

2006 Annual Report of Labor Safety and Health Research

Institute of Occupational Safety & Health, Council of Labor Affairs
Executive Yuan, Taiwan

Foreword

The Institute of Occupational Safety and Health (IOSH), a unit of the Council of Labor Affairs (CLA), is Taiwan's top agency in charge of occupational safety and health. The major tasks of IOSH include the analysis and detection of hazards in the workplace, and the proposal of solutions to those hazards.

The work of IOSH has evolved over the years, from the completion of industry surveys and the introduction of methods (techniques) in the initial period to the strengthening of research in the prevention of occupational injuries, the understanding of special safety and health issues, and the development of evaluation and management methods as well as protective gear. In line with the administrative needs of the CLA, in 2006 IOSH focused its efforts on safety and health policy study, integration of innovative control techniques, expansion of the results of guidance, and enhancement of international visibility. Among the main achievements of these efforts were the completion of working environment surveys for three high-risk occupations, plus technological extension and guidance for improvement, resulting in an average reduction of more than 37% in exposure concentration and an average regulatory compliance of 95.2%; the development of safety and health facilities such as bioaerosol capturing and detection equipment for use by industry; the collection and analysis of information from occupational injury and disease databanks, disaster-reduction strategies of the advanced countries, etc. for the CLA to use in the revision of laws and regulations, the improvement of system application, and the setting of standards; the compilation of technical manuals on such subjects as the prevention of slipping and the provision of related technical services; publication of periodical; propagation of safety and health know-how through safety and health exhibitions; and the provision of occupational safety and health databank downloading and consultation services to more than 1 million persons.

This Annual Report covers the major projects undertaken and important results achieved during the period of Jan. 1 through Dec. 31, 2006. By describing the different tasks and activities that were carried out in 2006 in line with the CLA's core administrative focus of "safety, happiness, and dignity," we hope that this report will boost the understanding of IOSH in the public mind.



Chairperson, IOSH

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Annual Report

Section 1 Responsibilities

The Institute of Occupational Safety and Health (IOSH) was established as a unit of the Council of Labor Affairs (CLA) in 1992. It is Taiwan's top occupational safety and health research agency, and it pursues the goal of creating a safe, healthy, and comfortable working environment by heightening domestic standards of workplace safety and health, arousing workers to emphasize safety and health in the workplace, reducing the incidence of occupational accidents, and preventing the occurrence of occupational disease. The Institute's organizational charter sets forth the following research goals:

1. Provision of a scientific basis for labor safety and health decision-making and administration.
2. Provision of solutions for crucial labor safety and health problems.
3. Provision of reference data for the formulation and revision of labor safety and health regulatory standards and management systems.
4. Heightening of technical standards for labor safety and health, and for inspection work.
5. Provision of information needed for labor safety and health training and consultation.

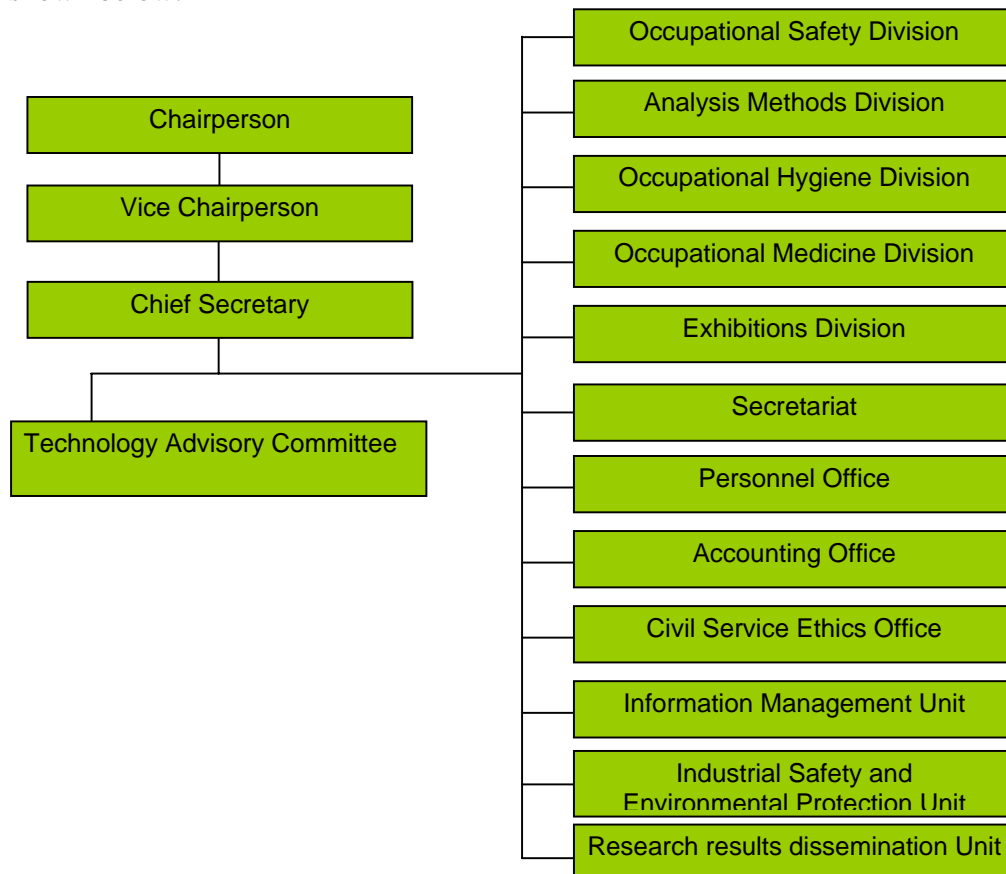
IOSH analyzed the characteristics of job-related disabilities and deaths among workers for the years 2003 and 2004 with the aim of gaining a forward-looking understanding of occupational injuries and diseases, and of establishing a localized safety and health databank. Key-point statistical analysis was carried out for disability and death in occupations covered by the Labor Safety and Health Law, with special emphasis on certain hazardous occupations such as fishing. Scientific techniques were used, the development priority of "establishing a safe and healthy working environment and further reducing the occurrence of occupational accidents" as contained in the Council of Labor Affairs' (CLA's) medium-term (2005-2008) administrative plan was adopted, and "expanded assurance of worker safety" was pinpointed as the strategic performance target in pursuit of the administrative vision of a "healthy Taiwan and happy workers" as propounded by the IOSH chairperson. IOSH has extended the results of its research in safety and health in order to help enterprises establish international-standard safety and health standards and reinforce their safety and health management, and, together with the resources of the private sector, to promote safety and health technology, as well as to bring about a continuing reduction in occupational diseases in high-risk occupations and those caused by hazard factors, and in the ratio of occupational deaths and disabilities. The overall aim is to prevent injuries and diseases among workers, improve their physical and mental health, and achieve advanced-country standards.

This Annual Report encompasses IOSH operations from January through December 2006, including the completion of 90 research projects. The Institute promoted the application of its research results through the holding of presentations, the transfer of technology, the publication of magazines and research papers, Internet retrieval, and the

organizing of exhibitions and seminars. During the year IOSH published 106 periodicals, research reports, and technical series; held 14 exhibitions (some of which were held in more than one location, resulting in a total of 22 events); and organized 15 academic seminars. A total of 44 IOSH papers were published in domestic and foreign publications and 58 were presented at domestic and overseas academic conferences. Five patents were won and technology transferred, assistance was provided in carrying out 28 occupational accident, injury, and disease surveys, and 32 cases of instrument calibration services for investigative agencies were provided.

Section Two Organization and Staff

IOSH is headed by a Chairperson, a Vice Chairperson, and a Chief Secretary, who oversee and direct the operations of an Occupational Safety Division, Occupational Health (Hygiene) Division, Analysis Methods Division, Occupational Medicine Division, and Exhibition Division. The research staff totals 65, including two contract employees and 19 alternative national service personnel. There are also three administrative units: Secretariat, Accounting Office, and Civil Service Ethics Office. The organization chart is shown below:



IOSH Organization

Section Three Research Budget

IOSH Research Budget for 2006

| Budget Item | Annual Budget |
|---|-----------------|
| Occupational Safety and Health Research | NT\$180,760,716 |
| Occupational Safety Division | NT\$37,764,643 |
| Occupational Health (Hygiene) Division | NT\$45,229,120 |
| Analysis Methods Division | NT\$33,714,342 |
| Occupational Medicine Division | NT\$36,057,032 |
| Exhibition Division | NT\$27,995,579 |

Section Four Key Research Projects and Results

IOSH focused on the following key tasks in order to meet its plan targets for 2006: strengthening of operating quality improvement and guidance for hazardous operations and emerging-industry workplaces; reinforcement of occupational safety management integration and research in accident prevention and safety monitoring; enhancement of research in working conditions and monitoring of occupational injury and disease, and vigorous promotion of health management in the workplace; reinforcement of occupational disease prevention management and research in control and prevention technology, and establishment of monitoring and assessment technology; and expansion of education, extension, and consulting services, and of international exchange, in regard to research results.

IOSH carried out the following tasks in 2006:

1. Surveying of hazardous-occupation working environments, and improvement of technological extension and guidance
 - (1) Guidance for occupational health improvement on the systemic level was provided to 10 factories (using toluene), following which the overall regulatory compliance of the 10 averaged 95.2%. Compared with the pre-guidance average of 49.1%, this was an improvement of 46.1 percentage points. Guidance was provided for the improvement of air circulation in plastic printing processes with the installation of circulation improvement technology and the provision of construction assistance to one factory. Twenty-four samples were taken before and after improvement; before improvement the average toluene exposure concentration was 52.43.ppm and after improvement it was 17.93ppm, for an improvement of 65.8%. In the provision of assistance for air circulation in screen printing processes, the installation of circulation improvement technology was completed and assistance was provided for construction in one factory. Thirty-six samples were taken before and after improvement, showing an average pre-improvement exposure concentration of 54.45ppm of toluene

and 32.05ppm of ethylene glycol monoethyl ether acetate and a post-improvement concentration of 29.65ppm for toluene and 20.04ppm for ethylene glycol monoethyl ether acetate. The average reductions were 45.55% and 37.47%, respectively.

- (2) Follow-up was carried out on the results of guidance to 55 factories in the synthetic leather, foam, and tape industries. The results were clear, with average before-and-after regulatory compliance for the different industries improving as follows: 69.2% to 78.4% for synthetic leather, 70.3% to 89% for foam, and 79.2% to 95.6% for tape. In addition, a follow-up mechanism for guidance results, as well as related guidance tools and a guidance information website, were established.
- (3) On-site interviews were carried out and 290 survey questionnaires were returned from 34 BSL-2 biological laboratories in colleges and universities, and a preliminary safety and health guide for BSL-2 laboratories was compiled. This guide will be extended to related laboratories for reference and application so as to reduce biohazard risk.
- (4) Forty Chinese restaurants were surveyed and assisted in improving their safety and health management. In addition, the development of improved fume control equipment was carried out and a restaurant health training DVD and manual were produced. The effects of educational publicity were expanded through lecture meetings that benefited thousands of workers.
- (5) Ventilating system and breathing area bacteria and fungus sampling and analysis were carried out for two medical centers and one regional hospital. A total of 1,368 samples were collected, and the resulting data supplied to Health care worker and the Department of Health for reference.

2. Development of safety and health equipment for industrial use:

- (1) The design of a filter paper cassette for a dust uniformity sampler was completed for a new type of silica dust sampler, and uniformity testing showed a one- to two-fold improvement over past sampling methods. Use of this new dust filter paper cassette together with the analysis method developed by Dr. Kohyama of Japan in 1985 can accurately determine the amount of crystalline free silica on the filter paper, and comparative testing shows no statistical difference between this techniques developed so far and NOISH 7500.
- (2) A comparison was carried out of the size-separation efficiency of the IOSH respirable dust sampler and similar devices available on the market, revealing that the sampler developed by IOSH conformed more closely to international size-separation standards. Quality management procedures for the IOSH-produced sampler were also worked out. The IOSH-developed Virtual Cyclone Sampler that conforms to international respirable dust sampling criteria, and the new IOSH size-separation sampler, were exhibited at the 2006 AIHce show in the United States.
- (3) Demonstration models of adaptive control programming and duct-noise PC-based active control were completed. A paper on the results of research on active noise control in ear muffs was submitted to the Acoustical Society of the

ROC and was presented at the 19th Symposium of the Society. The duct-noise active control model was demonstrated as part of the “Taiwan Go Go Go” activities in order to publicize this highly effective technology for the control of low-frequency noise, which can be used on-site to enhance the quality of the noise environment.

- (4) A uniform, rapid, standardized, and long-term-monitoring electrostatic particle collection system for the collection of bio-aerosols was developed and is in the process of patent application.
- (5) A fire-scene simulator using programmable logic control (PLC) of gas, air, ignition, and safety apparatus was developed for use by fire department and fire training units as a tool for fire-site reconstruction and fire-fighting simulation training. An analysis of heat flow at simulator fire scenes has been completed and the results reported in the IOSH quarterly, and the prototype fire-scene simulator is undergoing commercialization and safety enhancement.
- (6) Experimentation on and analysis of Japanese-standard intermediate supports (SK-80D horizontal type) were carried out, and the function and design of intermediate supports for horizontal lifelines were improved. The conclusions achieved by this project in regard to the mechanical behavior, areas that require strengthening, and effectiveness of different methods of strengthening will be useful to engineers in designing intermediate supports that are suited to use in Taiwan. The design options guide resulting from the analysis and comparison carried out during the study can also serve as a reference for engineers. The research report has been sent to the Dept. of Labor Inspection of the Council of Labor Affairs and other labor inspection bodies, and it may also be useful as a basis for the revision of laws and regulations. A review and comparison of Taiwan’s existing regulations governing intermediate supports with those of the United States and Japan also resulted in suggested revisions. Matters needing attention were extended to design and user parties through seminars and presentations.

3. Provision of strategies for the formulation, revision, and implementation of laws and regulations by the Council of Labor Affairs:

- (1) Information from occupational injury and disease databanks was collected and analyzed for application in the Council of Labor Affairs’ injury-reduction strategy, new statistical information on the rate of accidents based on insurance data were added, and analysis of the linking of the labor insurance databank with the Department of Health’s national health databank was carried out so as to provide a real-time grasp of the worker health situation.
- (2) Work was completed, by category, gender, age-specific, area, scale, injury type and media, using labor insurance data for 2005, on 84 files of rates of injury and disease adjusted for working hours, as well as on 26 statistical charts on the crude death rate by labor insurance category and statistical charts on potential lost years of work in related categories. The resulting data were used as a reference for measures in the CLA’s “223 Accident Reduction Program,” and are available for access on the website.

- (3) Work was continued on the establishment of data for 200,000 hearing threshold, needlestick injury, and occupational-disease-prevention health exam files for use as a reference in setting up an integrated domestic occupational injury and disease surveillance system.
- (4) Hospital medical records and labor insurance compensation data were used to investigate the correlation between type of work and cardiovascular disease. Scholars and experts were invited to organize an “overwork task force” to provide policy and research proposals and plans, and, with reference to research results and relevant Japanese determination criteria, they helped to formulate suggestions for revision of the “Diagnostic Criteria for Job-induced Acute Circulatory Illness.” These suggestions have been adopted and announced by the Council of Labor Affairs.
- (5) For many years, IOSH has been working to promote equality of the gender and take care of the viewpoints and needs of the female gender by collecting, analyzing, and studying data related to women’s occupational safety and health, and by working out preventive measures. The results have been supplied to the government and private sectors for reference in assuring the right of female workers to safety and health.
- (6) Analyses of occupational accident statistics (for annual and other regular periods) for specific groups (foreign workers, indigenous peoples, fishermen) were provided for use as a reference in mapping out accident-reduction strategies and redirecting the focus of accident-reduction efforts.
- (7) Comparative statistical analysis of occupational accidents in different counties and municipalities was provided, through the “Taiwan Go Go Go” program, to municipal and county labor agencies to use in formulating more effective accident-reduction measures.
- (8) Compilation, review, and arrangement were carried out for exposure limits in regard to five chemical agent Beryllium and its compounds, crystalline free silica, asbestos, methyl mercaptan, and acrylamide) and one physical agent (electromagnetic field) for use in establishing recommended exposure limits (REL) and reviewing permissible exposure limits (PEL) for such hazards.
- (9) Introduction and verification of sample analysis reference methods for five harmful substances (dichloroethyl ether, isopropyl benzene, 2-methylphenol, 2-chloroethanol, and ally glycidyl ether) were carried out. The results were reviewed by the Committee on Work Environment Determination Technology, and the Council of Labor Affairs was asked to announce them.
- (10) In coordination with labor inspections, assistance was provided for the analysis of inspection samples and suggestions were made. Data were completed on approximately 1,000 cases of harmful-substance exposure survey items and were provided to the Council of Labor Affairs for reference in formulating implementation policy and for help in reducing hazard exposure concentrations.
- (11) Seminars were held in northern, central, and southern Taiwan for representatives from different professions, and the opinions collected from these seminars, as well as from experts’ symposia, in-depth interviews, and questionnaire surveys, were compiled into law revision impact statements that

were provided for the reference of the Department of Labor Safety and Health, Council of Labor Affairs.

- (12) A survey was carried out of whole-body vibration exposure of the drivers of 20 garbage and recycling trucks, and deviations from current laws and regulations, as well as from the latest international standards, were analyzed for future use in revising Article 301 of the Regulations for Labor Safety and Health Installations.
- (13) Seven models of powered air purifying respirators (PAPRs) were tested by Japanese, European, and American standards, and by each standard at least one model was found to have negative internal pressure. The protection factor exhibited a lack of uniformity in qualification when the respirators were subjected to different tests. These results were provided to PAPR supplier and to workers as a reference in using PAPRs. The Bureau of Standards, Metrology and Inspection will also be asked to formulate relevant Chinese National Standards.
- (14) A study of female toll collectors on national freeways was carried out and the following proposals, among others, were made for the reference of the Department of Labor Safety and Health of the Council of Labor Affairs, and the National Expressway Bureau of the Ministry of Transportation and Communications: there should be a lapse of at least two days when a worker is changed from a midnight shift to another shift, work assignments should be arranged so that workers have at least one day off per week, and the number of night shifts worked should not exceed 20 per two months.
- (15) A study was made of American, German, Japanese, and Australian methods and approval mechanisms for the return to work following occupational injury and rehabilitation, and the results were reported at the presentation of IOSH achievements for 2006. An occupational injury rehabilitation committee was set up and the establishment of a platform for liaison between the Council of Labor Affairs and other units related to injury rehabilitation policy was tried. The results can be used by the Department of Occupational Safety and Health and the Bureau of Employment and Vocational Training for the formulation of related laws.
- (16) A thorough review of health threats and occupational injuries caused by the occupational exposure of personnel with various professional licenses was carried out, and the results can be used by the Council of Labor Affairs as a reference for the improvement of related laws, regulations, and systems. Based on the results of the study, it was recommended that pre-employment safety and health training of licensed personnel be carried out and that recognition of the workplace exposure of licensed personnel be heightened so as to reduce occupational accidents, protect the health of workers, and lighten the burden on national medical-care resources.
- (17) International low-temperature working standards of various kinds were reviewed and applied to localized low-temperature working environments in accordance with acquired evidence, and the results were provided to managers for use in evaluating low-temperature environments and worker health.
- (18) The physical fitness of middle-aged and elderly professional drivers was evaluated and its relationship to their accident rate and related risk factors

analyzed (including such factors as age, physical fitness, daily working hours, reaction ability, etc.) for use as a reference by the Ministry of Transportation and Communications in revising laws and the health management of middle-aged and elderly drivers.

- (19) A database on aborigine worker injury and health, and a related monitoring system, were established and updated, and statistics on the status and characteristics of occupational accidents were compiled and analyzed on a regular basis so as to maintain an understanding of trends in occupational accidents. A three-year “Indigenous Peoples Manpower Survey and Workplace Safety Network Plan” was instituted in 2005 together with the Council of Indigenous Peoples; a questionnaire was designed and 500 surveyors trained, and a general survey of more than 300,000 indigenous people was carried out. Safety and health films produced by IOSH (seven shorts and five longer films) were provided for broadcasting on the indigenous peoples’ TV channel. A 30-second short occupational safety and health short, and a workplace safety educational film, were produced, also for airing on the indigenous peoples’ TV channel. In addition, channels were established with 869 churches for the expanded promotion of accident-reduction education.
- (20) Standards of the U.S. Occupational Safety and Health Administration on maintenance and safety measures related to mobile crane human high-lift chambers, instructions for use, design criteria, and pre-use inspection and testing were collected and compared for use as a reference in formulating related domestic laws and regulations.
- (21) A dust explosability evaluation and prevention guide was completed. The compilation of the guide included the collection of 15 international dust explosability factor evaluation and testing standards, and the review of seven dust explosability characteristic parameters, 10 dust explosability impact factors, and six dust explosability prevention and protection techniques. Five dust explosion prevention techniques were provided to related operators for reference.
- (22) European, American, and Japanese pressure vessel design criteria were compared with current domestic standards, and a systematic comparison along with proposals was offered. The results of this study indicate that when designating foreign standards for use in Taiwan, the content of the different standards should be compared and contrasted in detail so that they can conform to current domestic safety needs.
- (23) An impact study was carried out on economic activity and worker safety issues arising from the sale of substandard machinery, along with a questionnaire survey of the willingness of companies to coordinate with legal enforcement. Demands for safety are made through import, production, and sale controls, and manufacturers are enjoined to adopt a strategy of safety protection and fulfill their safety commitments from the very start, beginning with design, on a compulsory, voluntary, or self-declaration basis. This can be used as a reference in the future revision of Article 6 of the Occupational Safety and Health Act to better protect the safety of workers.

- (24) A reliability assessment and collapse prevention guide for structural steel support systems was completed. The guide contains a summing up of design methods and criteria for upgrading the reliability of support systems and the avoidance of collapse; offers methods of dealing with reuse, residual stress, and non-uniform geology; and finally, in line with construction site monitoring apparatus, proposes standard operating procedures for the reference of designers. Collapse factors were addressed and preventive measures for the stages of design, construction, and use were worked out, and requirements were proposed. A structural steel support collapse prevention guide was compiled and supplied to operators so as to reduce incidents of collapse.
- (25) An analysis and comparison of accident-reduction strategies in the advanced countries was carried out. The study encompassed accident-reduction goals, items, priority tasks, and accompanying measures in the United States and five other countries, and pinpointed programs and measures suitable for application in Taiwan.
- (26) Guidance was provided to three small and medium enterprises on a trial basis, with site visits being undertaken to gain an understanding of the characteristics and current status of Taiwan's SMEs and with occupational safety and health systems being set up in accordance with the key management elements contained in the ILO-OSH 2001 Guidelines on Occupational Safety and Health Management Systems. A seminar was held on the methods used by SMEs for introducing safety and health management systems, and related regulations in Singapore, Japan, New Zealand, and Australia were reviewed. Suggestions on the mechanism for the establishment of occupational safety and health management systems by SMEs on the legal, systemic, and strategic levels were made for the reference of the Council of Labor Affairs.
- (27) Information on the status of development of occupational safety and health management systems in the United Kingdom, United States, Canada, Japan, and South Korea was collected, methods of establishing occupational safety and health management systems on the national and organizational levels were reviewed, questionnaires were used to assess the impact of regulatory revision on enterprises, and an implementation program for occupational safety and health management systems was proposed for the reference of the Council for Occupational Safety and Health.

4. Compilation of safety and health technical data, and provision of technical services:

- (1) A survey of the particle-size distribution of and exposure to chromium, nickel, and manganese in welding-environment fumes in one boiler construction plant and two shipyards was carried out, revealing that the exposure of some workers to manganese was greater than the level permitted by law. A "Technical Manual for the Assessment of Worker Exposure to Heavy Metals in Welding Operations" was compiled for the use of labor inspection and environment monitoring agencies.
- (2) The exposure of workers to lead was assessed via the skinwiping method. Dust testing was carried out to assess the lead loading of working environments for

three domestic operations related to lead exposure in order to determine the non-respiratory-tract load and form of exposure to lead. A statistical correlation was discovered between the amount of lead found in hand-wipe tests and in the blood of workers, and it is suggested that companies strengthen the management of lead contamination of the hands as an important element in lead-hazard prevention.

- (3) Studies of N-methyl formamide in the urine using high-performance liquid chromatography and of cadmium in the urine using graphite furnace atomic absorption spectroscopy were completed in accordance with the “Verification Procedures for Biological Monitoring and Analysis of Worker Exposure to Hazardous Materials in the Workplace.”
- (4) A survey of exposure to airborne styrene in the working environments of yacht manufacturers was carried out. High concentrations of styrene were found during lamination using unsaturated polyester resin, with an exposure range of 0.6-109 ppm and an average exposure of 15 ppm. In single-day random sampling, 10% of the samples were found to exceed Taiwan’s maximum permitted concentration of 50 ppm. The exposure of workers to styrene during lamination operations was found to be 0.2-160 ppm, with an average of 28 ppm, and about 18% of the samples exceeded the current legal maximum of 50 ppm. Exposure was particularly marked when using single-piece and narrow hull molds. To control exposure, it is suggested that convection in the overall air circulation and exhaust system be considered in air circulation equipment inside hulls. Employers should provide complete and appropriate protective gear including goggles or masks, filter or air-supply breathing devices, and protective clothing and safety gloves; should train workers in how to use the protective gear properly; and should strictly monitor its use. In addition, regular physical exams and environmental exposure surveys can be used to prevent the occurrence of abnormal health conditions.
- (5) Methods for testing the effect of protective clothing against nanoparticles were established; a study affirmed that such clothing is indeed effective in protecting against nanoparticles, but that attention must be paid to the problem of leaking. The results of the study can be used by enterprises in selecting protective gear.
- (6) Local exhaust ventilation add-ons and parameters were studied, and a review of factors influencing local exhaust ventilation parameter measurement was completed with the aim of discovering the reasons for problems. Influence ratios were analyzed, and a web page for the automation of related calculations was completed and opened for use by enterprises.
- (7) The extension, application, and evaluation of a dimensional atlas for protective equipment for different workplaces were completed. Related improvement was carried out at 10 plants and reports of the results were completed, and the work of promoting the atlas and producing and educational introduction is currently under way.
- (8) A slip-and-fall-prevention manual was compiled and human testing carried out with the purpose of extracting data on the dynamics of slipping and falling was carried out. The resulting data will be put online for download and used as a reference by enterprise units in reducing the risk of fall injuries.

- (9) The influence of polynuclear aromatic carbons on cardiovascular disease in workers was evaluated, and it was discovered that exposure to polynuclear aromatic carbons and suspended particulates leads to cardiovascular disease. Coking workers have a particularly high risk of exposure.
- (10) Exposure to cooking-oil fumes causes an increase in the severity of oxidative damage to restaurant workers, and to the risk of cardiovascular disease. It is suggested that restaurant kitchens with range hoods having an air speed of less than 0.4 meters/second install air curtains so as to reduce the exposure of workers to fumes. It is further suggested that urinary malondialdehyde, pulmonary function, and high-sensitivity CRP be added to health-examination test items for cooks and restaurant workers in order to boost the efficacy of preventive health exams.
- (11) Environmental conditioning and ventilation engineering were used to improve foundry working environments, and an understanding of the effects of on-site guidance and of worker health reaction was obtained. The results can be used as a reference by enterprise units and the Department of Labor Inspection.
- (12) Empirical research on excessive fatigue among high-tech workers has been carried out and overwork inventory have been developed for the use of related companies. Suggestions have been made to related companies about using their management systems to alleviate overwork.
- (13) An assessment of health threats to chemotherapy workers in hospitals and of their exposure to chemotherapy pharmaceuticals was carried out. Questionnaire results show that the primary exposure of hospital pharmacists is through skin absorption and of nursing staff is through respiration, the skin, and the eyes. Most of the affected believe that their subjective symptoms are work-related; in terms of personal sanitary habits, the impact of exposure through eating and drinking is relatively large. Environmental testing data show that pharmaceutical pollution exists even in non-prescription-mixing areas. A suggestion will be made that operators and the Council of Labor Affairs plan exclusive dining areas for workers.
- (14) Standing work health exercises were developed and made into an optical disk and manual for the use of workers and health personnel in reducing fatigue and preventing occupational disorder.
- (15) Health data and urine samples were collected for workers in explosives plants, and whether or not dangerous materials were related to health abnormalities in workers was studied. Analysis of the data revealed substantial differences in abnormalities between exposed and unexposed groups in the following areas: liver, kidney, and lung; nervous system; and blood. A chromatography-based method of detecting TNT and nitroglycerine in urine was established and provided for reference in the prevention of hazards.
- (16) An analytical study of electrical explosion dust hazard location classification standards and specifications of the International Electrotechnical Commission (IEC), the advanced countries of the European Union, the United States, and Japan was carried out and area classification technical guidelines were established for explosive dust atmosphere leak sources, danger area classification principles, dust layer hazard, and danger area classification

procedures and case studies. These guidelines have been sent to the Taiwan Explosion Proof Electrical Association, Taiwan Petrochemical Responsible Care Association, and other organizations, and can provide preliminary danger-area classification techniques for domestic enterprises and labor inspection agencies.

- (17) Electrostatic hazard protection goods and equipment testing standards adopted by the International Electrotechnical Commission (IEC), Electrostatic Discharge Association (ESDA), and the advanced countries were collected and analyzed; a review of basic electrostatic characteristic measurement and electrostatic hazard protection goods and equipment testing techniques was completed; and related testing guidelines were established and sent for reference to the Taiwan ElectroStatic Discharge Association, Industrial Safety and Health Association of Taiwan, and other concerned organizations. These guidelines can provide enterprise units and labor inspection agencies with a general understanding of testing standards, and can serve as a reference for those organizations and agencies in carrying out electrostatic protection measures.
 - (18) A study of the safety culture in the semiconductor industry was carried out and safety culture evaluation tools were established for that industry in order to gain an understanding of the current status of the safety culture in the industry and propose programs for reinforcing the safety culture: "Safety Culture Hero Case Program," "Safety Culture Day (Week) Celebrations," "Safe Behavior Encouragement Program," "Safety Culture Recognition Program," "Safety Commitment Card," "Safety Payback Card," "Safety Culture Improvement Activity Proposal," and "Safety Culture Improvement Team."
 - (19) Integrated construction safety management and monitoring system software was established to provide real-time information on construction site conditions and upgrade the performance of safety management. In addition, the system's digital information-saving function allows enterprise units to retrieve information for use in investigation, disposition, and internal and external auditing.
 - (20) In line with the safety management and disaster monitoring technology plan, the Southern Taiwan Science Park and Lee Chang Yung Chemical Industry Corp. were assisted in installing expert supporting systems for emergency response decision-making. The Southern Taiwan Science Park began applying the system on Oct. 25, holding a toxic substance and Southern Taiwan Science Park team emergency response drill at a certain optoelectronic plant.
5. Reinforcement of safety and health technical consultation services, provision of labor safety and health technical data downloading and consultation services, publication of labor safety and health periodicals, and holding of exhibitions to propagate safety and health know-how:
- (1) Materials published by IOSH over the years were digitized and put online, and offered for downloading free of charge. More than 1 million hits were recorded in 2006 and downloadings of IOSH publications totaled 250,000, helping to popularize the results of the Institute's research.

- (2) Eleven hundred copies each of issue 1-4 of volume 14 of the *Journal of Occupational Safety and Health* were published, along with 1,700 copies each of issues 75-80 of the *Labor Safety and Health Newsletter*. These publications were provided to scholars, experts, government agencies, enterprise units, and personnel involved in labor safety and health for use as a reference in sourcing data, carrying out innovative research, amending laws, and use in preventive work.
- (3) The holding of exhibitions in the IOSH Exhibition Hall and the mounting of traveling exhibitions were continued, and Occupational Accident Prevention Exhibitions and Safety Week activities were held in cooperation with the governments of Taoyuan County, Miaoli County, Taichung City, Kaohsiung City, and Tainan County. A total of 55 traveling safety and health exhibitions were held at schools in 2006, attracting about 59,000 visitors; and the Exhibition Hall hosted approximately 23,000 visitors, for a total of 82,000. At these events, visitors were given an opportunity to learn and their attention was captured through themed activities and lively interactive displays. These exhibitions stimulated the interest of visitors, making it easy for them to absorb the information presented and cultivating a healthy attitude toward occupational safety and health; and this, in turn, prompted them to change their unsafe behavior of the past. By promoting labor safety know-how and the results of IOSH research, and expanding the dissemination of education in the prevention of occupational accidents, these activities helped instill a consciousness of the importance of safety in the workplace.
- (4) In line with the CLA's "233 accident prevention" target, an "Initiating the Public Participation Mechanism – The First National Work Safety Week" event was held at the Taipei headquarters of the Chinese Petroleum Corp. An indoor exhibition included scaffolding and a confined-space hazard prevention model, as well as displays mounted on tripods and research-result display boards. Outdoors, IOSH led demonstrations of exercises designed to promote the mental and physical health of workers and their families.
- (5) A promotional multimedia video on the prevention of explosions in fires was produced, and 15 occupational accident news pieces were edited and compiled on a DVD. In addition, work on the establishment of a safety and health digital library was continued.
- (6) An international exhibition was mounted on Mar. 2-4 at the Taipei World Trade Center in coordination with Taipei SecuTech Expo 2006. The event attracted 18,000 visitors and provided opportunities for technical exchange and cooperation.
- (7) IOSH participated in the American Industrial Hygiene Association's AIHce 2006 industrial health symposium and exhibition in California. More than 400 participants visited the IOSH booth; more than 30 expressed an interest in IOSH products, and engaged in exchange with IOSH personnel.
- (8) Three sessions of "Basic Training for Vocational High School Safety and Health Seed Personnel" were held jointly by the CLAs' Department of Labor Safety and Health and the Ministry of Education, on Sept. 19 in Kaohsiung, Sept. 20 in Taichung, and Sept. 26 in Taipei. A total of 310 people participated.

The training curriculum included the application of safety and health regulations, chemical hazards, psychological pressures and health promotion in the workplace, and discussion of practical cases with the aim of enhancing the knowledge of teachers about the application of safety and health technology.

- (9) Three presentations of the IOSH's annual research achievements in the areas of on-site improvement guidance, industrial safety, construction safety, policy research, accident case studies, and health management were held on an expanded basis, one each in Taipei, Kaohsiung, and Yunlin, in order to extend the results of IOSH research. Response from all sectors was enthusiastic, with 1,000 people attending, and domestic safety and health standards were significantly upgraded.
- (10) Two "Safety and Health Instructor Training Camps" were held in cooperation with the Ministry of Economic Affairs on July 18-29, with participation by a total of 350 instructors from vocational high schools, colleges, and universities, as well as Ph.D. candidates from university safety and health departments.
- (11) A total of 272 seed instructors were trained in five "Basic Safety and Health Instructor Courses for Indigenous Peoples" and accident-reduction educational activities were carried out, with a total of about 250 people participating. Instructor teaching materials for three high-risk industries were compiled, and five 'indigenous peoples' work safety seminars were organized, with the aim of reaching indigenous peoples accident-reduction targets through inter-ministerial cooperation.
- (12) The annual income from patent royalties on IOSH's dust samplers, and from the transfer of technology for the Institute's gondola stabilizer, improved industrial safety helmet, tripod anchorage connector system, and 3D anthropometric data, has been increasing rapidly: NT\$150,000 in 2002, NT\$1.05 million in 2003, NT\$1.12 million in 2004, NT\$1.65 million in 2005, and NT\$2.08 million in 2006. This income will continue to be used for related research and the extension of resulting technologies.