ENVIRONMENTAL POLLUTANTS AND THEIR CONTROL

Gang Yu and Junfeng Niu
Department of Environmental Sciences and Engineering, Tsinghua University, Beijing R. China

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Summary

Chemicals play a major role in our lives and environment. As the municipalities of the world grow and develop, the amount of toxic chemicals deposited into the environment is enormous. These toxic chemicals contribute to most of the environmental problems of past centuries and decades. Global environmental hazards such as air pollution, ozone depletion, climate change, loss of biodiversity, and the cross-border movement of hazardous products and wastes, have caused adverse impacts on human health.

No society, however wealthy, can afford everything it might like to have. Resources are limited; so priorities must be established, certain things financed, and other forgotten or deferred. Some of the critical objectives for improving the environment and for instituting better development policies result from the concept of sustainable development. To achieve sustainable development, we must consider sustainable development in all its dimensions—ecological, social, economic, and political.

1. Introduction

Society's ever-expanding utilization of materials, energy, and space is accompanied by an increasing flux of anthropogenic toxic chemicals to the environment. Many toxic chemicals, although applied or introduced to confined locations, become widely dispersed even to the "ends of the earth." In addition to problems related to accidents and waste management, a major present and future task encompasses identification and possibly replacement of those widely used toxic chemical that may present unexpected hazards.

Environmental management can be directed to the various aspects of environmental performance. As toxics are a main concern for companies, reduction of toxics has to be one of these aspects. To achieve a substantial reduction in toxics, companies should develop a strategy with clear targets, a program, and an evaluation procedure for toxics reduction, and integrate toxics reduction in all components of the EMS.

Monitoring, including materials accounting of toxic chemical use and by-product generation, and requirements for purchased products and raw materials, should be part of the activities. The toxics reduction strategy should be extended to the whole field of potential impacts of toxics, the general environment, the working environment and products.

2. Effects of toxic chemicals

The development of modern technology has brought a dramatic increase in the production and consumption of chemicals. In a few cases, the benefits of chemical use have been accompanied by unexpected adverse effects. Although some of these "everyday" chemicals (e.g. pharmaceutical and cosmetic products, food additives) are not of direct environmental concern, numerous compounds are continuously introduced into the environment in large quantities (e.g. solvents, components of detergents, dyes and varnishes, additives in plastics and textiles, chemicals used for construction, antifouling agents, herbicides, insecticides, and fungicides).

The persistence and bioaccumulation of mercury, PCBs, kepone and dioxins are classic examples. Such cases have led to public concern that chemicals be fully evaluated in terms of potential risk before being approved for use. Some examples of such toxic chemicals are given in Table 1.

Structural types	Compound name	Sources
Pesticides	HCH, Parathion, Carbaryl, Chlordane, Chlordane, Trans-nonachloride, 1,2-dibromo-3-chloro-propane, DDT, DDE, DDD, Carbatyl, Dicofol (Kelthane), Aldrin, Endrin, Dieldrin, Endosulfan, Heptachlor, Heptachlorepoxide, Malathion (EI-4049), Methomyl (Lannate), Methoxychlor, Toxaphene	Insecticide and metabolites
	Simazine, 2,4,5-T, 2,4-D, Atrazine, ATA, Alachlor (Lasso, Lazo), Nitrofen, Trifluralin, Simetryn, Metribuzin, Chlordecone	Herbicide
	HCB, Benomyl, Mancozeb, Maneb, Metiram, Zineb, Ziram, Vinclozolin (Ronilan)	Bactericide
Industrial chemicals	PCP, Tributyltin, Triphenyltin,	Preservatives
	DEHP, BBP, DBP, DCHP, DEP, DAP, Di(2-ethylhexyl)adipate, D-n-HP, Dipropylphthalate	Plasticizers
	Alkyl-phenol (C_5-C_9), Nonyl-phenol, Octyl-phenol,	Surfactants
	Methylmercury, Cd and its complex compounds, Pb and its complex compounds	Heavy metal and its complex compounds
	2,4-Dichlorophenol, Benzophenone, 4-Nitrotoluene, n-Butylbenzene, Bis-Phenol A	Intermediates

	Aspartame	Food additives
	PCBs, PBBs, PBDEs, CPs	flame retardants
	Trichlorofluoromethane, Dichlorodifluoromethane, Chlorodifluoromethane	Aerosol propellants, refrigerants and blowing agents for plastic foams
	Dichloromethane, Trichloroethene, Tetrachloroethene, 1,1,1-Trichloroethane	Solvent
Pharmaceuticals and metabolites	Ethinyl-estradiol, carbamazepine, Norfloxacin, Ciprofloxacin	Human medicine
	Enrofloxacin	Veterinary use
By-products	PCDD/Fs	Industrial processes and urban wastes incineration
	PAHs	Incomplete combustion of fossil fuel

Table 1. Examples of important toxic chemicals

In 1976, the U.S. Congress enacted the Toxic Substances Control Act which requires the testing of chemical substances and mixtures for assessment of risk to human health or the environment. Public concern regarding environmental chemicals is usually centered upon their potential to cause cancer.

However, researchers do not focus solely on possible carcinogenic effects. Scientists recognize that problems associated with reproduction, including those that induce birth defects, are equally characteristic in animals exposed in experiments to large concentrations of environmental chemicals.

Recently, research has been initiated to discover whether humans who have been exposed to the same chemicals, albeit at lower levels, are also subject to reproductive problems. In order to detect the rather subtle effects likely to occur in humans, it is necessary to find and study human populations whose geographic location, employment, or diet may subject them to higher-than-average amounts of the chemicals of concern.

In addition to environmental concerns, dangerous levels of exposure which can threaten the health of workers must be prevented. Many workers die each year as a result of physical and chemical hazards at work, and the long-term effects of certain occupational conditions are unknown.

Protecting against potential public health hazards requires widespread knowledge about commercial chemicals-their mixtures, by-products and uses. We must know more about their persistence and fate in the environment, what effects they will have, and, most importantly, how we can minimize the risks they pose.

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Biographical Sketches

Dr. Gang Yu is a professor and the Deputy Head, Department of Environmental Science and Engineering, Tsinghua University, Beijing, China. He received an M.Sc (1989) degree in Environmental Chemistry from Nanjing University and a Ph.D.(1992) in Environmental Chemistry from the Research Center of Eco-environmental Science, Chinese Academy of Science. His current interests focus on persistent organic pollutants, including analytical method, behavior in multiple media, disposal technology, remediation technology, and control strategy.

Dr. Junfeng Niu is a post doctoral in the Department of Environmental Science and Engineering, Tsinghua University, Beijing, China. He received a Ph.D. (2002) in environmental science from Dalian University of Technology. His current interests focus on behavior and quantitative structure-activity relationships (QSARs) of persistent organic pollutants.