mately 90% of all workers) are engaged in agriculture. Only 10% of workers are employed in the formal economy, with the labor structure as follows: 29% agriculture/fishing/forestry, 24% mining/manufacturing, 14% trade/small business, 6% construction, 4% transportation, and 23% public administration, financial, and other services. As in many developing countries, the economy is disadvantaged and mostly rural and agricultural. Basic needs include improved sanitation and environmental health. Factors identified that influence the assessment and control of occupational hazards include the small scale of many work enterprises with the complications that typify small businesses, low capital investment in occupational health activities, and an insufficient number of occupational hygienists. Occupational hygienists are usually physicians with extra training, often with a focus on development of disease or clinical symptoms rather than on assessment of exposure. Factors that may affect the way exposure limits are applied include the use of child labor; genetic differences; long working hours; and economic, social, and climatic factors. Child labor is particularly prevalent in agriculture, fishing, and small enterprises. Working hours are much longer in Vietnam than in industrialized countries, and workers often have several jobs. Additional needs and barriers for the development of occupational hygiene are identified.

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ENGINEERING CONTROL TO PREVENT THE SPREAD OF TUBERCULOSIS AMONG HEALTH CARE WORKERS IN THAILAND. P.A. Jensen, NIOSH, Cincinnati, OH; W. Uthaivorawit, Chiang Rai Regional Hospital, Chiang Rai, Thailand; D. Garrett, P. Zuber, Centers for Disease Control and Prevention, Atlanta, GA; K. Limpakarnjanarat, CDC-Thailand HIV/AIDS Collaboration, Bangkok, Thailand

After decades of declining incidence, tuberculosis (TB) is once again a major public health problem. From 1990 through 1994 the annual number of patients with TB at a hospital in Thailand increased from 257 to 455, largely related to an increase in HIV+ TB cases. A separate study of health care workers (HCWs) at this time showed a pattern of higher tuberculin skin test (TST) positivity among persons working in direct contact with patients and who had been employed for $1 year. These results suggest that HCWs are at risk of *M. tuberculosis* infection (i.e., TST positivity) that may be related to occupational exposure.

Three hospitals in Chiang Rai District were surveyed. The path of the patient was followed through each hospital (inpatient and outpatient) along with all diagnostic procedures. Ventilation measurements, architecture, and general observations were noted. This project is focused on implementing interventions to reduce the risk of nosocomial transmission of *M. tuberculosis* and to reduce the development of active TB disease among HCWs. The general infection control program with specific engineering controls is reported here.

The challenge was the development of inexpensive, low maintenance engineering controls that were easy to implement by developing countries. The following recommendations were made. All outpatient TB activities should be consolidated into one area rather than having infectious TB patients walking throughout the hospital. The general TB ward is of open construction and should be so maintained. An exhaust ventilation system serving two multipatient and two single-patient negative pressure isolation rooms was designed and is currently being installed at a cost of less than $3000. Class I biological safety cabinets were evaluated (face velocities of 35-400 ft/min were observed) and recommendations made to modify airflow rates. Bronchoscopy is an extremely high-risk procedure. Ventilation for this bronchoscopy room should be designed to provide directional airflow from the HCW to the patient and out of the room. In addition, the system should also minimize transmission to other areas within the surgical suite. Other recommendations were made for maximizing air exchange rooms, counseling rooms, radiology, waiting rooms, and other areas of the hospital.

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DEVELOPMENT AND IMPLEMENTATION OF AN ENVIRONMENTAL AND OCCUPATIONAL HEALTH PROGRAM FOR DOWNSTREAM PETROLEUM IN LATIN AMERICA AND THE CARIBBEAN. F.C. Zampello, Exxon Co., International Florham Park, NJ; R. Gelatt, Esso Inter-America, Inc., Coral Gables, FL

As businesses expand internationally in areas of the world where worker health, safety, and environmental (HSE) resources are limited or absent, HSE professionals will be responsible for setting up programs in these new areas. This report describes how an environmental and worker health program was developed and implemented for downstream petroleum operations in Central American, South American, and Caribbean countries that were largely absent of HSE regulations and a supporting infrastructure.

The presentation covers key elements of program development such as HSE policies that provided overall support for the program; a needs assessment survey that was performed to identify priority issues; and training programs, tools, procedures, systems, and resources. Implementation aspects are also discussed including organizational roles, external resources, working in diverse cultures, and systems to provide management stewardship.

This experience points out that although many of the same risks need to be addressed for similar operations conducted in the United States, the limited availability of in-country HSE professionals, equipment, and supplies make development and implementation of these programs far more challenging.

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BUILDING OCCUPATIONAL HEALTH CAPACITY IN MEXICO: AN ONGOING COLLABORATION. A.L. Sussell, S. Baron, NIOSH, Cincinnati, OH; M. Tennassee, Pan American Health Organization, Washington, DC

In 1995, at the request of the Pan American Health Organization (PAHO) and the Secretary of Health of Mexico, NIOSH detailed a medical epidemiologist to Mexico to develop long-term collaboration with Mexican institutions to improve occupational safety and health. A collaboration was begun with the Mexican Institute for Social Security (IMSS), which has the most extensive research and training role in occupational safety and health. IMSS is supported by payroll taxes and provides comprehensive services for health and welfare to about 9.5 million workers and 30 million family members.

In February and March 1997 the speaker went to Mexico to develop a plan for industrial hygiene research and training in support of the NIOSH/PAHO project. He interviewed leading industrial hygienists in government and industry, accompanied IMSS and other government inspectors during 10 plant site visits, collaborated with Mexican investigators during 2 health hazard evaluations, and developed and taught 2 industrial hygiene courses. The plant site visits included small and medium-sized Mexican enterprises, as well as foreign-owned maquiladoras. At the current time, industrial hygiene is only beginning to develop as a profession in Mexico. There is lack of university training programs, and the regulatory agencies have not developed industrial hygiene expertise, promoting instead third-party private inspections. However, only a small group of the private industrial hygienists have education and professional experience comparable with U.S. standards. These hygienists reported that better government enforcement of the new Mexican occupational safety and health law of 1997 is needed to expand the market for their services in Mexico.

NIOSH, PAHO, and the World Health Organization are working with other public and private institutions to help develop industrial hygiene in Latin America. Planned activities are to develop a standard curriculum and promote continuing education of professionals.

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OCCUPATIONAL SAFETY AND HEALTH IN THE YEAR 2050: AN INTERNATIONAL LABOUR ORGANIZATION PERSPECTIVE. N.T. Watfa, International Labour Office, Geneva, Switzerland

The background of injury and disease against which the International Labour Organization (ILO) was established in 1919 was profoundly different from that of today. For example, 3197 miners died in the United States in 1907. In India a fatal accident rate of 1.29 per 1000 coal miners was registered in the period 1911 to 1920. By 1970 the U.S. fatalities in coal mines went down to about 150 year and the rate in India dropped to 0.34 in the 1980s. At the end of the century, accident rates in industrialized countries are typically 10 to 25% of their values in the first decades. Accident-free work can be achieved by the year 2050. This has been demonstrated by a few enterprises thanks to engineering control, self-regulation, harmonization of standards, and the future widespread of a safety culture. At the national level, the enforcing agencies will improve their techniques of enforcement. At the international level, data collection will depend on harmonized procedures that can be used for a global safety and health quality control system. The situation regarding health is more confused. Asbestos and silica dust-related diseases will, on a global scale, have lead to the premature deaths of millions of workers by 2030. The scale and significance of musculoskeletal diseases is just beginning to be recognized.

Abstracts

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