BUSINESS AND ENVIRONMENTAL PROTECTION

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If Greeks were to be asked whether the protection of the environment is important, the answer would be positive. Very few people, however, have ever visited one of the landfills in Attica and witnessed trash, industrial waste, oils, toxic waste, either in barrels or bulk, and medical waste, being discharged. A still smaller number of people have seen leachates, which are the liquids that flow out of the landfill area, and are aware of the pollutants that they contain, of their toxic-ity, the pollution they may cause, as well as the dangers that they entail.

No industry, business or manufacturing activity has ever included among its objectives the pollution of the environment. Nevertheless, production, services, consumption, transportation, construction and other activities, which are basic factors of a high standard of living, create wastes that inevitably result in the degrada-tion of the environment. The axiom "I produce (either products or work); therefore I pollute", applies to all aspects of human activity.

The volume of waste that is disposed of today is considerable. For example, the municipal solid type waste of Attica, which is almost 15,000 cubic meters a day, if placed in a line with a volume of 1 cubic meter per meter, would cover the dis-tance between Athens and Thessaloniki within a month.

Environmental pollution concerns water, air, and soil pollution. In all cases these pollutants enter the eco-system biocycles and have harmful consequences. The results of air pollution can be perceived directly, for example as smog, and can be transferred as acid rain to areas far away from its source. Water and soil pollution are closely related. Soil pollution passes into the water-table through the penetra-tion of rain waters into the subsoil, where it spreads via the flow of groundwater. Soil pollution is also transferred through the flow of surface waters to the potable and irrigation water reservoirs, and via the food chain to human beings.

Man is now conscious of the already exhausted ability of the natural environ-ment to cater for society's needs for non-renewable raw materials on one hand, and on the other, to receive wastes from a variety of human activities. These, if non-biodegradable, remain in a state of waste for years, while if biodegradable, release pollutants. Other wastes are by their nature hazardous and toxic. A typical list of waste production activities in the manufacturing sector follows.

Table 1: Waste Production in Manufacturing

	Research & Development	Manufacturing	Distribution Administration & Marketing	End Product
Solids & Liquids	Solvents, Chemicals, Paper	Fuel Oils, Packaging, Process Solvents, Paints, Reject Products, Protective Clothing and Industrial Wastewaters	Spillage, Packaging Paper, Used Tires and Lubricants, Samples	Used Products (Normal Waste)
Air Emissions	Laboratory Pilot Plant and Boiler Emissions	Gases, Dusts, Odors, Scrubbers, Filling, Lines, Incinerators and Boilers	Emission from Exhausts, Refrigeration, Boilers and Air-Conditioning	
Others	Noise and Visual Impacts	Noise and Visual Impacts	Noise and Visual Impacts	

Environmental protection technology aims at minimizing the harmful conse-quences of these wastes as well as at securing sustainable development. The first environmental protection methods appeared in the 50’s, a decade which was character-ized by extensive air pollution called smog, and high chimneys for dilu-tion, the solution=dilution process. In the 60's and 70's dreadful environmental accidents took place

in industrial plants such as Seveso, Love Canal, and Minamata, while Rachel Carson's book "Silent Spring" contributed to the rise of environmental consciousness all over the world. At the same time fundamental technologies of air pollution control and industrial wastewater treatment were be-ing developed. In the 80's emphasis was focused on remedying contaminated sites, especially in the United States, through the Superfund program. New concepts and legislative provisions were being introduced, as well as limitations such as biodiver-sity, which were applied step-by-step, to large projects. At the same time the technology of waste containment, through landfilling in covered ar-eas, was implemented. Biological decomposition, known as "composting", incinera-tion of organic wastes with energy recovery, and the fixation/immobilization of toxic wastes in solidified matrices, was also introduced. There were also significant develop-ments in the qualitative and quantitative identifica-tion techniques, for example in analytic chemistry, such as HPLC, enzy-matic tracing test for PCBs, etc.

The current decade is characterized by the global nature of pollution phenom-ena such as sick seas, for example the Mediterranean, the greenhouse phenome-non, and climatic changes. It is also characterized by the enactment of a global legislative framework to confront them such as the EPA and the European Union Directives. Countries that absorb significant industrial investment, and experience high industrial and economic growth, for example Hong-Kong, Indonesia, China, Korea, Malaysia, Israel, Turkey, and the Czech Republic, are adopting environmental legislation similar to those of EPA and European Union directives. Legis-lative provisions such as landfill bans for specific materials, minimum percentages for recycling, minimum content laws for consumer goods, environmental credits or pollution licenses, are being enacted for the first time across a wide range. A manufacturing plant may renew its operating license by buying already approved environmental credits from another manufacturing plant which has already in-vested in environmental protection. Finally, industrial wastewater and air treatment technologies are being further developed. In addition, the concept of compara-tive evaluation of materials with life-cycle analysis and the eco-nomic/ecological evaluation, called ECO/ECO balance, is being introduced, while companies are applying the risk principle, known as risk-based decisions, and cost/benefit analysis for environmental protection investments.

Today the rational solution of the problem calls for the protection of the environ-ment within the framework of a productive and developing society. Pollu-tion of the environment is essentially borrowing by society, at very high interest rates. Restoration, clean-up and remedy costs are of 2 to 3 orders of magnitude higher than the costs of protection at source. Prevention is always more economi-cal and more effective than treatment. The impression exists that environmental protection investments have no re-turn. In reality the opposite is true:

- Real estate value increases. In many areas characterized by high industrial activity, the operation of a waste-processing facility results in an increase in real estate value of up to two orders of magnitude. A potential example in At-tica is Thriassion, and especially the coastal zone, the Saronic Gulf-Elefsina Gulf, which is a fairly polluted area today. The Saronic Gulf and Thermaikos Gulf, together with the Gulf of Rotterdam and of Hong Kong, are the most polluted gulfs in the world. In the past it was one of the most attractive resorts and sacred places in Attica. This area can be enhanced, through sound environ-mental planning, into a multiple-use center, including tourism, marinas, recrea-tion and sports centers, companies' headquarters and so on, by establishing a system for the management of industrial and other wastes, relocation of indus-trial units from the coastal zone, and reparation.
- The European Union environmental protection legislation will be applied and enforced in Greece as well.
- Credit and funding ability internationally increases. Today large financial and credit organizations place great emphasis on the environmental record of compa-nies and agents that apply for financing and loans. A practical reason has been the fact that in projects which were financed in the past and had damag-ing impacts on the environment these organizations were forced to share a part of the cost for environmental remedy.
- Companies that invest in environmental protection projects have a significant comparative advantage through adopting and familiarizing themselves with all the relevant subjects, such as legislation, technology, and administration.
- Environmental technology is developed. Many companies that have invested in environmental protection have developed their own technologies, which they sell in the growing environmental market.

Environmental protection is provided today by companies that offer environ-mental services in a professional manner. In essence these companies offer Risk Management to their industrial, state or municipal customers. Wastes are defined as materials with high heterogeneity and subsequently increased entropy. A wide range of non-desirable attributes increase risk and are not wanted. This means that wastes have a negative economic value and whoever receives them pays a negative equivalent, that is, collects the corresponding positive amount. This tipping or deliv-ery fee represents the assumption of responsibility and risk for handling them. The greater their toxicity, the higher their negative value. For this reason the fee for processing wastes characterized by high toxicity is some 2 to 4 orders of magnitude higher than the corresponding fee for household-type wastes. Waste treatment centers within this framework are no different from the classic produc-tion units: they accept as raw materials matter with strong negative value, and add to it, through several processing steps, technological value. Thus they make it less negative, or even positive, through a process of detoxification and risk annihilation. WMX Technologies Inc. and its subsidiary Waste Management International is the largest company worldwide in this field. It offers financing, design, con-struc-tion and operation of facilities for the processing and disposal of wastes, as well as consulting services for the reduction of wastes, recycling and reuse.

The company sets the highest standards for environmental protection. These are always stricter than, or as strict, as those of the Environmental Protection Agency of the United States and the European Union. These often precede the above, for example RCRA, Subtitle D'Landfill Regulation, European Union Land-fill Proposal Directive, and are adopted by state or international organizations. In addition the company applies state-of-the-art technology and the most effective management of operations and services, in order to protect the environ-ment in the most effective way.

Recently, the Swedish Government has decided to cooperate with Waste Management International for the management of industrial wastes in that coun-try. In Hong Kong the company has recently put into operation the most up-to-date treatment center for hazardous wastes, worth $150 million, in cooperation with the state of Hong Kong. Through the processing of the area's toxic and hazard-ous wastes in this center, the pollution of the gulf of Hong Kong will stop and its ecological balance will be reinstated. Waste Management International's final disposal areas have received numerous awards; their end use includes recrea-tion parks, golf and tennis courts, football playgrounds, and so on.

In the consulting services field for waste minimization, an industry that has grown very fast lately, Waste Management International has already contributed significantly. Such services are applicable to all production stages. Consulting services aim at the minimization of cost and the achievement of environmental benefits:

- reduced disposal
- reduced transport
- redirected labor
- increased use of raw material
- recycling revenues
- integrated services

Characteristic examples where Waste Management's consulting services have resulted in notable environmental and financial benefits which follow:

Pharmaceuticals Manufacturer

Deionizer Regenerant Disposal	Source Reduction
Vacuum Pump Ethanol Loss	Source Reduction
Excess Reactant Disposal	On Site Recycle
Spent Solvents Disposal	On Site Recycle
Cleanout Solvents Disposal	On Site Recycle
Savings	$1,335,510/year
Waste Reduction	
Chemicals	209,790 Gal/year
Water	17 Million Gallons

Paint Manufacturer

Waste Water	On Site Recovery
Tank/Pipe Cleaning	Residual Recovery
Cleaner	Less Toxic Substitute
Hazardous Trash	Source Reduction
Savings	$565,000/year

Automotive Manufacturer

Hazardous Waste Paint Filtration	Source Reduction
Paint Residue, Thinner	Source Reduction
Packaging Waste	Reduction/Recycling
Machining Waste	Recycling, Source Reduction
Cost Savings	$2,533,000/year

Plastics Manufacturer

Hazardous Wastefrom Raw Material Filtration	Source Reduction
Spent Reaction Medium	Source Reduction
Equipment Cleaning Solvents	On Site Recycling
Spent Isopropyl Alcohol	On Site Recycling
Scrap Product from Polyurethane Production	Off-Site Recycling
Research Generated Waste	Toxicity Reduction, Recycling
Savings:	$818,000/year
Waste reduction:	1,215 tons/year

Through such facilities and services Waste Management International protects the environment and contributes to sustainable development worldwide. Because the environment is our future.

Professor **Christos Tsiliyannis** gained his diploma in Chemical Engineering from the National Technical University of Athens, (1981) his M.Sc. in Chemical Engineering in 1982; his M.Sc. in Applied Mathematics & Operations Research in 1985; and his Ph.D. in Chemical Engineering in 1986, all from the University of Florida, Gainesville, USA. He taught Chemical Engineering as invited lecturer at the University of South Florida and as assistant Professor at the City University of New York (1986-1990). He has held engineering and management positions with MOBIL USA, and with PepsiCo Foods International. He joined Waste Management International as Technical Manager in 1991.