THE INTELLIGENT PRODUCTS SYSTEM (IPS)

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Introduction

Since the beginning of the industrial era, production was regarded as most important whereas treatment of waste materials was not of great interest to producers. This led to a great number of chemicals and products for which no environmentally sound method of disposal exists. This is one major reason for today's global waste disposal crisis. Products from the chemicals industry are one major factor in this development.

The enormous and accelerating development of composites since the 1940's has led to more than 100,000 chemical products being registered in Europe alone. Concurrently the disposable consumer society ethic has been transferred to almost every industrial and newly industrialized economy worldwide. The result is an often undefined and dangerous chemical dispersion.

This leads to accumulation of substances in the food chain, toxic health effects and environmental damage. Chemical-by-chemical regulation of releases into the environment has failed due to the immense amount of manmade chemicals and the impossibility of controlling or cataloguing their cumulative impact.

For this reason, most environmental protection efforts so far have made little progress at solving the global health and environmental problems. Slowing the rate of destruction through "acceptable limits" is comparable to arsenic poisoning. It reduces the sensual perception of change, leading to delayed or ineffective remediation measures. Thus, the devastation continues and the process ultimately becomes irreversible.

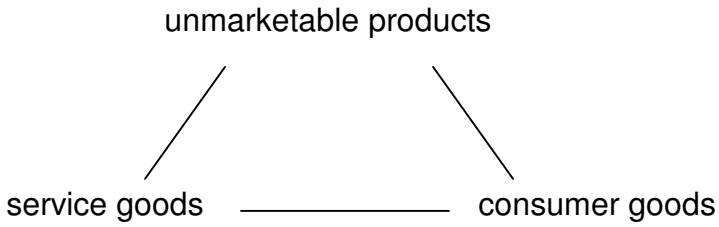
It has also become obvious through alarming increases in revenues of waste management companies that current systems of waste management are too expensive, environmentally unsound, and need to be replaced.

Instead of focusing on waste management and acceptable limits, a system needs to be implemented which concentrates on environmentally sustainable products.

A concept proposal was developed by BRAUNGART et al. for transforming the current regime of waste management to an economically and environmentally sustainable system of intelligent products instead of a "one-way, no deposit, no return" economy (BRAUNGART et al, 1990).

INTELLIGENT PRODUCTS SYSTEM

This is a system for transforming the current expensive global waste management regime to an economically and environmentally sustainable system of intelligent products. Waste management costs can be dramatically reduced by implementing basic principles and incentives for uses of materials. Looking at products available today from a life-cycle approach, it is apparent that all products could be assigned to three categories:



For each of these product categories, specific criteria for production and disposal were developed.

Consumption Products

Consumption products are purchased to be consumed, i.e. converted by chemical reaction into energy or by-products, e.g. washing powder, food, etc. These are usually used only once, then these products and/or their by-products become waste. They are normally put out into the natural environment after one use. Among other basic requirements, in a system of "intelligent products", these have to be:

* biodegradable and / or abiotically degradable
* non-bioaccumulative
* non-carcinogenic, non-teratogenic, non-mutagenic and - in applied concentrations - non-toxic to human beings.
* analyzed on a picogram level.

Service Products

Service products are defined as goods which are used to provide services, e.g. automobiles, TV-sets, washing machines, etc. Under the Intelligent Products system, these would be used within a special "service concept": Consumers with a demand for such a product only need to "lease" the product from the producer or put a refundable deposit on the purchase. The producer basically provides consumers with products on a service basis. After the product has served its function and has to be renewed, the consumer returns it to the producer who is responsible for disassembly and recycling.

This can be achieved via waste supermarkets. These can be compared with shopping markets: When shopping for new goods, the consumer also does a "de-shopping" by returning goods which have exclusively provided him with a service (e.g. packaging material, TV sets, washing machines, etc.). A waste supermarket,

consisting of separate compartments, is not a dumpsite but rather a source-separation warehouse for various products which have been used.

Waste supermarkets also provide for safe storage of service goods for which in the short run recycling technologies have yet to be implemented on a large scale, or are still to be developed. Present recycling for most materials is often "downcycling" because the materials and the products are of a lower quality after each recycling process (e.g. park benches or sound proof barriers made out of recycled plastics) On an interim basis it is necessary to collect and store these products separately until environmentally sound solutions for recycling have been developed.

By giving products back to producers in a closed loop, aided by a deposit-return system of financing, incentives are provided to maximize product disassembly and recycling, and minimize expensive toxic waste.

Unmarketable Products

Unmarketable products cannot be consumed or used in an environmentally sound way. e.g. waste from aluminum production. These are goods for which no safe recycling technology currently exists due to their dangerous effects and lack of demand or need. In the long term, these products should not be manufactured. In the meantime, they should be stored.

For safe storage in a retrievable state, EPEA developed a "Parking Lot Concept" for interim storage of hazardous waste in storage buildings.

Summary

An "Intelligent Products System" develops consumption and service products which encourage elimination of waste, and maximize use of recyclable and biodegradable materials. One effect of the Intelligent Products System is that responsibility along with financial incentives for reduction and maintenance of dangerous waste are transferred from the end user to the producer, but also provide the producer with a reasonable economic framework to work with. Communities are left only with responsibility for biodegradable Consumption products. This division of responsibilities helps to solve the current intractable problem of mixing industrial and biodegradable wastes, which creates much of the skyrocketing costs for waste management today.

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CRITERIA FOR SUSTAINABLE DEVELOPMENT OF PRODUCTS AND PRODUCTION

For practical application of the Intelligent Products System system, criteria for sustainable development of products and production are developed.

The environmental and health costs of industrial activities have been externalized from the cost of products for too long. Key global institutions such as the OECD are slowly recognizing this faulty accounting and are advocating the internalization of such costs. Once this is done, the release of substances such as heavy metals, CFCs, etc. into the environment will become uneconomic due to the enormous associated health and environmental costs. This will accelerate the development of environmentally sound products in a life-cycle-oriented economy.

First attempts at identifying criteria for sustainable development were developed by various organizations, e.g. Valdez Principles (CERES, 1990), Environmental Audits (ICC, 1991), Brundtland Report and Responsible Care. As these efforts have progressed alongside advances in science, certain strengths and weaknesses of each have emerged.

After reviewing these, Braungart et al concluded that key elements especially regarding chemistry were missing.

During years of analyzing company products, including consultation with company chief executive officers, leading environmental scientists and theologians, Braungart et al developed the attached criteria for sustainability.

Adoption of these criteria as long-term goals enables companies to begin a path of environmentally sound development.

Global Measurement Standard

A general global standard needs to be adopted to protect the world's people and the environment against chemical pollution. Such an idealized standard could be stated:

"Companies may no longer release chemicals into the environment which can be traced in mother's milk and which disrupt ecological systems."

Five Key Goals

Using this standard, five key goals have been developed:

1. Producers must establish long term environmental goals for worldwide operations, plus dates for achieving these.
2. Chemicals or products released into the environment must be biodegradable and not accumulate in environmental media or food chains. They must not be teratogenic, mutagenic or carcinogenic and they must not be acutely toxic to human beings in the concentrations occurring under field conditions. These chemicals must not disrupt ecological systems.
3. Producers must not produce organisms which disrupt ecological systems. It is the responsibility of the company to prove that this goal is being fulfilled.
4. Producers must only use renewable energy resources and must minimize energy consumption.
5. Producers must actively protect the existence of animals and plants in their natural habitats.

Twenty-Five Detailed Criteria

Further criteria are necessary to evaluate fulfillment of those goals. The 25 criteria for environmentally sustainable production are listed below. They require from producers:

1. *Long Term Goals:* Acknowledge long-term environmental goals as priorities. The company will make training and education available to the management and staff in order to translate longterm goals into reality.
2. *Global Standards:* Apply the same environmental standards for products and production and provide enforcement possibilities by independent authorities globally.
3. *Declarations:* Make complete declarations of the contents of its products publicly available.
4. *Analyzable Substances:* Produce only analyzable chemicals, so that each substance can be traced to concentrations of parts per billion.
5. *Degradation Knowledge:* Have full knowledge of the degradation processes of each product. The degradation should not produce any unknown and potentially harmful interim products.
6. *Life Cycle Assessments of Products:* Conduct life-cycle assessments for each of its products. Production processes for newly developed or persistent, bio-accumulative and highly toxic substances are top priority.
7. *Life Cycle Assessments of Facilities:* Conduct life-cycle assessments for production plants and waste/sewage treatment equipment. The basic elements to include in these analyses are energy, raw material and waste balances.
8. *Freedom of Information:* Make all environmentally relevant data and information on the toxicological hazards induced by its products publicly available.
9. *Technical Advice:* Ensure that individuals or citizens' groups opposing specific technical processes or facilities will have the possibility of receiving technical advice similar to the project's proponents.
10. *Catastrophic Accident Prevention:* Ensure that their production processes and facilities eliminate the possibility of any catastrophic accident.
11. *Proliferation Prevention:* Drastically reduce the variety of chemicals produced and only put substances on the market which can be completely defined in chemical and degradation terms.
12. *Hazardous Waste Retention:* Retain possession of all unmarketable products until an environmentally sound utilization or elimination is possible.
13. *Reduction of Non-Renewable Resources Use:* Drastically reduce its consumption of non-renewable energy and raw material resources, as well as the production of hazardous wastes.
14. *Water Conservation:* Establish closed-loop systems for water used in cooling and production. The quality of the used resources - air, water and soil - will not be diminished during the production process.
15. *Groundwater Contamination Elimination:* Avoid contaminating any groundwater either by production processes or by the use of the products themselves.

16. *Biotechnologies Guidelines:* Establish publicly analyzable guidelines on the use of biotechnologies, especially genetic engineering, and translate them into action plans.
17. *Competition in Environmental Activities:* Promote environmental protection in order to encourage environmental activities in competing corporations.
18. *Species Protection:* Acquire an appropriate plot of land to reduce the extinction of animal and plant species.
19. *Phase-out Animal Tests:* Strive to abolish animal tests and set up a phase-out schedule for this purpose.
20. *Weapons Elimination:* Not produce any biological or chemical weapons.
21. *Old Product Responsibility:* Accept responsibility for all substances it has produced in the past.
22. *Liability Acceptance:* Accept liability for its products.
23. *Return Policy:* Take back products which cannot be disposed of in an environmentally sound manner (Service Concept). Provide clear instructions to consumers for this procedure, e.g. environmental passport, background information.
24. *Phase-out Unsustainable Technologies:* The company will set a time limit and phase-out schedule for the use of environmentally unsustainable technologies which are currently used due to the lack of sound technologies.
25. *Support Environmental Organizations:* Actively support international environmental groups and international committees in establishing standardized global environmental regulations and a qualified independent supervisory agency.

Evaluation of production activities according to these criteria eliminates the need for "Environmental Auditing", which is currently based on non-standardized conditions and conducted by companies voluntarily. (Braungart et al., May 1992). The examination of products, production activities and production plants according to the described criteria is necessary to ensure environmentally sound development. The method of life-cycle assessment represents a practical tool for the investigation of production activities only if these criteria are applied.

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THE WASTE PARKING LOT CONCEPT

The Parking Lot Concept replaces the current practice of dumping waste in irretrievable locations where it is subject to leaching and high recovery costs. EPEA has developed models for this facility. However, it should be emphasized that waste parking lots can only be reasonable implemented if the entire Intelligent Products System is put into place. Otherwise waste volume becomes unmanageable in any case.

Criteria for safe storage in waste parking lots include:

1. no spontaneous combustion
2. no release of gas
3. no release of liquids.

These conditions can be fulfilled for any non-radioactive product. Whether these conditions are fulfilled, has to be determined on a "yes or no" basis due to the lack of methods of analysis for most of the known chemicals.

The different kinds of waste or substances are to be stored separately in the storage building, until a method has been developed to treat the waste in such a way that it can either be reused or finally disposed of.

The user of the storage building has to prove regularly to the authorities every 3-5 years that no method or technology has been developed to prevent, reduce or dispose of the waste in an environmentally sound way.

To ensure a strict separation between the owner of the storage building and the owner of the waste, the ownership of the storage building should be under public control. The owner of the waste remains responsible for the waste and has to guarantee safety and solve any problems resulting from storage of the waste.

This means that local communities responsible for dealing with waste would only have to handle biodegradable materials.

The responsible producer of the waste has to pay for renting a space in the storage building (as a car owner has to pay the rent in a multi-storage car park).

The advantages of the "Parking Lot Concept" are:

1. Enforcement of the "polluter pays" principle is practicable.
2. Separation of responsibilities is feasible between the owner of the waste and the owner of the storage building.
3. Development of new environmental technologies for specific waste problems is encouraged.
4. Over-capacities of waste treatment plants can be avoided
5. Zero-emission from the facilities can be guaranteed.
6. Interim storage in storage buildings promotes a reduction ofthe number of chemicals in the products (i.e. the less chemicals are being used, the easier and less expensive it is to recycle products).
7. False labeling of waste (false- declaration) or mixing of hazardous wastes with non-hazardous waste and exporting it into developing countries can be reduced because responsibility for the hazardous waste remains with the producer.

8. Use of environmentally sound chemicals treated with existing environmentally sound recycling technologies is supported.
9. The concept is compatible with a market-oriented economy because it is based on the "polluter pays" principle, thereby reflecting the true cost of product manufacturing.
10. Reuse of waste is easier because there is no mixing and no contamination of waste.
11. The burden of proof for environmentally sound methods to reuse or dispose of the waste falls on the producer.
12. The life cycle period of the storage building can be determined before construction. A complete recycling of the construction materials is possible, because it is ensured that materials are not contaminated.