzied is an apt word to describe the actions of many people across the nation on the debatable question of recycling solid wastes. On all sides we appear to be surrounded by self-styled ecologists and environmentalists--the overnight experts on solid wastes and air and water pollution.
>
> Just a few years ago, finding an ecologist or environmentalist would have been on a par with locating the proverbial needle in a haystack. While there may have been a few lone pioneers studying the environment, an examination of the studies offered by the schools of higher learning in the recent past show [sic] no description or classification of these subjects.
>
> This leads us to believe that it might be more accurate to call these Johnny-come-lately defenders of the environment, opportunists. In many instances we are being told by the headline seekers that recycling is the golden cure-all, that everything will go through the process and that nothing will go back into the ground.[17]

At least some of those engaged in the collection and disposal of solid wastes consider a general public awareness and concern for the environment a threat to their livelihood. They should be eager to inform concerned citizens of the lack of markets for much of their solid wastes and the difficulties they face in salvaging some of the

17. Id. at 16.

materials--the primary obstacles to broader scale recycling. Perhaps they put down environmentalists to avoid incurring the wrath of the virgin materials industries. Whatever their reason, articles such as the one quoted above do a disservice to everyone.

Until quite recently, this country has been viewed as possessing boundless resources, but those resources have been exploited with little thought to their conservation and reuse. Whole industries have been based upon the premise that minerals are to be extracted, refined, and manufactured into a product that is discarded after use. Naturally, there are some very strong vested interest in the extractive industries that oppose recycling on a large scale.

But there are other vested interests opposed to recycling. An example is the case of the vertically-integrated newspaper such as the *New York Times* and the *Daily News* which not only own their own paper mills but also their own pulpwood forests. It is not surprising to find that in the spring of 1971, the *New York Times* was using no recycled newsprint while the *Daily News* was using only about 1%.[18] M. J. Mighdoll, Executive Vice President of the National Association of Secondary Materials Industries, suggests that the use of virgin pulp to print newspapers is "only economical when the public is put to the cost of getting rid of the old paper. Count that cost ($36 per ton in New York), and pulp is vastly more expensive than used paper, though to

18. P. Bolter, *The Easiest Way to Destroy the Dump Piles*, 91 The American Legion Magazine 6 (August, 1971).

the public rather than to the newspapers."[19] This is only one example of burying a specific industry cost in what has come to be known as "social costs." This results in one industry's avoiding an expense because it is able to push it off on someone else, in this case, the taxpayers who pay for the garbage collection and disposal.

The bulk of the waste that enters the refuse stream is paper and related items. As previously mentioned, paper trimmings from manufacturing processes and waste paper from many large office buildings are currently separated at the source, while clean, and then sold for repulping. Another reason for the poor market for recyclable paper is that paper companies want to protect their sizeable investments in woodlands and pulping equipment.[20]

Ignoring the question of environmental cost mentioned earlier, attempts to recycle newsprint have been a failure. There are warehouses full of unsoiled newsprint that is rotting. Many ecology centers no longer accept it. The current market is glutted. Newsprint has a limited use in corrugated paper and similar products, and those plants which can handle it are at capacity. Here again, demand for those products that use newsprint as a raw material could be stimulated through legislation or by consumer demand.

It is thought that the developing technology could deal with the problem of soiled paper and produce a high quality of cellulose if it

19. Id. at 8.

20. California Continuing Education of the Bar, *Environmental Law Handbook* 54 (1970).

were not for the "intentional contaminants" of waxes, plastics, pigments clays, etc. that are added to paper in the manufacturing process. This problem is a difficult one, and, hopefully, careful study is being done to discover substitutes whose use would not impair efforts to recycle paper products.

True solid waste *management* would focus on the problems of reducing "waste" whether in the form of a tin-plated steel soft drink can with a soldered seam and an aluminum top, or a no deposit-no return bottle, or a fancy, but superfluous, package of virgin material, product with designed-in obsolescence. Moreover, true solid waste management would be concerned with developing markets for salvageable materials and techniques for their salvage. Unfortunately, those who claim to be in the business of solid waste *management* are really in the business of solid waste *disposal*. They view the job as finding new dump sites for solid wastes or as building better incinerators to reduce the volume of solid wastes before dumping. Above all, they are interested in disposing of solid wastes at the lowest possible cost consistent with local government requirements. Because solid waste management is left largely to local governments or to private companies contracting with local government or licensed by it to do the job, few funds are available for increasingly sophisticated approaches to solid waste management. Municipal governments, because of their small tax base and narrow scope of responsiblity, simply want to dispose of their trash as cheaply as possible.

A report sponsored by the San Francisco Planning and Urban Renewal

Association (SPUR) and funded by a grant from the Ford Foundation[21] has proposed the adoption of a regional approach to solid wastes management. Here, the term solid wastes management is used in its broader sense. The report states that its basic objective is the maximum reuse of the valuable resources contained in solid wastes.[22] One of the ideas put forth by the report considered by this article's authors as having great merit is the composting of the organic portions of solid wastes. (*See* p. 534 *infra.*)

The real problems cannot be dealt with effectively on a regional level any more than they can on a local level. Nevertheless, a regional approach does offer the advantages of economies of scale through very large solid waste handling plants that can make use of highly sophisticated separation devices to break the solid wastes down into reusable components. But the SPUR proposal, like most others, merely addresses itself to the symptoms and not the problem. The problem, hinted at above and to be discussed more fully later, goes to the very roots of Western society and its glorification of growth and materialism. It is one which we may not even be able to cope with on a national-international level given the dearth of leadership on those levels.

From Solid Waste Disposal to Mining "Urban Ore"

Without deprecating the value of on-site separation and salvage--the primary business of the nation's secondary materials industry, the greatest problems are encountered in recycling the mixed solid waste

21. Environmental Impact Planning Corporation, *A Solid Wastes Management System for the Bay Region* (1972).

22. Id. at 5.

of an entire city. This mountain of trash, which exceeds 200 million tons annually,[23] must be separated into various constituent components for recycling in one form or another. The various metals, cellulose fibers, and other directly recyclable products must be extracted in a usable form. The balance must also be utilized in an ecologically sound manner. This may be incineration, utilizing the excess heat for heating or electrical power generation with the residue being used for fill or for building materials. It may be composting the bulk of the organic and some inorganic residue to supplement tired soil. It can be any combination of the above or other uses which avoid the inexcusable wasting of resources found in solid waste by practices as sanitary landfill. Only a minute portion of the trash considered solid waste is "true waste." In this category are radioactive and some biological and chemical waste which, hoepfully, is never mixed with the common stream of refuse.

Sanitary landfill is essentially dumping aggregated solid wastes into trenches or upon low land to be built up by the fill process, compacting it with heavy equipment, and covering it with a layer of dirt. Once buried, the trash undergoes anaerobic decay resulting in a loss of volume and settling of the fill iste. A recent U.S. Public Health Service survey determined that 94% of all landfill refuse disposal sites fall short of meeting the minimum requirements of a "sanitary landfill" project and might be more correctly termed a "dump."[24] On

23. R. Grinstead, *The New Resource*, 12:10 Environment 2 (December 1970)

24. American Public Works Association, *Municipal Refuse Disposal* (Chicago: Public Administration Service, 1970) p. 92.

or more of the shortcomings that may result in a substandard landfill are: (1) failure to cover the fill frequently, thereby permitting food and shelter for rats and other vermin, (2) air pollution in the form of dust, (3) smoke or odor, (4) uncontrolled fire hazards, (5) leaching resulting in pollution of surface and ground waters, and (6) unacceptable noise levels.

Landfill loses its practicability when sites are located so far from the source that hauling expenses become great. Moreover, it is often not a justifiable use of land unless it can serve to enhance the utility of the land. Suitable landfill sites are becoming increasingly scarce, particularly near major urban areas. Nevertheless, dumping or landfill is still the most common method of disposal today.[25]

Returning to the problem of separation, several approaches are presently being developed and implemented. All these methods require that the solid waste first be broken down to a uniform size by means of hammer-mills, any large portion being removed manually. One approach, developed by Stanford Research Institute, uses an air classification system to sort the waste into its components.[26] This technique exploits the different aerodynamic characteristics of the constituents of solid waste by means of controlled columns of air. A system of this sort can be built on a scale to handle a large volume but requires "passes" through several classifiers to obtain reasonably pure components.

25. Office of Science and Technology, *Solid Waste Management: A Comprehensive Assessment of Solid Waste Problems, Practices and Needs* (1969).

26. R. Boettcher, *Air Classification for Reclamation of Solid Wastes* (1969

Of course, a simple air classifier cannot separate all metals nor distinguish colors of glass (assuming that were desirable). But the technique has several advantages: (1) a low power requirement, (2) high capacity, (3) low manpower needs, (4) no undesirable by-products, and (5) a capability to separate very finely. Stanford Research Institute has had a pilot plant in operation for some time, and a 500 ton per day plant will soon be built and operated by Sunset Scavengers to serve San Francisco.

The Bureau of Mines has developed a mechanical classifier for use with incinerator residue. It uses various screens and magnetic devices that are capable of separating ferrous metals as well as various colors of glass. Although this system is not capable of the sophisticated separation of the Stanford Research Institute's air classifier, its operating costs are estimated to be less than four dollars per ton. By operating this separator in conjunction with an incinerator operated for the generation of power, solid waste could, for the first time in history, be a profitable enterprise. The Bureau of Mines is currently operating a pilot plant, refining its techniques, and building a larger plant to obtain more accurate cost figures.

The Black-Clawson Company, a manufacturer of paper-making equipment, has developed a technique in which solid waste is pulped in water and then, by mechanical means with screens and centrifugal devices, solid objects are removed. Then, using a fine screen, about half of the cellulose is recovered. The fraction recovered consists of the longer fibers that are more easily reused and consequently more valuable

than the shorter fibers. Metal and glass are recovered separately and could be processed further and recycled. It is estimated that a plant handling 1,000 tons per day could break even. Unfortunately, a plant of this type requires a large amount of water that must be treated. A careful study must be made before this process can be deemed ecologically sound.

In the last few years, since the possibilities of large scale recycling first received extensive publicity, tremendous progress has been made in designing working separation units. There is every reason to believe that, with proper incentives, the next decade will produce increasingly sophisticated techniques that are more efficient and more economical. Because a System Dynamics approach has not been used to study the area of planning recycling, little can be said with certainty about the following questions: Which items should be recycled? What is the optimal product mix of recycled materials (e.g., is fiber reclamation preferable to more compost or vice versa)? How should recycled materials be priced in relation to virgin materials? There are many other important questions. Actually, the overall environmental problem facing mankind lacks, at the present time and for the forseeable future, not only a clear statement of the priorities or "right" answers but even a means of implementing them if they were known. Thus, the technology of recycling stumbles along absent necessary guidance.

After removing those components of solid waste that can be economically separated and recycled, there remains a residue consisting largely of soiled paper, garbage, and plastics. This residue can be

used in a variety of ways including landfill, incineration, pyrolosis (See p. 539 *infra.*), composting or a combination thereof.

Composting, a process involving the decomposition of organic matter either with oxygen (aerobic) or without oxygen (anaerobic), has been used on farms for the disposal of manure and other rural wastes. It may or may not be the panacea envisioned by some writers.

For most purposes, aerobic composting is superior to anaerobic. It is more sanitary, produces fewer objectionable odors, and can be accelerated to handle large volumes of material. A variety of types of composting operations are currently operating in the U.S. and throughout the world. They include a 150 ton/day Varro process operation in New York City, a 300 ton/day windrow process in Mobile, Alabama, and many others.[27]

The Ecology, Inc. composting plant has been operating in Brooklyn for about a year. This sophisticated process has a number of competitive advantages over earlier approaches. Its digester can handle refuse with up to a 90% paper content whereas most composting operations cannot process paper at all. Only ferrous metals are extracted before compostin the balance of the noncompostable materials is removed at the end of the process. By controlling all the variables of the process, the digester produces a uniform compost. Though there is a limited market for the enriched compost in the New York City area, the company is seeking other uses for its compost and with some freight rate breaks could sell the

27. J. Meyer, *Renewing the Soil,* 14:2 Environment 22 (March, 1972).

product throughout a large portion of the Eastern states.[28]

Though composting is increasingly recognized as essential to the long-range production of food and other crops, present day economics inhibit its wide scale use. The compost can be produced for approximately eight dollars per ton in the small, but modern, Brooklyn plant. Presumably, these costs could be reduced in larger scale operations. Moreover, these costs could be offset by any revenues from the other components of the solid waste received for treatment (to the extent they exceeded separation and shipping costs). The cost of shipping the compost from the large urban areas where most would be produced to rural areas where most of it would be used is too great for today's market. Since this market does not reflect the "true relative values," legislative changes are needed to make composting as economically feasible as it is ecologically desirable.

One of the most significant aspects of the SPUR report[29] is its composting proposal. The plan centers around the long-range preservation of Sacramento River delta land that is presently below the river level and protected from flooding by dikes. By composting all the otherwise nonrecyclable organic components of the San Francisco Bay Area's solid wastes, this land can be raised above the present water level.

28. Id. at 31.

29. Environmental Impact Planning Corporation, *supra* note 21.

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Two great virtues of this plan are the availability of relatively inexpensive barge transportation and the estimated capacity of the delta lands to absorb the compost produced in the Bay Area for the next 100 years.

One of the best markets that could be created in the short run (In the long run, farmers can be encouraged to buy compost.) for compost as well as for incinerator residue and demolition waste, would be to require strip miners to reclaim the land ravaged by their mining techniques. Incinerator residue and demolition waste could be used for large fill as could the overburden which was removed in the strip mining process. A substantial layer of compost on top of this fill would enable formerly barren land to support plant life. This, in turn, would open the land to any number of developmental, recreational, agricultural, or other uses.

Incineration is perhaps the classic method of bulk reduction. Although much open burning at dumping sites still takes place, it is certainly not desirable. On the other hand, technological developments have reached the point where incineration, both central and on-site, can be considered as a means of volume reduction, even in an urban area. The amount and type of pollutants released to the atmosphere can be maintained at safe levels. However, dangers still exist in the burning of the polyvinyl chloride plastics. This reaction produces hydrogen chloride gas which combines with water in the atmosphere to make hydrochloric acid. Needless to say, even small concentrations of this

strong acid in the air can be dangerous to humans and destructive of property.

Central incineration--incineration at a single location to which collected wastes are delivered--is the normal method of treating refuse in Europe with the large plants incorporating a variety of electrostatic precipitators, scrubbers, and other devices to practically eliminate particulate emissions. Condensers can be attached to exhaust stacks to cool exhaust gases and remove enough water vapor so that even in the winter, the traditional plume of steam is not visible.

Notwithstanding the technological capabilities of the present state of the art, a recent survey by the Office of Solid Waste Management Programs of the Environmental Protection Agency (EPA) showed that 75% of the incinerator installations in the U.S. were inadequate because they either failed to efficiently reduce the volume of wastes burned or because they caused air pollution.

Incineration may seem, at first glance, to be inconsistent with the aims of recycling. However, it should be remembered that the hydrocarbons in the organic materials are being returned to the atmosphere in the form of CO_2 and H_2O for recycling by nature through photosynthesis into new hydrocarbons. Moreover, when combined with a power generation operation utilizing the heat produced by the incinerator, valuable fossil fuels that would otherwise be used to generate the power are conserved. Also the typical solid wastes that are incinerated, although having a lower heat value than coal, are substantially

lower in sulfur compounds than coal. Oxides of sulfur can be particularly malodorous (SO_2) and also have the capacity to combine with water to make sulfuric acid (H_2SO_4). The total power generating capacity of the solid wastes produced in this country in 1969 at 33% plant efficienc is estimated to equal 8% of the total electrical energy consumed in that year.[30]

On-site incineration--at the site of the waste generation--is characterized by smaller, less sophisticated, less efficient, and hence more polluting incinerators. This approach offers the benefit of reduced collection expenses, but this method's pollution-rich exhaust largely offsets any other benefit.

Much research on new techniques of incineration is currently being conducted here and in Europe. Of interest is a project by Combustion Power that utilizes what is known as a *fluidized bed.* The incinerator uses a continuous process in which hot air is forced up through the mass of molten slag in the bottom of the furnace. Refuse is dried then fed into the furnace with the slag gradually being drawn off. Particles are removed from the hot exhaust gases which are used to power a gas turbine connected to a generator. The exhaust gas is then used to heat the intake air, to dry the refuse, and to heat a waste heat boiler. The incineration process is very complete and is capable of relatively efficient production of power. A full scale plant

30. J. Holdren, *Defusing Old Smokey by Plugging into Nature,* 56:8 Sierra Club Bulletin, 24, 27 (September, 1971).

will be operational this year. Many writers feel that incineration will play an important role in the ultimate resolution of the problems of solid wastes.

The primary difference between incineration and pyrolysis is that incineration takes place in the air while pyrolysis takes place in an inert atmosphere where heat is applied externally. The same process is used to make charcoal from wood. Recent studies using organic solid wastes as a feed have shown that a variety of gaseous and liquid organic materials, including methyl alcohol, acetic acid, and some heavier oils, are released, leaving charcoal and ash as residues. The gas is similar to that produced by incinerators, but the other products are combustible and are currently viewed mainly as fuels, although some other chemical products may be obtainable. Unfortunately, none of the products of pyrolysis enjoys a market that could absorb more than a small fraction of the huge quantities of these chemicals potentially available in the annual solid waste generated.

A related process, developed by the U.S. Bureau of Mines, involves reacting garbage with carbon monoxide and large quantities of water under high temperatures and pressures. This process produces an oil similar in its characteristics to crude petroleum. Although this is a dramatic technical accomplishment, the oil produced, which is used mainly as fuel, has a relatively low monetary value. Though the value of the oil obtained is two to three times that of the raw trash, only about half of the original weight of the trash is obtained as oil.

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Moreover, little, if any, increase in fuel value is likely, and the energy required in the conversion process is nearly equal to the energy value of the final product.

The important feature of the pyrolysis process is its ability to convert most organic materials to charcoal, which may be recovered for sale or for fuel, and volatile organic compounds. Some experts think that the conversion of trash to more manageable fuels by pyrolysis may simplify the problems of extracting heat values and meeting air pollution standards. Pyrolysis may become a strong partner with composting in that the fuel produced may find adequate markets in heavily urban areas while compost will enjoy a different market segment.

Given current economics, sanitary landfill will probably remain for some time as the mainstay of solid waste disposal for small communities that do not produce the volume of solid wastes to justify large sophisticated processing plants or are so far from such a plant to make shipping the wastes economically impossible.

Recently, there have been numerous proposals for converting refuse into building materials. Some proposals are: (1) to compact the refuse and coat it with an impervious layer such as asphalt to create large buildings blocks; (2) to mix shreaded, pulped newspapers with various components to form bricks; (3) to use fly ash and pulverized slag from incinerators as raw material in the manufacture of cinder blocks; (4) to mix virtually any inorganic material with Portland cement to make bricks; and (5) to grind glass as an additive for road surfacing.

Other ideas being discussed include the conversion of cellulose fibers into a compound which is 75% crude protein by utilizing bacterial cultures to convert the cellulose. The protein could then be used as animal feed. Of course, garbage, properly processed, is widely used today as an animal feed.

It is obvious from the foregoing discussion that the technology of separation is only a part of the problem. Intimately associated with the question of separation is the decision of which items are to be singled out to be reused, and which should remain unseparated. A corollary question arises: What items interfere so greatly with the processes of separation and recycling or are so costly to the environment that their use must be discouraged? Possible items in this category are certain plastics which do not break down and which, when burned, produce destructive vapors. Obviously, the multi-metal cans fall into this class. There are items in between, such as soiled paper, that could be separated and repulped to make new paper, but only by a process which is so costly and waste producing that it probably should be ruled out.

The decision of which items should be separated and recycled must depend upon a variety of complex factors. They include (1) the cost of separating and processing, (2) the cost of the virgin material, (3) the supply of the virgin material, and (4) the extent to which that supply is nonrenewable. Ideally, the two costs listed in (1) and (2) would reflect the actual economic cost, i.e., the traditional accounting

cost plus the environmental or social costs that are traditionally ignored in pricing and hence purchasing decisions.

Survival of the Species vs. Laissez-Faire Capitalism

The diametric opposition of these concepts must be faced by contemporary society. It is not sufficient to simply say that we must expand our recycling efforts. We must recognize the fact that not only has our economic system failed to protect our environment, it is actively pursuing policies that will result in the extinction of the very society that has tolerated, if not promoted, them. Certainly the standard of living has been enhanced very rapidly in nations with capitalistic economic systems. At the same time, one cannot honestly deny that this same economic system is following a course that will ultimately result in lowering the standard of living for all of the Earth's inhabitants. That course, if allowed to proceed to its natural conclusion, will lead to the destruction of the ecosystem of the planet.

It is unfortunate but true that "successful" executives today by and large put the "best interests" of their corporate employer above all else. This is, of course, what they are being paid to do. Big business today sees its primary responsibilities as financial ones owed to its sockholders in a collective sense. Corporations, large and small, feel few, if any, responsibilities toward society in general. They seem to adopt the "what's good for G.M. is good for the country" philosop and refuse to consider the long-range effects of their corporate policies on our society and environment. Executives of major corporations whose

stock is traded over-the-counter or on a listed exchange feel satisfied that they are doing their jobs if the market price of their stock performs better than or at least on a par with the market averages. All else is secondary. Social consciousness and social responsibility is as long overdue in the management of most big businesses today as it is in the leadership of most national labor unions. Union leaders, like corporate executives, are very myopic in their objectives. They view their responsibilities as obtaining more pay and benefits for their members, regardless of what they may have at any given time. They want more annual raises regardless of the productivity of their members. Union leaders feel that any increase in productivity should be passed on to labor in the form of increased wages while management feels that these benefits should be passed on to the stockholders in the form of increased profits. No one seems to think that the consumer should benefit in the form of decreased prices.

Prior to the creation of the Wage-Price Commission, the economic interests of the public simply were not represented. Though there is considerable reason to question the effectiveness of the public's representation even under the Commission, it is at least a step in the right direction--to curb the inflationary spiral. Inflation was allowed to continue for a considerable period of time before even these rudimentary steps were taken to bring it under control. How long will the growth syndrome be permitted to continue before steps are taken to protect the public's interest in achieving equilibrium in the ecosystem?

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Recent comments by William D. Ruckelshaus, Administrator of the Environmental Protection Agency (EPA), indicate at least the beginning of an understanding of the gravity of the situation. In an article outlining what he perceived the goals of the EPA to be, Mr. Ruckelshaus stated:[31]

> We must begin to seek in earnest answers to the most critical of what are euphemistically termed "long-range" environmental questions. We are still playing guessing games with matters that actually may determine the fate of the planet....
>
> We must seek better ways of determining the combined and synergistic effects of contaminants on human health and welfare.
>
> We must have improved instrumentation, improved overall environmental monitoring and more trained personnel.
>
> We must begin to anticipate disposal problems; we must learn to apply a systems approach to the production process, so that we create less waste in the first place.
>
> We must explore the practicability of making goods more durable. Obviously a longer useful life for major appliances, including automobiles, would conserve resources and reduce the solid waste and pollution load.
>
> We must give more attention to the original design of products and appliances of all kinds to ensure that eventual salvage and reuse will be economically attractive.

While it is doubtful that Mr. Ruckelshaus is proposing any plans whose scope is sufficiently radical to meet the real challenge of curbin

31. W. Ruckelshaus, *The Role of the Environmental Protection Agency*, 1 Environmental Affairs 528, 532 (November, 1971).

growth, a major test of his effectiveness in his position as Administrator of the EPA will be to convince the President and Congress that the situation is as grave as he perceives it to be. Hopefully, his perception of environmental exigencies and their sociological counterparts will grow with his experience in his new position and will not be limited by polical pressures.

In an article published at about the same time as the above remarks by Mr. Ruckelshaus, Lanier Hickman, Jr., Director of the Technical Operations division of the Office of Solid Waste Management Programs, a part of the EPA organization, addressed himself to the environmental irresponsibility of the packaging industry. He pointed out that over a 10-year period the consumption of packaging materials increased 26% while population in this country increased only half as much. In 1966, American consumers paid about $25 billion for 52 million tons of packaging material, 90% of which was discarded. This is up from an estimated 35 million tons of packaging materials consumed in 1958. This consumption is projected at 74 million tons by 1975.[32] The portion of the solid waste disposal burden which is attributable to the packaging industry can be appreciated from the fact that collection of municipal solid wastes amounted to approximately 260 million tons in 1967.[33]

Comprising over 20% of municipal solid waste, discarded packaging

32. U.S. Environmental Protection Agency Bureau of Solid Waste Management, *The Role of Packaging in Solid Waste Management* (1969).

33. J. Meyer, *supra* note 27.

materials contribute significantly to the total pressures on the disposa systems in operation throughout the nation. Various industry spokesmen have taken the position that the public must develop systems to handle increasing amounts of waste because of public demand for convenience packaging. In Mr. Hickman's words, this position "does not withstand scrutiny."[34] It certainly does not acknowledge the role of the industry's promotional efforts in creating that demand. Moreover, it also disregards the fact that the consumer is given little opportunity to express his displeasure with convenience packaging because nearly everything that he might wish to buy is coated with plastic, buried under a mountain of paper, bottled, canned or, more often, a combination of these packaging methods is used. Hickman adds that "[t]he packaging industry must accept a major responsibility for the impact their products have on the environment and develop programs to minimize these impacts."[35]

Suggesting specific goals for packaging industry executives to strive to accomplish, Hickman has spelled out the following ideas that are applicable to industry in general:[36]

1. Reduce the quantity of packaging materiels used;
2. Reduce the technical difficulty involved in processing packaging wastes for recycling and recovery;

34. L. Hickman, *Packaging Industry and Government*, 2:6 Waste Age 12 (November/December, 1971).

35. Id.

36. Id.

3. Reduce the destruction of valuable natural resources from which packages are made; and

4. Provide resources to manage the wastes resulting from packaging materials.

The fundamental objective underlying these suggestions is the conservation of nonrenewable natural resources through conservative use and broad scale recycling. Mr. Hickman concludes his remarks on the packaging industry with the following cogent observation:[37]

> ...We can no longer tolerate the attitude, taken by some, that industry's responsibility is solely that of providing the American public with consumer items that are aesthetically pleasing, efficient, durable, and at lowest possible cost, and that disposal of these items after use is solely the responsibility of the user.... [M]ore of the burden of disposal [must] be shifted to those who introduce waste into the environment.... Time is running out and as existing trends, practices, and attitudes continue, the situation worsens. We must look closely at packaging and its impact on environmental and resource use to determine present or future national policies. As the earth's available resources dwindle, the acceptability of convenience packaging may be governed by a different set of priorities.

It is clear from the attitudes and views expressed by the Administrator and a deputy of the EPA that a basic understanding of the underlying problems of solid waste management are understood by at least some members of the federal government. Hopefully, this understanding will be propagated both within the government and among the public as a whole.

Considering the economic system under which this country has developed,

37. Id. at 14.

it is understandable that the various members of the packaging industry, like every other industry, are interested in seeing their sales increase each year. It is also understandable that their promotional efforts would be aimed at selling more paper, plastics, cans and bottles. With respect to the bottles, for example, if the consumer is convinced that returning a bottle is too much trouble, then he will buy a new bottle for each soft drink or beer that he wishes to consume, thereby greatly increasing the number of bottles that the bottle manufacturers can sell to bottling companies and brewers. It is also understandable that, in addition to its advertising efforts, the lobbying efforts of this multi-billion dollar industry will be directed at opposing any reduction in the amount of materials used in bottling, canning, wrapping, bagging or other merchandising material for the consuming public.

Under that same economic system which emphasizes bigness, growth, and profits, the same responses are to be expected from automobile manufacturers. Cars could be built to last for 300,000 to 400,000 miles like highway trucks, or for an even longer life such as that of railroad rolling stock. However, the consumer is more susceptible to the promotion of annual model changes than is the trucker or railroad compan He can be taught to buy a car that will fall apart after a relatively short period of use. He can be conditioned to think that he needs a car because of the prestige or status "inherent" in a luxury car or in a new car. This same consumer is amenable to buying a new camera before the old one wears out because the manufacturer's latest development makes

the new model camera a better one, notwithstanding the fact that the "latest development" was known to the camera maker when the earlier model was marketed but was held back for the next model so that it would provide a new selling gimmick. This same tactic is repeated over and over again by a large number of consumer goods manufacturers. They know that if they make a product incorporating all of their technological know-how they will not have any new gimmick with which to sell their products the next year. Accordingly, their goods are built with planned obsolescence and made to wear out in a reasonable (for the manufacturer) length of time.

With practices like these being widely followed in American, if not other, economies, no amount of recycling will be adequate to preserve our nonrenewable natural resources. Patent in the above observations is the idea that our solid waste problems could be significantly reduced by the easing of the demands upon our limited resources by manufacturing and selling products designed for long lives, resistant to obsolescence (that is, containing all of the latest technology), easily repairable, and created with a minimal amount of virgin materials and a maximum amount of both recycled and recyclable materials.

It is interesting and frightening to note the many ways in which the manic drive for corporate growth manifests itself. Public utility comapnies supposedly exist to satisfy the public demands for power. However, they are not satisfied merely to meet the demands for power. They want to be bigger and have more power; hence, they advertise to

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promote the use of additional power. Electric power generation by fossil fuel fired steam turbine generators is one of the major contributors to air pollution. Moreover, the production of electric power by nuclear powered generators portends potentially more serious problems of thermal and radiation pollution. In the face of challenges by organizations such as the Sierra Club that electric power generation is irreparably damaging the environment and that grave consequences could result from locating a number of large nuclear powered generators along the California coast, Pacific Gas and Electric replies that these plants are absolutely essential to meet projected power demands. They say this in a manner that indicates that they are helpless to do anything about these rapidly growing power requirements while at the same time they mail advertisements with their statements urging their customers to buy more electric appliances and to use more power.

If public utilities, as an industry, really cared about the environment, they would be lobbying for legislation aimed at reducing the rate of growth in power requirements. This legislation could take the form of requiring that all buildings meet certain minimum standards, that central heating systems be installed on a community-wide basis to *use* the excess thermal energy of electric power generation, that the use of electric power for heating purposes be drastically limited because of its great inefficiency, or any number of other alternatives aimed at reducing future and even present power requirements. Many buildings could be designed and built in ways that minimize their power requirement:

for heating by taking advantage of the heat from the sun. There are a great number of steps that could be taken by responsible companies in the area of protecting the environment. However, they are being held back by their *need* to grow. Any steps aimed at reducing their potential markets are contrary to that ultimate objective of growth. Growth seems to be the ultimate culprit, the factor upon which the blame must ultimately rest. However, the blame must really be placed upon the shoulders of leaders in the country who, perceiving the problems ignore it or minimize it in an effort to appease those irresponsible individuals, companies, or industries who place their own personal objectives on a higher plane that the continuation of a high quality of life through preservation of the environment.

When considering the problem macroscopically, it is safe to label the automobile as one of the major contributors to the general degredation of the environment. Moreover, the adverse effects of the automobile on the environment, such as air pollution, resource depletion, the demands on limited land for highways and parking areas, etc., are really obvious and do not need further discussion. It is interesting to note the extent to which governmental planning and decision making is aimed at protecting this industry instead of providing the leadership necessary to develop alternatives, such as mass transit. Take the recent repeal of the excise tax on automobiles as an example. This move was made to "stimulate economy" at a period of general sluggishness. Repeal of the excise tax means that more autos will be sold adding to the undesirable

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effects of their manufacture and operation.

An environmentally sound alternative would have been to increase the excise tax on cars with the revenue from this source earmarked for development and construction of mass transit systems. In this way, a gradual move away from this undesirable mode of transportation could have been instigated while stimulating other areas of the economy in more need of stimulation, such as the aerospace industry. This, of course, assumes that the aerospace industry would enter the mass transit business, a field for which they are suited because of their manufacturing and engineering expertise.

Coupled with the repeal of the excise tax was an increase in the import duties on foreign cars. These import restrictions mean that fewer of the smaller (and hence environmentally preferred because they create less pollution, occupy less space, and place fewer demands upon limited resources, etc.) imported cars will be sold and more of the larger American varieties will be purchased. Again, this decision, though undoubtedly popular with the United Auto Workers and the auto industry in general, was very unsound from an environmental standpoint.

Another major roadblock in the effort to reduce the adverse effects of the automobile is the inertia of the status quo. For example, the auto manufacturers' tremendous investment in tooling for the manufacture of the reciprocating internal combustion engine precludes their coping with the exhaust pollutants problem by adopting a totally new engine such as the Wankel engine or Bill Lear's steam engine. Legislation

will be needed to force them to do so. The present legislation regarding exhaust emission standards simply requires that they meet requirements or else. The inherently "dirty" characteristics of the internal combustion engine, as opposed to the clean characteristics of the external combustion engines such as the steam engine, probably dictate against the continued reliance upon this engine for continued use in private cars. Nevertheless, most of Detroit's efforts have been aimed at cleaning up the existing engine rather than developing a different one that lacks the inherent problems of the internal combustion engine.

In the ideal world of Keynesian economics, the laws of supply and demand govern what goods are produced and marketed as well as their pricing. Thanks to the marketing man, that ideal Keynesian world exists only on paper. Admittedly, it is a gross oversimplification to place all the blame for our benevolent monopoly economic system on Madison Avenue. Blame could also be aimed at accountants for instance. Why not include those "social costs" referred to earlier with respect to the cost of publishing the newspaper? In that case, the "social costs" were the costs of collection and disposal or recycling the old newsprint. With respect to a newspaper, as an example, if the costs of collection and disposal or recycling were assessed against the newspaper company, then the company would be forced to charge a higher price for the paper. To the extent that the company could reduce the assessment by using recycled paper, the newspaper publisher would have an incentive to use an optimal amount of recycled paper. (Creation of such an incentive,

of course, assumes that the benefits of recycling newsprint outweigh the detriment to the water caused by the polluting effects of the recycling process.)

Former H.E.W. Secretary, Robert H. Finch, is on record favoring the recognition of "social costs" in industrial accounting:[38]

> ...We need to study ways of removing bottles and cans and other containers from the category of a "social cost." It may be "efficient" for industry to use these containers only because the efficiency formula excludes the cost to society of disposing of indestructible non-returnable containers. The separation and reclamation of such containers would clearly benefit society; the [present] nonreturnable container does not.

Traditionally, accounting has had the responsiblity of recognizing private costs, that is, those measurable resource costs that are borne by the firm in conducting its business activities. To maximize profits, it is necessary to minimize these private costs. Those costs, not recognized in the accounting procedures of business enterprises, are borne by others or by society in general. This results in an artificial understatement of the cost of the manufacturing process and leads to an underpricing of the product, i.e., all members of society pay part of the cost whether they use the product or not. This, in turn, creates a greater demand for the product than would exist in the ideal, laissez-faire system. These "social costs" are typically represented by resource

38. The Resource Recovery Act of 1969; Hearings before the Subcommittee on Air and Water Pollution of the Senate Committee on Public Works, 91st Congress, 1st Sess., S.2005, pt. 2 at 533 (1969).

values such as clean air, clean water, and resource reserves, which are destroyed by the firm and borne by society in general.

The problem was defined and exemplified by one accounting professor as follows:[39]

> All ecological "problems" represent costs to society. Unfortunately, these costs tend to fall under the classification of external diseconomics which economists have long recognized will wreck the society benefit maximization aspect of any laissez-faire based economic system. Externalities warp the allocation of productive resources. For example, a paper mill polluting a stream has artificially understated costs from a society viewpoint. Also, since competitive prices tend to be based upon production costs, the mill's price will also be understated. The result is that society tends to over-consume paper products. At the same time, some downstream producer, say a fishery, is saddled with higher costs as a result of the mill's action and thereby reflects higher costs and prices for fish. Society thus gets relatively too much paper and too little fish, with the users of fish in effect subsidizing the users of paper. In other words, society's resources are misallocated.

Clearly, if the free market is to continue to be allowed to make our resource allocations, then pricing and costing must be based upon not just the traditional private costs but must also take into consideration social costs. However, not only does the information enabling the consumer to make intelligent decisions respecting the environmentally-sound allocation of resources not exist, this information is not currently available even in a general way to provide general knowledge

39. J. Parker, *Accounting and Ecology: A Perspective*, 132:4 The Journal of Accountancy 41, 43 (October, 1971).

to support legislative action aimed at controlling the allocation of limited resources.

What currently amounts to a minority position within the accounting profession has been expressed in an article by two accounting professors

> Accounting as an organized profession has the responsibility to transcend the internal viewpoint of a private firm and to develop information which portrays a private firm's role in and contributions to society. Accounting information should lead to decisions that result in the efficient utilization of resources, the conservation of the environment and the equitable allocation of business income.

An expression of what is probably the majority view and certainly the majority practice was stated by another accounting professor:[41]

> "[T]he notion that the goal of the professional accountant is public or social service is nonsense. His function is to provide the best possible service to his clients, the people who pay for his efforts.

This old line view is undoubtedly shared by the majority of the older members of the accounting profession as well as by the majority of older business executives, lawyers, politicians, etc. This "profit only" attitude was undoubtedly in Jaques-Yves Cousteau's mind when he advised an assembly of students at the University of California that there is no hope that the older generations will reverse the trend toward increased pollution of the environment. He warned them that

40. F. Beams and P. Fertig, *Pollution Control Through Social Cost Conversion,* 132.5 The Journal of Accountancy 37 (November, 1971).

41. W. Paton, *Earmarks of a Profession - and the APB,* 131:1 The Journal of Accountancy 41 (January, 1971).

"the fight for survival calls for complete sociolgocial revolution."[42] Others have predicted[43] or solicited[44] radical approaches for dealing with our sociological/ecological problems. It seems axiomatic that nothing short of radical changes in our society will produce a society that is capable of coping with these problems and of surmounting them.

Also on the subject of the accountant's role in environmental problems, it is noteworthy that a recent article entitled "Production Costing in Open Pit Mining"[45] fails to even mention the possibility that the cost associated with restoration of the surface of the earth should be considered as a production cost. It should be noted here that relatively simple legislation with respect to this problem would go a long way toward creating a market for compost. That is, federal legislation requiring all strip mines to be leveled moderately and covered with a minimum of 15 to 20 feet of compost and planted in some crop to hold the soil would solve a number of problems. Because most of the large strip mines are relatively proximate to some of the nation's major urban population concentrations, the two needs would complement each other. It might also be desirable to use demolition

42. Address by Jacques-Yves Cousteau, University of California, Berkeley, Charter Day ceremony, April 6, 1972.

43. C. Reich, *The Greening of America* (New York: Bantam Books, Inc., 1970

44. R. Lowry, *Toward a Radical View of the Ecological Crisis*, 1 Environmental Affairs 350 (1971).

45. R. Davis, *Production Costing in Open Pit Mining*, Management Accountin 39 (January, 1971).

waste as fill for the deeper cuts prior to covering with a layer of compost. This is only one simple example of a way in which environmental problems might offset each other.

It is patently obvious that a business whose objective is to maximize private profits will not have an incentive to conserve resources which are free from its internal point of view. Therefore, conservation is generally in conflict with the profit objective. The current practices not only result in a failure to conserve nonrenewable resources but lead to excessive use and misallocation of air, water and other resources. Examples of the minimization of private costs by wasting environmental resources would be the release of unfiltered air into the atmosphere and polluted water into lakes and streams.[46] One proposal with respect to the latter suggested that all those industrial operations discharging wastes into streams be required to locate their intake pipes downstream from their discharge pipes. This would certainly force them to take a closer look at social costs.

Another major consideration which must be made when considering any recycling program is the energy consumption of the process. One interesting study of the relative expense, in terms of energy comsumption of returnable bottles versus throwaway bottles and cans concluded that the cost of each of the latter processes was nearly three times the former in terms of BTUs consumed.[47] We must consider the equally limited

46. F. Beams, *supra* note 40, at 38.

47. B. Hannon, *Bottles, Cans, Energy,* 14:2 Environment 11 (March, 1972)

reserves of fossil fuels as well as the thermal and radiation pollution effects of nuclear power generation in passing on the desirability of any particular recycling plan. The balance and optimal use of our ecosystem is an incredibly complex problem.

Most proposals respecting environmental problems merely address themselves to the symptoms and not the problem. This article's authors could reiterate another lengthy list of proposals that are aimed at creating and strengthening markets for reclaimed materials and at reducing the volume of solid wastes. These include elimination or reduction of depletion allowances for extractive industries, elimination of capital gains treatment for cutting timber, limiting the quantities of virgin material that can be used in a variety of products, assessing manufacturers a fee or tax based on the cost of disposing of or recycling their products, expanding the currently limited scope of the investment tax credit to include expenditures made for recycling equipment and installations and many others. These suggestions are all addressed to the symptoms of the environmental degredation. Certainly, their implementation would help reduce the pressures on the environment. However, they will not change the basic problem--an acquisitive, materialistic society. The radical changes espoused by Cousteau and others must be implemented in addition to the various proposals for symptomatic relief.

However, even radical changes in society, changes entailing concerted efforts at the reallocating of resources and alteration of present life

styles and social structures, will not of themselves be sufficient without a concerted application of the technological resources of our society to the solution of the problem. A message, signed by over 2,200 scientists from 23 countries warning of the "unprecedented common danger" facing mankind, was delivered to U.N. Secretary-General U Thant on May 11, 1971. The essence of that message parallels the conclusions reached by the M.I.T. study and concludes by urging the formation of an all out task force funded with the same sense of urgency that supported the $2 billion Manhattan Project in the 1940s and the $40 billion spent on the Apollo Program in the 1960s.

The message concludes:[48]

> Certainly massive research into the problems that threaten the survival of mankind deserves a higher priority than atomic or space research. It should be begun at once on a similar scale and with an even greater sense of urgency. Such research should be paid for by the industrial nations, which are not only financially best able to carry that burden, but themselves are the principal polluters, but it should be carried out by qualified men from all countries and various professions, unfettered by restrictive nationalistic policies.

In response to the message the Secretary-General expressed optimism that:

> [t]his global concern in the face of a grave common danger, which carries the seeds of extinction for the human species, may well prove to be the elusive force which can bind men together. The battle for human survival can only be won by all nations joining

48. *Urgently Needed: A Formula,* 154 Mensa Journal 7, 8 (March, 1972).

> together in a concerted drive to preserve life on this planet.[49]

It is difficult to share the Secretary-General's optimism in light of the basic philosophies governing life in not only the capitalistic nations of the West but also those of the Sino-Soviet block of Communist nations. How can a nation which is too blind to see the folly of its genocidal war in Southeast Asia muster the vision to see the suicidal nature of its uncontrolled patterns of growth? It seems too much to expect. Nevertheless, if the members of the younger generations can heed the warnings of the men of vision in their parents' generation, like Cousteau, then perhaps there is hope. But that hope lies not in thinking small. Neighborhood ecology centers are placebos that are contraproductive to the long-range needs of the environment because they pacify anxieties about environmental degredation without making a significant contribution. Recycling is certainly not the panacea envisioned by some of its advocates, but it can be a cornerstone of a System Dynamics model aimed at the conservation of limited resources and the optimal allocation of these limited resources.

49. Id. at 7.