TOXIC COMPOUNDS IN INDUSTRY

Perspectives on Current Occupational Medical Practice

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Occupational medicine is developing rapidly in a milieu which is quite different from that of even two years ago, and markedly different from seven years ago when the Occupational Safety and Health Act (the Act) was passed. While the Act specifically affects occupational medicine, it is only one of the many laws which in the last two decades are stimulating and mirroring a change in social policy which goes well beyond the practice of worker health. Our society is demanding that industry examine and accept responsibility for the effect of its activities on the health of its workers, on the community, on the users of its products, and on the environment.

Many laws concerning potential adverse effects on health because of exposure to noxious agents during industrial activities were amended several times in the last two decades. The Clean Air Act has been amended six times since its original passage in 1953; the Federal Water Pollution Control Act of 1952 has been amended eight times; and the Food, Drug and Cosmetic Act of 1938, 20 times, the latest being in 1970. I will not burden you with other laws and amendments, except to mention three noted as landmark legislation: the Federal Coal Mine Health and Safety Act of 1969, the OSHAct of 1970, and the Toxic Substances Control Act of 1976.

The government agencies which set standards and enforce compliance under these laws impact directly on health practices of industry and particularly on the chemical sector. But even more significant than the scope of these activities is the increasingly rigid interpretation of the intent of the law by the administrators in the agencies responsible for regulation and enforcement.

The total effect is to develop in the American public and in its workers an awareness, and now it seems a national belief, that if an accident or an illness at work occurs, someone is at fault.

It is either a negligent or malevolent act of some person or organization, often a profit making company, or failure on the part of legislators to pass a law to cover the situation, or the ineptness of enforcement on the part of the regulatory agencies. There is an increasing intolerance by the public to accept an explanation of ignorance, or inadequate information, or "an act of God" for any adverse health effect which can be attributed to the occupational environment.

Industry is responding, albeit irregularly and unevenly, to this social policy that it be held accountable for environmental or occupational health. It is adopting in major companies a policy similar to the one it has regarding the management of money; that is, it is appointing competent executives and providing them with the skills and disciplines necessary to identify and control potential hazards. It is also developing an internal information system which will permit proper and timely decisions about health. This acquisition of the pertinent skills and disciplines, and the restructuring of the company's bureaucracy and administration to integrate these disciplines in the corporate matrix, toxicology, industrial hygiene, environmental engineering, occupational medicine, regulatory affairs, and so forth, is taking place rapidly.

The most difficult discipline to incorporate into the industrial framework is medicine. Some patterns and experiences for the integration of full-time physicians are available, but the proper relationship of corporate staff and policy to the part-time or on-call physician serving the smaller units of a corporation presents administrative, logistic, and professional difficulties.

These difficulties in providing adequate occupational health services to the smaller plant have always existed, but they have taken on a new importance. Heretofore, they could be left to the local plant management to muddle along with whatever medical care was available in the community. However, in the present social climate, adverse health publicity reflects on the parent corporation both financially and publicly, and in some instances, may threaten the very existence of the corporation.

The impact of the changed legislative and social structure is equally great on the general practitioner or the part-time plant physician serving industry, whose work takes on a new demension and responsibility. For instance, it is difficult in a private,

group, or hospital practice to be certain that medical information is kept confidential, that patients have access to their records when needed, and that informed consent has been obtained when necessary.

It is even more difficult to accomplish these objectives when carrying out a diagnostic or therapeutic procedure in the work situation, and at the same time conform to the legislative and regulatory demands of OSHA, EPA, FDA, and so forth, to keep management appropriately informed, and to retain the confidence and trust of the worker and union.

Nevertheless, occupational medicine is a growing field, for the diverse health effects which can result from the massing of modern technology is at last being appreciated. Even were it not regulated, occupational medicine would offer a fertile challenge to the medical practitioner. The industrial chemical revolution is less than two centuries old, and the changes it induces in individuals and in whole populations are still evolving. Many are being recognized for the first time.

Although OSHA has been in existence for six years, the full effect on medical practice has not yet been realized because first years were concerned mostly with safety matters. During the last two years attention has been shifted to health, and some 40 criteria documents, reviews of the current status of knowledge of the relationship of a known industrial toxin to environmental levels, have been issued. These are compendia of published literature on specific toxins in industry and form an excellent library. OSHA has formally promulgated only four standards: asbestos, vinyl chloride, 14 carcinogens, and coke oven emissions, and is currently proposing two other standards, benzene and beryllium. It will be illustrative and informative to concentrate on medical aspects of the proposed benzene standard, which encompasses the background and problems currently extant in occupational toxicology.

Benzene, a major solvent, feedstock, and fuel, has been recognized as a toxic substance for more than three-quarters of a century. The primary route of entry is inhalation, although there is some skin absorption. Exposure to high concentrations affects the central nervous system producing narcosis, coma, and death. Lesser amounts can produce nervous excitation, headache, euphoria, and nervous irritability, and lower concentrations produce vertigo,

drowsiness, headache, and nausea. These acute effects are easily recognized and controlled.

Benzene inhaled in smaller amounts over a longer period of time exerts a toxic effect on the bone marrow. The clinical indications are essentially those of cytopenia, anemia, leukopenia, and thrombocytopenia. If exposure continues, depression of the bone marrow with aplastic anemia is produced. The clinical signs and symptoms are expressions of the cytopenia and numerous blood dyscrasias involving one or a number of these elements have been described. Death from aplastic anemia was common in years past.

The threshold limit value time weighted average (TWA), that is, the concentration of benzene that may be inhaled in a workplace without deleterious effect over a 40-hour week and a lifetime of exposure, has been reduced progressively from 100 ppm in 1941 and is currently at 10 ppm with a 25 ppm ceiling. The present standard does not mandate biological monitoring:

1941	100 ppm*	Maximum Allowable Concentration
1947	50 ppm	8-hour Time Weighted Average
1948	35 ppm	8-hour Time Weighted Average
1957	25 ppm	8-hour Time Weighted Average
1963	25 ppm	25-ppm Ceiling
1969	10 ppm	8-hour Time Weighted Average (ANSI)
1971	10 ppm	8-hour Time Weighted Average (OSHA)
1977	1 ppm*	8-hour Time Weighted Average (OSHA) - EMERGENCY STANDARD

* ppm = parts per million; 1 ppm = 0.0001%

The standard proposed by OSHA will reduce the allowable level to 1 ppm and a 5-minute ceiling sample and will buttress this standard with medical surveillance.

The reduction of the proposed standard is not based on evidence that disease has occurred at the 1 ppm level, but rather that benzene has been judged by NIOSH and OSHA to be a carcinogen.

It is administrative policy that all carcinogens be maintained at the lowest possible level for regulatory purposes. For benzene, this has been determined to be 1 ppm, a level which is only slightly higher than benzene air concentration which occurs naturally in some environments. The evidence for the leukemogenecity

of benzene is a number of epidemiologic reports, mostly in the European literature, and a recent study by NIOSH which has been demonstrated to have many flaws.

All these epidemiologic studies have grave deficiencies, and since leukemia has not been induced in animals with benzene, even though animal models for induction of leukemia exist, it is questionable that benzene is a true carcinogen rather than a suspect carcinogen. Nevertheless, OSHA proposes to reduce the standard to 1 ppm, when all substantial evidence indicates that any cytopenia occurs at 25 ppm or above, with a safety factor of 10, and is reversible if the individual is removed from exposure and not re-exposed.

Whether or not it makes the air concentration more restrictive, OSHA proposes that medical surveillance be established. Since they estimate that anywhere between 200 thousand and 2 million workers are exposed to benzene, the medical profession will have to provide this surveillance, based upon the requirements of OSHA.

The proposed standard states that the medical surveillance program consists of:

"1. A history which includes past work exposures to benzene or any other hematologic toxins, a family history of hematological neoplasms, a history of blood dyscrasias including genetically related hemoglobin alterations, bleeding abnormalities, abnormal function of formed blood elements, a history of renal or liver dysfunction, a history of drugs routinely taken, alcoholic intake and systemic infections.

2. A complete blood count including a differential white blood cell count.

3. Additional tests shall be conducted where, in the opinion of the examining physician, alterations in the components of the blood are related to benzene exposure.

4. All medical procedures shall be performed by or under the supervision of a licensed physician, and shall be provided by the employer without cost to the employee.

5. Medical surveillance and testing of each employee shall be conducted within thirty days of the effective date of this action, and quarterly thereafter. If an employee is accidently or otherwise exposed to benzene by ingestion,

inhalation, skin or eye contact, or for any reason, an employee develops signs and symptoms commonly associated with exposure to benzene, the employer shall provide appropriate medical examinations and emergency treatment."

The history and physical examination offers no problem. All physicians who have had experience with benzene agree the blood count is vital in determining earliest effects of benzene exposure, the first findings being a mild anemia and a macrocytosis which are reversible. Also, the blood count should include a white count and differential to be carried out at least annually.

The provision for additional tests does raise questions of scope and content, since there are no clinical laboratory tests which are specific for benzene. NIOSH recommends phenol in urine, reticulocyte and platelet count, and serum bilirubin levels. It is questionable whether these offer more than a complete, careful blood count.

The proposed regulations, and this is true of all the standards, demand that the employer inform the plant physician about the regulation, the duties of the worker, and worker exposure. It also obligates the physician to write an opinion on the results of his medical findings, whether or not the employee would be at risk, and any limits to employment.

The medical program carried out by the plant physician would depend on the physician's knowledge, acumen, and understanding of what is necessary, desirable, cost/effective, feasible, and practical to protect the worker. The physician must understand the toxicologic properties of benzene and relate the program to the use of benzene and the hazard it poses to the worker in the plant.

The plant physician must respond not only to the medical problems presented by the workers, but do so within the requirements of OSHA regulations. These may or may not be in harmony with the plant physician's viewpoint. Moreover, should OSHA adopt 1 ppm as the standard, the physician will have to do many needless examinations, since no effect has been demonstrated in any human being or animal below 25 ppm.

It is likely these medical requirements will never be changed by the regulatory agencies. Perhaps the most damaging aspect of

the rigid medical requirements is that once established, the physician will be unable to exercise his medical judgment or apply his time, effort, and concern to the welfare of his patients, where he believes it is most needed. Finally, any abnormalities of blood counts and liver and kidney functions which turn up will have to be interpreted in the face of vague OSHA regulations regarding medical restrictions.

The proposed standard, if passed, places new responsibility for worker health on the physician, because the social climate demands the physician be accountable for his actions to a regulatory agency. Industrial toxins will be controlled better, and adverse health effects will be recognized earlier and many prevented, but not without a great waste of time, effort, and physician manpower.

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