The Human Equation: Health and Comfort

TI0171-0747

IAQ 89
The Human Equation: Health and Comfort

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TI0171-0748

The Human Equation: Health and Comfort

Proceedings of the
ASHRAE/SOEH Conference
IAQ 89
April 17-20, 1989
San Diego, California

American Society of Heating, Refrigerating,
and Air-Conditioning Engineers, Inc.

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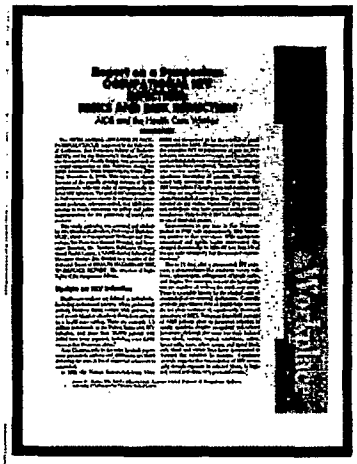

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OCCUPATIONAL HEALTH

The International Scene

As a long-time loyal member of the American Industrial Hygiene Association (AIHA), I sat in as observer on an April 1989 meeting of the International Occupational Hygiene Association (IOHA) in Geneva, Switzerland.

As readers of the *AIHA Journal* are aware, AIHA is one (the largest) of the founding organizations of IOHA, along with the American Conference of Governmental Industrial Hygienists (ACGIH), and national professional organizations of Australia (AIOH), Britain (BOMS and IOH), Canada (CRBOH), Finland, Italy, Netherlands, Sweden (AS and SYF) and Switzerland. Spain was represented as the Spanish Local Section of AIHA.

Other participants came from Denmark, West Germany, South Africa, Thailand, Venezuela, and Yugoslavia. In addition, there were representatives of the American Board of Industrial Hygiene (ABIH), the British Examining and Registration Board in Occupational Hygiene (BERBOH), the U.S. National Institute of Occupational Safety and Health (NIOSH), the International Labor Office (ILO), and the World Health Organization (WHO).

While IOHA is still in the organizing stage, its potential influence as an international society of teachers, researchers, and practitioners of "occupational hygiene" ("industrial hygiene" in the U.S. and some other countries) is enormous. The Geneva meeting was an invitational workshop on training in this specialty with a view to reaching an international consensus graduate level curriculum. The importance of linkages with national programs for registration and certification of qualified practitioners is obvious.

This observer was struck by the growing significance of international collaboration among specialists in industrial/occupational hygiene as a key discipline in occupational health practice. While many practitioners in North America, unless serving in multinational industrial entities, may have been only vaguely aware of major developments in occupational health in other countries, parochial attitudes toward modern practice are clearly outdated. The IOHA may lead the way in industrial hygiene, much as the International Commission on Occupational Health has been a beacon for practitioners of occupational medicine and nursing. The influence of the specialized agencies of the United Nations—ILO, WHO (including IARC), UNEP, IAEA, and UNDP—has been substantial at the governmental level, but the activities of the national and international professional organizations are probably of more consequence to most practitioners. A review of the mission, the objectives, and the programs of the international agencies may be of interest.

The International Labor Organization

The work of the International Labor Organization (ILO) is not as well known in the United States as that of its sister United Nations agency, the larger World Health Organization (WHO), including the International Agency for Research on Cancer (IARC). Yet ILO is the longer-established entity, founded in Geneva in 1919 as an autonomous part of the League of Nations, becoming in 1946 the first specialized agency associated with the United Nations. While its early efforts focused mainly on labor standards and human rights in the workplace, issues of occupational safety and health have been of increasing importance since the 1930s.

Publications of ILO in this field have been numerous, of which the best known is the two-volume ***Encyclopedia of Occupational Health and Safety*** (updated in 1983), an impressive collection of essays—subjects ranging from the hazards of specific occupations, including biohazards; the toxicology of commonly encountered chemicals, metals, and minerals; to the organization of preventive services, including medical, nursing, occupational hygiene, safety, and ergonomics.

Also widely recognized and in use around the globe is the renowned ***International Classification of Radiographs of Pneumoconioses,*** published by ILO. This set of 22 standard-sized radiographs with interpretative guidelines classifies in detail all types of pneumoconiosis that are characterized by regular and irregular opacities, including silicosis, asbestosis, beryllosis, and coal workers' pneumoconiosis. The classification has been developed and refined

OCCUPATIONAL HEALTH & SAFETY OF THE Workplace REPORT

through several editions by the ILO medical staff in collaboration with distinguished international experts on dust diseases. It is available from the Geneva office as ***ILO Occupational Safety and Health Series No. 22*** (Rev. 1980).

The Origins of ILO

In the words of ILO: "Toward the end of the First World War the Peace Conference set up a Labor Commission at the request of trade unions in several countries. Under the leadership of **Samuel Gompers,** President of the American Federation of Labor, the Commission agreed on a document which became part of the Peace Treaty of Versailles. It embodies the principle that universal and lasting peace can be founded only on the basis of social justice. With amendments, it remains to this day the charter under which the ILO operates. . . . [It] was created in 1919 to bring governments, employers, and trade unions together for united action in the cause of social justice. These three groups have always met on equal terms and with an equal voice in the ILO. This **tripartite** structure and the international focus on the ILO have remained constants ever since its founding. . . . The main task of the Organization at the outset was to improve conditions of life and work by building up a comprehensive labor code. The ILO's founders decided that standards laid down through the joint efforts of governments, management, and labor would be realistic, solid, and widely applicable. Standards emerging from these efforts addressed the most urgent problems of the time: hours of work, unemployment, forced labor, maternity protection, minimum age limits, and job safety.

"There are now 151 ILO member nations—more than three times the original membership. This growth has been accompanied by considerable changes in geographical representation and ILO activities. While improved working and living conditions and the promotion of full employment remain central aims of the Organization, it also deals regularly with occupational safety and health, labor-management relations, women and migrant workers, social security, and other pressing social issues.

"New challenges continue to arise as a result of technological, socioeconomic, and demographic change. The introduction of new substances and chemicals in the workplace, the rise of multinational enterprises, explosive population growth, innovations in industrial relations and novel developments in the organization of work—all are the subject of ILO study and tripartite debate and action."[1]

Structure

The member nations of the ILO subscribe to the principles written into its Constitution. They cooperate in its work which they also finance. Represented at policy-making bodies of the ILO are government, worker, and employer delegates, who confer together on the basis of equality. This tripartite structure is unique among international organizations. It reflects the desire to bring the three groups together as equal partners for united action.

The ILO is composed of a yearly general assembly (the International Labor **Conference**); an executive council (the **Governing Body**); and a permanent staff (the International Labor **Office**). The Organization also works through subsidiary bodies such as regional conferences, industrial committees, and meetings of experts.

The International Labor **Conference** meets each June in Geneva. Every member country sends a delegation to the Conference to establish international labor **standards**, elect the **Governing Body**, adopt the ILO budget, and discuss social and labor problems. Each national delegation is composed of two government delegates, one employers' delegate, and one workers' delegate, accompanied as necessary by technical advisers. In the technical meetings the votes are calculated to give each group a one-third voice in the outcome. U.S. government delegates to the annual Conference ordinarily are selected from the Department of State and Labor. The American employer delegate is from the U.S. Council for International Business, while the worker delegate is from the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO). Additional advisors are drawn from federal agencies and the business and labor communities as needed, depending on the technical subjects before the Conference.

In addition to the International Labor Conference, the ILO conducts and/or sponsors many different types of specialized meetings. **Regional Conferences** bring together government, employer, and worker representatives of a specific geographical region to study questions of particular interest to that region. **Industrial Committees** are permanent tripartite bodies that discuss social and

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labor problems in specific sectors of economic activity, such as petroleum, textiles, construction, and iron and steel. The results of deliberations of all of these bodies are faithfully recorded by ILO staff and are published in a variety of useful documents.

The Secretariat

The International Labor **Office**, headquartered in Geneva, is charged with the Organization's operational and informational duties. It serves as the Secretariat of ILO, preparing the documents that are the backbone of the conferences and meetings of the Organization. It recruits and guides ILO's technical co-operation experts throughout the world, issues a vast range of publications and technical reports, and works closely with members of the tripartite community. Some 2,950 officials and technical advisers of over 100 nationalities work at either the Geneva headquarters, in countries where ILO has technical co-operation projects, or in one of the 40 field offices of the ILO, including the Washington, D.C. Branch Office.

A staff of specialists in **occupational safety and health** serves in the Geneva office and in the field. Under an Assistant Director-General for Conditions of Work and Social Security, there is a Department of Working Conditions and Environment. Reporting to the Director of this Department is an **Occupational Safety and Health Branch (SEC HYG)**, which includes occupational hygiene and occupational medicine. The **Medical Section** is currently under the direction of Dr. G. H. Coppee, an experienced occupational health physician.

International Labor Standards

While **Resolutions** are an important product of ILO meetings, that term was rejected by the ILO's founders as a principal instrument for bringing about lasting change. They settled instead on the idea of international agreements in the form of labor **Standards**. Setting international standards and supervising their observance are two of the chief functions of ILO. Standards emerge from the International Labor Conference in the form of **Conventions** or **Recommendations**.

Conventions are similar to international treaties and are subject to ratification. When a member nation ratifies a Convention, it pledges to bring national legislation into conformity with its terms and provisions. **Recommendations**, on the other hand, do not require ratification; they are intended to serve as guidelines for national policy in given fields. Together, ILO Conventions and Recommendations comprise the **International Labor Code** that serves as a model and stimulus for national legislation and practice in member countries.

While the ILO is unable to dictate actions of member countries, it can and does keep a watchful eye on the way governments carry out their obligations under ratified Conventions. In fact, the U.S. House of Representatives Sub-Committee on International Organizations and Movements called the ILO system of supervision "the most sophisticated and effective in the international sphere," and concluded that "the ILO methods of protecting human rights should be emulated by other international organizations."[1]

Recommended Standards for Occupational Health Services

In the 70 years of its existence, the ILO has adopted several hundred Conventions and Recommendations. Of these, about a dozen have addressed health and safety issues. One of the most recent of these is **"Convention 161 and Recommendation 171 of 1985 on Occupational Health Services."**[2] A detailed discussion of the deliberations that resulted in the 1985 documents, with a critique of the agreements, has been published by one of the U.S. representatives to the 1985 Conference.[3]

Thus far seven countries have ratified **Convention 161**, which came into force in 1987. The International Labour Office is conducting regional seminars in order to promote the principles embodied in Convention 161 and Recommendation 171. It has also included in its programme for 1990–91 the preparation of guidelines for implementation concerning the functions of occupational health services and their personnel.

The 1985 **Recommendation** is of interest to occupational health practitioners everywhere. An introduction to recommended functions of an occupational health service (OHS) states that "The role . . . should be essentially preventive," tending to deemphasize the delivery of medical care services as an element of OHS under most conditions.[2]

A section on **Surveillance of the Working Environment** covers the principles of applied industrial hygiene, as well as the supervision of sanitary conditions, which is of major importance in small enterprises and in developing regions. **Surveillance of Workers' Health** includes mention of preassignment health assessment and selective periodic assessment on a hazard-specific basis. It also covers the valid purposes of return-to-work examinations, and examination "on and after the termination of assignments involving hazards which might cause or contribute to future health impairment." There is provision for "any examinations and investigations which may be necessary to detect exposure levels and early biological effects and responses," as well as biological monitoring "when a valid and generally accepted method . . . exists." Elements of the worker's right to know and protection of confidentiality of medical records are covered.

There is also mention of OHS participation in ergonomics and in public health programs, including immunization, rehabilitation, disaster planning, and

health promotion. Epidemiologic analysis of the results of environmental and biologic monitoring is encouraged. Selection and training of OHS staff is covered, and the value of a multidisciplinary team is pointed out.

Finally, certain **General Provisions** are recommended:

"44. (1) Within the framework of their responsibility for their employees' health and safety, employers should take all necessary measures to facilitate the execution of the duties of occupational health services.

(2) Workers and their organizations should provide support to the occupational health services in the execution of their duties.

45. the occupational health-related facilities provided by the occupational health services should not involve any expense to the worker.

46. In cases where occupational health services are established and their functions specified by national laws or regulations, the manner of financing these services should also be determined."[2]

Ongoing Safety and Health Activities

In keeping with ILO practice, the work and the budget of the safety and health function is prepared for a period of two years on the basis of **Conference Recommendations**, conclusions of scientific meetings, and suggestions of the **Governing Body**. According to an ILO statement, "for the present biennium of 1988/89, the work of the Occupational Safety and Health Programme may be grouped under the following headings:

"Codes of Practice

- A draft Code of Practice on safety and health in construction, as a direct follow-up to the adoption in 1988 of the new **convention** and **recommendation** on safety and health in construction.
- A draft **Code of Practice** on the prevention of major hazards, to provide guidance on hazards in industrial processes, their assessment and analysis, management of major accident prevention systems and emergency planning.
- A draft **Code of Practice** on safety and health in surface mining operations, covering coal, ore and mining of other materials.

"Training and Guidance

- A manual on the use of chemicals at work, for training of managers, supervisors and workers.
- A guide to safety and health in the use of agrochemicals, to provide information on practical measures to eliminate or minimize the harmful effects of agrochemicals and outline safe means of distribution, formulation, use, storage and disposal.
- Guidelines and training materials on radiation protection in industry, in co-operation with IAEA and WHO.
- An inventory of safety and health activities of employers' associations and trade unions in a wide range of countries, including general training programmes, awareness campaigns and on-the-job training in the prevention of accidents and diseases at the workplace.

"Programme Development

- A meeting of Experts on Safety in the Use of Mineral and Synthetic Fibres, to advise the **Office** and the **Governing Body** on action to protect workers against occupational exposure to mineral and synthetic fibres—held in Geneva in April 1989.
- A study on the provision of occupational health services at the national level for small-scale enterprises and agricultural workers, as a basis for developing relevant ILO activities.

"Seminars and Meetings

- The Seventh International Pneumoconioses Conference, held at Pittsburgh, August 1988, organized by ILO, NIOSH, OSHA, MSHA and BOM for the exchange of scientific and technical information on lung diseases, health hazards from dust and protective measures.
- Preparations for the Twelfth World Congress on Occupational Safety and Health, Hamburg, May 1990, organized by ILO, the International Social Security Association (ISSA), and the Central Associations of the Statutory Accidents Institutions of the Federal Republic of Germany.

"Operational Tasks

- Participation in the work of the International Programme on Chemical Safety (IPCS) of ILO/UNEP/WHO, to develop environmental health criteria documents on selected chemicals and provide health and safety guides.
- Organization of an International Occupational Safety and Health Hazard Alert System of ILO, in collaboration with national authorities in 101 member nations, to issue alert calls for information on a request basis in order to assist in possible action.

"Information Dissemination Through the International Occupational Safety and Health Information Centre (ILO/CIS)

- Dissemination of technical information, on new trends, important legislation, training materials

and specific hazards, in co-operation with National CIS Centres in 57 member nations, including periodic issues of the ILO-CIS Bulletin: **Safety and Health at Work.**

- A reference compilation on available chemical data sheets, on substance identification exposure limits, health hazards, preventive and protective measures and first-aid procedures.
- Collection and dissemination of information notes produced by many institutes and organizations on basic safety measures.
- A glossary of safety and health terminology in English, French, German, Spanish and Russian for some 4,000 items.
- Guidelines on the improvement of existing information departments and on the establishment of new information units; in particular, the several national CIS centres.
- A directory of major national institutions engaged in the prevention of accidents and diseases.

"Technical Co-operation

- The ILO also provides, within the framework of its International Programme for the Improvement of Working Conditions and Environment (PIACT), and often financed by the United Nations Development Program (UNDP), direct technical co-operation assistance to member nations on a request basis. This includes providing experts and other assistance for national seminars and training workshops, and organizing regional seminars and workshops."[4]

Note: The **Editor** of this issue of the **Report** participated in the preparation of working papers for one of these training exercises, the ILO Asian Sub-regional Seminar on the Organization of Occupational Health Services, held in Manila in May 1989, with attendance by representatives from 12 southeast Asian member nations. At Geneva headquarters, the staff of ILO/CIS provided invaluable assistance in the utilization of excellent bibliographic facilities as described in a supplemental note below.

Supplemental Note on ILO/CIS Functions and Computerized Data Bases

The International Occupational Safety and Health Information Center (CIS, from its French name) was established by ILO in 1959 "to collect the world literature that can contribute to the prevention of occupational hazards and disseminate this information at an international level. . . ." CIS is a unit of the Occupational Safety and Health Branch of ILO Headquarters in Geneva. Its staff of about 20 includes professional information officers with both linguistic and technical expertise. The work of CIS is supported by a worldwide safety and health information exchange network that includes over 50 affiliated National Centres. Their input in the CIS system includes: collecting and sending to CIS all the significant literature published in their respective countries and preparing abstracts of these documents; publishing and disseminating translated versions of various CIS publications; and participating in the preparation of publications such as multilingual safety and health dictionaries.

CIS receives approximately 40,000 documents each year. They originate from national centres, government agencies, trade unions, industrial institutions, and private publishers in over 50 countries, and come in more than 30 languages. Over 2,000 of these documents are selected for input according to specific criteria. Priority is given to new toxicity information; practical information on workplace hazards evaluation and control techniques; and information covering new fields such as work in extreme environments, robotisation, biotechnology, and electronics. In addition, information relating to current ILO concerns, such as conditions of work in developing countries, chemical safety, prevention and control of major hazards in industry, safety and health training programmes and legislation, receives priority in the selection process.

For each selected document, a record, including a CIS identification number, document titles, author names, full source information, an abstract, and indexing key-words or descriptors, is prepared both in English and in French. Completed records are entered in the CIS computerised database, **CISILO**, which is then used to produce various publications and services. CISILO presently contains over 30,000 records.

CISILO is made available for direct **online** access through commercial information services via international telecommunication networks. CISILO is available in Canada through the Canadian Centre for Occupational Health and Safety. In addition, selected parts of the CIS database are included in other databases, such as HSELINE, TOXLINE, and NIOSHTIC.

A recent and effective means of disseminating the CIS database has been its inclusion in CD-ROM (Compact Disc Read Only Memory) or laser discs capable of storing up to 600 million characters (600 Mb). The "OSH-ROM" produced by SilverPlatter Information Services contains the three major safety and health databases—CISILO, NIOSHTIC, and HSELINE—thus putting over 250,000 abstracts of the world literature at the disposal of the user. CCINFODISC, produced by the CIS national centre in Canada (CCOHS), contains, in addition to CISILO, 35,000 chemical safety information sheets in full text, as well as other databases. Annual subscriptions to both disc services include quarterly updates. Reading and retrieving information from these discs requires very little equipment and no special computer training. Basic

equipment includes an IBM-compatible microcomputer, a CD-ROM reader, and a printer.

A new factual database (IRCIS) is dedicated specifically to information on chemical hazards published in the standard format of "Material Safety Data Sheets." IRCIS already contains some 70,000 full text sheets in many languages and on thousands of chemicals. Full computerisation of IRCIS for eventual availability on-line and on CD-ROM is in progress.

A CIS **Thesaurus** includes 17,000 terms organized according to a subject or facet coding system and alphabetically. It contains all the indexing terms or descriptors assigned to abstracts in CISILO for easy retrieval. It is a very effective tool for searching the database and, since it exists both in English and French, it can be used as an English-French dictionary of safety and health terms. The Thesaurus and its annual updates are available for a nominal fee to subscribers and on-line users.

Most of the original documents selected for citation in CISILO and which have less than 150 pages are microfiched. In the case of longer documents and documents protected by copyright laws, only the title page and table of contents are microfiched. Each microfiched document is identified by the same identification number used for its corresponding abstract in CISILO. Subscribers and users can thus request and obtain a copy of an original document simply by quoting the CIS abstract number. The complete CIS Microfiche Collection holds more than 100,000 microfiches. Several CIS national centres have duplicate sets of this Collection.

Any individual or organization may become a CIS subscriber. An annual subscription includes 6 issues of ***Safety and Health at Work*** with annual 5-year indices, a copy of each of the regularly published ***CIS Bibliographies***, one free computer search per year on any topic chosen by the subscriber, and access to copies of most of the original documents abstracted in the CIS database and not covered by copyright protection. Detailed information on subscription prices and on all other CIS products, services, and publications is available upon request from ILO/CIS, c/o International Labour Office, CH-1211 Geneva 22, Switzerland, or Telefax (22)98-86-85. (*Source:* **Safety and Health at Work: CIS and Its Services**, ILO, Geneva, 1989).

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Volume 1, Number 5

Supplement to CHEMICAL HAZARDS OF THE WORKPLACE, 2nd ed.

Gloria J. Hathaway, Ph.D., and J.P. Hughes, M.D.

4,4'-METHYLENE DIANILINE
CAS: 101-77-9
$C_{13}H_{14}N_2$

1988–89 TLV = 0.1 ppm
Suspected Human Carcinogen

Synonyms. 4,4'-Diaminodiphenylmethane; DDM; MDA; 4-(4-aminobenzl)aniline.
Physical Form. Light brown crystalline solid.
Uses. Production of methylene diphenyl diisocyanate (MDI), which is used to produce polyurethanes; hardening agent for epoxy resins, anticorrosive materials, printed circuit parts, dyestuff intermediates, filament-wound pipe, and wire coatings.
Exposure. Skin absorption; inhalation; ingestion.
Toxicology. Exposure to 4,4-methylene dianiline (MDA) causes liver damage in humans; impaired visual acuity has been reported following ingestion. MDA is carcinogenic in experimental animals and is considered a suspected human carcinogen.

Occupational exposure of 12 male workers, whose hands were in contact with MDA several hours per day, caused toxic hepatitis.[1] The clinical pattern of the cases included right-upper-quadrant pain, high fever, and chills with subsequent jaundice. A skin rash was seen in 5 of the cases. Percutaneous absorption was considered to be the major route of exposure since workers in the same occupational setting who did not have direct skin contact with MDA were not affected. All patients recovered within 7 weeks, and follow-up more than 5 years later showed no biochemical or clinical evidence of chronic hepatic disease.

Over a 9-year period (1967–1976), 11 cases of jaundice were reported from a company which mixed preground MDA with silicon dioxide.[2] In one instance, transient signs of myocardial damage, in addition to transient signs of hepatic damage, were observed following MDA exposure from a defective filter system.[3]

The inadvertent ingestion of bread prepared with MDA-contaminated flour led to an outbreak of 84 cases of jaundice in Epping, U.K.[4] Liver biopsies from 7 of the patients showed partial inflammation, eosinophil infiltration, cholangitis, cholestasis, and varying degrees of hepatocellular damage. All patients made a good clinical recovery with no evidence of progressive liver damage.[5]

In a more recent case, ingestion of MDA in potassium carbonate and δ-butyrolactone resulted in severe systemic toxicity and visual dysfunction.[6] Transient effects included ECG abnormalities, bradycardia, and hypotension—suggesting myocardial involvement—and glycosuria with normoglycaemia, which indicated renal tubular dysfunction. Liver effects included slight hepatomegaly 6 weeks postingestion, which quickly resolved, and disappearance of jaundice 2–3 weeks later. Liver biopsy one year after the poisoning showed normal hepatocytes and a preservation of hepatic architecture, but disturbed liver-function tests were still evident 18 months after the incident. Most significant, however, was the development of toxic optic neuritis with severe visual dysfunction. Investigation of the retina revealed gross malfunction of the retinal pigment epithelium, reflected clinically as impaired visual acuity with severe loss of central visual field, color discrimination, and dark adaptation. Eighteen months later there was little improvement and all visual indices remained subnormal with little likelihood for further recovery.

Support for the role of MDA in causing visual disturbances is found in animal studies.[7] Oral doses of 25–50 mg/kg in cats caused retinal damage. The changes observed in the affected eyes consisted of severe granular degeneration of the rods and cones, and proliferation of the pigmented epithelial cells of the retina. The neuronal structures located beyond the pigmented layer remained intact. No visual disturbances were induced by MDA in the rabbit, guinea pig, and rat. In another study, degeneration of the inner and outer segments of the photoreceptor cells and the pigmented epithelial cell layer of the retinas of guinea pigs resulted from a total inhaled dose of 24 mg/kg.

Recent animal studies indicate a potential for carcinogenicity from oral administration of MDA and its dihydrochloride.[8] Treatment-related increases in the incidences of thyroid follicular-cell adenomas and hepatocellular neoplasms were observed in mice following

chronic ingestion in drinking water.[9] In rats, increases in the incidences of thyroid follicular-cell carcinoma and hepatic nodules were observed in males, and thyroid follicular cell adenomas occurred in females. Although not statistically significant, certain uncommon tumors such as bile duct adenomas, papillomas of the urinary bladder, and granulosa cell tumors of the ovary were also reported. These tumors are of low incidence in historical controls. In another report, MDA acted as a promoter of thyroid tumors in rats.[10]

An epidemiological study of workers potentially exposed to MDA (and numerous other agents) in the helicopter parts manufacturing industry showed very limited evidence of an association between MDA and bladder cancer, colon cancer, lymphosarcoma, and reticulosarcoma.[11]

IARC has determined that there is sufficient evidence for the carcinogenicity of 4,4′-methylenedianiline and its dihydrochloride to experimental animals.[8] Although there is limited evidence indicating that MDA presents a carcinogenic risk to humans, positive data in other mammalian species suggest that such a potential may exist.

Reports of allergic sensitivity to MDA are confounded by mixed exposures to chemicals such as epoxy resins and isocyanates which make it difficult to relate specific cause with effect. MDA does appear to cause an intense yellow staining reaction involving the skin (especially fingers and palms), nails, and occasionally hair in exposed workers.[12] The staining should serve as a marker for potential systemic exposure.

MDA has a faint amine odor, but the odor is not offensive enough to be useful as a warning property.[7]

Monitoring atmospheric levels of MDA may not be conclusive, as skin absorption may be a more significant route of exposure. Concentrations of N-acetyl MDA, a major metabolite of MDA, in the urine may be used to reflect overall exposure.[13]

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CHEMICAL SENSITIVITY: Growing concern over low exposures

A new report prepared for the New Jersey Department of Health is focusing attention on the controversial issue of whether certain manmade and naturally occurring chemicals can cause serious illness in some people at extremely low exposure levels.

The report states that "chemical sensitivity is increasing and could become a large problem with significant economic consequences related to the disablement of productive members of society."

The review was prepared by Nicholas A. Ashford, associate professor of technology and policy at Massachusetts Institute of Technology, and Claudia S. Miller, assistant instructor in the division of allergy and clinical immunology at the University of Texas Health Science Center in Austin. Ashford has done previous health research consulting for the New Jersey Department of Health, and Miller is a physician studying chemical hypersensitivity.

Illnesses allegedly caused by very low levels of exposure to some chemicals have been actively studied since at least the early 1950s. Some physicians working in the discipline call themselves "clinical ecologists" to differentiate their work from that of allergists. Physicians treating persons thought to be afflicted believe the disease starts with a heavy chemical exposure, from a large spill or fire, for example. Subsequently, the exposed people develop severe adverse health reactions even at very low exposure levels. Thus, there is a two-step process: sensitization by relatively high levels of manmade chemicals, followed by triggering by even low levels of either manmade or naturally occurring chemicals.

One of the best-known examples is the so-called "sick-building syndrome." No one knows how many people are affected by this controversial illness. Symptoms can range widely, from headaches (the most common) to severe depression. Ashford and Miller identify industrial workers as most likely to be affected, followed by residents of "tight buildings," residents in communities with air or water contamination, and anyone else with unusual exposures to certain types of chemicals. The lack of any pattern among people exposed to the same chemicals and the enormous differences in sensitivity have made the issue a sharp medical controversy.

Ashford (above) and Miller cite need for more research

Critical to the scientific basis for chemical sensitivity is the idea of adaptation. "It is very hard to discover this disease in people because of adaptation," Ashford says. The body changes to accept the exposure to a chemical, according to the authors, so symptoms cannot be detected by traditional medical methods because they are masked by the adaptation.

The only way to find out if a person is chemically sensitive is to use what is called an environmental unit. This specially constructed facility isolates a person from most external chemicals. After fasting several days—to dismiss possible food problems—the patient is exposed to individual chemicals to see if there is a reaction. Although this is a tedious and expensive procedure, Ashford and Miller report dramatic results in some patients.

The problem is that clinical ecologists and their treatments are not accepted by the general medical community. Ashford and Miller continually refer to bitterness between ecologists and mainstream allergists over who is doing more good, or harm, to patients. Miller speculates this controversy is one reason federal agencies supporting medical research are reluctant to support clinical ecologists.

The study has not yet been widely circulated, and reactions thus are still limited. Ashford stresses that the report does not say there definitely will be massive disability, but that "we need to start work on the problem." However, he expects criticism from the chemical and insurance industries—and some physicians. "If we are right, it means industry will need to regulate chemicals at part per billion levels, not part per million—and they won't want to hear that."

The Chemical Manufacturers Association so far is moving cautiously on this issue. "Our main concern," says Sandra L. Tirey, CMA associate director of health, "is that these advocates are trying to take a scientific issue—Does this disease exist or not?—and use the legislative process to say that it does exist." She points out that this was tried nearly

10 years ago in California. A bill passed by the state legislature, affirming the existence of chemical sensitivity, was eventually vetoed by the governor because the California Medical Association said clinical ecology is unproven in its diagnoses and treatments and lacks a sound scientific basis.

Ashford says he hopes that federal regulatory and health agencies will begin to do more research on chemical sensitivity, including the use of an environmental unit. "We need to have a much clearer idea of causation of chemical sensitivity," he says. Miller agrees. "Until you research the problem in the appropriate way, with a unit, we won't get any answers to the problem."

Copies of the report are available for $20 prepaid, to cover duplication costs, from Ashford at MIT, E 40-239, 77 Massachusetts Ave., Cambridge, Mass. 02139.

David Hanson

First observation of molecular rock and roll

The first direct observation of molecular vibration and rotation has been made using paired, extremely short pulses of laser light.

Chemistry professor Ahmed H. Zewail at California Institute of Technology, along with postdoctoral fellow Robert M. Bowman and graduate student Marcos Dantus, has used femtosecond laser spectroscopy to take a series of snapshots of an iodine molecule as it pulses and tumbles in the gas phase. The motions they see precisely match theoretical models, confirming both the models and the laser technique [*Nature*, 343, 737 (1990)].

The experiment follows earlier work in Zewail's lab that used paired, femtosecond laser pulses to watch bonds break during photodissociation reactions (C&EN, Nov. 7, 1988, page 24). In the Caltech technique, a very short laser pulse, lasting 20 to 60 femtoseconds (a femtosecond is 10^{-15} second), is used to excite iodine molecules simultaneously, so that they all vibrate in phase with one another. A second pulse, at a different wavelength, gives just enough energy to molecules whose iodine atoms are a specific distance apart to cause those molecules to fluoresce spontaneously.

By changing the time interval between the two pulses, the researchers watch the atoms in the molecule move in and out of this critical distance. Since a vibration takes about 300 femtoseconds, "catching" this motion in a snapshot requires taking snapshots only tens of femtoseconds apart.

To measure rotation, both the initiating and the detecting laser pulses are polarized, so that they excite only iodine molecules with a particular orientation. As the molecules excited by the first pulse rotate at different speeds, the second pulse detects fewer and fewer of them. But, because rotation is a quantum effect, when the slowest molecules have made a complete rotation (which takes about 600 picoseconds, or 600,000 femtoseconds), the faster ones will have made exactly two or three or some other whole number of rotations, so that they are once again all in alignment. This is detected by the second laser pulse.

When femtosecond spectroscopy is used to look at a reacting molecule, Zewail says, the molecule breaks up and is gone. However, the stable iodine molecules keep moving in the same motions. These experiments confirm that the technique can pick up all the vibrations and rotations that take place in such molecules, whether the molecule under observation is stable or undergoing reaction.

Zewail: iodine molecule pictures

Rebecca Rawls

Montedison chemist busted in trade secret scam

Police in Milan, Italy, arrested a Montedison researcher earlier this month on charges of stealing confidential company documents and attempting to sell them to Du Pont for $1 million. The documents describe a new economical process for producing fluorochemical lubricants, a market in which Du Pont is Montedison's major competitor.

The incident points out just how vulnerable even the largest corporations are to theft of intellectual property, acts that jeopardize multimillion-dollar markets.

A spokesman for Montedison says a Milan police officer posing as a Du Pont official arrested Antonio Marraccini, a junior chemist in a three-man team that developed the new patented manufacturing process for its subsidiary, Montefluos. Marraccini faces a possible two-year prison sentence. The other members of the team were not involved. The process put Montefluos "two years ahead of our competitors" with a simpler, more economic technique that produces a wider range of final products, the spokesman says. Producers currently use a difficult, low-yield production process. The new Montedison process produces a family of highly stable fluids and greases used under extreme temperature conditions and in a variety of aggressive environments. It is a multimillion-dollar market in which the lubricants easily may sell for $200 or more a lb, according to a spokesman for Phillip Townsend Associates, Mt. Olive, N.J., a research firm preparing a study of "Profit Opportunity in Organic Fluorochemicals."

The affair began last Aug. 14,

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assistant attorney general handling the case.

Legislation

SENATE PANEL SCHEDULES HEARING FOR 'GOVERNMENT WORKPLACE SAFETY BILL'

A hearing on legislation introduced by Sen. Terry Sanford (D-NC) that promotes safety and health in workplaces owned, operated, or under contract with the federal government is scheduled for Feb. 20 by the Senate Judiciary Subcommittee on Courts and Administrative Practice.

The measure, S 464, is known as the "Government Workplace Safety Bill" or the "Tort Reform Bill." Introduced in February 1989, Sanford's measure, like the House companion measure (HR 1095) sponsored by Rep. Willis D. Gradison Jr. (D-Ohio), would allow citizens to seek damages for injuries sustained in workplaces where the government violated or was negligent in enforcing occupational safety and health standards (18 OSHR 1674).

The hearing is scheduled for 2:30 p.m. in Room SD-226 of the Senate Dirksen Building. The subcommittee did not have a witness list prepared at press time.

One of the aims of the measure is to remove the federal government's ability to escape liability for violating health and safety standards by exercising a technical legal defense under the "discretionary function" exemption to the Federal Tort Claims Act.

Indoor Air Pollution

HOUSE PANEL SCHEDULES MARKUP ON HR 1530; OTHER HOUSE, SENATE ACTION REMAINS PENDING

The House Science, Space and Technology Subcommittee on Natural Resources, Agricultural Research and Environment has scheduled a Feb. 22 markup of HR 1530, Rep. Joseph P. Kennedy II's (D-Mass) legislation aimed at addressing inadequate federal and state efforts to deal with indoor air pollution.

The natural resources subcommittee is one of two House subcommittees with jurisdiction over Kennedy's Indoor Air Quality Act of 1989. The other subcommittee, the House Energy and Commerce Subcommittee on Health and Environment, has not scheduled hearings on the measure nor has it scheduled a markup, according to an aide with that subcommittee.

In addition, the House Education and Labor Subcommittee on Safety and Health is in the process of requesting jurisdiction over Kennedy's measure since it includes provisions that cover the Occupational Safety and Health Administration and the National Institute for Occupational Safety and Health.

A House aide told BNA that whether or not the safety and health subcommittee gets formal jurisdiction over the measure, it can hold hearings on OSHA and NIOSH involvement in indoor air issues, and may in fact do so this year.

Kennedy introduced the Indoor Air Quality Act of 1989 in March 1989, and the natural resources subcommittee held hearings on it in July and September 1989 (19 OSHR 405).

Progress on the indoor air legislation in the Senate, S 657, introduced March 17, 1989, by Senate Majority Leader George J. Mitchell (D-Maine), remains pending in the Senate Environment and Public Works Committee. The committee has not scheduled hearings or a markup yet, and action on the measure depends in part on the committee's progress with clean air legislation, a committee aide told BNA Feb. 8.

The committee's Subcommittee on Superfund, Ocean and Water Protection amended Mitchell's measure Nov. 15, 1989. The amended bill has five main changes, including a clarification of OSHA and NIOSH responsibilities in researching the health effects of indoor air pollution on workers.

Under Mitchell's bill, OSHA would be responsible for working with the Environmental Protection Agency to provide "by regulation" a method and format for filing comments and complaints concerning indoor air quality in federal buildings by workers and the public (18 OSHR 1112).

Ergonomics

KEY TO SOLVING CARPAL TUNNEL PROBLEMS IS WORKPLACE MODIFICATION, EXPERTS CONTEND

PORTLAND, Ore.—(By a BNA Staff Correspondent)—Workplace modification is the key to alleviating carpal tunnel syndrome and other disorders of the upper extremities, several experts said at a conference Feb. 5.

The two-day conference on Cumulative Trauma Disorders of Upper Extremities was co-sponsored by the Oregon Occupational Safety & Health Division of the Department of Finance, the University of Washington Northwest Center for Occupational Health & Safety, and the University of Michigan Center for Occupational Health & Safety Engineering.

Two physicians who spoke the first day said medical treatment of carpal tunnel syndrome is difficult. "There's no quick fixes," according to Scott Barnhart, associate director of the Occupational Medicine Program at the Department of Environmental Health, University of Washington. Most doctors have a great deal of trouble treating carpal tunnel syndrome and the results of medical therapy are poorly studied, he said. Like others at the conference, he said the number of such cases in his experience has increased over the past decade. He said they now make up 30 percent of his clinic's casework compared to 2 percent in the early 1980s.

Barnhart, as well as other speakers, said a high percentage of the cases are work-related, usually caused by repeated mechanical strain. For example, he said grocery clerks move an average of 6,000 pounds of goods per day across their scanners. The use of scanners at checkstands has increased productivity, meaning the clerks move more goods per day now than they used to move, he said. However, he said, "this is tremendous ergonomic exposure."

Workers Prone To Disorders

Other workers whose occupations make them prone to disorders of the upper extremities include tailors, butchers, and assemblers—all jobs that require repetitive, forceful hand motions, Barnhart said. Symptoms of carpal tunnel syndrome include numbness of the fingers and hands, tingling, and night pain, he said.

Conservative medical treatment of the syndrome includes