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Preface

The Institute of Occupational Safety and Health (IOSH) is a research institute under the jurisdiction of the Council of Labor Affairs (CLA), Executive Yuan.Its important mission includes application of scientific technology, surveys and analyses of various risk factors in the working environment, as well as development of countermeasures.

This annual report is a general report of the various activities of the IOSH, commencing on January 1, 2001 and ending on December 31, 2001. It is divided into four chapters: "Introduction", "Focus of Research", "Research and Results", and "Related Activities". In addition to providing a general overview of the various businesses and activities of the IOSH for the fiscal year 2001, we hope that this annual report could provide the community with an understanding of IOSH. A summary of the contents for each chapter is provided below:

1. Introduction: provides a summary of this annual report, organization and personnel of IOSH and their respective responsibilities, research expenditures, and research laboratory building construction projects.

2. Focus of Research: provides a brief introduction of research orientation of each division of

the IOSH.

3. Research and Results: provides research results of each division of IOSH, as well as a description on various research projects being implemented.

4. Related Activities: provide a list of academic and exchange activities held by IOSH, papers and presentations related to occupational safety and health, the publications of IOSH, computer/networking devices, promotion and exhibitions of IOSH's researches, assistance in occupational survey and other services.

The appendix includes a list of IOSH's research projects in 2001 and technical book collections (published in 2001) for readers' reference.

Director of IOSH

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Introduction

I. Overview

The Institute of Occupational Safety and Health (IOSH) was established in August 1992.From the beginning, the planning committee has clearly defined goals and directions of IOSH in its organizational regulation, which include:

1. Provide the theoretical basis for occupational safety and health strategies and administrative measures.

2. Provide solutions to important occupational health and safety problems.

3. Provide references for revisions of important occupational safety and health regulatory standards and management systems.

4. Upgrade the technological standard in occupational safety and health and inspection activities.

5. Provide necessary information for training and consultation in occupational safety and health.

In keeping with the spirit from the past, through open discussions from various parties, IOSH has developed Research Strategy 2001-2005 to guide future research, in response to changes in industrial structure and results of national survey of occupational hazardous exposures, and in accordance with administrative needs of the Department of Labor Safety and Health and Labor Inspection, and occupational safety and health standards issued by or proposed in European Union, International Standards Organization and World Trade Organization. Research Strategy focuses on serial and interdisciplinary research including: establishment of basic information on work environment and work condition, strengthening of research on prevention of occupational injuries and diseases, understanding of particular safety and health problem, develop evaluation, management and personal protection technologies. The purpose is to improve safety and health in domestic work environment, awaken workers' awareness of occupational safety and health, decrease occupational injuries and prevent occupational disease so that a safe, healthful, and comfortable working environment may be created for the nine-million-plus workers in Taiwan.

This annual report covers research activities from January 1 to December 31 of 2001, with the completion of 87 projects for fiscal year 2001. All results are open to the public through presentation of research results, technology transfer, publications, theses, Internet on-line searches, exhibitions, and various seminars and conferences. These include 7 publications, 2 exhibitions, 11 academic workshops, 42 scientific papers published in local and foreign publications, 57 papers presented in local and foreign academic conferences, and 4 patents. IOSH also assisted with investigations in incidences of occupational injuries and diseases, as well as provided calibration services for inspection agencies.

II. Organization and Personnel

IOSH is headed by a Director, a Deputy Director, and a Secretary General. It is divided into five divisions: the Division of Occupational Safety, the Division of Occupational Hygiene, the Division of Method Development and Analysis, the Division of Occupational Medicine, and Occupational Safety and Health Exhibition Branch.For administrative support, it has a Secretarial Office, an Accounting Office, a Personnel Office, and a Government Ethics Office (Figure 1).

1.Organization

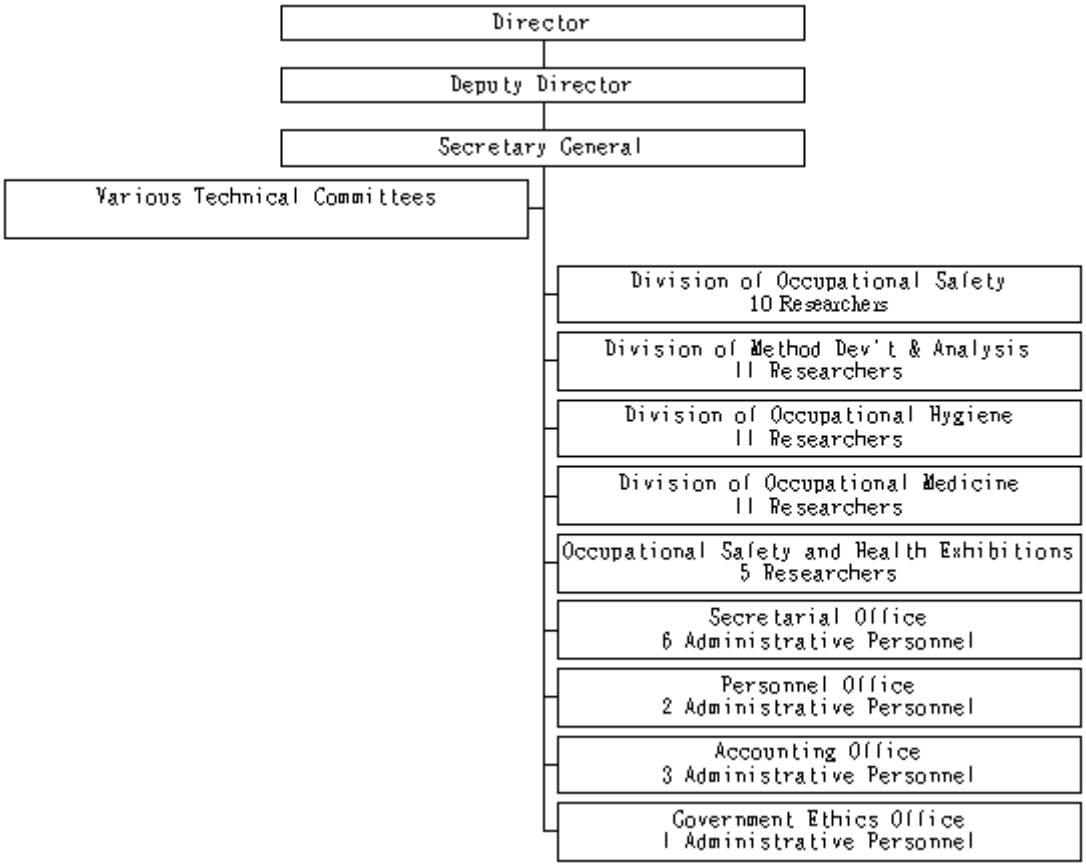


Figure 1Organizational Structure

2. Analysis of Research Positions

Table 1Anlaysis of Research Positions

Positions	**Senior Researcher**	**Researcher**	**Associate Researcher**	**Assistant Researcher**
Number of Employees	3	16	21	11

3. Analysis of the Level of Education in Current Research Personnel

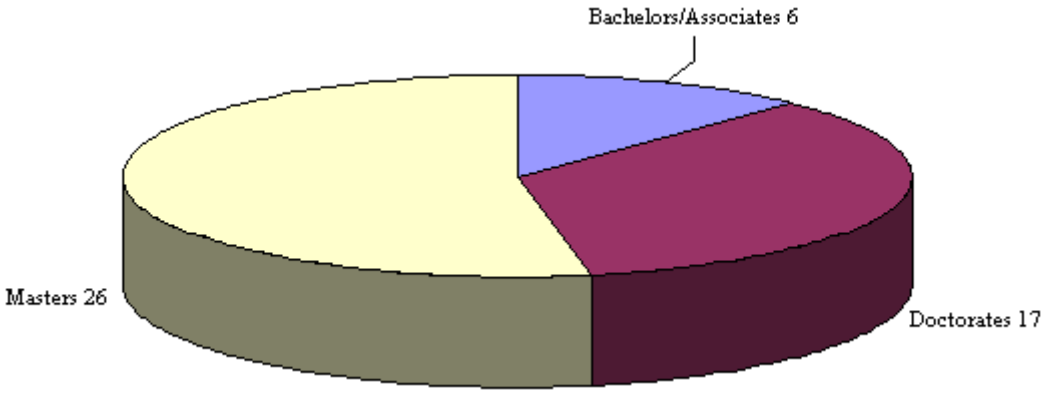


Figure 2Analysis of the Level of Education in the Current Research Personnel

Note:1. 2 positions are open.

2. Doctorate researchers include 3 that are on fix-term contract.

3. Currently, 9 research personnel are undertaking doctorate studies.

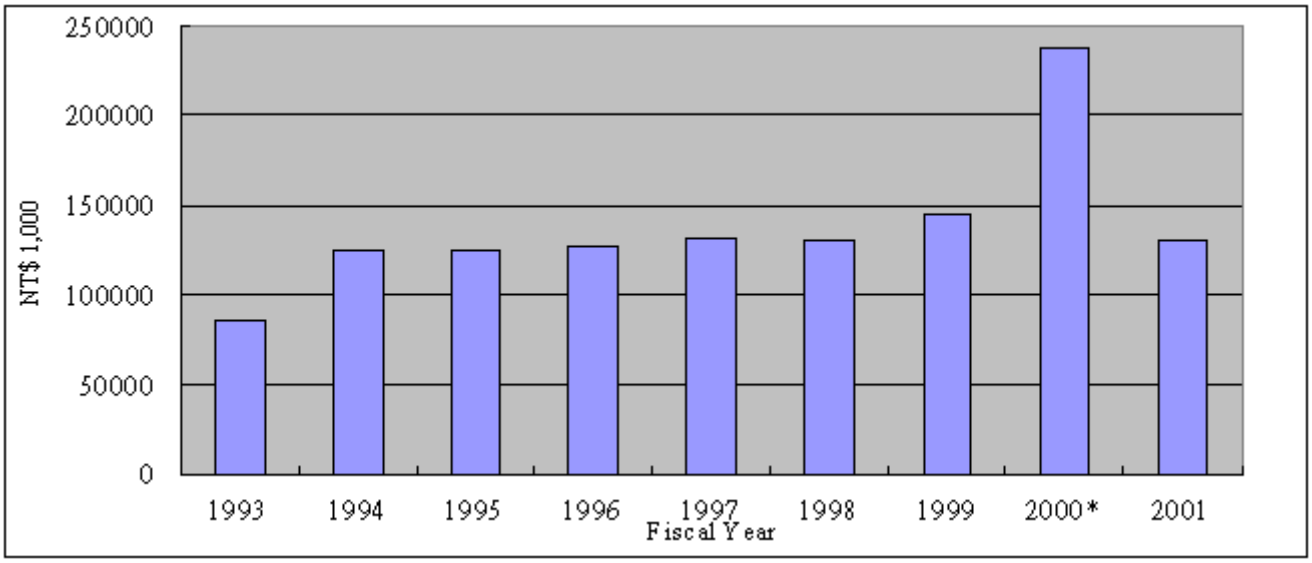
III. Research Expenditures

1. Budget for Fiscal Years 2001

Table 2Budget for Fiscal Years 2001

Unit: NT$ 1,000

Subject	**Budget for FY 2001***
Occupational Safety and Health Research	129,977
Occupational Safety Survey and Research	32,630
Method Development and Analysis Technology Research	22,239
Occupational Hygiene Survey and Research	26,747
Occupational Medicine Survey and Research	25,949
Occupational Safety and Health Exhibitions	22,412



2. Analysis of Research Expenditures over the Years

Figure 3Research Budget for Fiscal Years 1993 to 2001

Note: 2000* includes the second half of 1999 and the year 2000

IV. Research Laboratory Construction Project

1. Construction Plans

(1) Immediately after its establishment on August 1, 1992, IOSH has embarked on a plan to construct a laboratory building. After visiting numerous sites, IOSH requested for 8.6 hectares of land located in Hsi Chih, Taipei County, from the National Property Bureau, which was subsequently approved by the Executive Yuan.

(2) Pursuant to regulations provided under the "Management Guidelines for Development and Construction on Hilly Terrain", construction and development of hilly terrain must be reviewed by the local government. Permission will be issued in three stages: first, a permit for development on hilly terrain; second, a license for miscellaneous projects (including a license for their use and an application to change the zoning in non-urban areas), and third, a building license (including a building permit).

(3) An engineering consulting firm was commissioned to obtain permission for development in March. All necessary documents were submitted to Taipei County Government, which issued a permit for development a year later in July 1994.Designs for miscellaneous projects were prepared three months later for the application of a license, which was obtained in April 1995. These projects were contracted immediately thereafter, and were completed in October 1996, despite a delay due to weather, moving of ancient graves, and public protest.IOSH obtained a note certifying that no public property was damaged during the construction from Hsi Chih city government, and applied for a permit to use the

miscellaneous facilities and for zoning change to "land for special purpose enterprises". These administrative procedures were completed in June 1997.

(4) Architectural design for the laboratory building was completed in September 1996.However, due to the lengthy process in obtaining the permission for development in the second stage while "Technical Regulations on Construction" was revised at the same time, the design was modified accordingly.IOSH applied for a building license in August 1997. Approval of the construction permit was subsequently obtained on October 27, 1998.Building constructions were completed in July 2001 then sewage discharge permit was obtained. The buildings were put into use after passing fire inspection and having obtained operation permit, and officially opened on October 18, 2001.

(5) The new buildings of IOSH will be located on:

No. 99, Lane 407, Hengke Rd.,

Shijr, Taipei

Taiwan, R. O. C.

2. Contents of Construction

(1) Miscellaneous projects:

A. Entry/exit roadways

B. Sewage pipelines

C. Conservation of soil and water (drainage, retaining walls, landscape slopes)

D. Common drainage

(2) Main buildings:total area of 24,581.16 m 2 , including:

A. Research and administrative offices of 1,893.21 m 2

B. Laboratories of 13,249.07 m 2 , including 8 labs for occupational safety, 9 for method development and analysis, 9 for occupational hygiene, and 6 for occupational medicine

C. Exhibition hall and library of 2,678.8 m 2

D. Education and training center of 5,157.5 m 2 , including an auditorium, lecture halls, conference rooms, dormitory, and recreational areas

E. Underground parking lot of 1,602.61 m 2

3. Expenditures

(1) Miscellaneous projects:NT $ 46 million

(2) Main buildings and landscape architecture:NT $ 590 million

(3) Instruments and equipment: approved by the Executive Yuan and budgeted yearly in accordance with construction progress.

FOCUS OF RESEARCH

I. Research on Occupational Safety

The primary goal in occupational safety research is to ensure workers' safety by minimizing occupational accidents. The Division of Occupational Safety is responsible for research on occupational safety management, on technologies for mechanical safety, chemical safety, electrical safety, construction safety, on functional testing and certification of protection equipment, and for assisting the investigation of occupational accidents. Research areas include mechanical safety, chemical safety, electrical safety, construction safety, protective equipment and safety management policy. Research focuses on safety protective equipment and technology, warning and monitoring technologies, risk control and intrinsic safety technologies, personal safety equipment with design for comfort, safety management policy, and recommendations for revisions of regulations, standards, and safety evaluation and management.

The focus of the various research projects of occupational safety is as follows:

1. Research on Construction Safety

The frequency of occurrence and the severity of occupational accidents in the construction industry have always been the highest among all the industries.For this reason, the Council of Labor Affairs considers construction safety as one of the main issues in terms of prevention of occupational accidents. Emphasis of research in construction safety is not only focused on surveys of current conditions, safety management, and evaluation of construction safety, it is also focused on technologies of construction safety equipment and construction methods.It is hopefully to minimize occupational hazards in the construction industries. Research activities for this year mainly centered on: tunneling safety assessment and regulations suitability study, study of construction shoring displacement monitoring and collapse prevention, development of the computer-aided system of layout of framed scaffold, study in world's safety codes and techniques of steel assembling, the investigation of the hazards of construction equipment and research of the validity of relative regulations, the

development of the non-destruction test techniques of the temporary structure, and the evaluation of current regulation about construction materials storage.

2. Research on Mechanical Safety

Statistics of inspections of major occupational accidents shows that 130 cases have occurred in the manufacturing industry in 1999, only second to the construction industry.Struck by object, caught in or compressed by equipment, cuts and abrasions are the most common types of occupational accidents.Most of them were due to unsafe machinery. Research therefore focuses on cranes, lifts, steam boilers, and pressurized vessels that often result in serious injuries, and construction machinery and process machinery that often result in caught in or compressed by equipment and cuts and abrasions.In particular, the study of the safety interlock device of injection molding machines, improvement of the locomotion platform for mobile crane training system, the development of the computer-aided calculation system for steam boilers, regulation on non-open inspection technology for equipment containing high pressure gas, safety assessment of degrading pipeline, the detail design and assessment of remote payload attitude device and safety released device of tower crane, and design of safety locking device for LPG pipelines in tank cars were given priority in research.

3. Research on Electrical Safety

Occupational electrocution incidents are the second leading cause of serious occupational injuries. Technical guidelines for explosionproof electrical apparatus are also lacking.Besides, disasters of precision equipments such as instrumental control facility, caused by electromagnetic interference have been reported frequently and been studied extensively. Therefore, the planned research topics were: electric shock prevention, explosionproof electrical apparatus and EMI disaster prevention. The research focused on: investigation on causes of electrical installation related disaster and hazard, improvement of electrical safety related regulations, establishment of inspection contents and standard for electrical installation, development of safety technology for operation and maintenance of electrical apparatus, setting up guidelines for prevention of electrical shock, installation, maintenance and guidelines of explosionproof electrical apparatus, development of new explosionproof electrical apparatus, and hazard assessment and prevention of instrumental control facility and safe devices subjected to electromagnetic interference. Researches conducted this year focused on: prevention technology for hazard caused by power-frequency electromagnetic interference at work place, commercializing prototype design and test of the alarm device for warning mobile cranes from hitting the overhead power lines, and the electrical safety technology of low-voltage apparatus in plants.

4. Research on Chemical Safety

Focus of research includes safety and risk assessment of chemical processes, storage and transportation of hazardous and volatile chemicals, chemical hazard identification, and

safety in semiconductor and chemical manufacturing plants. Research included surveys of hazards in semiconductor manufacturing and chemical industries, control of run-away reactions, fire prevention in semiconductor manufacturing, development of risk assessment technology, modeling and characterization of explosive properties of chemical substances and related control technologies. Research conducted this year focused on: study of hazard prevention for electro-optics industry, the application of inherent safety on chemical process design, safety assessment for earth-covered tank in chemical process industry, guideline of the explosion-proof tank, filter and material entering system, and fire study of phosphine pipeline in semiconductor factories.

5. Research on Safety Protection Equipment

The provision of appropriate safety protection equipment is the last means to prevent injuries. Emphasis of research is focused on functional evaluations, proposing safety standards and testing methods, and design and development of new comfort safety protection equipments. Research objective is to promote the safety and willingness of workers to use these equipments. Research conducted this year focused on: study in feasibility of implementing certification system for personal protective equipment, and preliminary design of safety protection equipment for safety patrolling worker.

6. Occupational Safety Management and Policies

Focus of research is primarily on analysis of trends of occupational hazards, comparison and incorporation of intra- and international management systems, review of related regulations, evaluation of organizational functions, preventive measures to respond to potential occupational hazards.New indicators for occupational hazards, and new management technologies were developed in order to elevate safety consciousness for both employers and employees. Trends of types of occupational injuries, geographical distribution, and personal factors were analyzed to effectively support the enactment of policies. Feasibility of regulations (amendments), evaluation of safety management policies and organizations, and studies of the effectiveness of labor inspection were conducted in order to improve functions of safety management. Research conducted this year focused on: study of the construction safety management technique, study on increasing safety and health management efficiency for manufacturing industry and its audit system, study on safety and health management mechanism for workers doing contract work from large-scale enterprise, and the study of performance evaluation and auditing system for occupational safety and health in the industry.

II. Research on Method Development and Analysis

Research on Method Development and Analysis aims at developing methods for detecting hazardous substances in the workplace, and for assessing workers' exposures, as well as to promote laboratory QA/QC and the system for accrediting laboratories, in order to prevent occupational diseases, enhance productivity and the quality of the work environment.

According to the operational directives of IOSH, the functions of the Division of Method Development and Analysis are to establish sampling and analytical methods for environmental monitoring and biological monitoring, to assist in identifying occupational diseases through exposure assessment, and to develop workplace sampling equipment and evaluate its performance. Currently, emphases of research are: develop a practical particulate sampling method in workplace, develop sampling equipments and media for domestic use, establish technological database and provide technical assistance service, and transfer sampling and analytical methods to related organizations. The details of research projects is are:

1. Survey on exposure to chemical hazard

There are still cases of occupational diseases caused by different hazardous chemical present in the working environment today. The government has adopted various positive strategies to seek improvement measures to express its concern on this matter. Chemical hazard exposure studies are a series of studies among workers in highly hazardous industries. Together with exposure monitoring and occupational disease survey, these studies will be helpful in setting comprehensive and feasible regulations and policies. IOSH shall continue to conduct in-depth studies of highly hazardous substances used in large quantities in industries, with large numbers of exposed workers or high incidence of occupational diseases, which are also focus of labor inspection and subjects for the setting of regulatory standards.

2. Development of sampling and analysis techniques for hazardous substances in the work environment

The Council of Labor Affairs amended the "Permissible Exposure Limits of Hazardous Substances in the Work Environment" in 1995.More than 200 different kinds of hazardous substances were newly included or were substantially lowered their permissible exposure limits. In conjunction with these amendments, IOSH is actively developing standards for sampling and analysis of the newly included hazardous substances. Taking into account the special environmental conditions and analytical techniques employed in developed countries, localized methods for sampling and analysis have already been established over the years. An Environmental Monitoring Technical Committee was also convened to review various validated analytical methods, before submission to the Council of Labor Affairs for promulgation. Research activities focused on: continuation study on sampling and analysis techniques for each hazardous substance, and sampling and analytical method for mixed organic solvent used at the manufactories of water-soluble construction paints and organic solvents. The establishment of a database for method development and analysis will provide inquiry services to governmental agencies, academic research institutes, and enterprises to conduct various hazard surveys, and to collect information on local occupational exposures and health hazards.

3. Development and evaluation of samplers and sampling media

Currently, most of the sampling equipment used in environmental monitoring is imported from foreign countries. Not only are these equipment expensive, but they are also not necessarily suitable for the working environment in Taiwan, which is characterized by high temperature and high humidity.Developing local samplers and sampling media that are more economical, more convenient, and more accurate is needed.We have developed simultaneous vapor and aerosol personal sampler for toluene-2,4-diisocyanate, and studied sampling technology for hazardous particulates in work environment.On the other hand, technology transfers of three samplers developed by this institute, i.e. "New IOSH Cyclone", "Personal Foam Sampler", and "Virtual Cyclone" to companies were accomplished this year.

4. Development of biological monitoring techniques

It is essential to develop biological monitoring techniques to supplement environmental monitoring, since environmental monitoring only accounts inhalation exposures. Many industrial raw materials or process intermediates may also enter the human body through dermal contact and ingestion.In addition, differences in personal hygiene and inter-individual variability in skin absorption also increase the need for biological monitoring.Biological monitoring is the direct measurements of a biological specimen, such as blood or urine, to measure for the internal dose of hazardous substances or their metabolites.It also takes into account factors such as skin absorption, ingestion, work load, physical conditions, personal hygiene habits, and use of protection equipment to assess occupational health hazards.In recent years, research on occupational health technologies has caught the attention of developed countries in the world. In light of the above, IOSH invited scholars from various disciplines to form a Biological Monitoring Technical Committee, which had determined that priority should be given to blood lead, required by current labor physical examination regulations, and to eight organic solvents which were required to have biological monitoring in physical examination by the Japanese Labor Ministry.Biological monitoring researches conducted this year focus on: fast electrochemical analysis of lead ions in blood, and domestic workers' exposure to dioxin and polycyclic aromatic hydrocarbon.

5. Development of real time monitoring method for gaseous substances

The traditional exposure assessment frequently utilizes passive sampler for measuring TWA within eight hours. Although this method is simple, it can not provide exposure site or exposure concentration at any particular time. Therefore, it is not possible to obtain information on worker's operational condition. Direct reading instruments can measure exposure concentration in very short time, however, it also cannot provide detail information of exposure site and worker's operational condition.Besides, higher time resolution than necessary often results in difficulty when performing data analysis.Understanding cause and the exact site of exposure while conducting work environment monitoring is very important, hence, this institute has been actively involve in developing exposure assessment system through use of IR location identifying device, chemical sensor, and electronic control system.

Research work conducted this year focused on developing a continuous monitoring apparatus for collection of information such as labor activity, time and hazardous gas exposure.

III. Research on Occupational Hygiene

Occupational hygiene studies means for understanding and controlling risk factors in the work environment. According to operation guidelines of IOSH, the Division of Occupational Hygiene is responsible for research related to occupational health issues, such as occupational health management policies, survey and prevention of chemical, physical, biological, and ergonomic hazards, and measuring instruments and protection equipment related. Research is directed towards:

1. Survey of exposure to occupational biological hazard

Developing biotechnology is becoming an important business in our country; nevertheless, there is no integrated regulation or management system available. Therefore, the research works conducted in this division focused on potential occupational biological hazards in biotechnology industry so that the results may serve as good references for administrative organizations. As far as assessment of biological aerosol in work place is concerned, we continued working on investigation of airborne biological hazard. Assessment on exposure and detection of infection caused by *Mycobacterium tuberculosis* was studied so that an evaluation technique on environmental exposure in air can be obtained. A number of microbial biotechnology industries were also surveyed to gain knowledge of biohazard impact on workers.In addition, investigation on environmental safety and health at work place was also conducted this year to further understand the most dangerous factor in work environment affecting workers, the most urgent problems to be rectified, and work pressure as well as degree of work satisfaction, etc.

2. Prediction models of hazardous substancesin work environment and its control

Results from a study on the status of safety and health conditions in the work environment among workers in Taiwan, conducted by IOSH showed that workers believed that improvement was most needed on pollution of hazardous substances in the work environment. To lessen air pollution in the work environment, localized ventilation is most effective.However, with the complicated nature of airflow, effectiveness is greatly reduced by side stream and improper ventilation design. Emphasis of research lies in the development of control technologies for airborne hazardous substances in order to improve the work environment. Research conducted this year included: effect of hood flange on the capture performance, and influence of blocking materials on ventilation efficiency in work place.On the other hand, tuberculosis caused by silica in the work environment is the most frequently seen occupational disease in Taiwan. In order to understand the characteristics of free silica exposure at each specific business, we conducted investigations on exposure condition of

workers who repair boilers, and on characterization of solder flux fume frequently seen at electronic plants and its localized ventilation control.

3. Prevention of hazardous physical factor

Exposure to noisy work environment for an extended period may result in loss of hearing. According to a survey undertaken by IOSH on safety and health condition at work environment in Taiwan, noise is one of the problems that needed to be taken care of immediately.Hence, it is also essential that noise prevention and protection equipments to be emphasized. Research works mainly focused on: assessment technology for noise control at work place, development of identification technology for noise source, investigation on priority determination for noisy work places, and effectiveness analysis for noise insulation materials.Hearing protection project was also carried out so that user wearing noise protection equipment still can hear warning at work place. This division has completed establishment of an acoustic effect laboratory and a digital thermal exposure chamber. This division will continue collection of information pertained to heat and noise exposure work place, and improving hot and noisy work condition.Furthermore, we will survey background information regarding potential hazard caused by electromagnetic field, so as to understand occupational exposure situation of domestic workers.

4. Application of man-machine interface to hazard study

In the past, design of machine and work station is mainly based on production yield.IOSH has completed collection of anthropometric data and will use ergonomics to investigate anthropometry of domestic workers.Based on the results of evaluation of the past domestic ergonomic checklist, a guidebook of domestic ergonomic technology will be planned, and data regarding human surface area of current worker can also be obtained.

5. Control of occupational musculoskeletaldisorders

The worldwide occupational musculoskeletal disorders are becoming more serious in recent years. Research conducted this year emphasizes the design of sit-stand work chair for workers complaining sore lower limbs working at semiconductor plants, and investigation of slip resistant characteristics of shoe soleso the information obtained can serve as a reference for improvement of the design of shoe sole.On the other hand, to prevent those who have limb defectiveness from getting injured while operating computer work station, a study on man-machine interface was conducted to provide safe work places for them.In addition, a study was conducted to assess the pain and soreness of the upper limbs.

IV. Research on Occupational Medicine

Research on Occupational Medicine is related to the study of various occupational factors and health hazards, as well as the prevention of occupational diseases for the purpose of providing further protection and for promoting health of the workers. In accordance with

guidelines provided by IOSH, the responsibility of the Division of Occupational Medicine includes epidemiological study on occupational diseases, prevention of occupational diseases, health management, labor health promotion, and research on occupational psychology and physiology. Primary research orientation is focused on monitoring occupational diseases and analyzing health data, epidemiological study on occupational diseases, prevention of occupational diseases, labor health promotion, and occupational biological monitoring.Emphases of research are as follows:

1. Monitoring of occupational diseases and analyzing health data

The monitoring of occupational diseases and the analysis of health records are ways of understanding the occurrence of occupational diseases. Through joining efforts of a reporting system of occupational diseases and the collection of data from various channels (i.e. insurance data such as Labor or National Health Insurance), more accurate rate of occupational diseases may be documented, and more effective preventive methods for occupational diseases may be developed.

In fiscal year 2001, data have been collected for: compensation for labor and health insurance for both in- and outpatients, prevention of occupational diseases and health inspection, inpatient data from labor insurance due to occupational injuries and illnesses, health inspection for taxicab drivers, and death due to occupational injury.Based on these data, analysis of the indices is publicized periodically through the web site of the Institute for the public and the workers. In addition, these data will serve as a base for setting a monitoring system through the Internet.Based on these data, a diversified analysis and study can also be conducted to provide a basis for amendment of policies and laws, and to serve as a preliminary study for future epidemiological research.

An occupational monitoring system for multi-channel monitoring and controlling of: death due to occupational injury, occupational hearing loss, medical surveillance onacute occupational injuries in emergency rooms, occupational burn injuries, and occupational decompression sickness for compressed air workers has been established. A monitoring system for blood lead has also been developed. Recently, norms for workers' hearing threshold have been established too.

2. Survey on occupational diseases and occupational epidemiology research

Due to rapid industrial and commercial development in Taiwan in recent years, complex production technologies and various new chemical substances have continually been applied to the workplace. Workers are exposed to more and more complex working environment, leading to the emergence of various occupational diseases. Thus, the purposes of these researches lie in the surveying of occupational diseases to gain an understanding on the current situation of occupational diseases, establishing various epidemiological data on occupational diseases, studying hazardous factors derived from

epidemiology research to formulate measures to prevent occupational diseases, investigating and further fulfilling the needs for policies and regulatory requirements. In addition to chemical hazardous factors, research emphasis is also focused on new emerging occupational diseases and physical hazardous agents.

Research conducted this year focused on hazardous operations in restaurant business, aircraft maintenance workers, biotechnology industry, environmental hygiene business, semiconductor plant, ceramic industry, spray paint business, rayon plant, animal handler workers, business handling 1,3-butadiene, RCA employees, and coke oven workers in a steel plant. Research activities also included topics of new interests: pains due to musculoskeletal injuries, materials affecting central nerve system, and occupational cancers. Besides, this division also conducted statistic analysis of occupational injuries occurred in developed countries in the world and the result was compared with that of our country. Results of this study could serve as a good reference for those policy makers and for academic studies.

3. Research on Workers' Health Promotion

Not only does occupational hygiene concern with the prevention of occupational diseases and hazards, it is also involved in the active improvement of a healthy, safe, and comfortable working environment. The objectives of workers' health promotion include maintaining workers' physical fitness and productivity, developing human resources through work reassignment and improving the working environment, delaying the age at which workers retire, and appropriately introducing potential workers into the job market. This way, productivity may increase through hiring workers that are highly experienced as well as those who will stay on the job, and the health of the workers may be maintained through the prevention of occupational diseases and hazards and the promotion of and assessment of physical fitness in the work environment. Research interests included both mental and physical aspects: establishment of index and compensation guidelines for hearing loss related to labor safety and health regulations, establishment of evaluation tool for occupational counseling for those with physical or mental defectiveness, workers' health promotion: assistance plan for workplace health promotion, and comfort evaluation of hearing protectors: improvement technique.

4. Occupational Biological Monitoring

Hazardous substances enter the human body through various routes. Thus, there is a need to monitor the hazardous materials inside the human body through biological medicine technology to serve as workers' health hazard biological monitor index.Biomedical technologies are employed in epidemiological studies of hazardous factors and metabolic mechanism to achieve early detection and early prevention, and serve as a reference for permissible exposure limit.

Research activities centered on: a study of patch test and antibody measurement for

occupational dermatitis in spray painters, a study of patch test and antibody measurement for occupational dermatitis in spray painters, a study of the health effect about cardiac and neurolymphoid system on rayon workers, health hazard evaluation of coke oven workers in the steel factory, health hazard evaluation of coke oven workers in one steel factory, and comparison of OM physicians & nurses training programs among developed countries & ROC.

Research Results

I. Occupational Safety Research

The results of occupational safety research conducted in 2001 are as follows:

A. Mechanical Safety Research: focused on analyzing hazards posed by equipment, and developing monitoring devices.

Completed research on study of the safety interlock device of injection molding machines: improved effectiveness and reliability of the old safety door-locking device which tends to become malfunction.Set up a safety check list for the safety related parts as well as design of a simple inspection list for the safety system so that user can perform routine inspection on safety device of the injection mold.

Completed study on improvement of the locomotion platform for mobile crane training system: improved the proto-type walking platform and the worker receiving training can stroll around the platform 360 degree freely.Improvement focused on: (1) increasing stability of the double-layer track mechanism, (2) increasing smoothness of roller, (3) improving platform-supporting system, and (4) improving control technique for moving properties of motor. This new platform's movement can be controlled by the footstep of the operator to any direction regardless of moving forward or backward.

Completed study on design of automatic safety releasing device for tower crane: used wireless remote control system to adjust or release the material to be transported and can be evaluated by simulating with closed-to-real load situation so that the applicability of research result can be assured.Problems occurred during study have been corrected so that it can be used in construction site.

Completed study on improved design of safety coupling device for LPG pipelines for tank car. Continuing the study conducted in the past year, a safe connector for the flexible tubing on LPG tanker has been developed. The reliability of this connector has been tested for meeting the functional requirement.

Completed study on safety assessment of degrading pipelines: the cause and mechanism of its deterioration, and its remaining life were studied. A deterioration model describing the

growth of crack and the thinning of thickness was used for establishing an evaluation-software. User only needs to input basic operational information such as pipeline geometry, loading condition, environment condition, and pipeline material, the computer will show the residual life of pipeline and suggest the appropriate inspection time, etc.

Completed study on technique of non-open inspection codes in pressure vessel. The study offers an alternative for the open inspection code.Equipment for pressurized gases should be inspected first.Information on standards and systems used in other countries should be collected, to assist inspectors in understanding how information is managed in an enterprise internally to ensure equipment safety in the workplace. Government inspection agencies should set effective and feasible inspection standards.Inspections should focus on methods for implementing OSI, risk assessment, and determination of the remaining lifespan of the equipment. Private inspection agencies can be entrusted with the authority of document review and on-site inspection.

Completed study on development of a computer-aided calculation system for steam boilers: a computer-assisted calculation system with user-friendly interface design has been developed for regional labor inspectors. The system includes a material database, testing and calculations function, and a digital reference database.In order to assure data security, the system is equipped with a triple encryption security measure.

B. Chemical Safety Research:

Completed study on safety assessment for earth-covered tank in chemical process industry: investigated current safety situation of underground storage tanks of domestic chemical plants in oil refining and petrochemical industries. Technical guidelines issued by US, Germany and Japan were gathered and analyzed. As a result, a draft of a technical handbook showing methods of external and internal inspection, automatic inspection, inspection during operation, and routine inspection, etc. for underground storage tank was prepared.

Completed study on investigation of guideline of the explosion-proof tank, filter and material entering system. Investigated and prepared a guideline for electrostatic explosion prevention in domestic chemical processing plants so that electrostatic hazard, often occurred during material transfer, could be reduced to a minimum.

Completed study on fire of phosphine pipeline in semiconductor factories. Studied problems associated with fire explosion occurred at indium phosphide deposit process in semiconductor plant. Attempt has been made to remove the white phosphorus deposited on the machine so that it would not ignite and explode.

Completed study on hazard prevention at photoelectric plants:surveyed eighteen plants that manufacture photodiode and LCD device, and analyzed any existing potential hazard.We have proposed a hazard prevention strategy and also edited a guidebook for prevention of

safety and health hazard to be used as a reference for business sector.

Completed study on application of inherent safety to the design of chemical process. The purpose of this study was to understand how the concept of inherent safety was used in chemical process. In addition, method for obtaining the optimal design of inherent safety was investigated which will be then used as a reference for business sector.

C. Construction Safety Research:

Completed study on tunneling safety assessment and regulations suitability. To the existing domestic tunnel construction problem, we have investigated safety of tunnel construction and the appropriateness of the regulations from different points of view such as management, law, construction method and construction planning. Through drafting of a safety strategy, we developed hazard prevention technology for tunnel construction.Furthermore, recommendations for amending safety and health regulations concerning tunnel construction have also been made.

Completed study on construction shoring displacement monitoring and collapse prevention. Based on the current research results of mechanical behavior of construction scaffolding and with the aid of existing visual identification technology, a displacement monitoring system as well as a collapse alarm system for scaffolding assembly have been developed. This system can pin point the weak point of the scaffolding and make a correction immediately.It also can be used for alarming workers before collapse of scaffolding occurs (Figure 4).

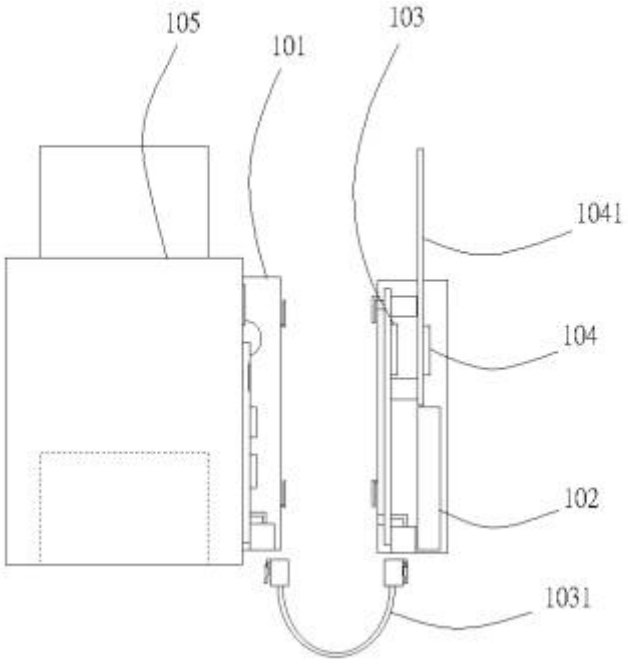


Fig. 4 The nondestructive detector for scaffolding testing developed by IOSH.

(The device uses wireless transfer module, which can be used repeatedly. It is rugged and its operation is easy and simple.)

Completed study on development of a computer-aided system of layout of framed scaffold. This research utilized CAD system and followed the guidelines such as scaffolding standard of CNS, construction safety and health installation standard, structural mechanics principles, and scaffolding position rules, for the development of this system. This system could perform analysis of scaffolding position and existing stress by following regulatory safety standards, and by taking into consideration of on site experience, and stress behavior. It could thus, provides the engineers with an accurate analytical result rapidly and accurately.

Completed study in world's safety code survey and techniques of steel assembling.Chapter 10 of construction safety and health facility standards of our country lists regulations concerning transport of steel by crane, things to be done by section manager on assembly and other related matters.However, these regulations were set up in 1994, since then the steel construction technology has advanced rapidly. Therefore, whether these regulations still fit for use needs to be reevaluated. We have surveyed new regulations concerning steel construction safety available worldwide and also visited many construction sites to find out problems existing in steel construction industry. This information will serve as a reference for preparation of needed standards and regulations for our country.

Completed study on the evaluation of current regulation about construction materials storage. Research focused on investigation of hazard that occurred at work place where piling up and storing of construction materials caused frequent injuries. A proper safety measure was drawn up, and recommendations to revise the related regulations were offered.In addition, a safety guideline for piling up and storing construction material was also prepared.

Completed study on the investigation of the current injury caused by construction equipment and research of the validity of relative regulations.Safety evaluation was conducted on construction equipment and installation, besides, injuries that may occur and the prevention strategy was studied. Recommendations were proposed on revising equipment standards for construction safety and health and on worker's safety and health. A survey on current status of the use of construction machinery in our country was done, and a construction machinery database was set up. This will serve as a reference for construction managers or workers so that worker's safety can be secured.

Completed study on the development of the non-destruction test techniques of the temporary structure. Research was mainly done on nondestructive sensing technology for large-scale formwork supporting system in construction industry."Standards for construction safety and health equipment" was proposed and a recommendation for revising regulations related to formwork support was offered. Analysis of loading effect for formwork supporting

structure was done. Real time monitoring was achieved through use of wireless transporting and receiving modules to give the stress of the formwork caused by operating loading. This unit is very durable, practicable, and is expected to be accepted widely. The stress sensor is extremely durable; each module can be used repeatedly and could thus easily bring the cost down.

D. Electrical Safety Research

Completed study on power-frequency EMI for preventing faults in factories: measurements of the magnetic fields and analyses of the EMI on equipment. Cases of interference from electromagnetic wave, and the extent of damages done to controlling equipments were gathered and analyzed.Based on the result, a correction measure was proposed. Distribution of magnetic field at work place was determined and we also used softwares such as FLUX3D and EMPT to analyze hazard done to controlling equipment by magnetic field interference. The purpose is to evaluate the effect of the extent of damages done to the controlling equipments. Finally, prevention measures were proposed.

Completed study on commercializing prototype design and test of the alarm device for warning mobile cranes from hitting the overhead power lines. Using the alarm device developed previously by IOSH as a base, we further modified its electrical circuit and added waterproof and shockproof characteristics to it so that it will meet commercialization requirement.We prepared 20 sets of this device, and we will hand them over to different organizations for test run to see if these devices need further improvement. The result can serve as a good reference for future technology transfer purpose.

Completed study on the electrical safety of low-voltage apparatus in the plants. We compiled electrical safety problems occurred at low-voltage installations in domestic industrial plants, and surveyed low-voltage apparatus safety regulations set up by developed countries. After comparison, an appropriate measure was proposed to correct existing safety problems.

E. Research into Functions of Personal Safety Protective Equipment

Completed study on design and manufacture of safety devices for concrete filling process inspectors. This device can be used by concrete filling process inspectors to protect them from getting injured as a result of the collapse of formworks. Designed especially for the construction sites, the portable safety device can withstand the impact of the collapse of formworks, and is easy to make, assemble and use.It also will not interfere with inspections of formworks.

F. Safety Management and Policy Research

Completed study on construction safety management technique. Since people are becoming more conscious of the importance of safety hygiene, every country has started setting up safety hygiene management system and occupational safety standards such as B8800 and

OHSAS18000.In our country, some manufacturing organizations have also started using related safety and hygiene management and certification systems. If we can establish a safety management system suitable for construction industry, we will be able to match the footsteps of the developed countries. Thus, there will be a regulatory system of safety management for construction industry and thereby this industry will have no problem matching the world trend of safety management.

Completed study on improvement of working place for the disabled. Aiming at improving the working place for the mentally disabled, each of the environmental hygiene and the restaurant business were selected for the study. Training program was started for educating some staffs that will be future trainer for field workers. A short course and a symposium were held each at the northern, central and southern districts of Taiwan to promote good workplace for the disabled. These activities had gained appreciative comments from both government and private organizations.

Completed study of promoting self-safety and health management effectiveness of manufacturing industry. A comparison of self-safety and health management effectiveness and related regulations of manufacturing industry among the developed countries and ROC was made.In addition, a revision of related regulations was also suggested.We also compiled !¢DThe guidebook for self safety and health management of manufacturing industry' to be used by business sector as a reference so that promotion of self-safety management can be accelerated.

Completed study on safety and health management mechanism for workers doing contract work from the large-scale enterprise.Injuries resulted from carrying out contract work for large-scale enterprise is common which are often closely related to interaction between human and environment. In consideration of both the ideal and practical situations, a correction measure was proposed.Since contract business is a kind of contract-linked diversified arrangement, the contents of the signed contract become critical. In this research, we have drawn up two examples of contracts so that domestic contract business organizations can use them as references.

Completed study on increasing safety and health management efficiency for manufacturing industry and its audit system. Assessment of safety and health management efficiency and an audit system was conducted by sending questionnaires to 807 domestic business organizations. The returned rate was 34.2%.In addition, we also visited 30 business organizations. Per results of the above work, and the gathered standards and guidelines of occupational safety and health management system, we have issued a guideline of audit system and the assessment of safety and health efficiency to be used by business organizations as references.

Besides conducting research projects, the Division of Occupational Safety had also performed the following activities in the year 2001: participated in the investigations into major occupational injury incidents in coordination with labor inspection agencies, assisted

enterprises in resolving occupational safety problems, held exchanges and collaboration with academic world in Taiwan and in other countries, and carried out space planning for the new research building.

II. Research on Method Development and Analysis

The abstracts of research carried out in 2001 on method development and analysis are as follows:

A. Chemical hazard exposure survey

Completed follow study on exposure assessment, health hazard assessment and control of 2-methoxy ethanol in copper laminate circuit board manufacturing industry. Results indicate that 40% workers had exposures over the regulatory standard, and 40% workers developed blood abnormality problems. The exposed workers showed higher methoxyacetic acid concentration in urine than those of the control group. After receiving our assistance, workers' exposures have been reduced to levels within limit, workers with blood abnormality problem have regained their health, and their methoxyacetic acid concentration has decreased significantly. We also assisted industries to set up their environmental monitoring programs, sampling strategies for follow-up exposure assessment.

Completed study on exposure assessment for highway toll station workers exposed to polycyclic aromatic hydrocarbons (PAHs). To obtain information on field PAH exposure, we had conducted a monitoring program involving 50 toll station workers at Taishan station where it has the highest vehicle flow in Taiwan. The vehicle flow rate and the lane information were recorded, and the composition and the ratio of gas to aerosol PAH were investigated. Result shows that exposure differs in accordance with the vehicle flow rate, types of vehicle, and work shifts.Nevertheless, none exceeded allowable limit, and result also showed that PAH exposure is closely related to l-OH-pyrene in urine.

Completed study on occupational exposure to organic solvents during paint stripping and paint spraying operations in the aeronautical industry.While workers were performing paint stripping work on aircrafts of Boeing 747 and Airbus A300, samples were taken and analyzed according to our CLA1210 and NIOSH 2546 of US. Result indicates that dichloromethane concentrations in air were 2-140 ppm and phenol concentrations were 0.1-2 ppm.On the other hand, while spray-painting a Boeing 747, styrene, acetone, methyl isobutyl ketone (MIBK), toluene, xylene, and n-butyl acetate were found in air. Styrene concentration was the highest ranging from 10 to 50 ppm. This environment should be improved or the workers need to wear appropriate personal protection equipments.

Completed study on analysis of contents of various crystallized free silica in molding sand. In the past, we have conducted raw material analysis for the industry used or produce silica in order to understand silica content. Result indicates that besides quartz which exists in the original raw material, and the molding sand contains some different types of free silica

probably due to heating during processing. In this year, a larger scale sampling and analysis plan was carried out to figure out concentration of each type of crystalline silica. Result reveals that only a few samples contain free silica with a quantity less than 10%.

Completed study on survey of formaldehyde exposure and ventilation system performance in an anatomical laboratory.Good results of lowering formaldehyde exposure were achieved by providing perpendicular laminar flow and installing a localized ventilation system. Patent application of the "Ventilation equipment for dissecting area" was submitted while this installation is open to universities and colleges for use without charge.

B. Development of sampling and analysis methods for hazardous substances in the work environment

Completed study on establishing analytical methods for pesticide regulated by labor acts (III): pyrethrum pesticides analysis and workplace carbamate pesticides survey. The purpose of this research is to set up a method for pesticide exposure analysis, and a regulatory standard.Pesticides produced and used in our country were sorted according to quantity used and their toxicity, hence, a priority was set up for conducting assessment. In past 3 years, assessment of pesticide exposure by field and pesticide production plant workers was completed and a set of analysis standard was proposed for use as a reference for occupational safety control. The carbamate exposure on pesticide plant workers was evaluated by using a validated air sampling adsorption tube and by patches on the clothes of workers.Survey of 24 workers from five carbamate manufacturing plants has been completed. Result indicates that except six workers who showed higher inhalation exposure probably due to failure of the automatic packing system, the exposure of the rest of workers were less than PEL, which were within safe range.

Completed study on development of sampling analysis method for multi-component solvent mixture in water-based construction paints. A sampling and analytical method of eight different organic solvents that are frequently used by water-soluble paint manufacturer was established.CLA has not established the PEL or assay method for propylene glycol monomethyl ether acetate, however, this chemical has been widely used by paint manufacturers and semiconductor plants. This research provides analytical method for CLA and other related organizations or laboratories.

Completed study on investigation of suitable analytical conditions for common industrial mixed organic hazards. Separation conditions for 36 organic materials using DB-1 column were established.Ethyl benzene and *p* -xylene can be completely separated by changing carrier gas from nitrogen to helium. DB-5 can also be used for separation of these two chemicals except that *m* - and *p* -xylene would overlap. Therefore, DB-1 or HP-innowax would be of better choice considering that the above mentioned chemicals frequently coexist in the samples. For selection of column, DB-1 was selected for esters, ethers, and chloromethane, HP-innowax for hydrocarbons such as benzene, toluene, and xylene. HP-

innowax is also good for analyzing ketones and alcohols.

Completed study on evaluation of air monitoring methods for nitrous oxide used as anesthetic in medical installations and hospital workers may expose to laughing gas (nitrous oxide). Literature survey reveals that nitrous oxide causes miscarriage and retards mental development. This research involved in screening of appropriate gas adsorbents, and the result indicates that the molecular sieve 5A is the best adsorbent for nitrous oxide. A calibration curve was obtained by using a Miran 1B IR-spectrophotometer with a closed circuit type calibration. Therefore, it is recommended that IR-spectrophotometer to be used for the assay of this gas. This research has completed establishment of the preliminary IR assay method for nitrous oxide.

C. Development and evaluation of the performance of samplers and sampling media

Completed study on the simultaneous personal sampling technology of hazardous TDI vapor and aerosol in the workplace.Currently, there are two vapor and aerosol separating and sampling methods for TDI, the double-filter-paper method and the circular gas-solid separation method. The problem associated with the former method is that the preliminary Teflon filter paper will absorb TDI gas which results in overmeasure of aerosol concentration, whereas the disadvantage of the latter method is that it is too bulky thus unsuitable for use as a personal sampler. Hence, this research has developed a new sampler containing three layers of filter papers. Through model estimation, the problems mentioned above were overcome. Results indicated that the new method improved the sampling deviation the traditional methods have.By connecting this new sampler to a multi-stage impinge containing glass fiber filter, it can perform size distribution sampling for aerosols.

Completed study on particulate sampling method in workplace. There are reports indicating that number of aerosol is more strongly related to occupational disease than the mass of aerosol. Therefore, it would be more appropriate to use aerosol number than to use the mass as exposure indication.On the other hand, the deposit distribution is more or less determined by its size in respiratory tract.It is necessary to develop a size distribution sampler so that the health effect of submicron particulate on health can be accurately evaluated. This research selected the particulate deposit curve for light worker defined by International Radiation Protection Committee, as the principle target curve. The width of the aerosol penetration curve will be affected by packing density of the foam rubber, fiber diameter, and the surface air velocity. Through adjustment of these variables, a better fit could be obtained.

Completed study on adsorption and desorption dynamics for the sampling media of hazardous air contaminants. This research identified physical properties of eleven sampling media, such as pore size distribution, specific surface area, or pore property. In addition, we determined the adsorption isotherm curve of target material on the media, determined the parameters and the sampling conditions of adsorption theory, in an attempt to develop new

sampling media. Result revealed that the properties of commercial media were much of a confusion and is difficult to come out with an objective standard. On the other hand, the limiting factor of silicone should be taken into consideration. As the inner pore size of the molecular sieve is smaller and more uniform, the diffusion rate becomes the determining factor for adsorption by molecular sieve, and the adsorption capacity is only 8% that of activated charcoal. It is hoped that the optimal sampling conditions could be established, thermal desorption method could be developed, and evaluation of sampling behavior of different sampling media could be completed.

D. Development of occupational biological monitoring methods:

Completed study on method development for the biological monitoring of acrylonitrile exposure. ACGIH has placed acrylonitrile in the high priority list that requires biological monitoring. To protect worker's health, this research established a biological monitoring method for workers exposed to acrylonitrile.

Completed study on survey of dioxins exposure of contract workers for incinerator maintenance in Taipei City. We have sampled 41 blood samples from workers who performed annual cleaning of the three incinerators located in Mucha, Neihu, and in Peitou and analyzed for the dioxin concentration, and the biochemical and immunological abnormalities.We also sent questionnaire to these workers to obtain exposure related factors such as their basic information on health, eating and working activities. Results reveal that no statistical difference was seen before and after cleaning.However, their dioxin concentrations were rather high in comparison with neighboring residents. In addition, these workers are likely to have higher degree of endocrine or immune problem compared to the control group.

Completed study on fast electrochemical analysis of lead ions in blood. An effective method was developed for lead detection by using a mercury membrane in combination with the cathode stripping voltammetry method. This research utilized a mercury membrane preoxidized screen printing carbon electrode (HgSPE) to increase the detection sensibility. Under optimal experimental condition, HgSPE showed two linear regions: 1-15 ppb and 15-100 ppb, and the detection limit (S/N=3) was 0.11 ppb. Finally, this method proved to be successful in analyzing Pb 2+ content in pig blood.

E. Development of real-time monitoring methods for gaseous substance

Completed study on development of a continuous personal monitor with time-activity-pattern recorder. This recorder has successfully combined IR location identifying device, chemical sensor, and electronic control system, and developed a new personal exposure evaluation system.It is portable and can precisely determine the location of workers, their type of work, and the amounts of exposure. This recorder utilized two sets of eight rechargeable nickel-metal hydride batteries and can last for 13 hrs. The emitted IR ray can reach 15 m with a diameter as large as 2 m. Laboratory verification indicates that this system can detect IR

coding within one second with 99.8 % accuracy. Results showed that this instrument is suitable for determination of activity patterns at work place and can replace manual observation method. This research has completed assembling of six sets of electric time activity recorders and personal exposure samplers as well as the operation manual.

F. Others

Completed study on the occupational safety and health consultation programs of Taiwan and other industrialized countries. This research dealt with concrete planning of the consultation system for labor safety and hygiene for the purpose of reducing occupational injuries. Research result brought forward two suggestions: (1) to address thoughts and feelings on consultation system for labor safety and hygiene system of other countries and to make plan for domestic consultation system for labor safety and hygiene, (2) to make the short term and the long term plans for consultation work with the priority be given to the construction industry. Conclusion was drawn for works done on system planning for workers need consultation, timing, scope of business, source of fund and performance evaluation.

Completed study on implementation of information management system for industrial hygiene accredited laboratories. The objective of this research is to establish a Laboratory Information Management System (LIMS). Analytical information from lab sample to be validated is processed by a computer data management system instead of using the current manual input method. This automated management system can effectively reduce clerical work, and save on human resource.Besides, it can provide on-line data calculation and automated data checking which can reduce errors and improve laboratory quality.

Section 3 Occupational Hygiene Research

The results of occupational hygiene research and its applications in 2001 are as follows:

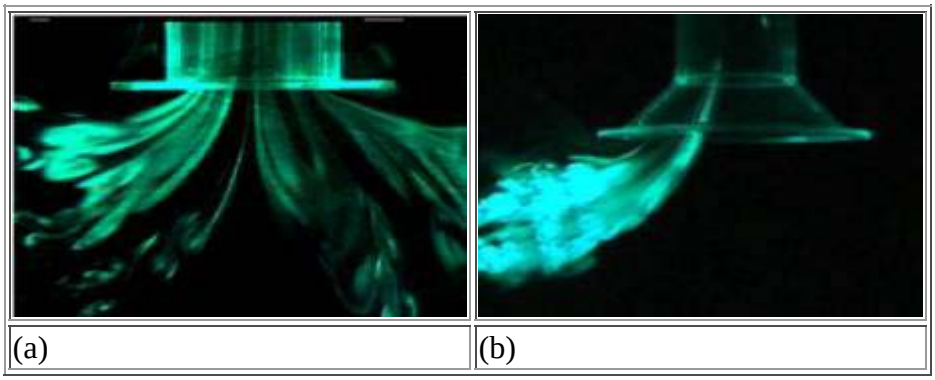
A. Survey of occupational biological hazard exposure

Completed studies on "A Study on the Development of Air Sampling & Strand Displacement Amplification Analysis of *Mycobacterium tuberculosis* in a Health-Care Facility", "A Study of Biohazards in Microbial Biotechnology Industry", "Survey of Employees' Perceptions of Safety and Health in the Work Environment in 2001, Taiwan", and "Survey for Workers Exposed to Free Silica in Furnace Maintaining". These researches investigated activity of domestic microbial industry, type of microorganism, type of product, and current situation of biological hazard prevention.We have collected 17272 questionnaires with a return rate of 82.0%. The information was tabulated into 159 tables covering physical examination, educational training, hazard awareness, physical condition, work pressure, and work satisfaction. These data can be used for evaluation of occupational biological hazard, establishment of assessment method for environmental exposure, prevention of occupational blood or body fluid infection, survey of potential occupational biological hazard in biotechnological firm and its management system, understanding the trend of worker's

awareness of safety and hygiene.

B. Studies on prediction models of hazardous substances in the work environment and its control

Completed studies on: "The Effect of a Hood Flange on the Capture Performance", "Investigation of the Solder Flux Fume Control Systems in Electronic Application", "Effect of Interceptors to the Ventilation System of Industrial Workplace", "The Simulation of Aerosol Deposition by Thermophersis in the Tail Gas Duct (II)", and "Establishment and Evaluation a Testing System for the Study of Filters Performance". Results indicate that the width of flange has a greater effect on capture zone at the place that is near the flange. The effect is not that significant at the center or at the upper stream of sidestream. Once the width of flange reached a critical value, it will no longer affect the size of capture zone (Figure 5-a). Method for eliminating sidestream's effect and the physical mechanism were also investigated (Figure 5-b).Installation of an appropriate designed baffle can give a good result. We have also investigated: hood principle at high flow rate / low wind velocity, designed experimental method and equipment, established efficiency evaluation method and used this method to assess the collection efficiency of hoods with different angles and heights. Through survey of engineering and protection methods, especially those related to ventilation and protection equipments, we studied the way to actually put this method and the protection equipment into use in specific work environment so as to reduce injuries due to exposure to hazardous materials. We also finished work on assembly of experimental module for "low wind velocity simulation environment" which can simulate the low flow rate of sidestream, frequently seen at work place. It also can be used to support experiments such as testing of characteristics of sampling device.In order to let the public understand the function and characteristics of this localized ventilation equipment, we have installed and exhibited the "local ventilation training equipment with variable wind flow adjustment"(Figure 6), together with the laser airstream photographs and conference activities, the public should have been deeply impressed.



(a) (b)

Fig.5 (a) gas collection by flanged hood (b) Effect of sidestream on collection by conical hood

Fig.6 Local ventilation training equipment with variable wind flow adjustment

C. Prevention of hazardous physical factor

Completed studies on: "The Development of Thermal Hazard Control Technique (I): The Establishment of Thermal Exposure Chamber and Thermal Insulating Clothes Testing Criteria", "The Survey of Electrical Magnetic Field Exposure in Occupational Environment", "The Effect of Hearing Protectors on the Perception of Warning Sound", and "A Pilot Study on Noise Sources Contribution in the Workplace". A digital thermal exposure chamber lab was set up in IOSH.We have collected worldwide information related to test method for thermal insulating clothes, and performed 300 tests on electromagnetic field of work environment. The result was then compared to those of other countries.In addition, investigation was done on worker's noise exposure and the degree of effect of these noise sources. The purpose of this research is to prevent these physical hazardous factors such as high temperature, intensive noise and electromagnetic field, from injuring workers.On the other hand, alarm sound of different frequencies was tested in combination with investigation of sound insulation property of protective clothes. The result obtained could be incorporated in the guidebook of hearing protection plan.

D. Ergonomic application and hazard control technologies

Completed studies on: "Investigation & Improvement of Slip Resistant Characteristic of Shoe Sole Used in Clean Room","Research on Local Ergonomic Guide", "The Study of Job Analysis Methods for Ergonomic Intervention", and"Selection of Computer-related Assistive Device for the Skeletal Impairment". A Pilot Study on Noise Sources Contribution in the Workplace "Guide to local ergonomics", "Ergonomic evaluation method improvement of work place", and "Selection of assistive device for the handicapped working on computer assignment". Research result revealed that the friction coefficient of the boots type shoe covering with a soft sole or the disposable shoe covering was too low, hence, use of these shoe coverings should be avoided.It is suggested that sole of rubber material be used in this

kind of workplace to raise the friction coefficient.On the other hand, the preliminary report of "Guide to local ergonomics" has been completed and examined. This report could be used as a reference by many business organizations for setting up their prevention plans for ergonomic musculoskeletal injury. We also wrote a computer program for evaluation of selection of assistive device for the handicapped working on computer assignment, which can help the handicapped find a job.Current research is trying to set up a concept that put human being as the main concern as far as mechanical design and work station arrangement are concerned. We are also trying to establish a simplified evaluation method for work place hazards, and a work place ergonomic improvement guidebook.

E. Control technologies for occupational musculo-skeletal disorders

Completed studies on: "A study of Musculoskeletal Disorders in Clean Room: Sit-Stand Work Chairs", and "Checklists for MSDs Risk Factors - Simple Measurements (I)". This dual purpose chair is now on trial evaluation at a large semiconductor firm. This firm is highly interested in having this chair and they firmly believe that it can reduce fatigue and pain at lower limb.On the other hand, we had set up a check list for the hazardous factors causing neck and shoulder pain which can be used by office workers to evaluate these hazardous factors. Through use and data analysis of the information regarding occupational musculo-skeletal injury and application of biomechanics principles, we are able to supply information for improvement of ergonomic safety and hygiene.

Fig.7 Sit-stand dual purpose chair for use in semiconductor clean room

Section 4 Occupational Medicine Research

The abstracts of occupational medicine research in 2001 are as follows:

A. Surveillance and analysis of occupational injury, disease and health data

Completed study on "Strategy for Surveillance of Risk Factors of Occupational Injuries: Study of Multiple-Mechanism Surveillance System (II)". Conference was held to determine and identify death due to occupational injury with multiple-channel surveillance system.Using this new definition, the data of 1079 cases gathered last year were reanalyzed. Result indicates that 976 cases matched the new definition. In addition, we have established five new information collection channels, namely Police Administration, Ministry of Interior Affairs; Research Institute of Forensic Medicine, Ministry of Justice; Department of Health, Executive Yuan; Ministry of National Defense; and udndata.com databank. Governmental discussion meetings were also held at Taipei and Taiwan cities.Other activities include visiting county and city halls of Taipei and Kaohsiung to ask for opinions and to establish interaction model. After all these activities were done, we would like to see establishment of routine multi-channel occupational death monitoring system, get into the new on-the-spot information gathering channel (including death certificate, ll9 vehicle dispatch slip, accident report from traffic police, emergency room of hospital), make law to plug the loophole in occupational death reporting system, and routinely publish statistical data for safety promotion.

Completed study on "Analysis of Data from the Surveillance of Noise-induced Hearing Loss". A database for occupational hearing impairment is established as a reference for the development of hearing conservation programs. Included in the database are audiograms of 17,825 workers reported in 2000. Results showed that hearing ability decreases with age.Males show significantly greater hearing loss than females. 17.3% male workers and 18.8% female workers have speech frequency hearing loss (hearing threshold greater than 25 dB), and extent of hearing loss increases with increased length of working time. The percentage of workers with abnormal hearing ability is the highest among furniture manufacturing, transport service, metal product manufacturing, transportation equipment manufacturing and maintenance, and metal industries. Recommendations for hearing conservation programs have been developed.

Completed study on "Female Occupational Disease Analysis from Labor Insurance Database".Based on the information from Labor Insurance and from Health Insurance, the related indexes for the female insured (over three millions people) such as fertility condition, disability payment, hysterectomy frequency, difference in out-patient number between male and female patients, natural miscarriage and abortion occurrence rates and frequency, mastectomy and hysterectomy operations, etc. were investigated. Through analysis of such a large number of health insurance information, the health condition and the state of occupation related sickness or disorder could thus be understood.

Completed study on "Analysis of Health Examinations from Labor Insurance Database". About two hundred and fifty thousand health examination files have been analyzed

according to age, sex, years of employment, occupational history, medical history and special examination items. This information was used to construct the "Special health examination database of Taiwan district" which is used for study of characteristics of the employer and the insured, and to statistically analyze the specific health examination information and related factors. To those insured showing high abnormality on their health examination record, an investigation and guidance will be carried out.

Completed study on "Announcement and Monitoring System for Worker's Blood Lead Value".Variation of blood lead values of workers was monitored and those who have high lead values were closely followed in an attempt to understand the cause of this abnormality.Currently workers lead value are all below 10 ¢Ggg/dL, those with high blood lead values (higher than 40 ¢Ggg/dL for males; higher than 30 ¢Ggg/dL for females) are less than 5%.

B. Occupational disease studies and occupational epidemiology

Completed study on "Pulmonary-related Diseases in Restaurant Workers".81 restaurant employees were selected for this study with 186 community people and 214 taxi drivers served as control group. After sending questionnaire regarding social economic situation and livelihood, gathering phlegm samples, it is found that as a whole, restaurant workers are healthier than community people or taxi drivers. This phenomenon probably due to routine labor health examination those restaurant workers must take, especially the chest X-ray check up is a must in labor health examination.Further investigation according to job function reveals that 16.7% of chefs or cooks have calcification in their lungs, which need serious attention. On the other hand, a number of chefs or cooks developed metaplasia from sputum examination, followed by the outfield people and the restaurant employees showed the least numbers that were affected.It can be seen that those who constantly exposed to oil smoke and who are heavy smokers would have higher chance to get into this problem. On the other hand, those rarely exposed to oil smoke but were always surrounded by secondhand smoking would have similar trouble too. The result of this survey clearly indicates that the lungs of chefs or cooks do need close attention.

Completed study on "The Occupational Health Effects among Aircraft Maintenance Workers". Aircraft maintenance workers of the three big airlines in our country were selected for study with questionnaire in order to gather information about their work history, medical history, current occupation, environmental and housing condition and other related factors. Health effect was evaluated by conducting questionnaire and using the health examination record.Multiple Logistic Regression method was used for investigation of the effect of occupational exposure of the aircraft maintenance worker on health condition. In addition, Generalized Linear Models were used to analyze the relationship among factors such as age, years of work, living condition or work environment, medical history, and hearing impairment. After the interference factors such as worker's age, medical history, physical or chemical hazard in living environment were fully studied and in control, it clearly showed that noise occupational hazard of aircraft workers did exist.Low frequency hearing impairment is

associated with workers in noisy work place whereas high frequency hearing impairment is proportional to length of work. Work of hearing protection measure and noise prevention plan should be continued so that safety and hygiene of workers can be assured.

Completed study on "Occupational Hazard Assessment in Biotechnology Industries".Biotech business is of high risk, high added value, but requires high technology and high R&D cost, and its employees could be exposed to unusual risk factors from chemical, physical, ergonomic, and biological agents.Considering the uniqueness of health protection requirement, hazard prevention of workers in biotech firms should not be neglected.We conducted questionnaire interviews by telephone and site visit of biotechnology industries.Data collected including product content, traditional safety and hygiene evaluation, health protection plans, safety in handling organism and microorganism, safety and hygiene in animal test, and protection and hygiene in chemical process. In addition, we are in collaboration with a pharmaceutical firm and had tested a yeast estrogen screening method. Ten male workers who have been in contact with this hormone were screened and tested. Additional cooperation with this firm will be necessary to continue this investigation.

Completed study on The Health Effects on Chromosome Aberration Micronuclei among Workers due to Long-Term Exposure to 1,3-Butadiene (III)". Sixteen butadiene (BD) pipeline maintenance workers, fourteen tank cleaners, and two filter cleaners from a petrochemical company and an ABS company, were target of this investigation. Additional twenty-five unexposed workers were selected as control group. Study proves that exposure to BD due to pipeline maintenance, and tank and filter cleanings results in higher rates of chromosomal abnormality and micronuclei change indicating gene damage might occur. With low level BD exposure, chromosomal abnormality and micronuclei change were more significant than the crossing-over rate of sister chromatids (last year).It is possible that the sensitivity would be high if chromosomal abnormality and micronuclei changes are used as early health index against BD exposure.Since workers who performed annual tank cleaning and thus exposed to BD showed higher rates of chromosomal abnormality and micronuclei change, it is suggested that they wear respiratory protection equipment or other protection measure so that their healths could be assured.

Completed study on "An Epidemiological Study on Health Outcome among Former RCA Employees (III) epidemiological study on health outcome among former RCA employees (III)". The cancer registration data file of the Department of health, and the cancer registration data file of Taiwan district during 1979-1997 were used for the calculation of standard occurrence rate. The female employees of the Far East and the Hsin Kuang textile companies and the Philip electronic company were used to calculate SIR due to cancer. It is found that the breast cancer SIR=1.18 (95% confidence limit: 0.98-1.41) for those female workers who have been with RCA for at least 6 months, whereas SIR=1.36 (95% confidence limit: 0.93-1.90) for age 35-39 female workers, and SIR=1.41 (95% confidence limit: 0.93-2.05) for age 40-44 female workers.Statistically these values are of ascending critical point.Medical case comparison study utilized two reference groups; one was RDA female

employee without cancer while the other was community female without cancer, with age over 30 and were picked from random sampling. Each medical case selected two persons from RCA reference and four persons from community reference.We visited a total of 73 breast cancer cases with 112 RCA references and 281 community references. After using multiple logistic regressional analyses, it was found that more patients developed menopause before age 45. The prevalence odds ratio was 3.91 (95% confidence limit: 1.51-10.1) for RCA reference group, while it was 5.78 (95% confidence limit: 1.48-22.2) for community reference group. These data show that the difference is statistically significant whereas the other variable items do not show significant difference after performing the same regressional analysis. Since the sample numbers are still considered as insufficient, it is doubtful whether RCA female employees have higher trend of getting breast cancer or whether they tend to have breast cancer while they were still young. Further studies need to be conducted to clear up these questions. Other questions such as effect of exposure to organic solvent at work place on menopause age or on endocrine imbalance can only be answered through further studies.

Completed study on "Taxi Driver's Health Study the Second-Phase Data Management". From the data of 1260 drivers who participated in "occupation safety survey of taxi drivers in Taipei" in year 2000, we selected 1242 drivers having legible questionnaires and their files. Applying multiple variate regressional analysis, we reanalyzed the data file containing record showing relationship between lower back pain and driving hours, and also estimated the prevalence odds ratio (POR) of lower back pain with relation to driving hours. Result indicats that it is statistically related (p=0.027). After adjustment done on age, sex, level of education, income, smoking and drinking habit, years of driving, days of driving per month, frequency of lifting heavy matters, activity involved in waist bending and twisting, activities after work, work pressure, in comparison with the drivers who drive less than or equal to 6 hours per day, those drivers having over 6 hours driving per day would have a lower back pain POR =1.49 (95% confidence limit: 1.02-2.18).

Completed study on "Analysis of Occupational Injury Statistics from Various Nations (III)". Statistical data and system regarding occupational injury were gathered from developed countries including US, England, Japan, Germany, Australia, and Canada, and those countries such as Singapore and Hong kong which are economically equivalent to our country.By comparison, it is found that the number of medical cases in our country is much less than that of other countries, indicating the importance of establishing the proper reporting and announcing system.However, it is rather complex, and improvements need to be done on: capability of medical treatment organization, training of medical personnel working in occupational illness field, establishing many more outpatient service center, establish occupational illness appraisal standard, and raising the amount of occupational illness compensation.

C. Occupational health promotion research

Completed study on "Labor Health Promotion: Assistance Plan for Business Health

Promotion". We have integrated experts from different fields into forming a "Health promotion counseling committee for business circles", and conducted counseling and assistance to eight selected organizations to promote their employee's health. Assistance provided includes: draw up a guidance plan, assist practice assessment, personnel training, and help editing teaching materials. In addition, we also edited worker's physical training materials including physical fitness guide book, exercise video, occupational stress reducing exercise, shoulder and back stretching exercise, and occupational health passport, so that business organizations could have enough health training materials.We also held a symposium to disclose our research achievement on workplace health promotion. This could serve as a reference for making future project improvement.

Completed study on "Index and Compensation Guidelines for Hearing Loss on Related to Laborer Safety and Health Regulations".We conducted tests on 17 workers aged 50 or less who been exposed to noisy environment and had developed hearing impairment. Tests conducted include: threshold value of hearing, middle eardrum graph, reflective threshold of auditory ossicles, threshold of hearing, the test of SPIV (speech perception in noise), sound test with noisy background, filling table of communication quantity, and constructive interview.We have established worker's hearing impairment index so that government can use it to set up related standards.We have also used this newly constructed hearing impairment index to evaluate the characteristics of hearing impairment in three different fields of business organization.

Completed study on "Development of a Vocational Evaluation Instrument for People with Hearing Impairment".Using "Job classification gist" and "Detailed guide to job search" developed and issued by US, and "Special issue of job information" compiled by Job Training Bureau, CLA, as the main reference materials, we developed an evaluation method for job counseling for the handicapped with hearing problem. A survey of 192 different jobs suitable for the handicapped with hearing problem was conducted by analyzing specific job property including data, human being, implements, learning ability, job aptitude, interest, physiological and physical demand, job disposition, and organization and job sketch. The analyzed data were then computerized into database. The user needs only to key in the vocational evaluation score, the right job name then the content description will appear immediately.

Completed study on "Comfort Evaluation of Hearing Protectors (II): Technique of Improvement". Investigation was conducted to establish evaluation indices and equipments for comfort of hearing protectors. Once the indices and equipments are set up, study will be conducted toward improvement of comfort of hearing protectors. We have focused on some ways to improve the comfort of hearing protectors.

Completed study on "Health Assessment of Housekeeping Service Industry Labor". The physiological fatigue and nutritional condition was evaluated by collecting questionnaires regarding fundamental data, medical history, self-described symptom, eating or drinking habit and its frequency, working environment observation, and physiological fatigue testing

at the scene. The data were then statistically analyzed with results showing: worker's fundamental data, exercise habit, individual health condition (such as: analysis of medical history, work injuries occurred within one year, the region where habitual skeletal pain develops, illness resembling carpal tunnel syndrome occurred within one year), type of material that employees would frequently be in touch with, occurrence of eye or nose illness and the use of protection equipment, survey result of fatigue symptom, analysis of fatigue classification and evaluation of work pressure, worker's physiological reaction analysis, evaluation of nutrition related knowledge, assessment of eating and drinking habit, and assessment of work pressure and mental or physical health condition.

Completed study on "Assessment of Female Fertility among Semiconductor Workers". A total of 1046 female workers (804 are working in clean rooms while 242 are not) were analyzed. Result indicates that those working in clean rooms have high percentage of menstruation abnormality. The most prominent effect is causing abnormal length of menstrual period and it showed a POR of 1.65 (95%CI=1.10-2.48), which is statistically significant. Judging from type of work, workers at the etching area have the most serious problem, as the physiological symptom prior to menstruation showed a POR of 6.33 (95%CI=1.21-33.29) which means hazard effect is very clear.In short, the female workers working in clean room showed high percentage of menstruation abnormality compared to those not working in clean room. This is a serious problem that needs our immediate attention to find out the hazardous factor and thus protecting female workers' health.

Completed study on "The Study of Health Effect among Ceramics Manufacturing Workers". Through questionnaire and environmental survey on six different types of ceramic industries (ceramic raw materials, construction use ceramics, industrial ceramics, daily use ceramics, ceramic tiles, and artistic ceramics), information such as: individual work history, financial situation, medial history, health condition, job situation, and habit was gathered. In addition, worker's health examination information was also collected in an attempt to understand the prevalence of respiratory system illness of workers in ceramic industries, and to know the relationship between occupation exposure and respiratory system illness.It is also worth mentioning that calcinations is one of the processes in ceramics manufacturing which requires workers to be exposed to high temperature environment. This research was also conducted by putting workers in a thermal exposure chamber, and by using a treadmill to simulate light, medium and heavy workload. The excreted sweat was collected and analyzed for its composition. The loss of copper and zinc through perspiration can serve as a reference for improving work environment and for health promotion.

D. Occupational biomedical monitoring

Completed study on "A Study of Patch Test and Antibody Measurement for Occupational Dermatitis in Spray Painters".Questionnaires were given to 94 exposed and 20 unexposed workers and result indicates that from the 91 effective questionnaires, 18.7% (17/91) of workers had skin allergy which is work related; 16.0% and 23.0% of workers developed respiratory track allergy and eye allergy, respectively, which are work related. The four

allergens identified are: Me-isothiazolinone/Me-Cl- isothiazolnone, diehyleneglycol diacrylate, nickel sulfate hexahydrate!F4,4-Diaminodiphenylmethane. In the control group, 5 persons showed no response to patch test whereas the rest 15 people only 3 reacted to goldsodium thiosulfate. The patch reaction of allergens showed no significant relationship with serum reaction, nevertheless, those showed skin allergy are apt to develop positive reaction in patch test as its P is less than 0.001(r=0.049). Those showed respiratory tract allergy are apt to develop positive serum IgG1 reaction as its P is less than 0.001 (r=0.803). As a whole, eye allergy is the most common allergy occurred in spray painters and applying patch is the best method for skin allergy test whereas serum IgG1 test works best for respiratory tract allergy.

Completed study on "A Survey of Asthmatic Diseases on Animal Handler Workers (I): Domestic Animal Feeder". We visited and collected questionnaires from 160 animal farm workers in central region of Taiwan.We also conducted the allergen test and the serum immuno-electrophoresis analysis on animal saliva and blood. Results indicate that over 20% of workers developed respiratory track allergy which is work related. This is far greater than the rate of eye or skin allergy development. Allergen test reveals that more workers developed positive reaction toward two allergens: pork and milk. Result of immuno-electrophoresis analysis shows that over 25% of workers had immunoglobulin E reaction toward saliva of pig. The results demonstrate that respiratory tract allergy of workers working in animal farm is associated with protein of animal saliva or blood.

Completed study on "A Study of the Health Effect about Cardiac and Neurolymphoid System on Rayon Workers". The basic information of worker's exposure to carbon disulfide, health examination, and exposure index information were established to draw people's attention toward workplace of rayon plant workers and their health conditions and to provide information for work-related disease prevention. Quantitative analysis revealed that content of bonded material in high exposure group was higher than those in low exposure group indicating that the bonded material, ¢G\, ¢G]-heterodimer of spectrin may serve as a bio-index for middle or long term carbon disulfide exposure.

Completed study on "Comparison of OM Physicians & Nurses Training Programs among Developed Countries & ROC".Surveillance on the latest information of training system for the medical specialists and nursing staff were conducted so that this information can serve as the basic reference for revising our training system. Result of this study suggests that the basic and occupational training of physicians and nursing staff should be strengthened.In addition, the monitoring system for occupational system should also be performed.

Completed study on "Health Hazard Evaluation of Coke Oven Workers in one Steel Factory". The effect of exposure to the discharge of coke oven on worker's liver, lung, and immunological functions was investigated. In addition, the influence of some metabolic genes such as CYPIA1and GST on liver malfunction was also studied.People used in this study are factory workers and administrators from a coking plant of a large steel company in the southern area of Taiwan. Their basic information such as age, sex, height, and weight

were collected and questionnaires were sent to them in an attempt to gather their job title, medical history, career history, frequency of protection equipment use (especially the frequency of poisonous gas filtration can use) and smoking and drinking histories. Determination of work environment, sampling of worker's blood and urine, checking of B type hepatitis surface antigen and C type hepatitis antibody, and testing of liver function (SGOT and SGPT) were all performed. Besides, we also performed DNA extraction from blood and analyzed polymorphism, and determined kidney function. As a result, the health conditions of workers at coke oven were compiled and those workers who are more susceptible to the discharge from the oven can be identified and confirmed by this method.Consequently, the research result can serve as a good reference for the setup of health management system by plant managers.

RELATED ACTIVITIES

I. Academic Activities

Academic activities are primarily focused on presentations of research results, and carry out local and foreign academic exchanges.For the fiscal year 2001, IOSH sponsored or jointly sponsored 11 academic conferences; presented 26 journal papers in local publications, 16 journal papers in foreign periodicals, 45 papers at local academic conferences and 12 papers at foreign academic conferences. In addition, 4 research projects received local or foreign research awards.

1. Academic Conferences

Table 3Academic Conferences

Name of Conference	**Summary of Activities**	**Date**
Presentation of Research Results on Ergonomic Safety and Workplace Improvement	150 participants attended the workshop including technologists on industrial mining safety and health, ergonomic engineering, occupational medicine, labor inspectors, safety and health professionals from industries. Methods for workplace improvement and ergonomic safety were demonstrated through cooperation between academic and business organizations.	01/04/02
Presentation of Research Results on Semiconductor at IOSH	120 participants attended the workshop including technologists on industrial mining or semiconductor safety and health, and administrative or process engineers.Presentation and promotion of research results on semiconductor related safety and hygiene research. Through exchange of information we are able to understand the needs of industrial organization.	01/05/04
Workshop on Evaluation of Career Assistance and	300 participants attended the workshop including labor career planner, and schoolteacher specialized in special	01/05/16-17

Safety and Hygiene Consultation for the Disabled	education. Exchanged research achievements and experiences on career assistance, job safety, and design and selection of supporting equipments for the disabled.	(Taipei) 01/05/30-31 (Taichung) 01/06/12-13 (Kaohsiung)
The 9 th Symposium on Chemical Sensing Technology	R&D on medical sensing technology, electrochemical sensing technology, and sensor materials were discussed. The latest sensing equipments were also exhibited.	01/05/19
Workshop on Method and Practice of Environmental Monitoring at Workplace	Discussed the new trend of method of environmental monitoring at workplace.	01/05/21-23
The Workshop on Chemical and Pesticide Poisonings	The proper concept of poison prevention for agriculture chemicals was promoted, in which research results and experiences between local and foreign scholars were exchanged.	01/06/01-02
Workshop on Environmental Chemical Analysis	Local and foreign scholars specialized in environmental assay method and proofing, R&D on new technology, work-place contamination analysis and safety evaluation were invited to present their research results.	01/06/02-03
The 2001 Conference on Aerosol Science and Technology	99 papers pertaining to atmospheric aerosol characteristics, indoor aerosol, chemical and physical properties of aerosol, aerosol in clean room, air pollution control method and bio-aerosol were presented.	01/09/14-15
The 2001 Presentation of Research Results on Occupational Medicine and Labor Health	500 participants attended the workshop including safety and hygiene personnel from business organization, and academic researchers. Exchanged research results on occupational epidemiology, work injury prevention, worker's health maintenance, and methods for identification of occupational disease.	01/10/29-30 (Changhua) 01/11/15-16 (Kaoshiung) 01/11/26-27 (Taipei)
The 2001 Presentation of Research Results on Ventilation and Industrial Ventilation	60 participants attended the workshop including technologists on industrial mining safety and health, and personnel from business sector specialized in safety and health. In this workshop, 8 papers were presented covering industrial ventilation, hood and pipe design, and computer-aided principles and practice.	01/11/22-23
Presentation of Research Results on Health	8 organizations demonstrated their achievements on health promotion projects for the purpose of training workplace	01/12/05-06

Promotion by Demonstration Organizations	health promotion personnel. Medical and nursing personnel, health and hygiene staff, personnel of medical treatment units, and safety and hygiene service organization personnel participated in this workshop.	(Taipei) 01/12/12-13 (Tainan)

2. Presentation of Theses - Local Publications (Table 4)

Title	**Publication**	**Authors**
Measurement of Workplace Methyl Chloride and Vinyl Bromide Using Thermodesorption /Gas Chromatography	Institute of Occupational Safety and Health Journal, Vol. 9, No. 1	Li, K. T. Lo, J. G. Uang, S. N.*
Multicompound Analytical Method in PU Artificial Leather Factory	Institute of Occupational Safety and Health Journal, Vol. 9, No. 1	Cheng, R. I.*
Tenax-TA Diffusive Tube Field Validation	Institute of Occupational Safety and Health Journal, Vol. 9, No. 1	Wu, L. J.* Chien, Y. C. Lwo, J. H.
Design and Field Validation of a Paint Brush	Institute of Occupational Safety and Health Journal, Vol. 9, No. 1	Lee, Y. H. Lian, Y. C. Chen, C. Y.*
Shoulder and Neck Pain among Workers in the Semiconductor Industry	Institute of Occupational Safety and Health Journal, Vol. 9, No. 1	Du, C. L.* Liang, H. W. Pan, C. H.*
A Cohort Study of Vinyl Chloride Workers in Taiwan	Institute of Occupational Safety and Health Journal, Vol. 9, No. 1	Wong, R. H. Chen, P. C. Du, C. L.* Wang, J. D. Cheng, C. J.
A Preliminary Survey on Respiratory Health of Workers Exposed to Isocyanates	Institute of Occupational Safety and Health Journal, Vol. 9, No. 1	Kao, M. J. Guo, Y. L. Huang, S. L.

		Chen, F. C. Chang, H. Y. Chen, C. J.* Chiung, Y. M.* Tsai, P. J.
Sampling and Analytical Method for the Simultaneous Determination of Multiple Aliphatic Aldehydes in Industrial Settings	Institute of Occupational Safety and Health Journal, Vol. 9, No. 2	Hsiao, Y. D. Wu, L. C.* Lin, J. M.
Application of Physiological-based Thermal-Hazard Empirical Assessment Models to Evaluate the Feasibility of Current Thermal-Hazard Prevention Standards	Institute of Occupational Safety and Health Journal, Vol. 9, No. 2	Wu, F. J. Tsai, P. J. Tu, H. H. Tong, M. J. Yeh, W. Y.* Lin, S. H.* Chen, W. Y.* Sun, Y. M. Juang, Y. J.
A Survey on Noise Exposure in the Semiconductor Industry	Institute of Occupational Safety and Health Journal, Vol. 9, No. 2	Yeh, W. Y.* Lin, S. H.* Lu, S. Y.*
Capture Envelope of a Hood Opening under Crosswind Conditions: A Wind Tunnel Experiment	Institute of Occupational Safety and Health Journal, Vol. 9, No. 2	Chen, Y. K. Huang, R. F. Chen, J. L. Chen, C. W.*
Development of a Job Exposure Matrix Model for Polyvinyl Chloride Workers in Taiwan	Institute of Occupational Safety and Health Journal, Vol.9, No. 2	Du, C. L.* Chan, C. C.

		Wang, J. D..
A Study of Normative Data of Hearing Threshold as a Function of Age	Institute of Occupational Safety and Health Journal, Vol. 9, No. 2	Chang, S. J.*, Chen, C. J.*, Zhao, B. Q. Pan, C. H.* Chiou, S. K.
Establishing Analytical Methods for Organophorus Pesticides in Air Samples	Institute of Occupational Safety and Health Journal, Vol. 9, No. 3	Li, H. P. Wen, P. C. Wong, S. S. Chen, C. Y.* Li, G. C.
Development of Sampling and Analytical Methods for Airborne Hydrogen-Containing Chlorofluorocarbons (HCFCs)	Institute of Occupational Safety and Health Journal, Vol. 9, No. 3	Huang, W. Y.* Uang, S. N.*
The Relationship of 1,3-Butadiene Exposure and Hemoglobin Adducts among Workers with Different Duties: A Preliminary Report	Institute of Occupational Safety and Health Journal, Vol. 9, No. 3	Chang, H.Y. Guo, Y. L. S.M. Ostermaan-Golkar, Chen, C. J.* Shih, T. S.* Wang, Y. P.
Capture Envelope of a Hood Opening under Crosswind Condition: A Numerical Approach	Institute of Occupational Safety and Health Journal, Vol. 9, No. 3	Chen, Y. K. Huang, R. F. Chen, C. W.*
Study on Particle Size and Dust Exposure in the Refractory Manufacturing Environment	Institute of Occupational Safety and Health Journal, Vol. 9, No. 3	Lin, M. H.*, Su, L. F. Yeh, W. Y.*

		Tsai, P. J.
The Effect of Electrostatic Charge Removal and Environmental Conditions on the Weighing Accuracy of Different Filter Materials	Institute of Occupational Safety and Health Journal, Vol. 9, No. 4	Shih, B. H. Tsai, C. J. Li, S. N. Shih, T. S.* Chien, H. M. Chang, C. T.
Tenax-TA Passive Sampler Evaluation for Six Organic Solvents	Institute of Occupational Safety and Health Journal, Vol. 9, No. 4	Chang, J. C. Huang, Y. S. Wu, L. J.*
Alternative Solvent Extraction Method for Acetonitrile	Institute of Occupational Safety and Health Journal, Vol. 9, No. 4	Cheng, R. I.*
Method Development for the Biological Monitoring of Methyl Isobutyl Ketone Exposure	Institute of Occupational Safety and Health Journal, Vol. 9, No. 4	Chou, J. S.* Shih, T. S.* Lin, J. D.* Shen, Y. J. Chan, H. Chen, C. M.
A Study on Biomechanical Model for Lower Back Pain	Institute of Occupational Safety and Health Journal, Vol. 9, No. 4	Lu, S. Y.* Yeh, W. Y.*
Chronic Liver Diseases amongst Taiwan Vinyl Chloride Exposed Workers: Case-Control Study	Institute of Occupational Safety and Health Journal, Vol. 9, No. 4	Wong, R. H. Chen, P. C. Du, C. L.* Wang, J. D. Cheng, T. J.
Establishment of Standard Management and Follow Up Procedures for Worker Cohort Databases in Taiwan	Institute of Occupational Safety and Health Journal, Vol. 9, No. 4	Fwu, C. W. Bai, C. H.

		Chen, Y. H. Wang, Y. C. Liu, M. R. Du, C. L.* Chen, C. J.* Wu, Y. P.*

Note: *IOSH Staff

3. Presentation of Papers - Foreign Publications

Table 5Presentation of Theses - Foreign Publications

Title	**Publications**	**Authors**
Design and Testing of a Personal Porous Metal Denuder	Aero Sci Tech, 2001, 35:611-616	Tsai, C. J., Huang, C. H., Wang, S. H., Shih, T. S.*
Computer Simulation of Particle Overlap in Fiber Count Samples.	American Ind Hyg Assoc J. 2001;62:281-287	Chen, C.C., Yu, T.S., Shih, T.S.*, Baron, P. A.
Capture Envelopes Of Rectangular Hoods In Cross Drafts	American Ind. Hyg. Assoc. J., 2001, 62(10):563-572	Huang, R.F., Sir, S.Y., Chen, Y.K., Yeh, W.Y.*, Chen, C.W.* , Chen, C.C.
The Capture Envelope Of A Flanged Circular Hood In Cross Drafts	American Ind. Hyg. Assoc. J., 2001, 62(2):199-207	Huang, R.F., Chen, J.L., Chen, Y.K., Chen, C.C., Chen, C.W.*, Yeh, W. Y.*
Computer Simulation of Particle Overlap in Fiber Count Samples	American Ind. Hyg. Assoc. J., 2001, 62(3):281-287	Chen, C.C., Yu, T.S.*, Shih, T.S.*, Baron, P.
Exposure Assessment to Airborne Endotoxin, Dust, Ammonia, Hydrogen Sulfide and Carbon Dioxide in Open Style Swine Houses	Ann. Occup. Hyg., 2001, 45(6):457-465	Chang, C.W.*, Chung, H., Huang, C.F., Su, H.J.J.
Exposure of Pig Workers to Airborne Microorganisms in Open-Air Swine Houses	Appl. Environ. Microbiol., 2001, 67(1):155-161	Chang, C.W.*, Chung, H., Huang, C.F., Su, H.J.J.

Urinary 2-Methoxy Acetic Acid Accumulation in Response to 2-Methoxy Ethanol Exposure	Arch Environ Health, 2001, 56:20-25, SCI.	Shih, T.S.*, Liou, S.H., Chen, C.Y.*, Chou, J.S.*, Smith, T.J.
High Performance Liquid Chromatographic Determination of 2-Thiothiazolidine-4-Carboxylic Acid as a Marker of Occupational Exposure to Carbon Disulfide.	Chromatographia. 2001, 53:665-668, SCI.	Chen, C.W., Shih, T.S.*, Li, C.C., Chou, J.S.*
Improved Sampling and Analytical Method for Airborne Carbon Disulfide Measurement at Workplace	Chromatographia. 2001, 54:383-388, SCI.	Wang, V.S, Lai, J.S, Lee, C.C., Wu, L.J.*, Chou, J.S.*, Shih, T.S.*
Gas Chromatography/Mass Spectrometric Assay for 2-Methoxy Ethanol and 2-Methoxy Acetic Acid in Human Plasma and its Application to Pharmacokinetic Study.	Chromatographia. 2001, 54:389-393, SCI.	Shih, T.S.*, Pan, R.N., Chou, J.S.*, Chen, C.Y.*, Hu, Y.P.
Belt Effects on Lumbar Sagittal Angles	Clinical Biomechanics, 2000,15:79-82	Lee, Y.H., Chen, C.Y.*
Collection Efficiency and Capacity of Three Samplers for Acidic and Basic Gases	Environ Sci Tech. 2001, 35:2572-2575, SCI.	Tsai, C.J., Huang, C.H., Wang, S.H., Shih T.S.*.
A National Survey of Psychosocial Job Stressors and their Implications for Health among Working People in Taiwan	Int. Arch. Occup. Environ. Health, 2001, 74:495-504	Cheng, Y., Guo, Y.L., Yeh, W.Y.*
Particle Collection Efficiency of an Inertial Impactor with Porous Metal Substrates	J Aero Sci, 2001, 32:1035-1044, SCI.	Huang, C.H., Tsai, C.J., Shih, T.S.*.
Collection Efficiency and Capacity of Three Samplers for Acidic and Basic Gases	Environ Sci Tech. 2001, 35:2572-2575, SCI.	Tsai, C.J., Huang, C.H., Wang, S.H., Shih T.S.*.
A National Survey of Psychosocial Job Stressors and their Implications for Health among Working People in Taiwan	Int. Arch. Occup. Environ. Health, 2001, 74:495-504	Cheng, Y., Guo, Y.L., Yeh, W.Y.*
Particle Collection Efficiency of an Inertial Impactor with Porous Metal Substrates	J Aero Sci, 2001, 32:1035-1044, SCI.	Huang, C.H., Tsai, C.J., Shih, T.S.*.

Note: *IOSH Staff

4. Presentation of Theses - Local Academic Conferences

Table 6Presentation of Theses - Local Academic Conferences

Topic	**Conference**	**Date**	**Presenters**
Evaluation and Improvement of Work Environment for the Disabled	2001 Ergonomics Conference	01/03/10	Chi, C. F.

			Chang, Y. Liu, S. L. Chen, r. T. Lin, Y. H.* Yeh, W. Y.*
Effect of MEK Coexisting Substances on Occupational DMF and NMF Biosensing	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Tsai, C. Y. Wang, W. S. Shih, T. S.* Chen, C. C. Chang, H. Y.
Effect of Three Different Types of Calibrations on 24 Hours Kinetic Study of Urine TTCA from Carbon Disulfide Exposed Workers	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Chou, T. C. Shih, T. S.* Wang, P. Y. Wu, C. C. Liu, Y. L. Chang, H. Y.
Evaluation of Tenax-TA Passive Sampling Method for Six Different Solvents	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Chang, r. C. Huang, Y. S. Wu, L. C.*
Analysis of Airborne VOC from a Semiconductor Plant by Automatic Sampling and by GC-MS	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Fung, C. T. Tseng, S. H. Uang, S.

			N.* Shih, T. S.* Luo, C. K
Study of Fungi in The Injured Eyes of Onion Harvesters at Hung-Chuen Peninsula	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Chang, C. W.* Chen, Y. C. Huang, Y. H. Chen, R. C. Ho, C. K. Chen, M. C. Chen, M. Y. Chang, C. Y. Liu, S. R. Chen, Y. R. Liu, Y. H. Lin, K. H. Huang, K. M.
Relationship betweenAirborne Toluene Diisocyanate Concentration Distribution at Work Environment in the Isocyanate Related Plants in Taiwan and the Product Types	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Yeh, h. J. Shih, T. S.* Tsai, P. C. Chang, H. Y.
Survey of Hand Skin Discomfort Caused by Wearing Latex Gloves in the Clean Room	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Pan, C. H.* Chen, C.

			J.* Sun, C. C. Chiang, Y. C. Tu, M. Y.
Survey on Size Distribution ofDust Particulate and Worker'sExposure at Refractory Brick Manufacturing Plant	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Lin, M. S.* Yeh, W. Y.* Tsai, P. C.
Prediction of Low Vibration Intensity factors Affecting Taxi Drivers	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Chen, C. C. Chang, W. R. Shih, T. S.* Chang, W. S.
Effect of Pressure Head for Complete Air Exchange on Spreading of Hazardous Substance	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Chen, C. W.* Yeh, W. Y.* Chung, C. C.
Evaluation of Hearing Impairment of Workers at Noisy Working Environment in Steel Plant	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Chang, S. J.* Chen, C. J.* Sung, H. C. Chiang, Y. T.
Reliability Evaluation of Body Vibration Prediction Model Used for Checking Taxi Drivers	2001 Symposium on Industrial Hygiene and Occupational Medicine	01/04/27-29	Chen, C. C. Chang, W. R. Shih, T. S.*

			Chang, W. S.
Health Evaluation for Semiconductor Employees (2)-Survey of Relationship between Protection Gloves and Arsenic Handling Worker's Health	Presentation of Research Result on Semiconductor at IOSH	01/05/04	Pan, C. H.*
Experimental System for Analysis of Particulate in High Rate Respiratory Tract	2001 Occupational Health Conference	01/05/18-19	Liu, C. Y. Huang, S. S. Wei, Y. K. Chen, C. C. Yang, T. T. Chen, C. W.*
Study on Relation between Health and Occupational exposure of Ceramic Plant Workers	2001 Occupational Health Conference	01/05/18-19	Wang, J.Y. Chen, C. J.* Hung, P. C.* Yeh, W. Y.* Lin, M. S.* Chen, J. Y.
Analysis of Hearing Characteristics of Plant Workers	2001 Occupational Health Conference	01/05/18-19	Chen, S. C. Tseng, C. S. Chen C. J.* Chang, S. J.*
Survey on Implementation of Occupational Health Activity of Lead Handling Companies	2001 Occupational Health Conference	01/05/18-19	Chen, C. W* Su, C. R. Yeh, W.

			Y.*
Effect of Carbon Disulfide Exposure of Rayon Plant Workers or Other Factors on Urine TTCA Concentration	2001 Occupational Health Conference	01/05/18-19	Chou, T. C. Shih, T. S.* Chang, S. J.* Wu, C. C. Chang, H. Y.
Theoretical Thermophoretic and Diffusional Deposition Efficiency of Particles in Cooled Laminar Tube Flow	2001 Conference on Aerosol Science and Technology	01/09/14-15	Lin, J. S. Tsai, C. J. Chang, T. P.*
Assessment of Collection Efficiency According to Collection Area	2001 Conference on Aerosol Science and Technology	01/09/14-15	Chen, Y. K. Huang, R. F. Chen, C. W.*
Study of Fungi in the Injured Eyes of the Onion Harvesters	2001 Conference on Aerosol Science and Technology	01/09/14-15	Chang, C. W.* Chen, Y. C. Huang, Y. H. Chen, J. C. Ho, C. K. Chen, M. C. Chen, M. Y. Chang, C. Y.

			Liu, S. J. Chen, Y. J. Liu, Y. H. Lin, K. H. Huang, K. M.
Survey on Dust Exposure and Silica Polymorphs in Refractory Brick Manufacturing	The 17 th Annual Conference of Asia Pacific Occupational Safety & Health Organization	01/09/24-29	Lin, M. H.* Yeh, W.Y.*
The Study for General Performance Factors of Local Exhaust Ventilation Systems	The 17 th Annual Conference of Asia Pacific Occupational Safety & Health Organization	01/09/24-29	Wang, S. C.* Chang, C. P.*
Assessment of Promotion Model for the Exercise of Neck and Shoulder at Workplace	2001 Presentation of Research Results on Occupational Medicine and Occupational Health Maintenance	01/10/29-30 (Changhua) 01/11/15-16 (Kaohsiung) 01/11/26-27 (Taipei)	Hsu, C. H.* Tsao, C. Y. Chen, C. Y.
Study on Assessment of Health Hazard of Workers Handling Arsenic in Semiconductor Plant	2001 Presentation of Research Results on Occupational Medicine and Occupational Health Maintenance	01/10/29-30 (Changhua) 01/11/15-16 (Kaohsiung) 01/11/26-27 (Taipei)	Pan, C. H.* Huang, Y. L. Lin, P. C. Du, C. L.* Hung, P. C.* Chen, C. K.
Survey of Labor Health Management Systems in the Developed Countries	2001 Presentation of Research Results on Occupational Medicine and Occupational Health Maintenance	01/10/29-30 (Changhua)	Chen, C. J.* Yang, K.

		01/11/15-16 (Kaohsiung) 01/11/26-27 (Taipei)	Y. Hsu, C. H.
Survey of Occupational Disease Identification Systems of the Developed Countries	2001 Presentation of Research Results on Occupational Medicine and Occupational Health Maintenance	01/10/29-30 (Changhua) 01/11/15-16 (Kaohsiung) 01/11/26-27 (Taipei)	Chen, Y. H. Su, W. L. Hsiung, Y. M.* Chen, C. J.*
Study on Application of Health Information to Labor Health Index	2001 Presentation of Research Results on Occupational Medicine and Occupational Health Maintenance	01/10/29-30 (Changhua) 01/11/15-16 (Kaohsiung) 01/11/26-27 (Taipei)	Du, C. L.* Wu, Y. P.*
Occupational and Psychological Hygiene Consultation Model	2001 Presentation of Research Results on Occupational Medicine and Occupational Health Maintenance	01/10/29-30 (Changhua) 01/11/15-16 (Kaohsiung) 01/11/26-27 (Taipei)	Chen, C. S. Wu, C. C. Chang, D. T. Chang, S. H. Yang, P. Chen, C. J.* Pan, C. H.* Hung, P.

			C.* Huang, T. C. You, C. Y.
Evaluation and Improvement of Comfortableness of Wearing Hearing Protection Equipment	2001 Presentation of Research Results on Occupational Medicine and Occupational Health Maintenance	01/10/29-30 (Changhua) 01/11/15-16 (Kaohsiung) 01/11/26-27 (Taipei)	Hsu, Y. L. Chen, C. J.* Pan, C. H.* Hung, P. C.* Huang, T. C. You, C. Y.
Prevention Technology for Vibration Hazard	The 14 th Conference of Chinese Acoustics Association	01/11/16	Ho, S. T. Liu, Y. W. Hung, Y. C. Chuang, H. Y. Yeh, C. S. Yeh, W. Y.* Lu, S. Y.* Yu, T. S.*
Hearing Loss Assessment of Textile Plant Workers	The 14 th Conference of Chinese Acoustics Association	01/11/16	Chang, S. J.* Chen, C. J.* Chiu, S. K.
Long Term Frequency Spectra Analysis for Mandarin and Taiwanese Dialect	The 14 th Conference of Chinese Acoustics Association	01/11/16	Tseng, C. S.

			Chen, S. C. Chen, S. Chen, C. J.* Chang, S. J.*

Note: *IOSH Staff

5. Presentation of Theses - Foreign Academic Conferences

Table 7Presentation of Theses - Foreign Academic Conferences

Topic	**Conference**	**Date**	**Authors**
A Rapid Method for Assessment of Regional Lung Deposition	2001 American Industrial Hygiene Conference & Exposurement	01/06/02-07	Chen, C.C., Huang, S.S., Liu, J. Y., Chen, C.W.*, Yeh, W.Y.*
A Serological Study of TDI Sensitized Workers Against Conjugates of 2,4-Toluenediisocyanate and Human Serum Albumin	International Council of Electrophoresis Societies, 2001	01/06/10-13	Chiung, Y.M.*, Yao, C.W., Tsai, J.J.
Analysis of Spectrum and its Conjugates Isolated from RBC of CS 2 Exposed Workers by Gel Electrophoresis	International Council of Electrophoresis Societies, 2001	01/06/10-13	Chiung, Y.M.*, Chen, C.J.*, Liu, P.S.,Shih, T.S.*
Field Study on Chemical Exposure during Preventive Maintenance of Metal Etching Machine in Wafer Plants	X2001-Exposure Assessment in Epidemiology and Practice	01/06/10-13	Yu, Y.C.*, Chang, C.P.*, Lin, Y.C.*, Shih, T.S.*
Field Study on Monitoring Workers' Time Activity Pattern Using a New Electronic Time Activity Recorder	X2001-Exposure Assessment in Epidemiology and Practice	01/06/10-13	Shih, T.S.*, Chang, H.Y., Wang, P.Y.
Using a Physiologically-Based Pharmacokinetic (PBPK) Model to Estimate the Contribution of Skin Absorption Resulting from the Exposure to 2-Methoxy Ethanol	X2001-Exposure Assessment in Epidemiology and Practice	01/06/10-13	Chang, H.Y., Chia, W.C., Chou, J.S.*, Shih, T.S.*
Using Employees' Self-Logged Record to Identify High-Risk Tasks of Exposure to	X2001-Exposure Assessment in	01/06/10-13	Chang, H.Y., Smith, T.J., Shih,

1,3-Butadiene in Petrochemical Industry	Epidemiology and Practice		T.S.*, Chen, C.J.*, Lin, W.C., Guo, Y.L.
Biomechanical Analysis of Ergonomic Risk for Camera Journalists	6 th PPCOE	01/08/21-24	Li, K.W., Chen, Y.C., Chen, C.Y. *, Yeh, W.Y.*
Occupational Safety and Health Evaluation for Handicapped Workers in Taiwan	Promotion of Health through Ergonomic Working and Living Conditions	01/09/02-05	Chi, C.F., Jang, Y., Liu, X.L., Chen, J. T., Yeh, W. Y.*
Occupational Noise-Induced Hearing Loss Surveillance in Taiwan: Database Analysis, 2000	Biology of Noise-Induced Hearing Loss	01/09/05-08	Hsu, J.H.*
Computer-Assist Information Management System for Industrial-Hygiene Accredited Laboratories	The 17 th Annual Conference of Asia Pacific Occupational Safety & Health Organization	01/09/24-29	Hsieh, C.M.*
An Experimental System for Rapid Measurement of Regional Lung Deposition	2001 American Association for Aerosol Research Conference	01/10/15-19	Chen, C.C., Liu, J.Y., Huang, S.S., Yang, T. T., Chen, C.W.*

Note: *IOSH Staff

Research Awards Received by IOSH Personnel

Award	**Recipients**	**Thesis**	**Date**
Outstanding Research Award of National Science Council	Chen, C. Y.	Biomechanical Effect of Lumbar Belt and Pelvic Belt	01/05/21
Outstanding Research Award of National Science Council	Shih, T. S.*	Measurement of Percutaneous Uptake of 2-Methoxy Ethanol Vapor in Humans	01/05/21
Outstanding Research Award of Executive Yuan	Shih, T. S.*	Worker's Carbon Disulfide Exposure Assessment	01/08/17
Research Award of Executive Yuan	Tsao, C. C. et al.	Survey of Occupational Safety and Health Management System Of Foreign Countries	01/08/17

Note: *IOSH Staff

II. Publications

Primary publications of IOSH include research reports, the Institute of Occupational Safety and Health Journal, IOSH Newsletter, Annual Report, and technical books (see Table 9).Depending on the nature of the organization, appropriate publications are sent to enterprises, government agencies, research agencies and associations, in order to distribute research results and information on occupational safety and health. For year 2001, a total of 17 new publications were published, with approximately 33,400 copies printed.

Table 9Publications for Fiscal Year 2001

Title	Type	Issues	Copies	Remarks
Institute of Occupational Safety and Health Journal	Quarterly	4	1100	Vol. 9, No. 1-4
IOSH Newsletter	Bimonthly	6	4600	No. 45-50
Technical Books	Irregular	7	200	Titles listed in appendix. Available in books, CDs, and Adobe PDF files

III. Information Services

1. Library

In conjunction with the development of the National Information Infrastructure, IOSH continues to expand its library collection and to improve the quality and quantity of software and hardware, in order to support occupational safety and health research.For the fiscal year 2001, the library had a collection of 5,124 books and 73 periodicals (see Table 10), including research reports, bulletins, conference proceedings, reports of fact-finding missions and studies. It is also open to public, providing up-to-date safety and health information services to enterprises.

Table 10Collections in the IOSH Library

Type	2000	Addition/ Subtraction in 2001	Total
Books	3,766	+1,358	5,124
Subscribed Periodicals	85	-12	73
Chinese	27	-2	25
English	44	-3	41
Japanese	14	-7	7
Audio Visual Materials	257	0	257
Video Tapes	60	0	60

Audio Cassettes	214	0	214

2. Computer/Networking Services

The main purpose of the IOSH's computer/networking services is to support occupational safety and health research in the Institute. The long-term goal is to become a national safety and health information center. The work completed in 2001 includes:

(1) Application and setting up a GSN (Governmental Service Network) networking for new IOSH's building, in order to provide our Internet services.

(2) Set up the intranet networking for IOSH's exhibition and the laboratory buildings.

(3) Purchased and set up a few servers for IOSH's Internet services.

(4) Establishment of databases of safety datadheets, occupational accidents, and workers' metabolic data.

The major work done in 2001 was application of GSN networking for the new IOSH's buildings at Shijr city. In addition, the existing servers and Internet services were moved from original CLA building to IOSH at Shijr city.

In order to promote worker's safety and health, to provide the public with an easy access to safety and health information, and to save the cost of printing publications, IOSH continues the effort in digitize all the publications. All publications of IOSH are available on-line for free download, which include: research reports, introduction to research projects, abstracts in English, technical books series, the IOSH Journals, IOSH Newsletters, Chinese and in English versions of IOSH Annual Report, and other materials from IOSH for promotion purpose. In 2001, our homepage was visited over 440,000 times whereas free download service for research reports and technical books was served 33,172 times.

IV. Technology Promotion and Services

For the year 2001, IOSH sponsored 2 exhibition, assisted in 13 investigations into suspected cases of occupational diseases, and offered calibration services for inspection instruments 2 times (see Table 10-13).

Table 11Exhibitions

Topic	Summary of Activities	Location	Date
Occupational Safety and Health Expo 2001	Exhibition of IOSH's research results, and there were plenty of IOSH's publications given to the public.	Taipei Train Station	01/07/09-10

Research Results Presentation on Occupational Safety and Health	Research results presentation was held in connection with !¢D2001 Conference of Trend of Occupational Safety and Health' and the completion of our new lab building.	IOSH Exhibition Hall	01/10/18-01/12/31

Table 12Investigation into Suspected Cases of Occupational Diseases

Name of Organization	**Items Investigated**	**Date**
Sheng* Company	Fatal accident of Thai worker	01/01/10
Cheng* Heavy Industrial Ltd.	Fatal accident of Thai worker	01/01/12
An* Company	Fatal accident of Thai worker	01/01/19
Taiwan* Electric Power Plant	Coal powder boiler explosion	01/01/28
Ya* Construction Ltd.	Electric leakage inspection of electric drill and extension cord	01/02/05
Yuen*** Company	Hydrogen sulfide poisoning	01/03/02
Chung* Enterprise	Myocardial infarction accident	01/03/05
Fu* Chemical Company	Chemical runaway reaction explosion	01/05/29
Yung** Company	Hearing loss injury	01/05/30
* Steel Company	Carpal tunnel syndrome	01/06/04
Min* Company	Carpal tunnel syndrome	01/07/18
Yang* Company	Herniated intervertebral disc	01/09/03
San* Inc. Co.	Electric leakage inspection of transformer cabinet leakage	01/11/29

Table 13Inspection of Apparatus and Calibration Services

Name of Agency	**Services**	**Date**
Inspection Organizations	2 oxygen and flammable gas detectors; 36 industrial safety inspection apparatus	01/06-01/11
Inspection Organizations	27 anemometers	01/07-01/10

Patent application and technology transfer are now under way for some important research results of the IOSH, such as the highly mobile ergonomic chair and the newly developed safety helmet for construction sites, following the appropriate regulations andprocedures. It is hoped that this business activity could result in the further integration of theory and practice, and positively contribute to occupational safety and health in Taiwan.

Table 14Patents

Patent No.	**Invention**	**Inventors**

ROC Patent No.171068	Unsymmetrical paint brush	Li, Y. H. Liang, Y. C. Chen, C. Y.*
ROC Patent No.172223	Over-rolling proof mobile crane	Wu. S. H.* Kao, T. Y.* Wang, C. S.
ROC Patent No. 177807	Locomotion platform	Tai, F. C.* Wu, S. H.* Kao, T. Y.* Li, H. T. Wang, T. H.
ROC Patent No. 179053	Force-sensor type cursor control device	Chen, S.C. Liu, Y. P. Chen, C. Y*

Note: *IOSH Staff

In terms of exhibition activities, IOSH's Mobile Exhibition began its virgin voyage since March 29, 1999.During the year 2001, it had successfully toured through 47 exhibitions. Among these were schools of all levels, industrial areas, business districts and related joint activities.It is estimated that 60,000 people had attended these exhibitions in 2001. Based on the evaluation of the exhibition questionnaires, 85 % of the participants were able to understand the contents displayed and realize the importance of occupational safety and health. To raise the public interest in the exhibitions, newer displays and designs were constantly created. The introduction of these new products helped the Mobile Exhibition to become more versatile; on the one hand it reached the goal of displaying the professional skills of IOSH and on the other hand it fulfilled the needs for a lively, vivid and attractive nature of exhibition.

During operation of Mobile Exhibition and through the resultant experience, it is apparent that there is a tremendous need for receiving education and training in safety and health among high school and vocational school students as well as regular business enterprise workers.On the same token, it is realized that planning should be made based on the nature of the guests of the exhibitions, such that different content of display is provided.In view of available manpower, the operation of the IOSH's Mobile Exhibition has been temporarily

transferred to private occupational safety and health organizations starting in October 1999. There are still a lot for improvement in occupational safety and health exhibition activities in Taiwan.In particular, new designs and products will be displayed and created to enhance the effectiveness of the exhibition tours.Other areas of development will include accessories for the Mobile Exhibition and enhancing display software in various occupational safetyand health exhibitions.It is hoped that through promotion of the exhibition tour and activities, the guests of the exhibition may become aware of various occupational hazards, and that they will be more cautious of the occupational safety and health of themselves and those around them while working.

V. International Exchange and Cooperation

Table 15Oversea Trips for Research and Study

Category	Country/ Organization	Topic	Name	Date
Visit	US/ AIHce and Washington University	Occupational physical hazard prevention method (including study on AIHce exhibition and paid nanometer!^	Cheng, C. W.	01/06/01-14
Visit	Sweden	Exposure Evaluation Conference	Yu, Y. C.	01/06/08-16
Practical Training	US/ World Safety Organization (WSO)	Attended WSO's "The 15 th International Environmental Health and Safety Conference & Expo" in Waco, Texas, then visited Dept. Public Health, Michigan University for occupational safety and health training courses.	Yeh, K. C.	01/09/08-19

Appendices

I. IOSH Research Projects in 2001

Project Number	Title
IOSH90-A101	Research on the Simultaneous Personal Sampling Technology of Hazardous TDI Vapor and Aerosol in the Workplace
IOSH90-A102	Establishing Analytical Methods for Pesticide Regulated by Labor Acts (III): Pyrethrum Pesticides Analysis and Workplace Carbamate Pesticides Survey
IOSH90-A103	Study of Particulate Sampling Method in Workplace
IOSH90-	Development of a Continuous Personal Monitor with Time-Activity-Pattern Recorder

A104	
IOSH90-A301	A study on the Occupational Safety and Health Consultation Programs of Taiwan and other Industrialized Countries
IOSH90-A302	Adsorption Dynamics for the Sampling of Hazardous Air Contaminants
IOSH90-A303	Analysis Study of Contents of Various Crystallized Free Silica in Molding Sand
IOSH90-A304	Investigation of Suitable Analytical Conditions for Common Industrial Mixed Organic Hazards
IOSH90-A305	Survey of Formaldehyde Exposure and Ventilation System Performance in an Anatomical Laboratory
IOSH90-A306	Survey of Dioxins Exposure of Contract Workers for Incinerator Maintenance in Taipei City
IOSH90-A307	Longitudinal Exposure Assessment, Health Hazard Evaluation and Control of 2-Methoxy Ethanol in Copper Laminate Circuit Board Manufacturing Industry
IOSH90-A308	Exposure Assessment for Toll-way Station Workers Exposed to Polycyclic Aromatic Hydrocarbons
IOSH90-A309	Development of Sampling Analysis Method for Multi-component Solvent Mixture in Water-based Construction Paints
IOSH90-A310	Method Development for the Biological Monitoring of Acrylonitrile Exposure
IOSH90-A311	Fast Electrochemical Analysis of Lead Ions in Blood
IOSH90-A312	Occupational Exposure to Organic Solvents during Paint Stripping and Paint Spraying Operations in the Aeronautical Industry (I)
IOSH90-A313	Study and Implementation of Information Management System for Industrial Hygiene Accredited Laboratories
IOSH90-A314	Evaluate Air Monitoring Methods for Nitrous Oxide Used as Anesthetic in Medical Unit
IOSH90-E101	Performance Evaluation of the Omnibearing Spread Program for Occupational Safety and Health Technology !V The Economic Assessment of Establishing the Exhibition Hall
IOSH90-H101	A Study on the Development of Air Sampling & Strand Displacement Amplification Analysis of Mycobacterium Tuberculosis in a Health-Care Facility
IOSH90-H102	The Effect of a Hood Flange on the Capture Performance
IOSH90-H121	The Development of Thermal Hazard Control Technique (I): The Establishment of Thermal Exposure Chamber and Thermal Insulating Clothes Testing Criteria
IOSH90-H122	A study of Musculoskeletal Disorders in Clean Room: Sit-Stand Work Chairs
IOSH90-H123	Investigation & Improvement of Slip Resistant Characteristic of Shoe Sole Used in Clean Room
IOSH90-	Development of Job Assistive Devices for Person with Disabilities: Production,

H124	Modification, and Promotion of Ergonomic Computer Devices
IOSH90-H303	A Study of Biohazards in Microbial Biotechnology Industry
IOSH90-H304	Survey of Employees!| Perceptions of Safety and Health in the Work Environment in 2001 Taiwan
IOSH90-H305	Investigated the Solder Flux Fume Control Systems in Electronic Application
IOSH90-H306	Effect of Interceptors to the Ventilation System of Industrial Workplace
IOSH90-H307	Survey for Workers Exposed to Free Silica in Furnace Maintaining
IOSH90-H308	The Simulation of Aerosol Deposition by Thermophersis in the Tail Gas Duct (II)
IOSH90-H312	Establishment and Evaluation a Testing System for the Study of Filters Performance
IOSH90-H325	The Survey of Electrical Magnetic Field Exposure in Occupational Environment
IOSH90-H326	A Pilot Study on Noise Sources Contribution in the Workplace
IOSH90-H327	The Effect of Hearing Protectors on the Perception of Warning Sound
IOSH90-H328	Research on Local Ergonomic Guide
IOSH90-H329	The Study of Job Analysis Methods for Ergonomic Intervention
IOSH90-H330	Selection of Computer-related Assistive Device for the Skeletal Impairment
IOSH90-H331	Checklists for MSDs Risk Factors - Simple Measurements (I)
IOSH90-M101	Strategy for Surveillance of Risk Factors of Occupational Injuries: Study of Multiple-Mechanism Surveillance System (II)
IOSH90-M102	An Epidemiological Study on Health Outcome among Former RCA Employees (III)
IOSH90-M103	The Study of Pulmonary-related Diseases in Restaurant Workers
IOSH90-M141	Index and Compensation Guidelines for Hearing Loss on Related to Laborer Safety and Health Regulations
IOSH90-M142	Comfort Evaluation of Hearing Protectors (II): Technique of Improvement
IOSH90-M161	Development of a Vocational Evaluation Instrument for People with Hearing Impairment
IOSH90-M301	The Occupational Health Effects among Aircraft Maintenance Workers

IOSH90-M302	Occupational Hazard Assessment in Biotechnology Industries
IOSH90-M321	The Health Effects on Chromosome Aberration Micronuclei among Workers due to Long-Term Exposure to 1,3-Butadiene (III)
IOSH90-M322	Analysis of Health Examinations from Labor Insurance Database
IOSH90-M323	Analysis of Occupational Injury Statistics from Various Nations (III)
IOSH90-M324	Female Occupational Disease Analysis from Labor Insurance Database
IOSH90-M325	Taxi Driver!|s Health Study the Second-Phase Data Management
IOSH90-M341	Labor Health Promotion: Assistance Plan for Business Health Promotion
IOSH90-M342	Health Assessment of Housekeeping Service Industry Labor
IOSH90-M343	Assessment of Job Content and Stress in Taiwan
IOSH90-M344	Assessment of Female Fertility among Semiconductor Workers
IOSH90-M345	The Study of Health Effect among Ceramics Manufacturing Workers
IOSH90-M361	A Study of Patch Test and Antibody Measurement for Occupational Dermatitis in Spray Painters
IOSH90-M362	A Survey of Asthmatic Diseases on Animal Handler Workers (I): Domestic Animal Feedler
IOSH90-M363	A Study of the Health Effect about Cardiac and Neurolymphoid System on Rayon Workers
IOSH90-M364	Comparison of OM Physicians & Nurses Training Programs among Developed Countries & ROC
IOSH90-M365	Health Hazard Evaluation of Coke Oven Workers in one Steel Factory
IOSH90-S101	A Study on Power-Frequency EMI for Preventing Faults in Factories: Measurements of the Magnetic Fields and Analyses of the EMI on Equipment
IOSH90-S102	The Study of Construction Safety Techniques: Tunneling Safety Assessment and Regulations Suitability Study
IOSH90-S103	Study of Construction Shoring Displacement Monitoring and Collapse Prevention
IOSH90-S104	The Study of Residual Life Evaluation and Continuous Safety Operation
IOSH90-S105	Safety Assessment of Degrading Pipeline
IOSH90-	The Study of Performance Evaluation and Auditing System for Occupational Safety

S106	and Health in the Industry
IOSH90-S307	Guideline of the Explosion-Proof Tank, Filter and Material Entering System
IOSH90-S308	Safety Assessment for Earth-Covered Tank in Chemical Process Industry
IOSH90-S309	The Study of Hazard Prevention for Electro-Optics Industry
IOSH90-S310	The Investigation of the Current Injury of Construction Equipment and Research of the Validity of Relative Regulations
IOSH90-S311	Development of the Computer-Aided System of Layout of Framed Scaffold
IOSH90-S312	The Development of the Non-Destruction Test Techniques of the Temporary Structure
IOSH90-S313	The Research of Promoting Self Safety and Health Management Effectiveness of Manufacturing Industry
IOSH90-S314	Study of the Construction Safety Management Techniques
IOSH90-S315	The Development of the Computer-Aided Calculation System for Steam Boilers
IOSH90-S316	The Detail Design and Assessment of Remote Payload Attitude Device and Safety Released Device
IOSH90-S317	The Study of The Safety Interlock Device of Injection Moulding Machines
IOSH90-S318	Improvement of the Locomotion Platform for Mobile Crane Training System
IOSH90-S319	Commercializing Prototype Design and Test of the Alarm Device for Warning Mobile Cranes from Hitting the Overhead Power Lines
IOSH90-S320	The Application of Inherent Safety on Chemical Process Design
IOSH90-S321	The Fire study of Phosphine Pipeline in Semiconductor Factories
IOSH90-S323	Study in World!|s Safety Codes and Techniques of Steel Assembling
IOSH90-S324	The Evaluation of Current Regulation about Construction Materials Storage
IOSH90-S325	The Surveillance of Workers!| Safety Behavior for Construction Industry
IOSH90-S326	The Electrical Safety of Low-Voltage Apparatus in the Plants
IOSH90-S327	Design and Manufacturing of Economic Size of Electric Motion Platform for Training System
IOSH90-S328	Study in Feasibility of Implementing Certification System for Personal Protective Equipment

II. Technical Books Collection

Serial No.	**Title**	Publishing Date
IOSH90-T-038	A Guide to Work Safety Program in Confined Space	01/04
IOSH90-T-040	Guidance of Exposure Survey of Hazardous Substances in Workplace (II): Toluene in Automobile Industry	01/09
IOSH90-T-041	Guidelines of Management on Needlestick Injuries	01/09
IOSH90-T-042	Precautionary Guidelines of Human Factors on Musculoskeletal Disorders	01/12
IOSH90-T-043	Guidance of Exposure Survey of Hazardous Substances in Workplace (III): 1,3-Butadiene in ABS Industry	01/12
IOSH90-T-044	Guidance of Exposure Survey of Hazardous Substances in Workplace (IV): Organophorus Pesticides and Organic Solvent in Pesticide Industry	01/12
IOSH90-T-045	Guidance of Exposure Survey of Hazardous Substances in Workplace (V): Formaldehyde in Hospitals	01/12