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REMEDIATION OF HAZARDOUS WASTES IN CENTRAL AND EASTERN EUROPE: TECHNOLOGY AND HEALTH EFFECTS

D. O. Carpenter[1], K. Bláha[2], A. Buekens[3], M. Cikrt[4], T. Damstra[5], B. Dellinger[6], A. Sarofim[7], W. A. Suk[8], H. Wyes[9], J. Zejda[10]

[1]School of Public Health, University at Albany, N.Y., USA
[2]Department of Ecological Risks and Monitoring, Ministry of Environment of the Czech Republic, Prague, Czech Republic
[3]Free University of Brussels, Belgium
[4]Centre of Industrial Hygiene and Occupational Diseases, National Institute of Public Health, Prague, Czech Republic
[5]WHO – IPCS/IRRU, International Program on Chemical Safety, NC, USA
[6]University of Dayton Research Institute, Environmental Science and Engineering, Dayton, OH, USA
[7]Reaction Engineering International, Salt Lake City, UT, USA
[8]National Institutes of Environmental Health Sciences, Chemical Exposures and Molecular Biology Branch, NC, USA
[9]WHO-ECEH Bilthoven Division, Bilthoven, The Netherlands
[10]Institute of Occupational Medicine and Environmental Health, WHO Collaborating Center, Sosnowiec, Poland

Address for correspondence: D. O. Carpenter, School of Public Health, University at Albany, One University Place, Rensselaer N.Y., 12144, USA

The countries of Eastern and Central Europe face many challenges, ranging from such basic societal needs as provision of adequate food, shelter and jobs for their populations to the greater challenges of restructuring government, industry and business to function efficiently in a market economy. These are diverse countries. Some are very large, as is the case for Russia and the Ukraine, while others are small. Some are well advanced in this transition to democratic government and market economies, and are on the verge of joining the European Union, while others still retain tight central controls and have made only small movements away from a previous form of government. While there are similarities among the countries of the region at least in terms of a political past, in reality each has its own culture, in many cases its own language, and years of history of defending itself against neighbors. Each country is struggling with the sometimes conflicting goals of preservation of its own culture and identity, and at the same time building an economy that is self-sufficient and strong. Each suffers to a greater or lesser degree with inadequate resources to meet the expectations of the population and to deal with the legacy of actions taken in the past which are detrimental to quality of life.

Contamination of the environment with substances hazardous to human health is one of the many challenges to the countries of this region. While there is little doubt but that environmental contamination is a serious problem here, there are a number barriers to determining the precise degree of danger to human health. These include lack of funds, inadequate and often unreliable data, lack of contemporary analytical and remediation equipment and lack of trust in government. Environmental contamination is by no means the only or probably even the most serious threat to human health. In several countries in the region life expectancy is actually declining, due to a variety of factors of which diet and smoking play a large role. But contamination of the environment is certainly a contributing factor to ill health. Environmental contamination contributes to real human diseases, but also results in a deterioration of quality of life. The psychological impact of environmental contamination in at least some cases may be almost as negative an effect as the biologic impact.

The papers in this issue of the Central European Journal of Public Health are the proceedings of a conference held in Prague on 16–19 November 1997. This conference was part of a series of meetings in the region sponsored by the US National Institutes of Environmental Health Sciences (NIEHS), the World Health Organization (WHO) and the University at Albany which attempt to bring together leaders from Eastern and Central Europe, together with a few experts from Western Europe and the US, to discuss problems of environmental contamination and hazardous wastes from several points of view. Previous conferences have been focused on the *Neurotoxicity of Metals* (Tihany, Hungary, 1993), published in Cellular and Molecular Neurobiology, volume 14, number 6, pp 589–857, 1994, *Remediation of Hazardous Wastes* (Prague, Czech Republic, 1994), published in Central European Journal of Public Health, Supplement, volume 2, pp 1–88, 1994, and *Children's Environmental Health* (Sosnowiec, Poland, 1996), published in Central European Journal of Public Health, volume 5, pp 51–96, 1997.

The philosophy of organization of these meetings is derived from that of the Superfund Basic Research Program of NIEHS, which brings together scientists who study human disease with toxicologists, ecologists and engineers. When the environment is contaminated there are effects on people, animals and the ecosystem, but the solutions to environmental contamination must involve those professionals with the expertise to do something about it. These individuals are both government officials who have programmatic responsibilities for policies, usually in ministries of the environment and health, and individuals from the engineering community who develop and implement the technologies necessary to remediate contamination. While this range of professionals – epidemiologists, toxicologists, ecologists, engineers and government officials – often do not communicate, we believe that such communication is essential in dealing with environmental contamination in any country. In a time of inadequate resources, the engineer-

ing community and government should focus priority in dealing with those issues which pose the most serious threat to human health. At the same time, engineering solutions may pose new hazards to human health, as is the case with incineration that generates release into the atmosphere of dioxins and metals.

Interdisciplinary approaches to problems such as hazardous waste are not common in any country, especially when the relevant disciplines are biomedical sciences and engineering. But for all of the reasons mentioned above, problems such as those posed by hazardous wastes and environmental contamination cannot be solved without a bringing together of professionals in these areas. It is also of extreme importance that future leaders in both the scientific disciplines and government understand the importance of interdisciplinary approaches to solving such problems. Therefore, it is critical to identify those individuals who will be the national leaders in these diverse disciplines in the future, and promote interdisciplinary approaches to finding solutions to these problems.

The present conference was organized in response to concerns voiced at the previous Prague conference. In many countries in the region it has been only relatively recently that hazardous waste has been distinguished from garbage, and almost all waste has been disposed of in landfills. However, incineration is rapidly becoming a common practice, both for garbage and burnable hazardous wastes. Medical wastes are of particular concern in the region, and incineration of medical wastes pose problems in all parts of the world (1). While incineration is an excellent way to reduce the volume of hazardous materials, uncontrolled emissions from incinerators may pose serious health problems. Particulates from incineration contribute to air pollution, known factors in respiratory diseases including asthma (2). Often these particulates contain toxic metals, of which lead and cadmium are of particular concern. Polyaromatic hydrocarbons (PAHs) such as benzo-a-pyrene are carcinogenic products of combustion. Of particular concern is the generation and release of dioxins and furans, which are the products of combustion of plastics. 2,3,7,8-tetrachlorodibenzo-dioxin is widely known as the most toxic of man-made chemicals and is generated by incinerators (3). The degree of release from the stack is a function of both what is burned and operating efficiency. The problems posed by metal release, because metals are natural substances which will not disappear, and dioxins, because dioxins are very persistant in the environment and in the human body, are of greatest concern to human health. In addition to release of metals and dioxins into the air, there is also the problem of the residual fly ash, containing high levels of these and other toxic substances.

The overriding goals of this conference were to bring together leaders from a number of countries in the region to discuss the particular problems with hazardous waste issues, engineering solutions and health concerns. While particular attention was paid to incineration, papers were also presented on other remediation technologies for removal and treatment of hazardous wastes, and other problems relating to human and ecological damage caused by environmental contamination. A total of 18 countries were represented, and for most a country report was presented which was designed to indicate some of the problems of hazardous wastes in the specific region. A number of younger scientists were also invited to be participants in the conference, and to present papers on issues relevant to either the engineering aspects or the health effects of environmental contamination.

Several issues became apparent at this meeting which need to be addressed in future conferences of this sort. While this meeting brought together a good balance of junior and senior health effects people, we had experts from the engineering community, but inadequate representation of more junior engineers. We identified a number of specific subjects that need to be addressed in future conferences. While there is considerable knowledge of the problems with metals in the region, influenced by the widespread mining industry and presence of smelters, much less is known concerning organic pollution. Analysis of persistent organics, especially, requires expensive analytical equipment which is often simply unavailable. However the widespread use of pesticides, herbicides and PCBs, and the increasing combustion of substances which generate dioxins is evidence that concern regarding these substances should be no less than in other parts of the world.

Another significant need in the region is the development of more effective risk communication and involvement of communities in issues of hazardous waste and environmental health. None of us do this adequately, but it is increasingly clear that to be effective in reducing the dangers of environmental contamination necessitates not only being effective in communicating to the general public, but also involving the public in the debate (4). While there are some environmental hazards that are unavoidable by individuals, many can be reduced by personal actions, such as not eating contaminated foodstuffs or practicing better sanitation. However, the general public rarely will change life habits simply because a government official or an academic scientist tells them to do so. They must be involved so as to understand in personal terms why it is important to alter behavior, and they must make their own decision. There is little precedent here for this kind of community empowerment, but it is no less important than in any other part of the world.

The environmental health problems of Eastern and Central Europe are not unique, since the toxic substances present there are the same ones found elsewhere. There are of course some unique circumstances in the region which will have lasting impact on physical and psychological health, such as the Chernobyl disaster. But there is in the region a bright and energetic cadre of scientists committed to solving the problems related to environmental pollution, and many of them were participants in this conference.

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