GOOD ENVIRONMENTAL PRACTICES - GOOD BUSINESS PRACTICES

Dr. Donald Huisingh
Science Center Berlin
Federal Republic of Germany

INTRODUCTION

In the last two decades we have become increasingly aware of the multiple environmental impacts of humans upon the earth. Governmental leaders responded to this by enacting a series of pollution control legislations. Most of the legislation was enacted in response to a new awareness of a crisis in the air, on the water or on the land. Thus, most of the regulations have an end-of-pipe focus and are medium specific, focusing upon the control of pollutant "X" from entering the air or upon pollutant "Z" from entering the water, etc..

Concommitant with the development and enactment of these piecemeal regulations, cadres of governmental officials have evolved to enforce them. Unfortunately, air pollution control officials see their job one way and water pollution control officials see their job in another. The resultant regulatory and bureaucratic chaos is bad but the environmental consequences are frequently worse. All too often the pollutants are merely transferred from the air to the water or from the water to the land where once again, the substances cause additional problems that are costly to clean up.

Fortunately, there has been a growing interest in the possibility of shifting focus from sole emphasis upon pollution control to pollution prevention and waste reduction. In the United States, such conceptual approaches are called: Waste Reduction, Source Reduction, Waste Minimization or Pollution Prevention. In Europe, similar emphases move forward under titles such as: Low and Non-Waste Technologies, Clean Technologies or Environmental Technologies. The key element in most of these approaches is the development of system-wide approaches to the reduction or prevention of wastes in the beginning rather than focusing upon controlling or destroying the wastes after they are produced.

This shift in focus received some regulatory support in the United States when the United States Congress enacted the 1984 amendments to the 1976 Resource Conservation and Recovery Act (RCRA). The essence of the amendments is two-fold:

(a) Burial of many categories of hazardous wastes is to be phased out during the years following 1984; and
(b) All industrial leaders must prepare and implement a waste reduction plan and must report biennially on progress made toward their corporate waste reduction goals.

In the fall of 1986, the United States Office of Technology Assessment (OTA) and the United States Environment Protection Agency (EPA) separately released reports their agencies had prepared in response to the 1984 RCRA amendments. Both agencies concluded that some waste reduction has been done and much more can be accomplished wih presently existing technologies. However, both reports also identified areas in which further research is needed to expand the development of waste reduction and pollution prevention approaches, that could help industries to further reduce their waste production.

The spirit and letter of the RCRA amendments had important implications for industrial and institutional leaders throughout the United States. They also have the potential of affecting their industrial counterparts in other parts of the world as well. In the sections that follow, I address some of the waste reduction and pollution prevention concepts and approaches that have been found to be successful in a wide array of corporations throughout the world. Some illustrative successes selected from over 500 are presented. An example dealing with silver and related materials in a film processing firm is presented in detail to illustrate the technical applicability and the economic advantages of the utilization of waste reduction and pollution prevention concepts in industrial management.

In this final section of the paper, I address the importance of the development and use of codes of ethics by industrial and professional groups, to guide their decisions and actions so that human and other species have a sustainable life-support base rather than one bespoiled by our short- sighted and selfish emphasis upon short-term profits. A copy of two codes of ethics is included to illustrate the range of issues to be addressed in clarifying our values and responsibilities to present and future generations of plants, animals and humans. Increasingly, it is imperative that we internalize these types of ethical values so we avoid developing technologies that jeopardize the life-support fabric upon which this living planet is built. Industrial and governmental leaders have special responsibilities in these areas; but, all of us also share in those responsibilities.

Certainly, if there are to be humane societies on this planet 100, 500, 1,000 or 10,000 years from now, all 5 billion of us here, must work together as co-responsible crew members on "space-ship" earth. Industrialists, governmental officials, researchers, educators, physicians,

attorneys, theologians, psychologists, and citizens-at-large, all have significant roles to perform to ensure that the biophysical life-support system continues to provide life-sustaining air, water, food and high quality, uncrowded, physical spaces for human communities. In short, the goal of long-term sustainability demands some attitudinal and procedural changes.

A working definition of sustainability assumed throughout this paper is: "Sustainability is the capacity of the earth's biophysical, life-support system to continuously sustain and nourish plant and animal life." This definition implies a system capable of providing for the long-term physical and emotional human needs in ways which ensure aesthetically pleasing and humanely just opportunities for all.

Within this context, industrial leaders must learn to function in harmony with the earth's basic biophysical system so as to continue to provide society with safe and nutritive foods, useful tools, and meaningful employment opportunities. Industry and agriculture must do this while not bespoiling the planet and endangering the life-support system upon which all life depends.

Some industrial leaders are already engaging in practices that fulfil these requirements. However, a number of additional industrial and societal changes must occur if the goal of sustainability is to be realized globally. In the following sections, some of the attitudinal and technological changes that will be helpful for moving societies toward the goal of sustainability, are addressed.

WASTE REDUCTION AND POLLUTION PREVENTION CONCEPTS AND APPROACHES CONDUCIVE OF THE MOVE TOWARDS SUSTAINABILITY

The first steps in moving towards the goal of sustainability are attitudinal. Among them are the following type of attitudinal changes:

(a) From either an environmental or economical stance to an attitude that acknowledges that both are thoroughly interwoven and rise or fall together;
(b) From a short-term emphasis upon corporate profits to an emphasis upon long-term economic health for the entire society; and,
(c) From the concept of "How can I get by" to the ethical question of "How can my company and I contribute to the health of the society of the environment while providing reasonable corporate profitability?" Perhaps all of us would do well to remember the statement: "There is enough for man's needs, but not enough for man's greed."

After these attitudinal changes have been made, the next responsibility is to make the commitment to work to reduce waste and prevent pollution throughout the entire corporate structure. Top management officials must be informed and convinced that such attitudes and practices will simultaneously help them to meet production quotas, environmental standards and economic goals. Once the leaders are convinced that system-wide emphasis upon pollution prevention is economically and ecologically sound, they must develop appropriate company policies that support and reinforce such practices throughout the entire company. To illustrate this point, the Chevron Corporation developed and implemented a company-wide Waste Reduction Policy. Since its implementation, extensive progress has been made in reducing waste production throughout the corporation. Chevron's Waste Reduction Policy is to:

(a) Prioritize all waste streams in terms of hazard, treatment/disposal costs, and waste-to-yield percentages;
(b) Set long-term waste reduction goals for each waste stream with steps and time-frames for fulfilling each goal;
(c) Obtain technical and research assistance to meet the waste reduction goals;
(d) Annually, report progress made toward the waste reduction goals; and,
(e) Revise the waste reduction plans and procedures as necessary.

Many other corporations, large and small, have also developed and implemented similar waste reduction policies and are seeing increased profits and decreased negative environmental impacts. The key technological approaches to most successful waste reduction/pollution prevention programs include combinations of the following categories:

(a) Housekeeping changes;
(b) Materials' substitution;
(c) Changes in design and operation of processing equipment;
(d) Reuse and recycling of material within the plant or in off-site facilities.

Detailed discussions of the specifics under each of these categories have been published (see References); and therefore, will not be repeated here. Based upon the author's evaluation of more than 500 industrial case studies, in which the companies successfully implemented waste reduction and pollution prevention concepts and technologies, the following general points can be made about the benefits to the company of implementing waste reduction/pollution prevention policies and approaches:

(a) Decreased costs of raw materials;
(b) Decreased cost of energy;
(c) Reduced waste disposal costs and decreased dependency upon waste treatment and disposal facilities;

(d) Reduced or eliminated risks of future liability for clean-up of contamination from buried wastes;
(e) Reduced regulatory complications;
(f) Decreased operational and maintenance costs;
(g) Reduced employee, public, and environmental risks and expenses, both in the present and in the future;
(h) Decreased liability insurance costs; and
(i) Improved employee morale, productivity and product quality.

While not all of the foregoing benefits may be experienced by a particular company in each situation, these are the ones most frequently obtained. The results of nine case studies are summarized in Table 1.

The percentage reduction in the quantities of waste produced by each company ranged from 85% to 100%. The payback periods ranged from 3 years to 1 month. This underscores the contention that ecology and economy can go together. The industries involved include old industries as well as new high-tech industries. The methods employed include incorporation of in-line technologies, such as ion exchange and ultra-filtration; process modifications in which the previously used substance is replaced with a new, less polluting substance; the change of a process from one dependent upon the use of large quantities of caustic or acid to one that is primarily mechanical and uses little or no caustic or acid and therefore generates little or no waste.

The technologies for some of the changes are readily available on the market, others are newly-developed proprietary processes. Incidentally, some companies that developed new processes to reduce their own wastes, have sometimes gone on to patent their new processes and to sell or lease them to others for a profit. Thus, they solved their own problems and developed a new product at the same time.

The photographic processing firm referred to in Table 1, is PCA International, Inc. of Matthews, North Carolina. The firm previously generated substantial quantities of wastes during the photographic processing of color portraits. In order to reduce the waste load they discharge to the municipal wastewater treatment facility and in order to reduce raw material's costs, PCA made the following process modifications:

(a) They incorporated a series of in-line ion-exchange systems to remove the contaminating bromide ions from the used film developer. This resulted in 85% reuse of the developer;

TABLE 1

Characterization of Waste Reduction Approaches

Industry	Method	% Reduction of wastes	Payback
Pharmaceutical production	Water-based solvent replaced organic solvent	100%	<1 year
Equipment manufacture	Ultrafiltration	100% of solvent and oil, 98% of paint	2 years
Farm equipment manufacture	Proprietary process	80% of sludge	2.5 yrs.
Automotive manufacture	Pneumatic cleaning process replaced caustic process	100% of sludge	2 years
Microelectronics	Vibratory cleaning replaced caustic process	100% of sludge	3 years
Organic chemical production	Adsorption, scrap condenser, conservation vent, floating roof	95% of cumene	1 month
Photographic film processing	Electrolytic recovery ion exchange	85% of developer, 95% of fixer, Ag and solvent	<1 year

(b) They incorporated countercurrent rinses for film rinse water. This reduced rinse water usage by 90%;
(c) They installed several electrostatic silver recovery units to recover the silver from the fixer solution. This resulted in the economic recovery of the silver to environmentally safe levels; and,
(d) They implemented a process of restandardization of the bleach solution.

This resulted in 90% reduction of bleach usage.

The initial cost of $120,000 for the process modifications was paid back in less than a month by the following annual savings:

(a) $360,000 in the cost of developing solution;
(b) $25,000 in the cost of fixer solution;
(c) $780,000 in the cost of bleach solution; and
(d) $1,410,000 in silver recovered.

With a total annual saving of $2,575,000, the PCA corporation was handsomely rewarded economically for making process modifications that produced fewer pollutants (Huisingh et al. 1986).

While many other similar examples are cited by various authors and readers are referred to them (Campbell/Glenn 1982, Chazelon 1982, Bringer/ Zoss 1984, Gardner/Huisingh 1987, Royston 1979, Economic Commission for Europe/United Nations Environmental Programme 1982), the foregoing example is illustrative of the types of modifications that can be made and of the benefits that are realizable when corporations establish the goal to systematically reduce their waste production. The author is convinced that many industrial firms are already doing an outstanding job of minimizing their wastes, however, many may be able to further improve their operations by approaching all their processes with the systems approach to reducing or eliminating waste production in the first place rather than with the objective of controlling pollutants after they are formed.

Such industrial successes are encouraging and are being replicated in many firms in many countries. However, not all waste streams can be so readily and extensively reduced with presently existing technologies. Some processes will require intensive research in order to discover and to develop new less polluting processes. For this, international cooperation and coordination is desirable for establishing research priorities, for funding research activities and for helping to ensure that the research results are applied within the relevant industries.

ETHICAL CONSIDERATIONS

Earlier in this paper, I suggested that governmental regulations provide the driving force, in some instances, of corporate change of focus from pollution control to pollution prevention. In many cases, the economic benefits and productivity enhancement benefits are the prime motivators of change. In other cases, the avoidance of liability risks or the attempt to maintain a positive public image are primary considerations in making the changes.

There is, however, a growing awareness that sole reliance upon external motivators may be inadequate to move society to practice truly sustainable lifestyles. This limitation is being faced by various groups in their development of environmental pledges or codes of ethics designed to help individuals internalize values that provide the environmentally and ethically-sound framework and guidelines for decision-making and action.

Two illustrative statements or codes are included here for consideration.

CODE OF ENVIRONMENTAL ETHICS FOR ENGINEERS

The World Federation of Engineering Organizations, Committee on Engineering and Environment, with a strong and clear belief that man's enjoyment and permanence on this planet will depend on the care and protection he provides to the environment, states the following principles:

To all Engineers

When you develop any professional activity:

1. Try with the best of your ability, courage, enthusiasm and dedication to obtain a superior technical achievement, which will contribute to and promote healthy and agreeable surroundings for all men, in open spaces as well as indoors.

2. Strive to accomplish the beneficial objectives of your work with the lowest possible consumption of raw materials and energy and the lowest production of wastes and any kind of pollution.

3. Discuss in particular the consequences of your proposals and actions, direct or indirect, immediate or long-term, upon the health of people, social equity and the local system of values.

4. Study thoroughly the environment that will be affected, assess all the impacts that might arise in the state, dynamics and aesthetics of the ecosystems involved, urbanized or natural, as well as in the pertinent socio-economic systems, and select the best alternative for an

environmentally sound and sustainable development.

5. Promote a clear understanding of the actions required to restore and, if possible, to improve the environment that may be disturbed, and include them in your proposals.

6. Reject any kind of commitment that involves unfair damages for human surroundings and environment and find the best possible social and political solution.

7. Be aware that the principles of ecosystemic interdependence, diversity maintenance, resource recovery and interrelational harmony form the basis of our continued existence and that each of those bases poses a threshold of sustainability that should not be exceeded.

Always remember that war, greed, misery and ignorance, plus natural disasters and human induced pollution and destruction of resources, are the main causes of the progressive impairment of the environment and that you, as an active member of the engineering profession, deeply involved in the promotion of development, must use your talent, knowledge and imagination to assist society in removing those evils and improving the quality of life for all people. (Approved by the Committee on Engineering and Environment of the World Federation of Engineering Organizations, in the 6th Annual Plenary Session, New Delhi, 5th November 1985. Printed in Buenos Aires, Headquarters of the Committee, 1986.)

This code of environmental ethics contains many principles that are highly laudatory and which, if they indeed serve as internalized ethical guidelines for the practicing engineer, will result in the use of technologies that are more supportive of sustainability than those frequently utilized at the present time.

A second code or pledge I wish to include for consideration is one developed by a religious community as a contemporary statement of values for their guidance.

THE SHAKERTOWN PLEDGE

Recognizing that the earth and the fullness thereof is a gift from our gracious God, and that we are called to cherish, nurture, and provide loving stewardship for the earth's resources, and recognizing that life itself is a gift, and a call to responsibility, joy, and celebration, I make the following declarations:

1. I declare myself to be a world citizen.
2. I commit myself to lead an ecologically sound life.
3. I commit myself to lead a life of creative simplicity and to share my personal wealth with the world's poor.
4. I commit myself to join with others in reshaping institutions in order to bring about a more global society in which each person has full access to the needed resources for their physical, emotional, intellectual, and spiritual growth.
5. I commit myself to occupational accountability, and in doing so I will seek to avoid the creation of products which cause harm to others.
6. I affirm the gift of my body, and commit myself to its proper nourishment and physical well-being.
7. I commit myself to examine continually my relations with others, and to attempt to relate honestly, morally, and lovingly to those around me.
8. I commit myself to personal renewal through prayer, meditation, and study.
9. I commit myself to responsible participation in a community of faith.

This pledge illustrates the broader scope and dimensions of values that are being incorporated into many group's decision making processes. It illustrates how the Shakers see their responsibility to help maintain a healthy environment and a healthy body while they remember they are world citizens. They further emphasize that each person is occupationally accountable to avoid the creation of products which cause harm to others.

Societally and professionally, these types of pledges may help to instill ethical values within corporate citizens so that they increasingly make decisions that are more ecologically sensitive and which will help to move our entire society to develop and implement policies and practices that will ensure sustainability for all forms of life upon earth including human. All of society has similar obligations. Together, we must succeed or certainly we will all fail.

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Professor **Donald Huisingh** is currently Professor of Environmental Sciences at Erasmus University in Rotterdam. He has led and directed interdisciplinary research teams and fact-finding task forces in his effort to implement preventative approaches to environmental quality improvement. Dedicated to the development of integrated approaches for the solution of societal problems, Professor Huisingh has collaborated with industrialists, political leaders, academians and students alike in coordinating educational and research mechanisms capable of accomplishing such holistic, system-wide approaches. A recipient of numerous grants and awards, he is the author of more than 90 publications, most recently on hazardous waste reduction and pollution prevention. Professor Huisingh is currently also assisting the United Nations Environmental Office in the Develpment of a Global Information Network on Concepts, Policies and Technologies on Low and Non-Waste Technologies.