Occupational health and safety in chemical industries in transitional economies

It is time that we deliberate on occupational health and safety in chemical industries in transitional economies. As new industries develop, existing industries expand, and new technology is introduced, the environment is increasingly placed at risk and hazards to human health arise. History has shown that industrial innovation is rarely matched in speed with corresponding protection of the community and its environment. It is estimated by the International Labour Organization that some 200,000 work-related deaths occur each year all over the world. In addition, a large number of workers are victims of work-related accidents and illnesses. Against this background, the highly complex chemicals encountered in the work environment necessitate constant vigilance through an occupational health program to provide a scientific basis for decisions aimed at protection of human health from the adverse consequences of exposure to these substances in the occupational environment.

Chemicals have become an indispensable part of human life, sustaining activities and development, preventing and controlling many diseases, and increasing agricultural productivity. Despite their benefits, chemicals may, especially when misused, cause adverse effects on human health and environmental integrity. Widespread application of chemicals throughout the world increases the potential of adverse effects. Growth of chemical industries, both in developing and developed countries, is predicted to increase. In this context, it is recognized that the assessment and management of risks from exposure to chemicals is among the highest priorities in pursuing the principles of sustainable development.

Risk assessment is a process involving several steps. First, the risk factor (what is dangerous) must be identified and its health effects (what type of damage) described. Next, the mechanism of adverse effects (how damage is caused) must be clarified and effect-modifying factors characterized (does the damage become more or less in the presence of other factors). The “severity” of the risks must also be known on the basis of exposure–effect and exposure–response relationships (how much exposure causes how much damage; what is the “safe level”). Finally, extrapolation is made to the occupational setting to assess the magnitude of the problem (how many cases of illness). This process needs a multidisciplinary endeavor in which the occupational health physicians hold a central position. Their contribution is crucial for identifying the hazard, for describing its mechanisms, and for quantifying the risk. Risk assessment also relies on other disciplines such as epidemiology, statistics, toxicology, occupational hygiene, and ergonomics.

The fact that classical occupational diseases still occur means that we have failed to implement already existing knowledge. This may not require any additional research. On the other hand, there are still severe gaps in our knowledge about a great many occupational hazards.

In the field of occupational hygiene, the setting of permissible levels of hazards in the work environment is one of the mechanisms used in occupational health to prevent health impairment in the worker. The term “permissible level” has been defined. Basically, it is a quantitative hygiene standard for a level considered to be safe, expressed as a concentration for a defined average time. In recent times, the World Health Organization has preferred to use the term “recommended health based occupational exposure limit” in place of permissible level. This term refers to levels of harmful substances in the workplace air at which there is no significant risk of adverse health effects. Such health-based standards do not take into account the level of technological and socioeconomic conditions that prevail in different nations. In recognition of this deficiency, it is the responsibility of each nation to set its own occupational exposure limits. All too often, we do not set operational occupational exposure limits depending on local circumstances, but tend to rely on permissible levels borrowed without modifications from developed nations. It is essential to consider first the development of health-based recommended exposure limits, which are determined purely on
the basis of scientific evidence, and then the conversion of these scientifically determined exposure limits to operational limits

In the field of toxicology, the existing methods of biological monitoring of exposure should be validated and methods for additional chemical substances should be developed. For some industrial chemicals, the data from biological monitoring can be reliably translated into health risks; while for the majority, it only indicates uptake but no interpretation of health risk or exposure is possible. For such chemicals, comparing the results with data from similar industries may help determine whether smaller exposures are possible. There is still a long way to go to develop human biomarkers for use as hazard indicators, e.g., in cancer research. Epidemiologic studies of work-related cancers demand much more valid and detailed exposure data than hitherto.

The combined effects of several concomitant exposures, e.g., chemicals, noise, and vibration, are interesting. Furthermore, there are factors such as drug therapy, cigarette smoking, alcohol ingestion, and coexistent disease, etc., that may influence the individual susceptibility to occupational exposures. Recognition of the actual presence of multiple exposures, on the one hand, and data gathered from experimental toxicology, on the other, have resulted in some degree of concern over potential aggravation of health problems caused by multiple exposures that may be synergistic (additive or potentiating). Assessment of long-term exposure to multiple factors in the workplace, particularly in long-term low-level exposures, needs more study. It must also be admitted that biological monitoring of combined exposures needs to be improved. There is also a need to develop systems for environmental monitoring of combined exposures at work and for monitoring of the resulting health effects.

Considering their variation in different settings, the work-related etiologic fractions of many diseases with multiple etiology, such as reproductive health, chronic non-specific respiratory diseases, neurotoxicity, mutagenesis, carcinogenesis, etc., still need quantification and measurement of “various” exposures and potential confounding factors. The approach of the occupational physician differs in many important respects from that employed by physicians in other fields, e.g., knowledge of epidemiology and occupational hygiene principles are required. Very often, judgments have to be made in the face of inadequate scientific information being available on risk, given the vast array of often poorly understood hazards found in modern workplaces.

Modern industrial plants are by no means immune from catastrophe, as the events at Chernobyl and Bhopal have shown. It is safe to assume that no man-made system is foolproof, and in industries where a catastrophic failure in a safety system would have devastating effects on both the workforce and those living around it, plans must be made to deal with the worst-case event. Knowledge of the processes within the factory and the chemical and physical hazards to which the workers are exposed will determine the likely emergencies that may result from the exposures and the measures needed to deal with them. The occupational health department has the most important role of anticipating emergencies, of preparing policies for how to deal with them at the local level, and of having an input into disaster planning. It follows that this important task can be undertaken only by occupational health professionals who are conversant with what is going on within the plants for which they have responsibility, and part of their duty must be to ensure that they keep up to date with any changes that take place. Those who do not have this knowledge are failing in their professional responsibilities.

The interdependence of economies is today reflected in the transfer of certain types of technology from developed to developing countries. New technologies can contribute to improved safety. On the other hand, they may introduce new occupational risks. It is our shared responsibility to ensure that full safeguards, as applicable in developed nations, are made accessible to the developing world also. To this end, exchange of information on risks and their management must be encouraged.

The agenda is broad and we are conscious that there are gaps in knowledge. Research is needed to answer questions of direct relevance to the control of hazards in the occupational environment. Symposia, conferences, and continuing education courses are directed toward specific industrial processes, important chemicals, different research approaches, application of available technology, and other related matters. I am sure that there shall be positive response from all stakeholders.

REFERENCES
