

## PREVENTION - GREEN CHAIN OF PRODUCTION

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I wish to thank Dr. Vlavianos-Arvanitis for inviting me to participate in this workshop. I will try to fill in some gaps, summarize some important points, and present an opinion on certain statements made previously. Environmental and public health protection presents many problems that re-quire solutions. The following steps need to be followed:

- realization that a problem exists;
- acceptance of the fact that a particular problem exists. Even today in Greece, many - if not most - people in government and professional positions of authority still state that; "Greece is not very industrialized, therefore it is mostly unspoiled and does not have a major pollution problem..." However, the fact that two thirds of Greeks live within the eight major urban-industrial complexes and never even visit the relatively unspoiled peaks of Mt. Olympus, the distant, unfrequented clean beaches, or breathe clean air for more than a few weeks each year, must be taken into account;
- definition of the problem and its parameters as accurately as possible. If a problem is not defined correctly, a brilliant solution will be found to the wrong problem. For instance, both internationally and in Greece, people tend to lose sight of the fact that the purpose of pollution control/clean-up effort is to protect public health and the environment. Instead, too often the purpose of the problem solution becomes the enforcement of regulations, bigger budgets, the pouring of more concrete, the installation of more machines and computers, etc;
- design of many alternative solutions or plans, without forgetting that some-times not doing anything, or the "no project" alternative, is the best course of action. However, because bureaucrats justify their importance by the size of budget they manage, and engineers get paid a percentage of the project cost, the "no project" option, the pollution prevention instead of pollution control option, is not looked upon very favorably;
- implementation of the best alternative solution at the time of the evaluation. The composition and overall expertise of the evaluating team, as well as economic and political considerations and public pressures, will affect the choice of alternative;
- finally, it is very important that a monitoring system should be set up in order to measure the actual results of implementing a solution or plan, and to keep looking for improvements. This is something that, unfortunately, is not often done. The opportunity is therefore missed of gaining experience, in order to create better solutions in the future, and of determining how various assumptions have worked out in practice. Especially in the case of pollution prevention, which has to be an on-going process and not a project that is completed and forgotten, monitoring the results and upgrading the alternative solution being implemented, is essential.

In recent years in the United States and Canada, a new three-part philosophy in environmental and public health protection has been legislated, implemented, and is gaining ground among professionals and bureaucrats. Its components are:

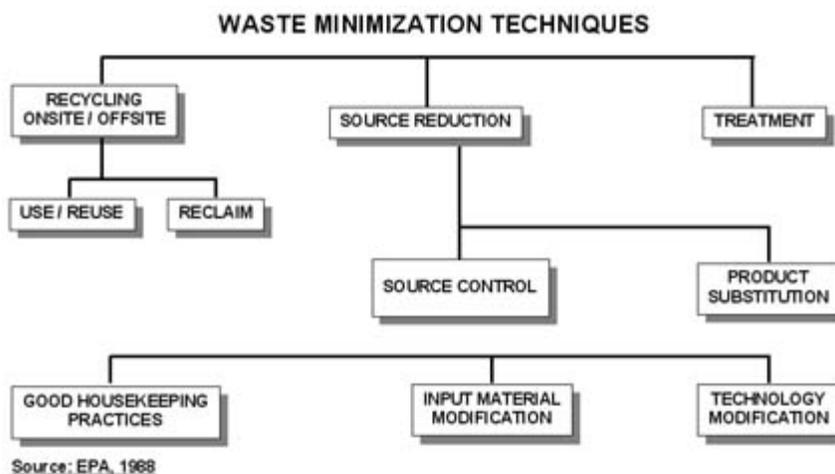
- integrated planning, design and management, with anticipation of environmental impacts;
- emphasis on pollution prevention, waste minimization, ecological engineering and clean technology;
- consideration of the broader, long-term cost to society, not merely the bottom-line of a company, as well as evaluation of the life-cycle cost of products and projects.

An increasing number of businesses are realizing that to stay competitive they have to incorporate this philosophy into their strategic planning. The Conference Board, the leading international business organization whose purpose it is to "improve the business enterprise system and to enhance business's contribution to society ", sponsored several reports and a 1991 symposium on "Championing the Global Environment." In these the following proposals were made and initiatives taken:

- business has to play a pro-active role in championing the environment, not simply to agree to demands from customers and activists. It has to use science, not emotion or politics, as a basis for its decisions;
- it has to make an effort to recycle waste into profitable products and materials;
- business must voluntarily, (i.e., in the case of pollution prevention and waste minimization), go beyond what is required at the present time. It should not wait to be pressured by legislators and customers;
- each business must make the environment and the protection of public health a strategic priority;
- a National Environmental Development Association was established in the United States;
- Ashland Chemical's "Responsible Care" initiative for the continuous reduction of emissions, initially promoted for the United States Chemical Manufacturers' Association and the American Manufacturers' Association, is nowadays being supported internationally.

Increasing numbers of businessmen and bureaucrats are being persuaded to try the Pollution Prevention process because of the economic and environmental improvements, and the improved public relations, liability reduction, and other benefits which have been realized. Capital investments for small to medium-sized Waste Minimization projects have been found to have a pay-back time of between a few months and two years, while larger projects have been shown to have a pay-back time which is still only a few years. However, there is a growing number of managers and entrepreneurs - among them, prominently, is the founder of Body Shop International, Ms. Anita Roddick - who have added an extra dimension to business: "Social and environmental conscience" as main policy. Mr. Boutaris philosophized on this subject, speaking about the need for redefining, and develop-ing a new dimension for the concept of "business profit", better to include social and environmental costs. An integral part of the pollution prevention strategy must be the principle of "people's-right-to-know," or advance knowledge of the risks imposed on society because of the production, storage accumulation and release of hazardous materials. However, society cannot demand such disclosure from industry while at the same time the armed forces installations, some of the worst hazardous waste contamination sources worldwide, hide behind the excuse of "national security" to perpetrate irresponsible outright pollution and gross environmental mismanagement. The United States Environmental Protection Agency proved this point in court after nearly two decades of legal battle, and today members of the environmental divisions in all armed forces branches are among the proponents of pollution prevention. Citizens must make the same demands of themselves and of all other government installations. The old "polluter pays" principle has been proven inadequate, inefficient, impossible to apply in many cases, and not cost-effective for society as a whole. The new cornerstone of the effort for environmental and public health protection must be the principle of Pollution Prevention.

Figure 1 shows the various possibilities under the two categories of Waste Minimization techniques, that is recycling and source reduction. Treatment of produced waste streams should be the last option considered. Incineration is not considered as one of the pollution prevention techniques at all. These techniques are, as stated above, recycling and source reduction.



**Figure 1:** Waste Minimization Techniques

What prevents everybody from implementing such a program? Most industries have been slow to implement Pollution Prevention programs.

This is because, even though Waste Minimization seems to solve many - if not most - pollution problems, in practice there are certain disincentives or barriers that have to be overcome if the full potential of the strategy is to be realized. Therefore, the pollution prevention program implementation team of an industry should recognize potential obstacles to the success of such a program at the start, as it sets goals for Waste Minimization and then defines specific objectives. Table 1 lists examples of disincentives or barriers to the success or efficiency of implementation of a Waste Minimization project, in such areas as jurisdictional management conflicts, economic realities, technical aspects, and regulatory limitations.

#### **Jurisdictional / Management Barriers**

A major roadblock to implementing a pollution prevention program is largely internal and lies in the fact that, organizationally, many companies are ill-equipped to change the focus of their programs on a corporate-wide basis. The lack of in-house engineering expertise needed to determine where wastes are generated and where they go, often prevents companies from taking the most basic steps toward implementing a Waste Minimization program. A related problem centers on the key personnel who are given responsibility for administering such programs with-out, in many cases, the authority required to implement them. Waste Minimization programs, where a clear commitment to achieving pollution prevention is not stated as a corporate policy, have little chance of success.

Table 1: Obstacles to Waste Minimization

DISINCENTIVES	Source Reduction	Off-site Recycling	On-site Recycling
<b>JURISDICTIONAL MANAGEMENT</b>			
Corporate Organization	X		X
Lack of In-house Experience	X		X
Lack of Authority	X	X	X
Lack of Corporate-Wide Policy	X	X	X
Unclear Corporate Commitment	X	X	X
Conflicts Between Groups	X		X
Status Quo	X	X	X
Lack of Employee Participation	X		X
Lack of Employee Motivation	X		X
<b>ECONOMIC MATERIALS</b>			
Lack of Capital	X		X
Financial Liability		X	
<b>TECHNICAL BARRIERS</b>			
Attitudes Toward Unfamiliar Methods	X	X	X
Batch Processes			X
Lack of Information	X	X	X
Technical Limits of Process	X		
Technical Quality Concerns	X		
<b>REGULATORY BARRIERS</b>			
Need to Obtain TSD Permit	X	X	X
Perceived Stigma of Managing Hazardous Waste		X	X
Revisions to Other Environmental Permits	X	X	X
Limited and Vague Legislation	X	X	X

Although Waste Minimization projects can lead, among other things, to reduction of operating costs and improvement of environmental regulatory compliance, they can also create conflict-related barriers such as the desire to maintain the status quo and avoid the unknown. These factors can disrupt a Waste Minimization program as well. Another attitude-related barrier is the negative response often given by people who are called upon to implement aspects of a Waste Minimization program, because they do not fully understand the nature of the proposed options and their impact on operations. That is why program participants should be included in brainstorming sessions in order to experience an often-encountered barrier, which is fear that the waste minimization option will diminish product quality, in those cases where unused feed materials are recovered from the waste and then recycled back into the process. The deterioration of product quality can be a valid concern, if unacceptable concentrations of waste materials build up within the system.

On the other hand, jurisdictional/management conflicts among various groups within a company will arise when, for instance, a new operating procedure reduces waste but may also create a bottleneck that decreases the overall production rate. Or adequate space is not available for the installation of new equipment, and extensive maintenance of the new machines may be required. In addition, more intensive quality control may be needed, as a result of the new processes or modifications needed for the implementation of a Waste Minimization program.

### Economic Barriers

Unless top management is really committed and budgetary provisions have been made, there may not be enough capital to fund the Waste Minimization projects and to implement all the program parts required to achieve the full potential in Pollution Prevention. In practice, HSWA requirements are so broadly stated in terms of the actual level of waste minimization to be achieved, that it is largely at the discretion of industry to decide to what extent they will actually comply, and what an "economically practicable" Waste Minimization program is for them. Therefore, there is an inherent disincentive to contribute the larger capital investment that would be required for the fullest implementation of pollution prevention within an industry. On the other hand, a particular plant manager, where a Waste Minimization project has been planned, may be tempted to divert funds allocated for the project to production increase, maintenance requirements, facilities expansion, or any other area considered as having a higher priority. Additionally, off-site recycling efforts may present an economic barrier because of financial liability on the part of the industry which has waste material recycled. Finally, changes in product characteristics may affect customer acceptance, resulting in income loss. Technical Barriers

Since any type of Waste Minimization program or project is, in general, heavily dependent on technological advances, changes or new inventions, it should be obvious that certain technological obstacles may also exist. Such barriers include:

- fear, exhibited by many managers, engineers and workers, of dealing with unfamiliar methods and technology;

- greater difficulty and labor-intensive-ness of operating batch processes involved in on-site recycling of waste materials, versus the ease of operating automated production processes;
- lack of information regarding the technological developments and new machinery or processes that could be used to achieve waste minimization and have already been implemented by others;
- technological limitations in new processes or equipment used for pollution prevention which do not allow elimination of contaminants beyond a certain degree;
- quality concerns involving the new equipment and processes implemented in the Waste Minimization program and their impacts on the products of the industry.

Additional examples of technological barriers to pollution prevention include:

- non-availability of the adequate utility infrastructure required for new equipment being considered;
- adverse impact of the new non-hazardous material to be used upon the efficiency of the existing waste-water treatment facility of the industry;
- possible malfunctioning of the new piece of equipment under the intended conditions because it has not been demonstrated in a similar situation;
- need for extensive replacements in equipment and processes of production, brought about as a result of incompatibility with the new machinery or process intended for the Waste Minimization program;
- expectation of a "debugging period", following the installation of new equipment, which may have an impact on the overall efficiency of production.

### **Regulatory Disincentives**

One of the main reasons why most industries do not have a Waste Minimization program, (and those that do, have only a limited one), is that although Congress has recognized the need for more stringent pollution control regulation, it has not enacted much specific and comprehensive multimedia waste management and minimization legislation. Currently, there are few actual regulations to force industry to minimize waste and prevent pollution, and although the HSWA endorses the concept, it states that: "The generation of hazardous waste is to be reduced or eliminated as expeditiously as possible, whenever feasible." HSWA also requires that: "Generators of hazardous waste have programs in place to reduce the volume/toxicity of the waste to a degree which is economically feasible." The Environmental Protection Agency demands of the generators that they: "Certify their Waste Minimization effects by signing a statement on each manifest." These requirements are obviously hard to monitor on a routine widespread basis and they are also stated very broadly, in terms of the actual level of Waste Minimization to be achieved. Therefore, as the regulations are not well defined, it is left to the discretion of individual industries to decide to what extent they will comply and what "economically practicable and feasible" means, in their case.

Other regulatory disincentives include the need for an industry with a Waste Minimization program to obtain a permit for its storage, treatment and disposal facilities; the perceived bad image and adverse publicity involved in managing hazardous waste on-site instead of having it removed somewhere else; the possibility of having to revise the industry's other environmental permits; the possible need for a lengthy resolution of regulatory issues in order to accept another plant's waste as feedstock, as a part of the Waste Minimization program; the difficulty of developing such programs in a relative regulatory vacuum, while possibly running into trouble as a result of future regulations, or needing to make major changes when they come into existence.

In conclusion, despite these disincentives and barriers, efforts should be directed internationally towards more projects involving pollution prevention and clean technology, and fewer projects concerning pollution clean-up. This will require a disturbance of the status quo, a change of philosophy, and a rethinking of basic engineering education. And, of course, it will also require the broad dissemination of information about success stories.

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economic impacts of this unprecedented water resources project.