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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, 2002 and ending on December 31, 2002. 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 2002, 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 2002 and technical book collections (published in 2002) for readers' reference.

Acting Chairperson

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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. The 2002 researches were conducted under the following objective: in response to changes in industrial structure and results of national survey of occupational

hazardous exposures, in accordance with Council of Labor Affairs (CLA) medium-term administrative plan 2002-2005: Establish a safety & health work environment, the 2002 administrative plan and needs of the Labor Inspection Office, referring to occupational safety and health standards issued by or proposed in European Union and trend of new developing ISO safety and health standards, and considering the change of industrial structure and its influence on safety & health after joined in WTO, etc.

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 labors' 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 2002, with the completion of 92 projects for fiscal year 2002. 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 5 publications, 1 exhibitions, 15 academic workshops, 30 scientific papers published in local and foreign publications, 43 papers presented in local and foreign academic conferences, and 6 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 chairperson, a vice chairperson, and a chief secretary. It is divided into five divisions: Occupational Safety Division, Occupational Hygiene Division, Analysis Methods Division, Occupational Medicine Division, and Exhibitions Division. For administrative support, it has a secretariat, an accounting office, a personnel office, and a civil service ethics office (Figure 1).

1. Organization(2002)

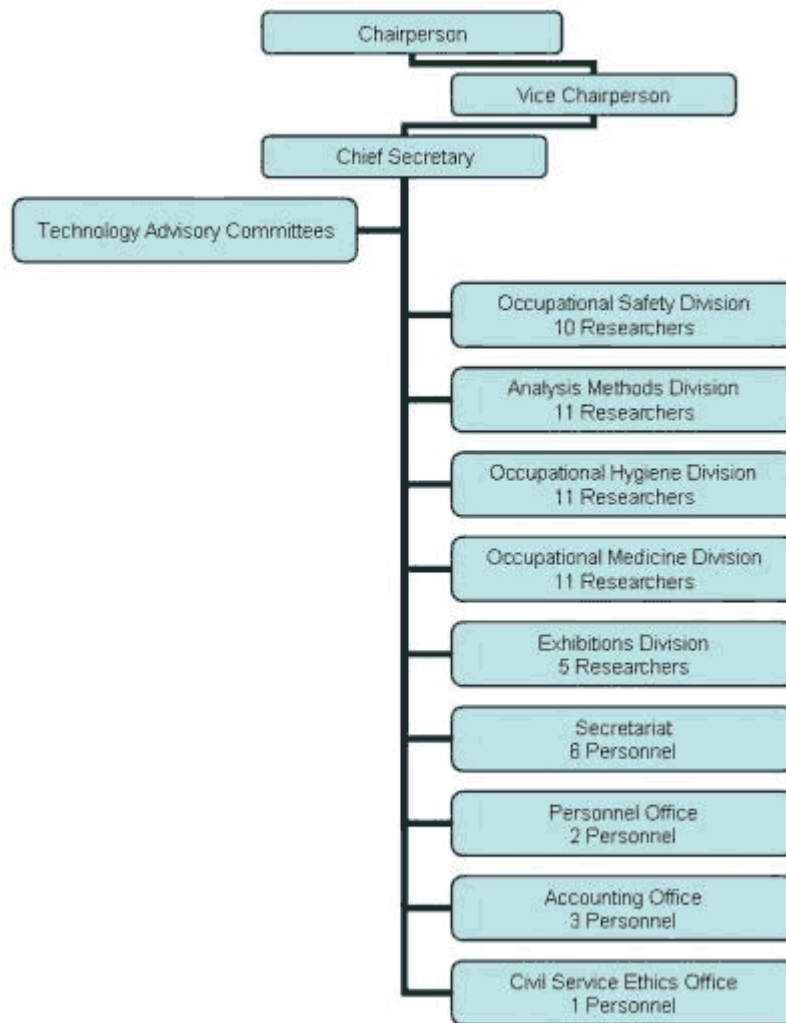


Figure 1 IOSH Organizational Structure(2002)

2. Analysis of Research Positions

Table 1 Anlysis of Research Positions

Positions	Senior Researcher	Researcher	Associate Researcher	Assistant Researcher	Reserved Duty PERNONNEL for Science and Technique
Number of Employees	3	16	20	11	8

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

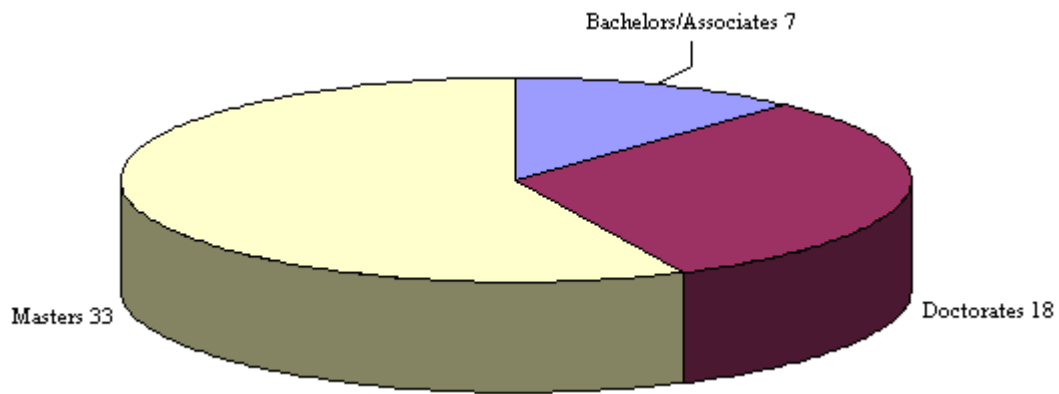


Figure 2 Analysis of the Level of Education in the Current Research Personnel

Note: 1. Doctorate researchers include 2 that are on fix-term contract.

2. Currently, 9 research personnel are undertaking doctorate studies, 1 is undertaking master's degree study.

3. Including 8 reserved duty personnel for science and technique.

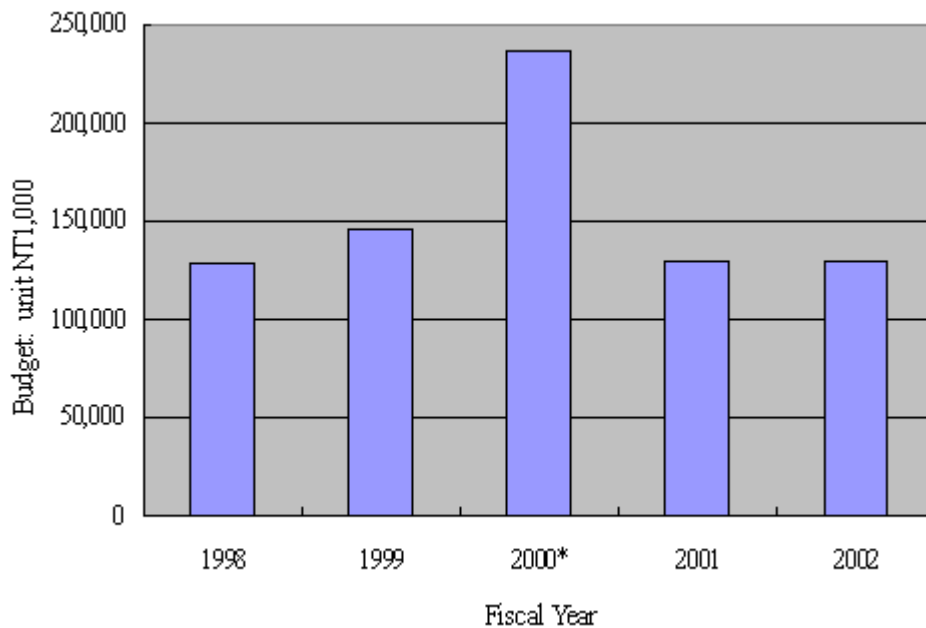
III. Research Expenditures

1. Budget for Fiscal Years 2002

Table 2 Budget for Fiscal Years 2002

Unit: NT\$ 1, 000

Subject	Budget for FY 2002 *
Occupational Safety and Health Research	129, 461
Occupational Safety Survey and Research	30, 343
Method Development and Analysis Technology Research	22, 329
Occupational Hygiene Survey and Research	28, 992
Occupational Medicine Survey and Research	27, 307
Occupational Safety and Health Exhibitions	20, 490



2. Analysis of Research Expenditures over the Years

Figure 3 Research Budget for Fiscal Years from 1998 to 2002

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

IV. Facilities of IOSH

IOSH is located in 99, Lane 407, Hengke Rd., Sijhih City, Taipei County, Taiwan. New buildings finished construction and to start using in July, 2001.

Building A: Research Laboratory Building, which is a four-story building which provides researchers of 4 divisions (e. g., Occupational Safety Division, Occupational Hygiene Division, Analysis Methods Division, and Occupational Medicine Division) to conduct experiments or tests.

Building B: Exhibition and Education Building is a five-story building.

1 st floor: Exhibition Hall of Occupational Safety & Health with area approx. 920m². It is open to the public.

2 nd floor: Offices for all research divisions

3 rd floor: library, information center, multimedia/presentation room, and a multi-purpose conference room.

4 th floor: administrative offices

5 th floor: one international conference hall, and 3 conferencerooms.

Building C: Trainee's Dormitory. It includes a cafeteria, amityhalls, and 50 dormitory room swith air condition.

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 hazard prediction, monitoring technologies, risk control and intrinsic safety technologies, 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 assessment 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: study of construction safety auditing system, analysis of serious occupational accidents in construction industry- unsafe behavior and condition, establishing hazard recognition handbook for labors, monitoring and collapse prevention of construction supporting frames, and the research of safety construction methods for full-span precasted bridge.

2. Research on Mechanical Safety

Statistics of inspections of major occupational accidents shows that 178 cases have occurred in the manufacturing industry in 2001, 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. Developing a technology for monitoring a controlling process machinery safety also included. For this year mainly centered on: establishing auditing guide of extension and alternative inspection for pressure vessels, the failure mechanisms and risk assessment of pressure vessel and its boundary components, study on construct a seismic design code for high pressure gas vessels (I), expert diagnosis system development for mechanical equipment-boiler, development of performance inspection system for safety devices on injection-molding machine, and design & manufacturing of economic size of electric motion platform for training system and technology transfer.

3. Research on Electrical Safety

In Taiwan, technical guidelines for explosion-proof electrical apparatus are lacking. Besides, disasters of precision equipments such as instrumental control facility, caused by electromagnetic interference (EMI) have been reported frequently and been studied extensively. Therefore, the planned research topics were not only electric shock prevention but also explosion-proof electrical apparatus and EMI accidents 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 safe technology for operation and maintenance of electrical apparatus, technical guidelines for prevention of electrical shock, guidelines for selection and maintenance of explosion-proof electrical apparatus, hazard assessment and prevention of instrumental control facility and safe devices subjected to EMI and applied technology for reducing the strength of electromagnetic wave. Researches conducted this year focused on: the investigation on standards for explosion-proof electrical apparatus in the domestic plants, edit paradigms for classification of hazardous areas and the selection of explosion proof electrical apparatus for batch reaction process, the system scheme survey for the type test of explosion-proof electrical apparatus, and the study on electromagnetic interference for preventing faults in factories (II): radio frequency.

4. Research on Chemical Safety

Accidents such as run away reactions, chemical leaking, fire, and explosion happened during chemical transportation, loading, storage and manufacturing procedures have been reported frequently. The operators lack of chemical safety techniques and appropriate process safety management are considered to be the reasons. The research focused on: amending safety inspection system, safe chemical storage,

methods of occupational accidents identification, hazard assessment techniques. Researches conducted this year focused on: performance of review and inspection system in dangerous workplaces, investigation on the danger of fires and explosions in chemical-related laboratories in universities and colleges, the hazardous analysis for the contractual operations in the petrochemical industry.

5. Research on Occupational Safety Management 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: the assessment of labor safety behavior prior and post safety guideline intervention-case study of construction workers, the study of safety culture and safety performance at construction industry, study of performance index of labor inspectorate, study of deficiencies in occupational health and safety management in domestic manufacturing industries, the study of the vessel safety inspection and management system, comparing occupational safety and environmental healthy system with developed countries and assessing its training needs, research and development of expertsystem for decision marker on emergency plan (I), etc.

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 accredited laboratories, 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: developing a practical particulate sampling method in workplace, developing sampling equipments and media for domestic use, establishing technological database and providing technical assistance service, and transferring sampling and analytical methods to related organizations. The details of research

projects are:

1. Survey on exposure to chemical hazard

There are still cases of occupational diseases caused by various hazardous chemicals 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 study is one of the most important tasks thus the IOSH conducted a series of investigations. Together with providing result of exposure monitoring and occupational disease survey to government agencies, 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

According to the Council of Labor Affairs regulation-Permissible Exposure Limits of Hazardous Substances in the Work Environment, more than 400 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 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. Sampling & analytical method databank was established and provided government agencies, academic institutes, and business sections to use. Research activities focused on: continuous study on sampling and analysis techniques for each hazardous substance, and simultaneous sampling and analytical method for mixture in air in order to develop easier sampling and analytic methods.

3. Development and evaluation of samplers and sampling media

Currently, most of the sampling equipment used in environmental monitoring are imported. 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

Besides considering the route of hazardous substance entering human body through the respiratory system, environmental monitoring is an implement. 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 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 industrial hygiene technologies has caught the attention of developed countries over 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 workers' operational condition. Direct reading instruments can measure exposure concentration in a very short time; however, it cannot provide detail information of exposure site and workers' operational condition. Besides, higher temporal 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 involved in developing exposure assessment system through use of IR location identifying device, chemical sensor, and electronic control system. Research work conducted these years 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 risk factors understanding and controlling 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. Management and survey of exposure to occupational biological hazard

Health care workers have faced a variety of biological hazards in their every working day. As far as assessment of biological aerosol in work place is concerned, assessment of *Mycobacterium tuberculosis* was studied in order to establish an evaluation technique on environmental exposure in air. A method combined with PCR technology and aerosol sampling was developed, and tested in 3 medical facilities. Beside the health care institutes, the potential hazard existing in biotechnology industries was also evaluated. We not only actively compile related foreign regulations and their management systems, but also visit the manufacturers to collect their opinions and current status of biological hazard prevention and management. In addition, we provide suggestions on biological safety cabinet and exhausting system of air conditioner so that can be used as reference for government agencies and industries.

2. Hazardous substances control and prediction models in work environment

This plan is based on aerosol technology to discuss the distribution, measurement, and evaluation of pathogenic organism and air pollutant as well as their effect to human health. In addition, the study on ventilation and respiratory protection apparatus technologies were considered to be solutions. The influence of parameters such as airflow upward velocity, high and width of hood, hood flange, and liquid level on the performance of blow & suck hood were discussed. Research results will be used on improving operation rules of hoods design; further more, business units can control the spreadable chemical hazard by efficient and economic methods. Besides, results indicated that improved control ratio type is easiest understood as well as it suit to install wind volume controller so that technician can proceed long-term functional monitoring. In response to development of high-tech industry and to improve local protection techniques to nano-particle, IOSH established test technologies on generation and determination of nano-particle as well as the capture efficiency of filters. IOSH has compiled techniques on facility of chemical hazard elimination as well as investigated the preparation of local industries on chemical

leakage, management and installation of emergency shower system was proposed.

3. Prevention of hazardous physical factor

Long-term exposedness to some physical factors such as high temperature, noise, and vibration will cause danger to human health. In order to eliminate noise problems, continuous improvement of the engineering technology is necessary. Besides, IOSH completed primary evaluation of labor hearing obstacle by introduced NIOSH and ISO evaluation methods on analysis of local labor hearing threshold. Potential hazard from electromagnetic wave is now being noticed. IOSH has conducted studies on this topic, however, the suggestible safety value is indefinite. Current researches are major in local exposure investigation and hazard control technology. Through controlling hazardous factors, establishing evaluation techniques, and developing new technology, results can be applied on making strategies for occupational safety and health. They can also be used as reference for business units to evaluate work environment and improve related techniques so that the labors' risk on occupational disease can be reduced.

4. Ergonomics application and hazardous control technology

Application of ergonomic technology and theory is emphasized to understand labors' capacity and environmental restriction then localize the design of machine, tool, and system to prevent musculoskeletal injury, and ensuring the labor safety and health. It is including development of neck injury checklist and field monitoring technique to investigate RSI of upper limbs. For observing working posture, results indicated that static posture will has better identity. The shoulder and neck exercise is simple and also lead to best relief on ache. Experiences and techniques achieving from developing field monitoring technique can be used on integrating and expanding data recorder in future. In addition, results of operators press emergence off (EMO) button in remissness were found by means of collecting and analysis questionnaire. A general rule of the location where EMO may be installed was proposed. It may be helpful to semi-conductor industries.

Industrial hygiene related studies focus on recognizing hazard in workplace through the investigation into hazardous factors including chemical, physical, biological, and ergonomics to reduce injury and disease in workplace. According to rise in safety conscious and demand, industries are suffering from lacking labor for their works with high risk, high pollution, and hardship. Most of the local industries are middle to small size. They don't have ability to conduct research and design, therefore, their demand for safety & health techniques are eager. It is urgent to help those industries creating a safer and comfortable work workplace. However, business units don't take effective management result for poor effect on occupational disease prevention. Therefore, through the spot guidance and edit safety & health guideline to gether with administrative inspection, establishing the management system of business units as

well as the efficiency index of occupational health will both achieve.

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, labor health promotion, and research on occupational psychology and physiology. Primary research orientation is focused on surveillance of 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. Surveillance of occupational diseases and analyzing health data

The surveillance 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.

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 surveillance 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 surveillance system for multi-channel monitoring and controlling of death due to occupational injury, occupational hearing loss, medical surveillance on acute 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. Researches completed in the year 2002: A study on labor insurance occupational disease prevention health check data reported through computer, setup automatic analysis for high risk worker cohort, the study of working environment of dental

personnel.

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 health care workers, cotton textile workers, machinery maintenance workers, bus drivers, food supply workers, road pavement workers, semiconductor manufacturing workers, extreme low humidity work places. Besides, the statistics of occupational disasters was compared to that of the major countries. Results were provided to government agencies and academic institutes for their references.

3. Research on Workers' Health Promotion

Not only does occupational health 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 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, the master plan of macroeconomic change and workers' health, case studies of occupational disease to occupational

safety & health and its inspect strategies.

4. Occupational Biological Monitoring of Health Effect

Hazardous substances enter the human body through various routes. Thus, there is a need to monitor the health effect of 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 health strategy discussion and biological hazard investigation including, health hazard evaluation of Arsenic workers in semiconductor industry (II)-acute hazard prevention and biomarker research, an epidemiological study occupational herpes exposure in the health care, a survey of asthmatic disease on animal handler workers-animal slaughters, special health examination and health management of potentially dangerous work in different counties.

Research Results

IOSH research results are edited as technical handbooks for the use of promotion and reference by the labor units, business units and other related parties. Meanwhile, they also provided reference for the Council of Labor Affairs in making policies and amending regulations.

Besides, our research results are announced in occupational safety and hygiene scientific seminars. They also published on some major journals worldwide.

Those researches with commercial have filed for patents in some countries. The research techniques have transferred to specific domestic companies.

This chapter summarized the research results of IOSH for the 2002 fiscal year below.

I. Research on Occupational Safety

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

The study on diagnosis expert system developed for mechanical equipment: boiler had completed. This study integrated the computer technology on establishing a boiler safety examination technology for providing the information on safety operation. The system also provided the establishment of fault tree, collecting parameters, rule establishment, examining programming and auto system test (refer to figure 4). In

addition, this system established the boiler management system skeleton, maintenance items, qualitative and quantitative risk standards, and alternative examination process.

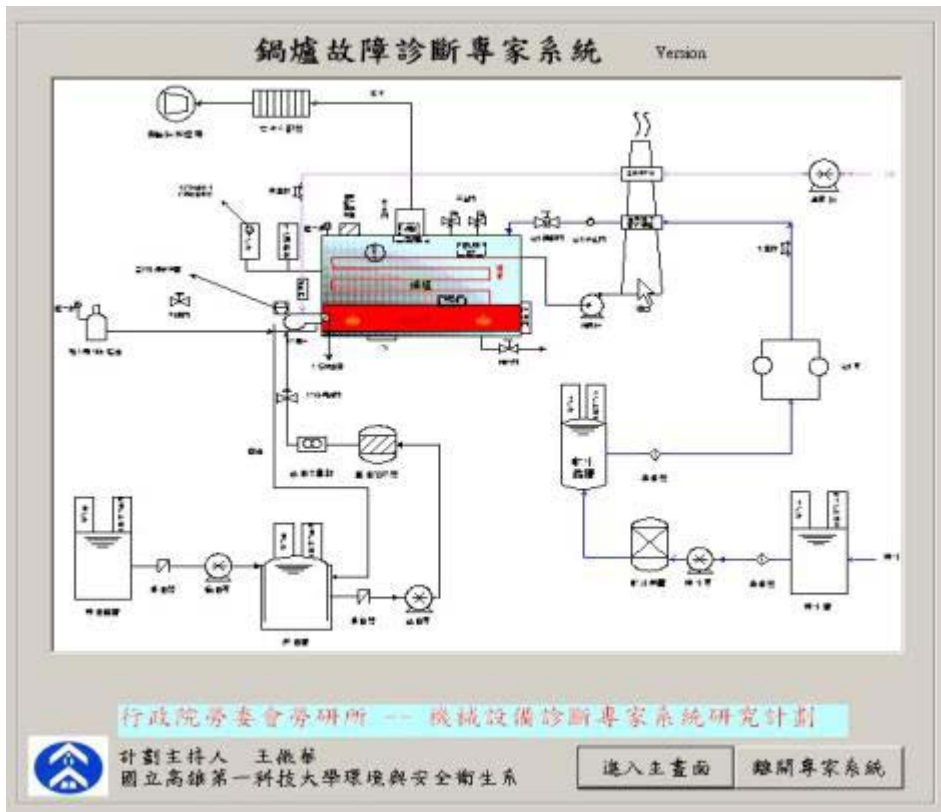


Fig.4 Boiler breakdown diagnosis expert system executive display screen

Completed the study on establishing auditing guide of extension and alternative inspection for pressure vessels, which is aimed at establishing alternative inspection plans, risk analysis and life evaluation mode on pressure vessels. Its content includes: (1) evaluation and analysis of various possible damage mechanisms (2) various possible damage mechanisms examination methods. (3) risk analysis of the pressure vessels as the base of the examination implement. (4) processing and analysis of the examination data. (5) drawing up an acceptable examination interval on internal audit for Department of Labor Inspection, CLA to carry out the dangerous machinery checking system improvement.

Completed the study on construct a seismic design code for high pressure gas vessels (I). This project completed the establishment of importance scale for high pressure air equipment as well as the standard and guideline of high pressure air equipment according to their important level, seismic zone factor, and the geology increasing factor. In addition, the earthquake effect model has also established. Basing on the earthquake characteristics and equipment properties, it provide echo and stress analysis data for the design of earthquake durable machinery and pipe

lines.

Completed the study on design and manufacturing of economic size of electric motion platform for training system (II). By reducing the cost of simulate training system and improving its implementation convenience, this platform can be used as personal simulate training system in near future.

Complete the study on the development of performance inspection system for safety devices on Injection-molding machine (I) It could be used to self check the injection molding machine, insure the labor safety and reduce risk. This technology is now pending patents and waiting for technology transferring. It matches European safety standards as well.

B. Chemical Safety Research:

Completed the study on performance of review and inspection system in dangerous workplaces. The above study provided efficiency index for auditing the dangerous workplaces and improving the implementation of safety and hygiene management system of the business.

Completed the study on investigation on the danger of fires and explosions in chemical-related laboratories in universities and colleges. The study collected the cases of accidents caused by using chemicals in the laboratory, experimental data of incompatible chemicals, and the result of regulation review. Furthermore, this study also investigated the safety rule on the use and storage of chemicals in laboratory.

C. Construction Safety Research:

Completed the study of construction safety auditing system. Due to the highest accident rate in the construction industry, under implementation of the safety management is one of the major causes. The safety audit tasks will be extremely important regarding to fully implementation of safety management. Through collecting and comparing safety audit systems of some countries as well as focusing on the characteristics of domestic construction management, this project provided framework for audit structure, operation models, content, feed back models. This study also establishes a safety audit system suitable to domestic construction industry.

Completed study on analysis of serious occupational accidents in construction industry: unsafe behavior and condition. Through collecting the recent five-year (1997-2001) construction occupational accidents, analyzing the reasons of occurrence, defining the relations to unsafe behavior and unsafe condition in different tasks, the IOSH stimulated accident prevention strategies. Meanwhile, the hazard recognition handbook was prepared for the reference of government agencies and the labors. IOSH defined different code for representing different operations, unsafe

behavior, and unsafe condition to make comparison and summary more convenient. This classification and coding system can be used in accident analysis in the future.

Completed study on the research of safety construction methods for full-span precasted bridge. Purposes of this study were mainly for safety construction of Taiwan high-speed rail overpass section during the stages of pre-cast, transport, hanging, launch, and fix the parapet. (as figure 5) This study used hazard analysis method to find out the potential crisis in each stage. Furthermore, the suggested amending of related regulations is provided thereafter. The FSPLM safety construction practice handbook is edited for reference in the future.



Figure 5 Pre-cast viaduct assembling

The study on monitoring and collapse prevention of construction supporting frame was developed to prevent large-scale public construction site from collapse. This study use a serious of module sensors aided by wireless transferring and signal processing techniques to transmit and evaluate the pattern of the plate supporting system. Meanwhile, through preset alarm level, this system can notice related parties by means of its mobile phone module when the loading force reaches its preset warning zone. This system is not only a real time monitoring framework but also reference in emergency situation.

D. Electrical Safety Research

The study on electromagnetic interferences for preventing faults in factories (II): radio frequency collected and analyzed EMF cases worldwide. Those data includes the strength and distributions of radio frequency magnetic field and the influence of EMI on the control equipments. Based on the result, the study suggested the probable

area which control system can be influenced by radio frequency electromagnetic wave and be the reference for machinery EMI prevention.

The study on the investigation standards for explosion-proof electrical apparatus in the domestic plants investigated the standards that were adopted in domestic petroleum refining plants. The hazard demarcation method and cross tabulation with proper explosion-proof electrical equipment in different hazardous level were established and proposed.

Completed study on edited paradigms for classification of hazardous areas and the selection of explosion proof electrical apparatus for batch reaction process. We compiled the reference material for the demarcation of electrical explosion-proof dangerous zone and classification of explosion-proof electrical apparatus. Comparison and analysis of these materials was then used in editing example for the demarcation of electrical explosion-proof dangerous zone and classification of explosion-proof electrical apparatus in resin and paint batch manufacturing industries. These 7 samples can be used by industries and labor inspection agencies as references to promote safety level on site.

Completed the study on the system scheme survey for the type test of explosion-proof electrical apparatus. We compiled the type test data of explosion-proof electrical apparatus in major countries such as the United States of America, Europe Union, Japan, China, and Korea. The study evaluated the advantage and disadvantage of each system. A feasible type test management system for explosion-proof electrical apparatus was then provided to related government agencies for their reference.

E. Safety Management and Policy Research

Completed the study of the vessel safety inspection and management system. We summarized inspection standards and management data on high pressure gas vessel. This research selected some major high pressure gas manufacturers, such as Chien-chen, Lienhwa industrial gases, and San fu chemical company for investigating their inspection and management system. Besides, the user, manufacturer, inspector, and related experts were invited for discussion the advantages and disadvantages of related regulation. The study found out that some countries integrate the insurance companies or the third-party certification into inspection system can be used as a reference for short, medium, long-term projects in my country.

Completed study on comparing occupational safety and health training system with developed countries and assessing domestic training needs. We compiled and compared the regulations regarding to occupational safety and health training in the developed countries such as the United States of America and Japan with domestic regulations. The study used questionnaire, sampling on domestic industries, to figure out future training demand. The study found out that our industrial structure was

mainly in small and medium size, therefore, this characteristic should be taken into consideration by planning for future demand on occupational safety and health education and training.

Completed study of deficiencies in occupational health and safety management in domestic manufacturing industries. The study was conducted by sending questionnaires to manufacturers which had employees between 50-90. Deficiencies in their occupational health and safety management were analyzed and concrete suggestion on improving was then proposed.

Completed study on the assessment of labor safety behavior prior and post safety guideline intervention: case study of construction workers. The study targeted on the molding workers in northern Taiwan. The study concluded: (a) analysis of the workers' safety knowledge, attitude and demands by different population characteristics (b) self-leading safety education model establishment (c) evaluation on safety knowledge, attitude and the use of protective equipment under safety instructions (4) the influence of different safety instruction on workers' safety knowledge, attitude and the use of protective equipment (5) the promotion on labor safety education promotion.

Completed project on improvement on workplace safety and health for disability. We conducted 19 workplace safety and health facilities and management system improvement. To make assistants or manage personnel improving concepts of safety and health and prevent accidents, the "Workshop and research results presentation on workplace safety and health for disability" were held each in northern, middle, southern Taiwan.

Completed study on research and development of expert system for decision markers in emergency plan (I). The optimal design for facilities safety and accident prevention emergency response system were provided. It not only was used on preventing labor injuries or death resulted by facilities accidents, but also provided education and training materials for emergency response.

Besides conducting research projects, the Occupational Safety Division had also performed the following activities in the year 2002: participated in the major occupational injury incidents investigations in coordination with labor inspection agencies, assisted enterprises in resolving occupational safety problems, held exchanges and collaboration with academic organizations in Taiwan and in other countries.

In the aspect of preventing the occupational accidents, we announced 7 articles on occupational safety alerts to industries and vocational schools through 50 industrial park managing centers, the Ministry of Education, and the Ministry of Transportation and Communications. By doing this, we could help avoid occupation accidents. It was

estimated each article was sent to over 4000 addresses.

II. Research on Method Development and Analysis

A. Chemical hazard exposure survey

In the year 2002, we completed the following chemical hazard surveys: "Assessing Free Silica Exposures to Municipal Waste Incinerator Demolition Workers", "Occupational Exposure to Organic Solvents during Military Aircraft Maintenance Operations", "Survey of Heavy Metals Exposure of Contact Workers in the Working Environments of Electric Arc Furnaces", "Longitudinal Exposure Assessment, Health Hazard Evaluation and Control of 2-Methoxy Ethanol in Copper Laminate Circuit Board Manufacturing Industry", "Exposure Assessment, Dermatitis Survey, and Control Measures of Chromium in Cement for Construction Workers", "Assessing the Exposures and Health-Hazards Associated with PAHs Exposures for Asphalt Pavers", which highly hazardous industries and worker chemical exposure were evaluated. Results will be used in writing the labor chemical exposure evaluation technical handbook as reference for business sector.



Figure 6 Paint stripping work during aircraft maintenance

Among them, the higher exposed works such as raw materials mixing, resin mixing, and dispenser works in printed circuit board manufacturer accepted our technical consultations in improving factory ventilation and the industrial hygiene management. The 2-Methoxy Ethanol exposure of the workers has been reduced under to the PEL. Besides, the blood abnormality of the employee has been improved and returned to normal range. Lower toxicity chemicals have replaced the 2-Methoxy Ethanol by most

of manufacturers. This showed a remarkable success.

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

In the year 2002, IOSH reviewed sampling and analytic methods of 21 kind of chemicals, such as magenta and sent to the Council of Labor Affairs as reference of official announcement. In addition, the application of the solid phase microextraction and thermo desorption integrated method in industrial hygiene sampling and analysis was then further discussed on their applicability.

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

In the year 2002, we put our effort mainly in the practical use and field verification of the IOSH developed personal respirable virtual cyclone and the simultaneous vapor and aerosol personal sampler (developed by IOSH) in order to understand the performance of these two samplers. In additions, the instruments mentioned above are now pending for patents.

D. Development of occupational biological monitoring methods

Method Development for the Biological Monitoring of p-Dichlorobenzene Exposed

Completed the following researches on Development of biological monitor method of p-dichlorobenzene and toluene diisocyanate, Bloodlead electrochemical analysis technique field test, and Urine TTCA electrochemical analytical technique study. In addition, the study evaluated the quantitative analysis of urinary S-PMA of workers exposed to benzene, and also established the urine TTCA analytical methods.

Completed studies on exposure assessment of polychlorinated dibenzo- *p* -dioxins and Dibenzofurans (PCDD/Fs) for workers of secondary ferrous metal smelting refining plant electric arc furnace, and contracted maintain workers of municipal waste incinerators located in southern Taiwan. We found the works in electric arc furnace crane operation are in highly exposed. Except writing the dioxin exposure evaluating technical manual for industry references, we also requested the manufacturer to carry out the monitoring of the dioxin concentration. The information was given to the Environment Protection Agency as a requirement, which demand the employer to improve the work place ventilation efficiency and enhance the occupational hygiene management.



Figure 7 Smelt process using electric arc furnace in ferrous metal refining plant-feeding

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

IOSH designed a new exposure model based of continuous personal monitor and time-activity-pattern recorder to verify the ability of the second laboratory. This new equipment successfully solved the technical problem thus enabled to determine the real-time exposure including the strength and duration. The technology has granted patents in R.O.C. and now waiting for technology transfer.

F. Others

We not only assisted 33 manufacturers in the field of lead battery, PVC plastics stabilizes, and ceruse manufacturing industry etc. in measuring work environment. We also edited the labor lead exposure evaluation technical handbook as a supervision guideline on work environment measurement for labor inspection agencies.

Completed study on construction plan of panorama VR for the laboratory buildings in the institute of occupational safety and health: an integrated technology with panorama VR, web, and hazard analysis. This technology can be used on building a laboratory safety and health management system as well as on emergency response and training the new employees. In order to survey well the hazards in semiconductor and defense industries, both the investigation of chemical exposure in 300 mm semiconductor industry and the survey of workers exposure to chemical hazards

in defense industry were completed.

III. Research on Occupational Hygiene

A. Survey of occupational biological hazard exposure

Completed study on the environmental monitoring of *Mycobacterium tuberculosis* and occupational infection among health care workers. By analyzing the air samples from three health-care facilities, those indicated no significant differences in tuberculosis positive rates. Positive rates of Tuberculosis are at only 2.7%, which are quite lower than those found in the 2001 project. Important difference was found between international anti-tuberculosis guidelines under review and current infect control measures in a medical center, especially with regards risk assessment, administrative & workpractice control, environmental & engineering control outside of isolation rooms, respiratory protection program and medical screening of health care workers.

Completed study on prevention and management research of biological hazards in microbial industry: establishment of the standard model of safety restraint for biological safety cabinet and air conditioning and exhausting system. Study aim sat the key facilities including biosafety cabinets and air condition & exhausting system, that often used by biotechnology industries. We compile local and foreign regulations and guidelines then edit the guideline for the usage, installation, and efficiency confirmation of bio-safety cabinet as well as safety guideline for air condition & exhausting system. We collect the opinions and current condition of biological hazards prevention and management by visiting the biotechnical manufacturers. In addition, the efficiencies and protect abilities of the biosafety cabinets under using were determined. According to the site visits and results of practical measurements, suggestions have been proposed, including: proper and reasonable management on biological safety is necessary, biological safety should begin from education, and controlling tasks should begin from safe facilities.

Completed study on evaluation of germicidal efficiency on airborne *Legionella pneumophila*. Our results demonstrate that only 3.46×10^{-6} *Legionella pneumophila* can survive by treating ultraviolet dosage of 0.289 mW at relative humidity of 55%. Their survival fraction is decreasing by increasing the ultraviolet dosage. In addition, with TiO₂ filter operation, it was indicated that penetrations of *Legionella pneumophila* were 0.47 without treated by UV light, and 0.1 with UV treated at RH 55% and 0.123 m/s of wind velocity.

Completed study on occupational health performance indication (I): manufacture industry. We collected the local and foreign promotional methods and expert dialogues on occupational health and investigated the actions of occupational health in 242 domestic industries by questionnaires. For the occupational health effective index, we suggested industries to choose four prior categories such as health

management, education & training and communications, work environment, and executive management. Thereafter, the protective equipments and occupational injury and sick may be added to the effective index according to the practical demands.

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

Completed study on the model of the hoods for dispersed contaminants. We designed and assembled an airflow supply system to simulate the emission of chemical pollutant from a tank. We put an air jet and hood on each open side at the edges where the air flows upwards, then used laser ray visible smoke flow field technique on investigating the characteristics of this type of hood. In the different blow and suck range, characteristic flow modes can be distinguished as four types: scatter mode, transfer mode, enclosure mode, and strong suction mode. The last two modes can completely capture vapor type pollutants.

Completed study for numerical control of local exhaust ventilation systems. We provided a simple "Improved Ratio Control Strategy" as main technique in numerical control. Commercialized inexpensive parts such as frequency transformer and electronic flow control gate were used on an economy local exhaust ventilation system. The effectiveness of this variable flow system was verified by flow field visualizing test using an IOSH developed laser beam projector. Due to its low cost, it may attract manufacturers to use this technique on monitoring the local exhaust ventilation system thus labors' health can be ensured.

Completed study on the filtration characteristics of nanoparticles through electret filter media. Through the nanoparticles generating and measuring techniques, the filtration efficiencies of commercialized filtering masks were determined. Results indicated concept of the most penetrating practical size of commercialized filtering masks is changing from 0.3 μm of the traditional filtering material into nanoparticle size. This changing is same as the direction of developed countries amending their test standards on particle sizes. Besides, results showed that electrostatic charge provided adequate filtering efficiencies. As the electrostatic charge on fibers reduced, the aerosol penetration values increased considerably. In the mean time, the most penetrating particle size noticeably shifted from nanometer to sub-micrometer particles range.

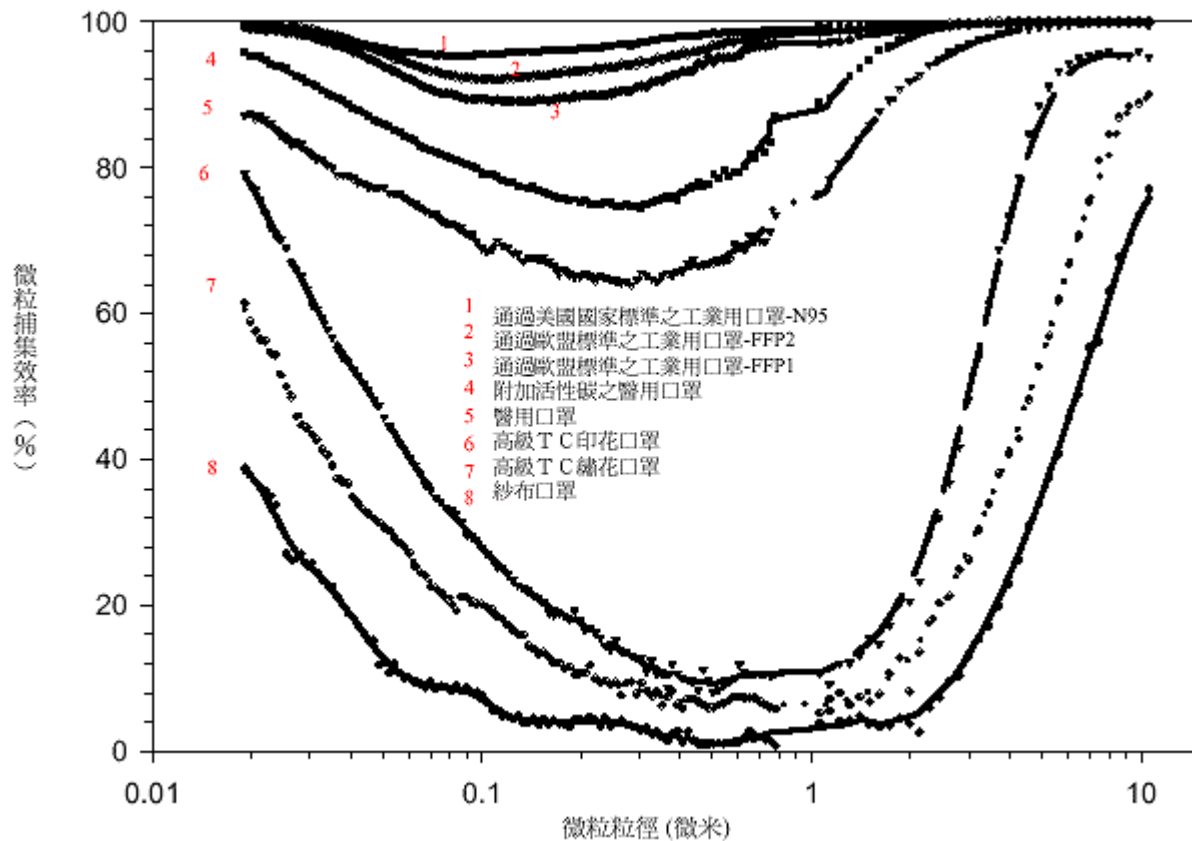


Figure 8 Diagram of collecting efficiency vs. various masks-flow rates at 30L/m

Completed study on occupational hygiene emphasis program to lead. We compiled related technical and promotional articles and edited a hazard prevention technical handbook for lead battery manufacturers. Besides, an easy hazard prevention manual with illustration was edited for related labors. We also estimated the technology to identify hand-wash hygiene for used in related training courses. Single page promoting articles were edited and provided to manufacturers for their references. We guided all the manufacturers to examine all the workers and to care the abnormal worker in checkup. 12 manufactories have established their independence management projects with our guidance in this project.

Completed study for worker exposure in cross draft with an exterior hood. IOSH followed former researches and introduced tracer gas releasing and determination techniques. We not only tested and verified the efficiency of IOSH developed blockage plate, applying for patent, but also simplified the design following simple blockage plate design concepts as easily calculated, easily made, and low cost. Furthermore, we found that chemical concentration decreased obviously when labors stand vertically to the cross draft regardless of blockage plate was installed or not.



Figure 9 A IOSH developed same ratio-reduced-scale models applied physically study in the wind tunnel. We integrated the results of our "Taiwanese labor anthropometry data" and "three dimensions anthropometry data" studies to make a model fitting Taiwanese laborers' figure characteristics

C. Prevention of hazardous physical factor

Completed study on development of systematic thermal hazard predicting model for optimizing thermal environment parameters. At the premise that radiation temperature, work conditions, and smocks were not changed. For steel casting plants, result shows physical environmental factors which control the workers' working time in order are air temperature, humidity, and air velocity. For dyeing plants, those are humidity, air temperature, and air velocity in order. Besides, thermal hazard predicting and eliminating system as well as the environmental factors improvement software were designed. These are provided on IOSH website for occupational hygiene personals to download then used as reference for drawing up improving strategies.

Completed study on establishment and proficiency testing of sound absorption for acoustical materials in reverberation room. There is no standard sample for laboratory comparison on measurement of sound absorption coefficient. Foreign articles indicate the standard deviation of repeatability of the sound absorption coefficient for plane absorbers can be used to verify the laboratory test quality. The IOSH conformed to ISO354 and established a test system and its standard procedures on sound absorption coefficient measurement of acoustical materials. Based on the accuracy of tests, our testing quality has reached the quality of domestic well-known laboratories. This laboratory can provide efficiency test service of sound absorption in future.

Completed study on the risk assessment for hearing loss in workers. We found that database of NIOSH and ISO valuation method is not quite the same. The result presents hearing loss over 25 dB by the NIOSH method and the ISO method only shows risk ratio at 25dB. If we used a common method, Speech Average Loss Method, hearing lost over 25 dB is defined as light hearing obstacle. On the other way, the ISO method provides the more detailed risk predictive data. According to domestic database, a program for assessing the risk of Taiwanese hearing obstacle was designed. This is used both to promote the "Labor hearing protection project" and to evaluate the risk of hearing loss before and after businesses doing the engineering improvement.

Completed study on whole-body vibration of forklift truckdrivers and control strategy. The results of primary studies indicate that forklift truck drivers are exposing to high whole-body vibration. Comparing to the regulation of labor safety and health installations article 301, 70% of the drivers' daily allowable exposure duration are 4 hours or less. For the design and installations of drivers' seat, efficiency on reducing vibration is limited. The high frequency vibration can be reduced to 40% of the trucks' bottom plate. However, the efficiency is not good for the 8Hz frequency band vibration and some installations amplify the vibration.

Completed study on the low frequency electrical magnetic field exposure assessment and control in occupational environment. We found that the low frequency electromagnetic field exposure level of local labors is not higher than those of other countries. The background occupational exposure value of low frequency electromagnetic field was determined. The results indicate that if keep far away from emission source, even a strong magnetic field exists, the exposure can be eliminated. In the most of cases, EMF exposure will reduce if we keep three meters from the emissive source.

D. Ergonomic application and hazard control technologies

Completed study on establishment of evaluation tool for neck-shoulder pain. We found the harmful parameters on musculoskeletal for labors working in warehouse contained overweight cases, bad working posture, constant working posture, overtime working, leads to grow, and extremely stretch out body for picking articles. Aiming at the goods selecting task, we completed the spot observation, evaluation, and improvement then a feasible improvement project was proposed.

Completed study on influence of mechanical properties of inclined surfaces on falling. Results indicate, under the common walking speed at 1.0 m/s, floor angle of inclination within 10 degree, and floor friction coefficient over 0.15, people will not fall down and keep stable when they are going downward on slope. If the floor angle of inclination over 15 degrees, the coefficient of friction should higher than 0.15 to keep people stable. When the speed is increasing, the coefficient of friction must increase

coordinately to avoid slipping and falling down.

Completed study on development of a monitoring technology for risk of CTD in upper extremities. The purpose of this project is to develop a portable data logger. The data logger integrates pulse plethysmogram transducers, electric goniometer, accelerometer, and EMG active electrodes to record a workers' heart rate, joint angles, repetitive frequency, and magnitude of muscle exertion during working hours. After success in development, these can be used in ergonomics hazard related researches and as reference for spot data collection and determination on the suspect occupational musculoskeletal injury cases.

Completed The Ergonomic Evaluation of the Emergency-Off (EMO) Button in Semiconductor Machines. We analyzed the collected questionnaires and found the probable reasons of touch in mistake. For examples, which hand that operator tend to use, age, post, and manufacturing process are all possible. Besides, a general rule where EMO bottom should be installed was proposed by the questionnaire analytic results and opinions from the persons who were questioned. Two improved design was provided, one is the improvement on EMO protective cover the other is changing traditional bottom to the new slot design. We expect that these results may have help for semi-conductor industries.

IV. Research on Occupational Medicine

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

Information sources of this year was mainly from labor insurance payment data, occupational disease preventive physical examination data, and analytical statistics of occupational disease on skin, bone, muscle, respiratory system, cancer and mental disease.

Completed the study on the strategy for surveillance of death of occupational injuries: study of multiple-mechanism surveillance system on work related death (III). Results indicated that top 10 caused of death in occupational disease come first from traffic related accidents, the traffic accident to or from work, third is traffic accident on business trip, tenth is aero vehicle accident. The above four causes totally hold 41.2%. The rest of the causes are falling. Electricity shock, drawn, collapse, pressed, hit, and falling articles. The labor force in northern Taiwan over the age of 15 totally has 3.08 million, the death rate caused by occupational injuries was 5.3/100,000; in southern Taiwan was 10.2/100,000; in Taoyuan, Shinchu, and Miaoli areawas 12.5/100,000; in eastern Taiwan was 12.7/100,000.

Completed the study of media filing model on occupational disease preventive physical examination data by labor insurance. It cost a lot of time and money to set up

the database and it could only collect previous years' data. It is not effective in tracing and consulting the occupational disease cases, therefore, we planned to computerize the filing system on the previous years' experience. We expected to get timely and accurate specific physical examination data by setting up the computerized filing system.

Completed the study on the setup automatic analysis for high risk worker cohort. The study proceeded data maintaining and personalizing among four occupational generations (Pneumoconiosis, shipbuilding worker, lead related worker, environmental /hygiene service) to further link to 6 health related database (mortality, hospitalization by health insurance, hospitalization by labor insurance, labor insurance cash payment, detail hospital expense by occupational disaster, hospital by occupational disaster application file). The study recorded the manipulation principle and process as well as any difficulty and critical factors. Furthermore, under consideration of information privacy, the study developed a management software to select and maintain database.

Completed a study of working environment of dental personnel. In the aspect of environment monitoring, results of the workplace measurements are as follows: Average of MMA vapor concentration, 11.33ppm; average of total aerosol concentration, 0.27771 mg/m³; average of respirable aerosol concentration, 0.07148 mg/m³; instant maximum sound level for gas gun, 112.3 dBA; instant maximum sound level for metal grinder, 89.7 dBA; daily noise dose, less than 100%; 8-hour time-weighted-average sound level, less than 90 dBA. All are below the current standards specified by the law. In the aspect of hearing test, expose team was higher both in number and percentage than comparison team. Partial results regarding physical examination of nerve system are as below.

1. Clinical symptom was mainly nerve injury in nerve physical examination.
2. The results of nerve conduction study show that workers have distal latency abnormality are in major.
3. The results of exam of sensory system show that amplitude drop account for most abnormality cases, 26.3%, followed by abnormal of distal latency, 21.1%. The total bacterial clones in teaching hospitals and local hospitals were qualified. However, one of the local clinics was not qualified in this issue. The results also demonstrated inhibition of MMA to human gingival fibroblasts, but not shown in MMA to neural cells. By the questionnaire, results indicated dental staffs were not sensitive to the level and requirement of cleaning in the air of working environment.

B. Occupational disease studies and occupational epidemiology

The investigation was focus on the chemical substances, physical hazards, should &

neck symptoms, and occupation related cancer. We completed study on respiratory effect on cotton textile workers. Results are as follow:

1. According to the WHO classifications, prevailing rate of chest abnormal or shallow breath caused by cotton dust symptom was 5.2%, cotton dust related respiratory system stimulation was 6.1%.
2. This study sample on local environment by IOM sampler; average concentration was $0.88 \pm 0.5 \text{ mg/m}^3$; geometry average concentration was 0.76 mg/m^3 .
3. Results showed the prevailing rate of lung function abnormal workers was 14.3% and 15.8% for the chronic lung function abnormal workers.

Completed study on the occupational health among shipyard workers. This study sent out 1200 questionnaires, 1103 were recovered (recovery rate 92%). 367 personnel were in organic solvent group, 498 in repair group and 238 in administration group. Through this study, we found that major exposure in shipyard including: paint, organic solvent, welding, high temperature operation, electric welding, carrying heavy stuff, and long time fixed posture. These danger factors showed much influence on respiratory system, visual & hearing, skin, and nerve system in shipyard workers.

Completed study on work and health among Taipei Metropolitan Aborigines (II). Study result revealed that natives usually work unstable and often bear liabilities. Almost 60% of them incurred occupational injuries during one year. Only 80% of them have health insurance, 10% of them have chronic disease, 30% of them feel inconvenient to see doctors. Linkage analysis showed that unstable work or alcohol drinking may be resulted from occupational injuries.

Completed study on workstress by bus driver shift-pattern and its impact on cardiovascular effect. This study found that bus driver in government sector and private sector show differences in and resistance and compliance of radial artery. Those in private sector also have higher DHEA. However, that is not the case in cortisol. Those with working experience under 10 years have higher DHEA ($P < 0.001$). Researches revealed that DHEA is produced by adrenalin and the DHEA production quantity may be declined by age. It was proved that DHEA is an anti-vascular sclerosis in animal experiment. DHEA can improve the activity of SOD, protecting cell from oxidize. DHEA related with obesity, mental disease (e. g. melancholia). DHEA is an anti-stress hormone (proved by rate experiments). DHEA can antagonize cortisol to adjust emotion. Decrease DHEA/ cortisol can reduce stress; Psychi Research, 1999. Pressure management can force DHEA decrease.

Completed the study on musculoskeletal disorders in restaurant workers. Research result revealed that 12-14% of the interviewee in box meal and vender line business occurred tendonitis or back pain, 9-10% occurred joint inflammation. The occurrence

of carpal tunnel syndrome in box meal line; 6.1%, is far higher than those in vender line; 2%, or fast food line; 0%. Those interviewee in those three lines about 31% felt uncomfortable on shoulder, finger & wrist, back & waist. Among them, those work in box meal shop got the highest rate (42.3%, 39.2%, 41.2%). Joint ache occurred more frequently. Female workers have higher occurrence of musculoskeletal uncomfortableness than male workers. This revealed that female participants were more sensitive to the uncomfortable symptoms. Restaurant workers were easy to get burned on arm(19.3%), elbow(10.6%), hand or fingers(27.4%) but only 5.1% of those went to see doctors. Those workers in fast food stores got hand or fingers burned were 44.6 times per 1000 people every month.

Completed the study on health effect among road pavement workers. The study indicated that total PAHs in the air run in the following sequences: road paver driver (2107.50ng/m³), road pavement worker (1535.08ng/m³), roller driver (1339.20ng/m³), and road shaver driver (539.41ng/m³). The rate of gas/solid phase PAHs in the air were road paver driver (26.17), road pavement worker (20.07), roller driver (16.83), and road shaver driver (4.38) separately. Average concentration of 1-OHP in urine was 0.18µg/mol creatinine in exposure group, and control group was 0.05µg/mol creatinine. Both showed statistically significant (p< 0.0001). In regression mode, although pyrene sickness in air and 1-OHP concentration in urine were not statistically significant, they are marginal related (p = 0.06). This indicated that asphalt paving workers' 1-OHP in urine was influenced to some extent by pyrene in the air. The rate of workers that occurred musculoskeletal problem and carpal tunnel syndrome off duty were not specifically high compared to other industries, but it needs continuous observation. As to the fatigue occurrence rate, road shaving worker on 'tired now' was 29.17%, and road paving worker on 'eyes fatigue' was 25.76%, it was not specifically high compared to other industries.

Completed study of establishing cohort data among workers in semiconductor manufacturing industries. The study shows that average age of workers in semiconductor manufacturing industries are 28.5 for male and 24.3 for female, average pregnancy age are 30 for male and 24.6 for female. In general, they got married in proper age, get pregnant right after marriage and divorce rate is around 1-2%. The point is that they married after they entered this industry and they have child after marriage. Therefore, this group has potential in reproductive related study. The health exam in male workers reveal: aural abnormal in right ear has 17 people (11.4%), in left ear has 24 people (16.1%); blood test analysis shows that abnormal uric acid has the highest remark of 52 people (34.9%), next is abnormal triglyceride, TG with 31 people (20.8%), 30 people are hepatitis B carriers (20.1%). Those in female workers are aural abnormal 3 (17.2%), in blood test results are abnormal cholesterol 7 (20%), abnormal triglyceride, TG abnormal 4 (11.4%), hepatitis B carriers 8 (22.9%). Health exam and questionnaire data concluded that hearing loss is more serious in high frequency and those with longer working years intend to be

more serious, too. Exclude the factor of age, in Speech Average Loss Method and high frequency SALM, hearing loss occurred more frequently at the age of 25-29, with 10.1 dBA and 8.1dBA respectively contrary to what we expected. In women self-awareness symptom, abnormal items run from muscle system (30.4%) and digestive system (23.9%). It shows remarkable difference in musculoskeletal system by departments. There are about 20% of the workers have menses disorder. Among male workers, abnormal muscle system is 22.6% and respiratory system is 18.4%, these are higher items. Abnormal nerve & muscle system are significant different by department. Among them, abnormal nerve and muscle occurred more often in operation area, with 13 people (16.7%) and 24 people (30.8) respectively.

C. Occupational health promotion research

We engaged in multiple studies on labor health care for improving work environment and labor mentality health. We completed the studies on labor health improvement plan, index on evaluating hearing loss, evaluation tool on occupational consultation of disable persons, physical fatigue and nutrition evaluation.

Completed study on development of a vocational evaluation instrument for people with mental illness. We considered the characteristics of those with mentally illness to set up an evaluation method and score scale on occupational consultation of mentally illness people. We concluded 70 kinds of jobs suitable for those people. A set of duty measurement table was developed to evaluate their competent in handling information, obstacles and relationship. This table proved to be effective and efficient. This database totally has about 450 kinds of jobs that could be as references for those mentally illness people to get jobs.

Completed study on the relationship of chemical exposure and hearing loss at work place. The study concluded that, although noise is the major cause of hearingloss, the existence of those ear toxic chemicals (such as trichloroethylene, benzene, carbon disulfide, arsenic, heavy metals, carbon monoxide, and carbon dioxide) can be more harmful to hearing. Meanwhile, different from noise damage in high frequency zone, these chemicals can even injure the sound frequency zone commonly used in conversations. Therefore, those works in these kinds of chemicals exposure noisy area not only need to wear earplugs and earshades, control work hours and also need intensified notice in wearing breath protective device.

Completed study on occupational hazard assessment in biotechnology industries (II): hazard identification and management program in safety and health. The study revealed that trainees are significantly improved in conscious about biohazard ($p < 0.0002$). We invited experts to test on reliability of trainees' self-evaluated results, and we found that there are certain relation between self-evaluated results and experts' interview results. However, experts' interview results are still lower than self-evaluated results (0.015). It indicated that self-evaluated results may overestimate the conscious

degree of biohazard matters and the executions situations. We translated the biological short database (BSDB, constructed by PPHB; Population and public health branch) into Chinese edition for reference of those engaged in microorganism operation.

Completed project of labour health promotion (II). We make up three kinds of physical exercise for computer users, occupational driver and those who need to stand on working. These exercises help preventing occupational related musculoskeletal injury, increasing productivity and economic competition. This health promoting effect evaluation set up the scientific data on the health promoting plan.

Completed the master plan of macroeconomic change and workers' health. This study indicated that most of the shutdown businesses (about 90%) have less than 10 employees. Most of them are retailers, restaurants, manufacturers or in construction industry. If we analyzed the insurance situation, death rate of the shutdown business is 2.673% higher than contrast group in year 2000. We further separate the identity of the insurer by possessing jobs; death rate of the shutdown business is 2.607% higher in year 2000.

Hearing loss resulted from noisy operation (88.1%) take extremely majority part in specific health exam and graded health management. Most of them are in textile and cement manufacturing industries and follow by hospital.

Among the total suspected occupational diseases, most of them are abnormal pressure disease (1448 cases, 46%) in the announcing system of the Department of Health. Most of the above are in nearby sea fishing and rice farming industries. Among the confirmed cases, suspected pneumoconiosis has 85 cases (36.3%). Most of them work in hospital and rice farming next. The business occupational disaster cases concentrated on manufacturing industry and followed by constructing industry. Among the labor insurance cash payment data, dust lump disease has most cases of 22225 (93.2%) due to enlarge payment scope on labor insurance. Except for dust lump disease, occupational bottom backache has the most cases. Most of them are in manufacturing industry and wholesaler, retailer, restaurants are next.

D. Occupational biomedical monitoring

We use bio-medical technology to research on epidemiology and bio-index to reach the goal of real time prevention.

Completed survey of asthmatic disease on animal handler workers (II): animal slaughters. We summarized the questionnaires and found out that labors contact with pig blood and saliva 15 times a month take 40%, contact pig secretion usually take 55.9%. Those occurred allergy syndrome take 35.7% by self statement. IgE test result reveal that contacting animal secretion is an important factor causing cough. 56.1% of

those allergy labor react IgE positively on animal blood and 100% react positively on animal saliva. Those syndrome revealed that those contacting bodies and working in the area are easily affected by bio exposure. We should further investigate on labor health to evaluate the related regulation has enough protection on labor health.

Completed study on health hazard evaluation of arsenic workers in semiconductor industry (II): acute hazard prevention and biomarker research. We investigated three semiconductor companies and the results showed that there were significant differences in total arsenic concentration in blood, hair, finger and toe nail on 185 arsenic area workers and 123 in the control group, respectively. There was significantly positive correlation between total arsenic concentration in air and total arsenic concentration in blood, and there was also significantly positive correlation between total arsenic concentration in air and total inorganic arsenic metabolites concentration in urine for one of the three companies with the highest mean arsenic concentration in the air of personal sampling. The powder waste generated from arsine and inorganic arsenate salt mixing procedure is arsenic oxide mixture. In 31 arsenic related industries, over 70% of the industries have gas monitor calibrated or maintained over the proper period, and all the industries did not calibrated or maintained the monitors within every three months. Therefore, periodical calibration and maintenance of gas monitors should be practiced to insure the function of hazard prediction. According to the standards of environment monitoring, only the indoor workplace using As₂O₃ for manufacturing needs to be proceeded environment monitoring every half a year. There is no regulation on the management of other arsenic compounds, and it is necessary to be improved.



Figure 10 Collection of hair specimen for workers

Completed study on occupational herpes exposures in the health care workers.

Results indicated 80.6% (315) and 84.9%(332) of the 391 invited study subjects were agreed for questionnaire and donating saliva, respectively. The prevalence of HSV-1 in the working environment and saliva were 0 and 0.3%, respectively, as well 20.5% and 3.9% for VZV in the air and saliva, respectively. 35% of the total study subjects did not have a VZV infection or didn't know their VZV history. Besides, 65.5% of the study subjects agreed to have a vaccine. After adjusting for the potential cofounders, working years and contacted with herpes patients were correlated with the HSV-1; kids was correlated with the saliva VZV. Saliva DNA identification could not serve as an ideal method to predict HSV-1 or VZV susceptibility. A vaccine is providing for susceptible health-care workers in Europe, Japan, and Korea. We suggest that health administrations should attaching importance to safety and health of health-care environments.

Completed study on comparison of law forbidding child and women workers from dangerous Industries between developing countries & ROC. There is conflict in legislatively constraining womens' working condition and execution of the "Gender Equality in Employment Law". We should take the current labor union situation into consideration. If we adopt untie policy, the government should afford more responsibility in establishing more updated dangerous material standards and regulations. The classification of forbidden dangerous material and job item is not quiet the same in some countries. In EU and UK, the major classification is: physically dangerous obstacle, chemically dangerous obstacle, carcinogen or dangerous environment (including various radiation dangerous obstacle) . We should increase the constrained job items of children worker by the pace of development in Taiwan society, not just restrained in chemically dangerous obstacle and mechanically harmful related items. There is strict age constrain matched with in term training of School Law in USA. Regulations regarding dangerous obstacles harmful to pregnant women were increased with the higher standards in forbidden items.

To summarize, the current research focus is efficiently using physical examination data to control over preventing occupational diseases. We should use epidemiology to complete the health care study on labor in specific operation. Otherwise, to reduce to injury resulted from environmental factors, we should move on aggressively the hearing protection plan, labor health care promotion research in order to effectively prevent occupational diseases and create a comfortable working environment.

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 2002, IOSH sponsored or jointly sponsored 15 academic conferences; presented 19 journal

papers in local publications, 11 journal papers in foreign periodicals, 40 papers at local academic conferences and 3 papers at foreign academic conferences. In addition, 2 research projects received local or foreign research awards.

1. Academic Conferences

Table 3 Academic Conferences

Name of conference	Summary of activities	Date
The Labor Inspectors Workshop on Lead Poisoning Prevention	In order to enhance the inspection of the lead relative workplaces and to reduce the lead exposure of labor, IOSH and Department of Labor Inspection (of CLA) held this workshop. 50 participants attended the workshop including labor inspectors and IOSH researchers.	2002/02/18
The Labor Inspectors Workshop on Hearing Conservation Program on Aviation Noise	In order to promote the airport apron labor hearing conservation program, IOSH and Department of Labor Inspection (of CLA) held this workshop. 20 participants attended the workshop including labor inspectors and IOSH researchers.	2002/04/15
2002 Symposium on Industrial Hygiene	Both IOSH and Occupational Hygiene Association of Taiwan used "Build up a 21st Century Health Work Place" as the topic and held this conference. Scholars and experts in the industrial hygiene related fields from Korea and Australia were invited to give lectures or speeches and to join the discussion. In addition, many papers were presented.	2002/04/26
The 8 th Symposium on Chemical Sensing Technology	Most of the participants were professors or graduated students major in chemical sensing technology from local universities or academic institutes. We invited two topic lecturers to give speeches. 50 research papers were also presented in this symposium. We suggested that related academic communication can be supported continuously so that local technology in chemical sensing can reach to the same level as developed countries.	2002/05/10
The 2002 Conference on Environmental Chemical Analysis	The topics of this conference are including methods and verification of environmental analysis, development of new techniques, discussion on practical affairs, analysis of environment pollution, and safety assessments.	2002/06/02-03
The 2002 Presentation of Research Results on Occupational Medicine and Labor Health	500 participants attended the workshop including safety and hygiene personnel, teachers, and researchers. The related topics in occupational epidemiology, prevention of occupational injury and disease, labor health and health care, and occupational disease identification techniques were	Taipei 2002/07/01-03 Changhua

	discussed.	2002/07/17-18 Kaohsiung 2002/07/30
Pan-Pacific Symposium on Occupational Ergonomics, Safety, and Health	Both IOSH and the Ergonomics Society of Taiwan held this conference. 500 scholars or experts in ergonomic engineering related fields were invited to join discuss or give lectures in health promotion, noise control and management, participative ergonomic engineering.	2002/07/06
The Workshop on Tunnel Plans, Designs, Constructs and Disaster Prevention Considered Operation	In order to enhance the safety of construction and to reduce the accident rate, we held the workshop and provided construction safety related techniques to participants. 160 participants attended the workshop including engineers and labor safety & health managing staffs of constructors, government engineers and inspectors, and the designers or projectors from consultant companies.	Taipei 2002/07/12 Kaohsiung 2002/07/19
The Occupational Medical Doctors Workshop on Lead Hazard Prevention	In order to improve the safety of work places as well as to reduce labors' blood lead concentration, IOSH invited health care related personnel to the workshop and joined the discuss on lead hazard prevention. 160 participants attended this workshop including doctors of local occupational health centers, occupational medical doctors, doctors or nurses of high lead hazard manufactories, and government labor inspectors.	2002/08/03
The Workshop on Vibration Hazard Prevention	50 participants attended the workshop including labor safety & health staffs, occupational medical doctors, health care personnel of industrial units, practical engineers, and students. The occupational hazard result from vibration and its prevention were discussed. We hope the vibration hazard will be noticed so that the related problems may be prevented.	2002/08/20
The 2002 Workshop on Method and Practice of Environmental Monitoring at Workplace	The IOSH invited personnel from local environment monitoring institutes and the qualified laboratories as well as occupational hygiene inspectors and other related personnel to participate the workshop. In this year, topics to be discussed are lead sampling technologies and its sampling strategies.	2002/08/22-23
6 th International Aerosol Conference	Over 630 papers from the countries in Asia, America, and Europe were presented during this one week conference. The topics including indoor air quality, physical and chemical characteristics of aerosol, and the trend of nanotechnology were	2002/09/09-11

	discussed.	
The 2002 Presentation of Research Results on Ergonomic Engineering	60 participants attended this workshop including labor safety staffs, the nurse, labors, and manage staffs. We introduced our "Guideline on Ergonomic Engineering for Preventing Musculoskeletal Injuries" and helped industrial units to prevent their labors from injuries.	2002/09/10
The 2002 Presentation of Research Results on Ventilation and Industrial Ventilation	60 participants attended the workshop including safety and health staffs from industrial units and practical engineers. In the workshop, we presented our research results on industrial ventilation and provided its proper concepts and techniques.	2002/09/19
The Workshop and Presentation of Research Results on Safety & Health Workplaces for Disability	300 participants attended the workshop including personnel from employment service organization, employment assistant from private disability welfare organization, occupational therapist who engages in career rebuilding, and special education teacher.	Taichung 2002/11/21-22 Taipei 2002/11/25-26 Tainan 2002/12/03-04

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

Title	Publication	Authors
A Field Study of Different Acidic Aerosol Samplers	Institute of Occupational Safety and Health Journal vol.10 no.1	Tsai, C. J., Lin, Y. C., Shih, T. S*.
A Study on Grounding Techniques for Preventing Electric Shocks	Institute of Occupational Safety and Health Journal vol.10 no.1	Ku, CH Liou, GJ Yang, CF Yen, SS

		Wu, CJ Lee, SY Su, WY* Hu, YM
A Case Study of Stability Analysis and Test of Aerial Lifts	Institute of Occupational Safety and Health Journal vol.10 no.1	Wang, HL* Fung, CP Sun, HH
A Study of Safety and Health Management System Perception of Taiwanese Labors-size Enterprises	Institute of Occupational Safety and Health Journal vol.10 no.1	Chang, MK Yang, SC*
Development of User-Friendly Structural Safety Checking System for the Type I Pressure Vessels	Institute of Occupational Safety and Health Journal vol.10 no.1	Li, WL Yang, CY Tsauro, CC*
A Study of Cumulative Injuries of Upper Extremities for Elementary School Teachers and Typists	Institute of Occupational Safety and Health Journal vol.10 no.1	Wang, CY Sun, JS Ho, CK Chen, CJ* Pan, CH*
Investigation of Self-Reported Musculoskeletal Symptoms and Biomechanical Analysis for Photograph Reporters	Institute of Occupational Safety and Health Journal vol.10 no.1	Li, KW Cheng, YC Chen, CY* Yeh, WY*

<p>The Integrated Application and Research of the Industrial Robotic Safeguard System with Ethernet</p>	<p>Institute of Occupational Safety and Health Journal vol.10 no.2</p>	<p>Yu, WJ Huang, CF Chieng, WH Gau, CY*</p>
<p>A Study of Workplace Environmental Monitoring Regulations - Chemical Agents</p>	<p>Institute of Occupational Safety and Health Journal vol.10 no.2</p>	<p>Wu, LJ* Shih, TS*</p>
<p>Investigation of Inspection System for Frame-Type Scaffolding Used in Taiwan</p>	<p>Institute of Occupational Safety and Health Journal vol.10 no.2</p>	<p>Yen, T Peng, JL Lin, IC Huang, YL Cheng, HG Shih, IM*</p>
<p>An Assessment of Vehicle Flame Arresters</p>	<p>Institute of Occupational Safety and Health Journal vol.10 no.2</p>	<p>Huang, CC Lin, YF Wu, HJ* Lin, MJ</p>
<p>Asbestos Exposure Assessment and Workplace Improvement in the Brake Lining Industry</p>	<p>Institute of Occupational Safety and Health Journal vol.10 no.2</p>	<p>Wang, KS Yu, JP Yeh, WY* Chen, CW* Fu, WS</p>
<p>A Study on Contaminant Dispersion and Pressure</p>	<p>Institute of Occupational</p>	<p>Chen,</p>

Difference of General Ventilation	Safety and Health Journal vol.10 no.2	CW* Yang, CY Chung, KC Chen, YK
Occupational Safety, Health Evaluation and Job Accommodation for Handicapped Workers	Institute of Occupational Safety and Health Journal vol.10 no.3	Chi CF Jang, Y Liu, XL Chen, JT Yeh, WY* Lin, YH*
An Analytical Method for Carbamate Pesticides in Air Samples	Institute of Occupational Safety and Health Journal vol.10 no.3	Li, HP Wong, SS Chen, CY* Li, GC
Surveillance on Noise-Induced Hearing Loss in Taiwan	Institute of Occupational Safety and Health Journal vol.10 no.3	Hsu, JH* Chen, CJ*
The Study on Passive Sampling and Gas Chromatography Mass Spectrometry Analysis for Air Borne Carbon Disulfide Monitoring	Institute of Occupational Safety and Health Journal vol.10 no.4	Wang, VS Lee, CC Wu, LJ* Lai, JS Shih, TS*
Medical Surveillance on Dental Technicians in Taiwan	Institute of Occupational Safety and Health Journal vol.10 no.4	Yeh, CY

		Chen, RY Chen, CJ* Chang, YM* Kuo, YC Hong, CL
The Investigation of Whole Body Vibration Exposure for Container Tractor Drivers	Institute of Occupational Safety and Health Journal vol.10 no.4	Liou, YM Yeh, WY Lu, SY*

Note: *IOSH Staff

3. Presentation of Papers - Foreign Publications

Table 5 Presentation of Theses - Foreign Publications

Title	Publication	Authors
Overall Performance Evaluation of Aerosol Number Samplers	Aero Sci Tech, 2002, 36: 84-95	Lai, CY Chen, CC Hwang, JS Shih, TS*
A Method for Measuring 1, 3-Butadiene in Blood, Aliva, and Exhaled Breath	Appl Occup Environ Hyg.2002	Chang, HY Shih, TS* Lee, CC Smith, TJ
Suspended Matters in Onion Farms and Their Potential Effect on Corneal Injury of the Harvesters	Arch. Environ. Health., 57(1): 78-84	Hwang, YH Chou, EJ Chang, CW * Chen, CC,

		etc
Fungi Genus and Concentration in the Air of Onion Fields and Its Opportunistic Action Related to Mycotic Keratitis	Arch. Environ. Health., 57(4): 349-354	Chang, CW * Ho, CK, Chen, ZC Hwang, YH Chang, CY, etc.
Clinical Course in Patients with Chronic Carbon Disulfide Polyneuropathy	Clinical Neurology and Neurosurgery, 2002	Huang, CC Chu, CC Wu, TN Shih, TS* Chu, NS
Toluene Diisocyanate (TDI) Concentration Investigation among TDI-Related Factories in Taiwan and Their Relations to the Type of Industry.	Int J Exp Ana Environ Epi, 2002	Yeh, HJ Shih, TS* Tsai, PJ Chang, HY
An On-line Automatic Sample Clean-up System for the Quantitative Detection of the Benzene Exposure Biomarker S-phenylmercapturic Acid in Human Urine by Electrospray Ionization Tandem Mass Spectrometry	J Ana Toxicol, 2002	Liao, PC Li, CM Lin, LC Hung, CW Shih, TS*
Asbestos in Taiwan: Country Report	J. of UOEH, 24(S2): 90-94	Chang, HY Wang, JD Chen, CW * Yeh, WY *

		Yu, JP Lin, YC, Shih, TS *
Elevated Triglyceride and Decreased High Density Lipoprotein Level in carbon disulfide workers in Taiwan	JOEM, 45(1): 73-78, 2003 (SCI)	Luo, JC Chang, HY Chang, SJ* Chou, TC Chen, CJ* Shih, TS*
The Effect of Environmental Conditions and Electrical Charge on the Weighing Accuracy of Different Filter Materials	Sci Total Environ, 2002	Tsai, CJ Chang, CT Shih, BH Aggarwal, AG Li, SN Chein, HM Shih, TS*
Urinary 1-Hydroxypyrene as a Biomarker of Exposure to Polycyclic Aromatic Hydrocarbons (PAHs) in Carbon Black Workers	The Annal Occup Hygiene, 2002, 46: 229-235	Tsai, PJ Shieh, HY Lee, WJ Chen, HL Shih, TS*

Note: *IOSH Staff

4. Presentation of Theses - Local Academic Conferences

Table 6 Presentation of Theses - Local Academic Conferences

Topic	Conference	Date	Presenters
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Analysis of Lead Ions in Blood in the first half year of 2002	The Labor Inspectors Workshop on Lead Poisoning Prevention	2002/02/20	Pan, CH* Chen, CJ*
Elevated Triglyceride and decreased High Density Lipoprotein level in Carbon Disulfide Workers in Taiwan	2002 Symposium on Industrial Hygiene	2002/04/26-27	Luo, JC John Chang, HY Chang, SJ Chou, TC Chen, CJ* Shih, TS*
Carbon Disulfide Induced Hearing Loss among Viscose Workers	2002 Symposium on Industrial Hygiene	2002/04/26-27	Chang, SJ* Shih, TS* Chou, TC Chen, CJ* Chang, HY Sung, FC
The Establishment of Sampling Strategy for Chemical Substance in Workplace Environmental Monitoring	2002 Symposium on Industrial Hygiene	2002/04/26-27	Huang, HH Huang, YS Shih TS*
Survey of Dioxins Exposure of Contract Workers for Incinerator Maintenance in Taipei City	2002 Symposium on Industrial Hygiene	2002/04/26-27	Wu YL Lin YC Huang BJ Liao BC Shih TS* Lee CC
Survey of Self-reported Complaints among Female Workers in Semiconductor Industry	2002 Symposium on Industrial Hygiene	2002/04/26-27	Chiang, YT Chang, SJ* Hsieh, GY

			Chen, CJ* Sung, FC
Analysis of Working Environment Measurement in Semiconductor Fabrication Process	2002 Symposium on Industrial Hygiene	2002/04/26-27	Lee KJ Lee LW Chueh MJ Huang YS Shih TS*
Personal exposure sampling strategy for the petroleum chemical Industry	2002 Symposium on Industrial Hygiene	2002/04/26-27	Chien, SC Huang, XH Zhuang, WG Lee, LW Shih, TS*
A Case Study for Automatic Flow Modulation of Local Exhaust Ventilation System	2002 Symposium on Industrial Hygiene	2002/04/26-27	Wang, S. C* Chang, C. P*
Solid phase extraction for the determination of metabolite of PGME-(1-methoxy-2-propanol) in urine	2002 Symposium on Industrial Hygiene	2002/04/26-27	Wu, YJ Lee, MK Chou, RS* Shih, TS*
The investigation and experience of control on Local Lead Exposure	2002 Symposium on Industrial Hygiene	2002/04/26-27	Yeh, WY* Chen, CW*
Compare Hearing Threshold of Labor between Taiwan and America	2002 Symposium on Industrial Hygiene	2002/04/26-27	Chang, SJ* Chen, CJ* Chiou, SK Chen, YJ
Compare Hearing Loss Level in Automobile Manufacturing Workers with Industrial Workers	2002 Symposium on Industrial Hygiene	2002/04/26-27	Chang, SJ* Chen, CJ*

			Kuo, YC Chiou, SK
Exposure assessment of SO ₂ for workers in fumigation operation of Day Lily	2002 Symposium on Industrial Hygiene	2002/04/26-27	Lin, YC* Shih, TS* Lee, MK Kuo, SC Lin, WC
The development of an integrated occupational exposure index in consideration of both routes of inhalation and skin exposure to N, N-dimethylformamide	2002 Symposium on Industrial Hygiene	2002/04/26-27	Tsai JY Lin YQ Shih TS* Chang HY
Filtration Characteristics of Cigarette Filters	2002 Symposium on Industrial Hygiene	2002/04/26-27	Lin, WY Huang, SH* Chen, CW* Chen, CC
Effect of Packing Density on Aerosol Penetration through Filter Foams	2002 Symposium on Industrial Hygiene	2002/04/26-27	Weng, YM Chen, CC Huang, SH* Shih, TS*
Characteristics of Volatile Organic Compounds (VOCs) in the Atmosphere of a Toll-way Station	2002 Symposium on Industrial Hygiene	2002/04/26-27	Chen, MR Tsai, PJ Lee, CC Shin, TS* Liu, SH Lai, CH
Improvement of Personal Respirable Virtual Cyclone	2002 Symposium on Industrial Hygiene	2002/04/26-27	Yu, JH

			Liu, YL Huang, SH* Shih, TS* Chen, CC
Occupational Health Discomfort Evaluation on Electroplating Workers	2002 Symposium on Industrial Hygiene	2002/04/26-27	Pan, CH* Huang, YL Chen, CJ* Du, CL* Hung, PC Chen, CK
Accumulation of urinary 2-thiothiazolidine-4-carboxylic acid (TTCA) for rayon manufacturing workers repeatedly exposed to carbon disulfide	2002 Symposium on Industrial Hygiene	2002/04/26	Wu, CC Chou TC Shih TS* Wang PY Chang, HY
Study on Quantitative Analysis of Aniline by Microwave-assisted Solid Phase Micro-extraction	2002 Symposium on Environmental Analytic Chemistry	2002/05/25	Yen, CT Cheng, CF Shih, TS*
A Study on N, N-dimethylformamide (DMF) Absorption through Human Skin Using Exposure Chamber	2002 Symposium on Environmental Analytic Chemistry	2002/05/25	Chu, YM Lin, YC Wang, PY Hsieh, TS* Chang, HY
A Study on Development of Exposure Evaluation methods for hazardous substances in the work environment	2002 Symposium on Environmental Analytic Chemistry	2002/05/25	Shih, TS*
Assessment of Hearing Loss among Steel Manufacturing Workers and	2001 Presentation of Research Results on	2002/07/06	Chang, SJ*

Compare Hearing Threshold of Labors between Taiwan and American	Occupational Medicine and Occupational Health Maintenance		
A Study on Comparing Hearing Threshold of Restaurant workers to the Average	2001 Presentation of Research Results on Occupational Medicine and Occupational Health Maintenance	2002/07/06	Chang, SL Chang, SJ* Chen, CJ* Sung, HC
A Study on Using FMEA on Construction Safety Assessment	6 th Construction Engineering & Management Presentation of Research Results	2002/07	Lin, YH Lin, CC* Li, WC Mu, HC
Development of a Chinese Computerized Job-Matching System	8 th Asia-Pacific Congress on Deafness	2002/08/03-07	Wu. MY Shih Chen, MJ Su, CY Chang, CC Chen, CJ*
Development of a Model of Vocational Assessment for People with Hearing Impairment	8 th Asia-Pacific Congress on Deafness	2002/08/03-07	Wu. MY Shih Chen, MJ Su, CY Chang, CC Chen, CJ*
Determination of Uniformity of Filter Deposits	The 6 th International Aerosol Conference	2002/09/09	Lai, CY Chen, CC Hwang, JS Shih, TS*
Invention of a Triple Filter System for Simultaneous Sampling of Vapor and Aerosol Phase TDI	The 6 th International Aerosol Conference	2002/09/09	Tsai, CJ

			Cheng, KC Shih, TS* Hung, IF Lin, HC
Characteristics of Polycyclic Aromatic Hydrocarbons (PAHs) in the Atmosphere of a Highway Toll Station	The 6 th International Aerosol Conference	2002/09/09	Tsai, PJ Chen, HL Shih, TS* Lee, WJ
Assessment of Hearing Loss among Viscose Workers	17 th Asian Conference on Occupational Health	2002/11/01-04	Chang, SJ* Shih, TS* Chou, TC Chen, CJ Chang, HY Sung, FC
Dust of Feed Flours and Exudates of Animals are Causing Factors of Respiratory Hypersensitivity on Domestic Animal Feeders in Taiwan	17 th Asian Conference on Occupational Health	2002/11/01-04	Chiung, YM* Liu, PS Liu, YT
Occupational Health Hazard Evaluation on Electroplation Workers	17 th Asian Conference on Occupational Health	2002/11/01-04	Pan, CH* Huang, YL Chen, CJ* Du, CL* Hung, PC Chen, CK
Preliminary Survey of Needle Stick Injury among Hospitals in Taiwan	17 th Asian Conference on Occupational Health	2002/11/01-04	Lin, MH* Chen, CJ*
Work Site Health Promotion	17 th Asian Conference on Occupational Health	2002/11/01-04	Hsiao, SC

			Hsu, JH*
The Investigation of Labor hearing Loss in Semi-conductor Industries	The 15 th Conference of Chinese Acoustics Association	2002/11/15	Chang, SJ* Chen, CJ* Chen, YR Chiang, YT Sung, HC
A Study on Sound Pressure Distribution Predicting methods	The 15 th Symposium of Acoustical Society of ROC	2002/11/15	Yeh, WY* Lu, SY* Yu, TS*
A Study on Establishing Risk Management System	The AIROC 14 th Presentation of Architectural Research Results	2002/11/23	Lin, YH Tien, YY Lin, CC* Don, YH

Note: *IOSH Staff

5. Presentation of Theses-Foreign Academic Conferences

Table7 Presentation of Theses-Foreign Academic Conferences

Topic	Conference	Place	Date	Authors
A Proportionate Cancer Morbidity Ration Study of Workers Exposed to Chlorinated Organic Solvent in Taiwan	American Associate of Cancer Research, Annual Meeting 2002	San Francisco, CA, USA	2002/04/04-05	Liou, SH Tai, CF* Yang, SW Chen, CJ*
17.08 Evaluation of Electro cardiograph Components of Workers Exposed to Carbon Disulfide	12 th Conference of the International Society of Exposure Analysis (ISEA) and 14 th Conference of the International Society for Environmental Epidemiology (ISEE)	Vancouver, BC Canada	2002/08/11-15	Chang, SJ* Shih, TS* Chou,

				TC Chen, CJ* Chang, HY Sung, FC.
25.01 Atypical Metaplasia Identified in Sputum among Restaurant Employees	12 th Conference of the International Society of Exposure Analysis (ISEA) and 14 th Conference of the International Society for Environmental Epidemiology (ISEE)	Vancouver, BC Canada	2002/08/11-15	Chang, HL, Sung, FC Chen, CJ* Chang, SJ*

Note: *IOSH Staff

6. Research Awards Received by IOSH Personnel

Award	Recipients	Thesis	Date
Executive Yuan Outstanding Research Award	Shih, TS Tai, CF Yang, RC Chen, CJ Wu, LJ Chang, YM	The Health Effects among Workers due to Long-Term Exposure to 1, 3-Butadiene (III) - Exposure assessment, Health hazard evaluation and Control	2002/08/21
Executive Yuan Outstanding Research Award	Hsieh, JM Lin, YC	Study and Implementation of Information Management System for Industrial Hygiene Accredited Laboratories	2002/08/21

II. Publications

IOSH publications include: research reports, the IOSH Journals, IOSH Newsletters, Annual Reports, 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 2002, IOSH published 15 new publications (research reports were excluded), which approximately 32, 500 copies printed.

Table 9 Publications for Fiscal Year 2002

Title	Type	Issues	Copies	Remarks
Institute of Occupational Safety and Health Journal	Quarterly	4	1100	Vol.10, No.1-4
IOSH Newsletter	Bimonthly	6	4600	No.51-56
Technical Books	Irregular	5	100	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 collections and to improve the quality and quantity of both software and hardware. For the fiscal year 2002, the library had a collection of 5,783 books and 69 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 occupational safety and health information services.

Table 10 Collections in the IOSH Library

Type	200 1	Addition/ Subtraction in 200 2	Total
Books	5, 124	+659	5, 783
Subscribed Periodicals	73	-4	69
Chinese	25		25
English	41	-3	38
Japanese	7	-1	6
Audio/Visual Materials	274	0	274
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 researches. The long-term goal of IOSH's computer/networking services is to build up a national safety and health information center. The IOSH's computer/networking services in 2002 are described as below:

1. Set up the optical fiber intranet networking among IOSH buildings.
2. Purchased and set up a few servers for IOSH's Internet services.
3. Set up a new e-mail server.
4. Enrichment of databases management system, and developed a Law/Regulation expert system program.

Besides, IOSH is continuously setting up an office automation and paperless official document environment. Most of administrative managements are controlled and completed via intranet. In order to spread IOSH's up-to-date information, to provide the public with an easy access to occupational safety and health information, and to save the cost of printing publications, IOSH continues the effort in digitize all the publications. All IOSH publications are available online for free download, which include: research reports, introduction to research projects, Research Programs (abstracts in English), technical books series, the IOSH Journals, IOSH Newsletters, Annual Report (available in both Chinese and in English versions), etc. In 2002, our homepage was visited over 920, 000 times, and IOSH free download service was served 64, 013 times.

IV. Technology Promotion and Services

For the year 2002, IOSH sponsored 1 exhibition, assisted in 41 investigations into suspected cases of occupational diseases, and offered calibration services for inspection instruments 1 times (see Table 10-13).

Table 11 Exhibitions

Topic	Summary of Activities	Location	Date
The Exhibition of CLA Administration Efficiency	IOSH Research Results Presentation in coordinate to the Exhibition of CLA Administration Efficiency	Square in front of the Office of the President, ROC	2002/06/02

Table 12 Investigation into Suspected Cases of Occupational Diseases

Name of Organization	Items Investigated	Date
**Plastics fiber factory	Electric welding accident	2002/03/04

**Industry company	Reactor explosion	2002/05/02
**Textile company	Hearingloss	2002/05/31
**Fishing boat	Ammonia poisoning	2002/06/02
**Mining factory	Electric shock accident	2002/06/05
**Battery company	Lead poisoning	2002/06/21
**Steel enterprise company	Steel crank shaft connector draws in	2002/06/27
**Chemical company	Dimethyl Sulfate	2002/06/27
**Thermal power plant	Boiler explosion	2002/07/12
**Company	MbOCAexposure	2002/07/26
**Enterprise limited company	Suspected death of electric shock	2002/08/16
the recycling truck service worker	Death of falling	2002/08/28
**Electrical engineering company	Drill work accident	2002/08/29
**Cement company	Hearingloss	2002/09/30
**Company	Lead poisoning	2002/10/02
**Hospital	Herniated intervertebral disk	2002/10/17
**Occupational labor union	Lead poisoning	2002/10/21
**International commercial centerconstruction site	Crane fall from earthquake	2002/10/22
Inspect Taipei 101 construction site	Investigate the fence meet safety requirement or not	2002/10/23
**LPG store	Carpal tunnel syndrome	2002/10/24
**Industrial company	Intervertebral disk abnormality	2002/11/07
**Car repair and maintenance factory	Wrist pulled	2002/11/12
**Occupational labor union	Reynolds syndrome	2002/11/12
Kuantien industypark** technical company	Dust explosion of magnesium aluminualloy	2002/11/18
Varnish industry(the indoors paints)	Lead poisoning	2002/11/18
Porcelain and ceramics maker	Pneumoconiosis	2002/1120
**Car industrial company	Fluorohydric acid/ Nitric acid exposure	2002/11/22
**textile string factory	Carpal tunnel syndrome	2002/11/25
**Silicapowdercompany	Pneumoconiosis	2002/11/29
**Occupational labor union	Nervous systeminjuries	2002/11/29
**Air conditioning company	Hearingloss	2002/12/05
**Hospital	Tuberculosis	2002/12/05
**Health care institute	Health examination abnormality	2002/12/10
**Hospital	Hearing loss	2002/12/11
**Hospital	Hearing loss	2002/12/12
**Company	Carpal tunnel syndrome	2002/12/13

**Steel company	Hearing Loss	2002/12/17
**Industrial company	Hearing abnormality	2002/12/18
**Industrial firm	Carpal tunnel syndrome	2002/12/18
**Electrical company	Carpal tunnel syndrome	2002/12/18
**Freight transportation company	Herniated intervertebral disk	2002/12/27

Table 13 Inspection of Apparatus and Calibration Services

Name of Agency	Services	Date
Inspection Organizations	2 oxygen and flammable gas detectors; 30 industrial safety inspection apparatus	2002/10-2002/12

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 and procedures. 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. Basing on IOSH 2002 research results, a total of 6 patents were obtained (see Table 14).

Table 14 Patents

Patent No.	Invention	Inventors
ROC Patent No.188786	Lifting belt	Lin, JH Chen, CY* Huang, CH Chen, HY
ROC Patent No.155369	Over turn signal detecting and warning device for forklift trucks	Tai, CF* Wu, SH Kao, CY* Chiou, CC
ROC Patent No.158061	Method and device for monitoring workers' exposure pattern at workplace	Hsih, TS* Wang, PY
ROC Patent No.161259	Vibration suppression of tower crane maneuvers and attitude control of its payload	Tai, CF* Kao, CY*

		Shen, YL* Chiou, CC
ROC Patent No.194120	Pipeline safety link device	Tai, CF* Kao, CY* Shen, YL* Yang, CH
ROC Patent No.164610	Exhausting device for an atomic operation	Lin, CL Chang, CP* Cheng, RY*

Note: *IOSH Staff

In terms of exhibition activities, IOSH's Mobile Exhibition began its virgin voyage since March 29, 1999. During the year 2002, it had successfully toured through 32 exhibitions. Among these were schools of all levels, industrial areas, business districts and related joint activities. It is estimated that 50, 000 people had attended these exhibitions in 2002. 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 safety and 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 15 Oversea Trips for Research and Study

Category	Country/ Organization	Topic	Name	Date
Visit	Greece	International Symposium on Occupational Safety and Health	Yu, TS	2002/10/04-13

Appendices

I. IOSH Research Projects in 2002

Project No.	Title
IOSH91-	
A101	Improvement and Field Verification of Personal Respirable Virtual Cyclones
A102	Research on the Simultaneous Personal Sampling Technology of TDI Vapor and Aerosol: Field Study
A103	The Development and Field Validations of a New Exposure Model Based of Continuous Personal Monitor and Time-Activity-Pattern Recorder
A104	Studies in Microwave-Assisted Solid Phase Micro-Extraction for the Toxic Chemicals in Sorbent
A301	Assessing Free Silica Exposures to Municipal Waste Incinerator Demolition Workers
A302	Occupational Exposure to Organic Solvents during Paint Stripping and Paint Spraying Operations in the Aeronautical Industry (II)
A303	Occupational Exposure to Organic Solvents during Military Aircraft Maintenance Operations
A304	Method Development for the Biological Monitoring of p-Dichlorobenzene Exposed
A305	Blood Lead Electrochemical Analysis Technique Field Test
A306	Urine TTCA Electrochemical Analytical Technique Study
A307	Survey of Workers Exposure to Chemical Hazards in Defense Industry
A308	Quantitative Analysis of Urinary S-PMA to Workers Exposed to Benzene
A309	Investigation of Chemical Exposure in 300mm Semiconductor Industry
A310	Construction Plan of Panorama VR for the Laboratory Buildings in the Institute

	of Occupational Safety and Health
A311	Implementation of Monitoring Programs for Highly Lead Concerned Exposure Industries
A312	Survey of Heavy Metals Exposure of Contact Workers in the Working Environments of Electric Arc Furnaces
A313	Exposure Assessment, Dermatitis Survey, and Control Measures of Chromium in Cement for Construction Workers
A314	Assessing the Exposures and Health-Hazards Associated with PAHs Exposures for Asphalt Pavers
A316	Development of Biological Monitor Method of Toluene Diisocyanate
A317	Exposure Assessment of Polychlorinated Dibenzo- <i>p</i> -dioxins and Dibenzofurans (PCDD/Fs) for Workers of Secondary Ferrous Metal Smelting Refining Plant electric Arc Furnace
A318	Exposure Assessment of Polychlorinated Dibenzodioxins and Dibenzofurans (PCDD/Fs) for Contracted Maintain Workers of Municipal Waste Incinerators Located in Southern Taiwan
H101	A Study on the Environmental Monitoring of Mycobacterium Tuberculosis and Occupational Infection among Health Care Workers
H102	The Model of the Hoods for Dispersed Contaminants
H121	Development of Systematic Thermal Hazard Predicting Model for Optimizing Thermal Environment Parameters
H122	Establishment of Evaluation Tool for Neck-Shoulder Pain
H123	The Evaluation of Manual Material Handling in Warehouse
H301	A Study for Numerical Control of Local Exhaust Ventilation Systems
H302	Study on Occupational Health Performance Indication (I): Manufacture Industry
H303	Establishment and Proficiency Testing of Sound Absorption for Acoustical Materials in Reverberation Room
H304	The Risk Assessment for Hearing Loss in Workers
H305	A Study on Whole-Body Vibration of Fork-Lift Truck Drivers and Control Strategy
H306	The Low Frequency Electrical Magnetic Field Exposure Assessment and Control in Occupational Environment
H307	Filtration Characteristics of Nanoparticles through Electret Filter Media
H308	Survey of Hazards and Inspection Standards in New Applied Industries
H309	A Study on Occupational Hygiene Emphasis Program to Lead
H310	Study on Adsorbent System for Chemical Release
H311	Study on Emergency Shower Devices
H341	Prevention and Management Research of Biological Hazards in Microbial Industry: Establishment of Standard Model of Safety Restrain for Biological Safety Cabinet and HVAC system
H342	Establishment of Emergency Response Procedure for Laboratory

H343	A Study for Worker Exposure in Cross Draft with an Exterior Hood
H344	Influence of mechanical properties of inclined surfaces on falling
H345	Development of a Monitoring Technology for Risk of CTD in Upper Extremities
H371	Evaluation of Germicidal Efficiency on Airborne <i>Legionella Pneumophila</i>
H372	The Ergonomic Evaluation of the Emergency-Off (EMO) Button in Semiconductor Machines
M101	Strategy for Surveillance of Risk Factors of Occupational Injuries: Study of Multiple-mechanism Surveillance System (III)
M121	Respiratory Effect on Cotton Textile Workers
M141	The Relationship of Chemical Exposure and Hearing Loss at Work Place
M142	Development of a Vocational Evaluation Instrument for People with Mental Illness
M161	Occupational Herpes Exposures in the Health Care Workers
M301	The Occupational Health among Shipyard Workers
M302	Occupational Hazard Assessment in Biotechnology Industries (II): Hazard Identification and Management Program in Safety and Health
M303	The Study of Work and Health among Taipei Metropolitan Aborigines (II)
M304	Work Stress by Bus Driver Shift-Pattern and Its Impact on Cardiovascular Effect
M305	Research of Electronic Media Report of Labor Health Examination
M306	Setup Automatic Analysis for High Risk Worker Cohort
M321	The Study of Musculoskeletal Disorders in Restaurant Workers
M323	The Study of Health Effect among Road Pavement Workers
M324	The Study of Working Environment of Dental Personnel
M325	Study of Establishing Cohort Data among Workers in Semiconductor Manufacturing Industries
M341	The Effectiveness of Health Promotion Program in Workplace
M342	Study on the Health Effect from Workplace Climate Change: Extreme Low Humidity
M343	Comparison of Law Forbidding Child and Women Workers from Dangerous Industries between Developing Countries & ROC
M344	The Master Plan of Macroeconomic Change and Workers' Health
M361	A Survey of Asthmatic Disease on Animal Handler Workers (II): Animal Slaughters
M362	A Study on the Policy of Labor Safety and Health and Inspection from the Occupational Disease Cases
M363	Health Hazard Evaluation of Arsenic Workers in Semiconductor Industry (II): Acute Hazard Prevention and Biomarker Research
S101	A Study on Electromagnetic Interferences for Preventing Faults in Factories (II): Radio Frequency
S102	The Study of Computerized Inspection of Mobile Crane

S103	Expert Diagnosis System Development for Mechanical Equipment: Boiler
S104	Performance of Review and Inspection System in Dangerous Workplace
S105	Monitoring and Collapse Prevention of Construction Supporting Frames
S106	Study of Construction Safety Auditing System
S108	The Study of Safety Culture and Safety Performance at Construction Industry
S301	The Investigation Standards for Explosionproof Electrical Apparatus in the Domestic Plants
S302	Edit Paradigms for Classification of Hazardous Areas and the Selection of Explosion Proof Electrical Apparatus for Batch Reaction Process
S303	The System Scheme Survey for the Type Test of Explosionproof Electrical Apparatus
S304	The Hazardous Analysis for the Contractual Operations in the Petrochemical Industry
S305	Investigation on the Danger of Fires and Explosions in Chemical-Related Laboratories in Universities and Colleges
S306	The Development of Performance Inspection System for Safety Devices on Injection-Moulding Machine (I)
S307	Design and Manufacturing of Economic Size of Electric Motion Platform for Training System (II)
S308	The Failure Mechanisms and Risk Assessment of Pressure Vessel and Its Boundary Components
S309	A Study on Construct a Seismic Design Code for High Pressure Gas Vessels (I)
S310	Establishing Auditing Guide of Extension and Alternative Inspection for Pressure Vessels
S311	The Study Plane of the Vessel Safety Inspection and Management System
S312	Analysis of Serious Occupational Accidents in Construction Industry: Unsafe Behavior and Condition
S313	The Research of Safety Construction Methods for Full-Span Precasted Bridge
S314	Study of Performance Index of Labor Inspectorate
S315	Study of Deficiencies in Occupational Health and Safety Management in Domestic Manufacturing Industries
S316	Research and Development of Expert System for Decision Marker on Emergency Plane (I)
S317	The Assessment of Labor Safety Behavior Prior and Post Safety Guideline Intervention: Case Study of Construction Workers
S318	Comparing Occupational Safety and Environmental Healthy System with Developed Countries and Assessing Its Training Needs

II. Technical Books Collection

Serial No.	Title	Publishing Date
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IOSH91-T-046	Guidance of Exposure Survey of Hazardous Substances in Workplace (VI): Free Silica in in Fire Brick Manufacturing	2002/01
IOSH91-T-047	Guidance of Exposure Survey of Hazardous Substances in Workplace (VII): Mercury Vapor in Fluorescence Lamp Manufacturing	2002/02
IOSH91-T-048	Construction Safety Guide of Cast-in-Place Bridges	2002/07
IOSH91-T-011	Reference Methods and Validation Procedures for Sampling and Analysis of Hazardous Substances in the Work Environment (2nd ed.)	2002/10
IOSH91-T-020	Guidelines for Occupational Hearing Protection Plan (3rd ed.)	2002/12

III. Index of Accompanying Figures

IV. Index of Accompanying Tables