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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, 2003 and ending on December 31, 2003. 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 2003, 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 2003 and technical book collections (published in 2003) for readers’ reference.

Chairperson

Contents

Contents

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 2003, with the completion of 90 projects for fiscal year 2003. 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 13 publications, 3 exhibitions, 17 academic workshops, 61 scientific papers published in local and foreign publications, 70 papers presented inlocal and foreign academic conferences, and 5patents. 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 (2003)

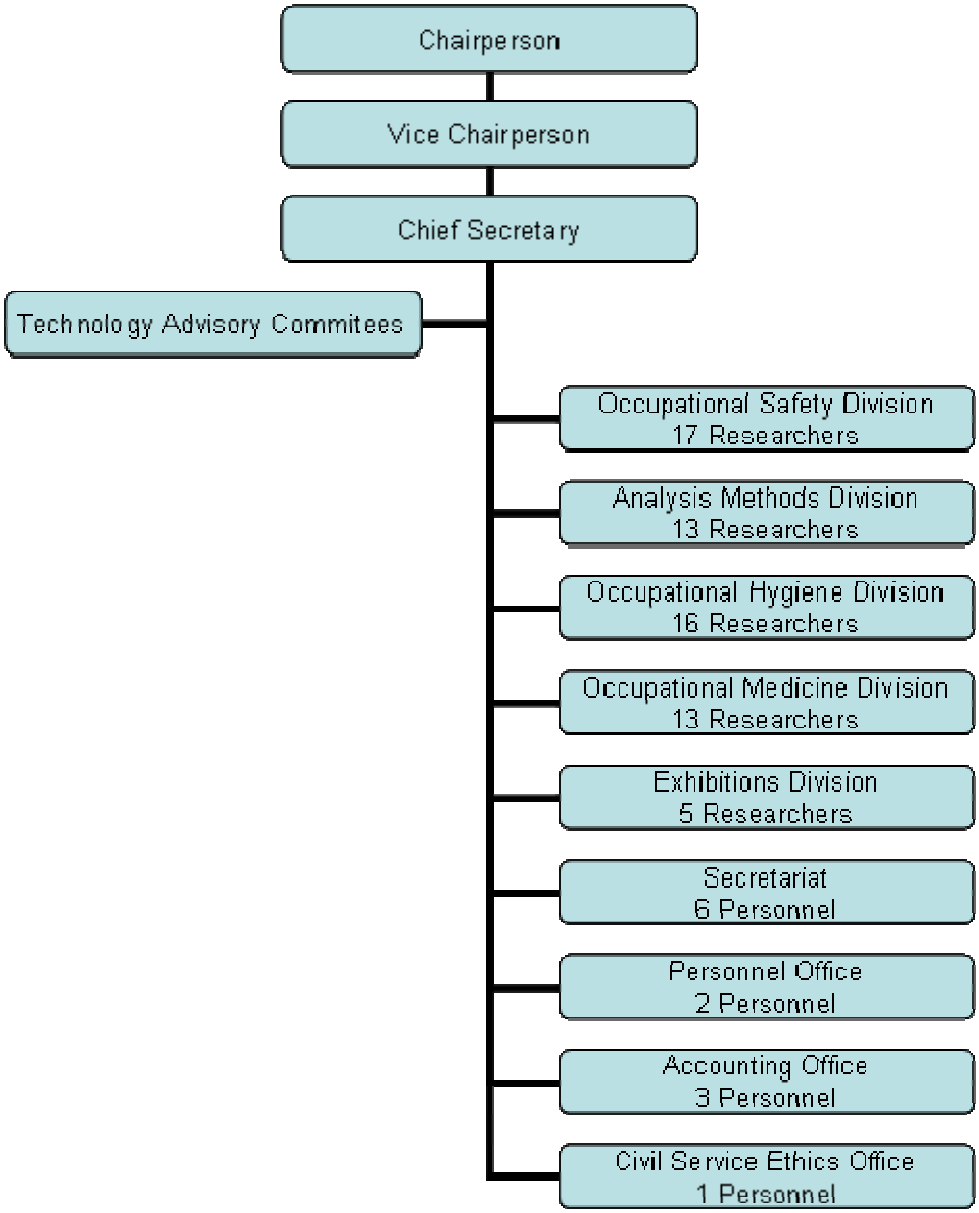

Figure 1IOSH Organizational Structure (2003)

2. Analysis of Research Positions

Table 1 Anlaysis of Research Positions

Positions	Senior Researcher	Researcher	Associate Researcher	Assistant Researcher	Reserved Duty Pernonnel for Science and

					Technique
Number of Employees	3	16	20	10	18

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

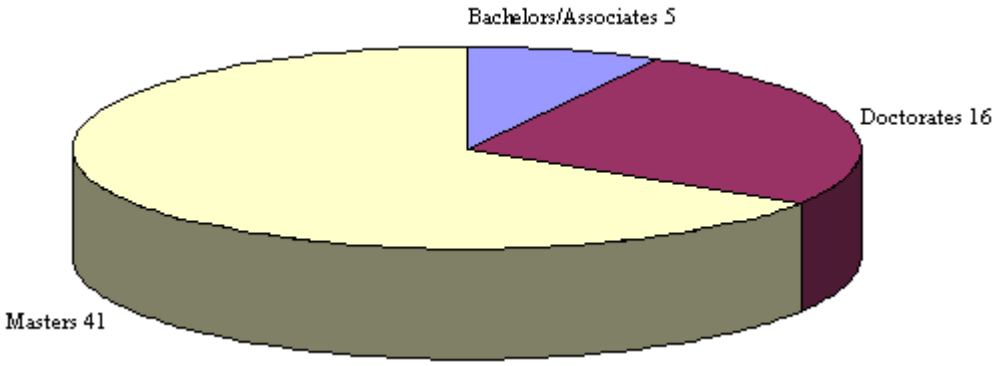

Figure 2 Analysis of the Level of Education in the Current Research Personnel

Note:
1. 5 positions are vacant.
2. Doctorate researchers include 2 that are on fix-term contract.
3. 9 research personnel are undertaking doctorate studies,1 is undertaking master's degree study currently.
4. Including 18 reserved duty personnel for science and technique.

III. Research Expenditures

1. Budget for Fiscal Years 2003

Table 2 Budget for Fiscal Years 2003

Unit:NT$ 1,000

Subject	Budget for FY 2003*
Occupational Safety and Health Research	146,856
Occupational Safety Survey and Research	31,544
Analysis Method Development and Research	27,904
Occupational Hygiene Survey and Research	28,940
Occupational Medicine Survey and Research	27,450
Occupational Safety and Health Exhibitions	31,018

2. Analysis of Research Expenditures over the Years

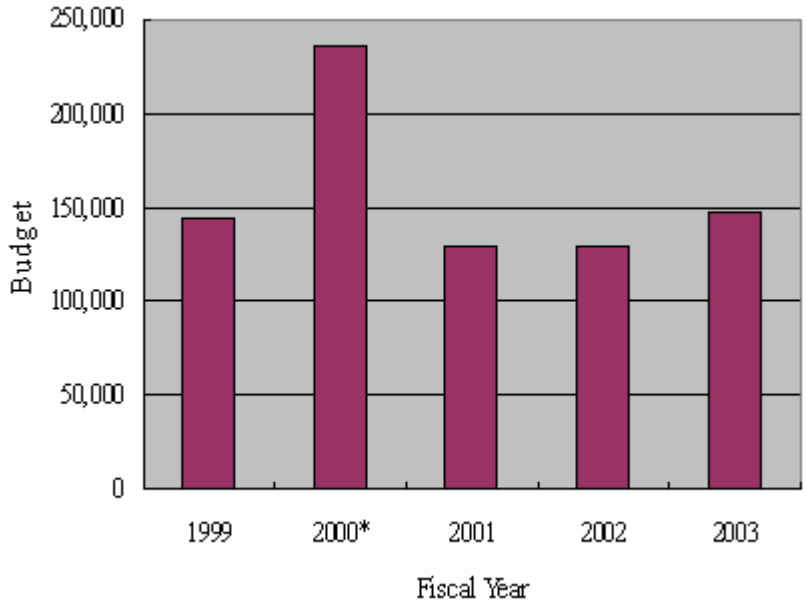

Figure 3 Research Budget for Recent 5 Fiscal Years (Unit: NT$1,000)
*: includes the second half of 1999 and the year 2000

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 Occupational Safety Division 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.Emphases of researches in construction safety are not merely focused on surveys of current conditions, safety

management, and assessment of construction safety; they are also centered on technologies of construction safety equipment as well as various construction safety monitoring and controlling approach methods. It is hopefully to minimize occupational hazards in the construction industries. Research activities for this year are mainly concentrated on:study of tunnel excavation safety management and monitoring to prevent collapse and inundation, safety of construction operations near water, river or offshore, the evaluation and test for forming monitoring system, the evaluation and test of the safety performance of the scaffold, the tripod anchorage connectors for confined space rescue systems, wind and seismic effects during construction of high-rise buildings evaluation and safety, and safety analysis for high place inspection and repair beneath bridge.

2. Research on Mechanical Safety

Labor activity annual inspection report shows the top occupational accident among all industries in year 2002 is from manufacturing industry. It indicates there are total 242,272 days as gross working day loss plus 3,342 person/time as frequency of disable hazard. Struck by object, caught in or compressed by equipment, cuts and abrasions are the most common types of occupational accidents; most of them are caused by unsafe machinery.Meanwhile, interface happens between the operator and machinery movement due to semi-automation is still major used in manufacturing procedure nowadays.Occupational accident is therefore seduced whenever an interface occurs from incomplete safety designs.Meanwhile, research focuses on developing a technology for monitoring a controlling process machinery safety is also emphasized. For this year, investigations are mainly centered on:the study of the prevention for industrial casualties caused by using rolling machine and automation, the degradation and safety evaluation on safety helmets for work site use, study on establishment of seismic design specifications for tower cranes, study on construct a seismic design code for high pressure gas vessels (II), the study of computerized inspection of truss girder boom mobile crane, the development of performance inspection system for safety devices on injection-molding machine, development of performance inspection system for safety devices on injection-molding machine, design &manufacturing of economic size of electric motion platform for prototype – merchandize, the improvement and evaluation on safety secure stabilizer of gondola, and a design, fabricate, and function testing for plate lift clamp tool.

3. Research on Electrical Safety

In Taiwan, technical guidelines, information, and research report for explosion protected electrical apparatus are somewhat lacking. Site industry units and related units require technical documents of explosion protected electrical apparatus. The planned research topics therefore are not only electric shock prevention but also explosion protected electrical apparatus technique. The researches are focused on: investigation on causes of electrical installation related disaster and hazard, improvement of electric 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 protected electrical apparatus.Researches conducted this year are focused on: the guideline of installation and practice for flameproof electrical apparatus, and temporary grounding for safe line working on de-energized power.

4. Research on Chemical Safety
Chemical accidents such as runaway reactions, chemical leaking, fire, and explosion occurred during chemical transportation, loading, storage and manufacturing procedures have been reported frequently. Lack of chemical safety techniques among operators and inappropriate process safety management are considered to bemain factors. The researches are focused on: revisionsof safety inspection regulations, techniques on safe chemical manufacturing, storage, transportation, and usage, methods of occupational accidents investigation, risk assessment techniques. Researches conducted this year are mainly focused on: survey and prevention policy of industrial batch-process fires and explosions in the recent decade, process safety analysis in batch reaction system, investigation of military chemical process hazards: high explosive manufacturing process, the study for preventing capsizing accidents of roadtanker, and safety investigation of transport of dangerous goods during loading/unloading process with loss prevention approach: flammable liquids.

5. Research on Occupational Safety Management Policies
In order to comply with national occupational safety and hygiene management policies also improve domestic occupational safety and hygiene management technique, IOSH's 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 incidents, 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 study 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. Researches conducted this year are focused on: the studyon norm for SCQ at construction industry in Taiwan, development of expert system for decision maker on emergency plan (II), etc.

II. Research on Analysis Methods

Research on analysismethodsis aimed at developing methods for monitoring hazardous substances in workplace, for assessing workers' exposures, as well as to promote laboratory QA/QC and the system for accredited laboratories, to prevent occupational diseases; to enhance productivity and the quality of the work environment. According to

the operational directives of IOSH, the functions of the Analysis Methods Division 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 along with 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 presenting in the working environment today. The government has adopted various positive strategies to seek improvement measurements to express its concern on this matter.Chemical hazard exposure study is one of the most important tasks thus IOSH conducted a series of investigations. Together with providing resultsfrom exposure monitoring and occupational disease survey to government agencies, these studies shall be helpful in setting comprehensive and feasible regulations and policies.IOSH will continue to conduct in-depth studies on highly hazardous substances used in large quantities in industries, with large numbers of exposed workers or high incidence of occupational diseases. These researches are also primarily focus of labor inspection, permissible concentrations, and subjects for 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 for government agencies, academic institutes, and business sections to use. Research activities are 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 equipments 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 as both high temperature and high humidity. Developing local samplers and sampling media that are more economical, more convenient, and more accurate is needed. IOSHtherefore has developed a new exposure-based personal alarm system for workers and effect of aerosol loading on cyclone performance. 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 respiratory system, environmental monitoring is another implement.Many industrial raw materials or process intermediates may also enter human body through dermal contact and ingestion.In addition, differences in personal hygiene and inter-individual variability in skin absorption also increase the needs for biological monitoring. Biological monitoring is the direct measurement 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. Research on industrial hygiene technologies has caught the attention of developed countries over the worldrecent years. 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 lead in blood, required by current labor physical examination regulations, and to 8 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: a fast, sensitive, and convenient electrochemical method based on screen-printed electrode for detection of Lead Ion (Pb^{2+}) in blood, and domestic workers’ exposure to benzene, dioxin as well as polycyclic aromatic hydrocarbon (PAHs).

5. Development of real time monitoring method for gaseous substances

The traditional exposure assessment frequently utilizes various sampler interfacesas absorbing for measuring TWA within 8 hours. This method can not provide exposure site or exposure concentration at any particular time although it is quite simple, which also means it is impossible to obtain information on worker’s operational condition. Direct reading instruments can measure exposure concentration in a very short time; however, it cannot provide detail information of exposure site and worker’s 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 involve in developing exposure assessment system through use of IR location identifying device, chemical sensor, and electronic control system. Researches conducted these years are 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 is the knowledge for us to understand risk factors plus controlling in the work environment. According to the operation guidelines of IOSH, the Occupational Hygiene Division 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 as well as protection equipment related. Research esare directed towards:

1. Management and survey of exposure to occupational biological hazard
Healthcare workers have faced a variety of biotechnology hazards during every working day. Probability of exposure under biological hazard increases relatively besides the chemical and physical hazard in traditional industry. There is no complete official biological hazard management and survey island-wide yet, IOSH therefore emphasizes research on potential occupational hazard biotechnology and make it the reference guidelines for administrative department in the near future. It aims studiesas key facilities including biosafety cabinets and HVAC whichare often used in biotechnology industries, hospitals and colleges. In order to upgrade the environment safety for domestic biotechnology workers, IOSH compiles local and international standardsplus guidelines then edit the guideline for the usage, installation, and efficiency confirmation of biosafety cabinets as well as safety modules for HVAC. Located in subtropical zone makes Taiwan high temperature along with high humidity year round, this also produces a perfect breeding ground for biological aerosol. Epidemiologic episodes of affective diseases in health care institutes happen from time to time, for instance, *tuberclebacillus* and *legionella pneumophila*.All reasons above makes developing environment surveillance technique and related management control measurements top priority.Furthermore, in order to reduce exposure concentration in every hazard working environment – as IOSH's focus of this part, it assists those high risk hazardous business units enhance safety of working environment, insure workers' healthy condition through: individual factory environment examination, health management, education training, and project improvement, etc.

2. Hazardous substances control and prediction models in work environment
According to Labor Inspection Yearbook, function of ventilation system equipment generally doesn't meet the requirement of regulations. Controlling technique of industry airing system so far is still designed by experienced unit engineers who lack of design norm and basic parameters. The circumstance makes most business units possess merely apparatus but not well controlled concentration of contaminants. Ventilation outcome depends on design parameters as well as technical manual instead of simply wind speed.In addition, product quality various and price war due to respiratory device product inspection system is not well-established yet. Consumers can not get effective,

comfortable, and cost-effective respiratory protection even though domestic professions have invented and manufactured up-to-date material with advanced value. That is because inspection skills are not accepted through international market yet. In light of above, IOSH and Bureau of Standards, Metrology & Inspection (BSMI) of Ministry of Economic Affairs plan to initiate and establish examination approval system for respiratory protector. They expect the implementation of this practice ensures quality and technology capability of respirator nationwide. IOSH also brought nosocomial infection control within results from researches over the years; meantime, it conducted investigations to survey the moving path and flowing field for the personnel in negative pressure room during SARS's attack.

3. Prevention of hazardous physical factor
Long-term exposure to some physical factors such as high temperature, noise, and vibration will cause danger to human health.Research work here is focused on techniques of engineering control, and exposure evaluation on high risk exposure group based on international standards. Exposure to whole-body vibration might be connected with the incidence of back pain and the disease of degenerated herniated intervertebral disc, according to many epidemiological studies. Transportation vehicle and construction machinery drivers are especially high risk of whole-body vibration. During current stage, IOSH focuses on local exposure evaluation to vibration, as next step will be prevention strategy. Both outcomes can be used as reference for industrial and official to implement and educate on vibration hazard prevention related, so that the risk of obtaining occupational disease will be reduced hopefully.

4. Ergonomics application and hazardous control technology
Ground recline angle and frictional characteristic cause center of weight bias of worker then trigger tip over or more seriously, falling off. In order to get a better understanding of protection effect of height on current defense railing, experiment assessment is conducted in order to revise laws and regulations plus prevent slipping related accident. Musculoskeletal disorders have become one of the most common occupational diseasein recent years. It differs from various tools/instruments, postures, or even to the site of pain or injured location on the labors due to diverse work functions. However, there are complicated causing factors for musculoskeletal disorders. Besides the most important factor of work, individual activities for relaxing in daily life, idiosyncrasy, general physical-mental status or tension are all the possible factors. Facing such general existing with overwhelming problem, it's actually not easy to prevent it. The current research is focused not onlyon proactively establishingbasis ergonomics data for the labors, but also on conducting researches for localized evaluation and technical improvements, and on developing field assessment tools for musculoskeletal disorders.

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, responsibility of the Occupational Medicine Division 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 ratio 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 ofdeath due to occupational injury, occupational hearing loss, and occupational decompression sickness for compressed air workers has been established. A monitoring system for lead in blood has also been developed. Researches completed in the year 2003 include: the study on labor insurance occupational hearing disease prevention health check datareported through computer; the study of health effect among asphalt blend workers; the study of health outcomes among autobody repair shop workers (III); and the research on occupational hazards of waste anesthetic gases in medical workers.

2. Survey on occupational diseases and occupational epidemiology research
Due to rapid industrial and commercial development in Taiwan recent years, complex production technologies and various new chemical substances have continually been applied to the workplace. Workers are exposed to much more complicate working environments which lead to the emergence of various occupational diseases. Thus, the purposes of these researches lie in the survey 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 onthe cohort study of incinerator demolition, health survey for the long-distance bus drivers, the study on noise exposure and vibration of bus drivers.

3. Research on Workplace 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 workplace 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 who are well experienced as well as those who are willing to stay on the job, and 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 working environment. Research interests include both mental and physical aspects: the investigation of health promotion in industries and the function planning of their health center; labor health promotion plan – special designed callisthenic exercise training program; evaluation of a health promotion program for professional drivers; special health examination and health management of potentially dangerous work in different countries; work characteristic and cardiovascular disease; study on the health effect from workplace climate change: low humidity; and the relationship of chemical exposure and hearing loss at workplace (II).

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 are centered on health strategy discussion and biological hazard investigation includinga study of healthy effects on dichlorobenzene exposure, an investigation of healthy problems on spray painters about chemical exposure, plus health hazard evaluation for coke oven workers exposed to polycyclic aromatic hydrocarbons.

5. Emerging Occupational Health
Emerging occupational health troubles generate continuously as change of structure of both industry and society, investigations and preventions on this part become the top

priority. IOSH therefore needs to establish proper occupational safety and hygiene management policy with all haste through analyses plus investigations in order to prevent possible problems. Thus, focused researches include emerging occupational health hazard from newly rising industries, healthy subjects about disadvantage minority, and career switch, re-employment, or even unemployment due to industrial structure transformation. Completed studies in year 2003 are: development of a work evaluation system for individuals with disabilities (I), development of a vocational evaluation instrument for people with visual impairment, health hazard surveillance of female worker focusing on medical professionals, occupational hazard assessment in biotechnology industries (III), and “Factory Closure and Workers Health”.

Research Results

IOSH research results are edited as technical handbooks for the use of promotion and reference by labor units, business units, along with other related parties. Meanwhile, they also provide reference for Council of Labor Affairs when makerelevant policies in addition amending regulations. Besides, its research results are announced in occupational safety and hygiene scientific seminars. They are also published on several major journals worldwide. Those researches with commercial have filed in for patents in some foreign countries. The research techniques have transferred to specific domestic companies as well.
This chaptermainly summarizes researchesand results of IOSH for the 2003 fiscal year below.

I. Research on Occupational Safety

A. Mechanical Safety Research:
Complete the study on the prevention for industrial casualties caused by using rolling machine and automation. Interface happens between the operator and machinery movement due to (semi-)automation is still major used in manufacturing procedure nowadays. Occupational accident is therefore seduced whenever an incomplete safety design of interface occurs. Meantime, struck by object and caught in or compressed by equipments are always primary on occupational hazard in machinery operating; they especially happen in rolling machine and automation types. By means of safety protection improvement from research sum up, IOSH provides advice of modification to not only technique but also management levels.
Accomplish the case study of degradation and safety evaluation on safety helmets for work site use. This study is basically designed to test the hardness, hitting/strike, and puncture on broadly collected local helmets with various manufacturing dates and industries. Meantime, it categorizes helmets within their structure design, material, expiration date, as well as frequency of usage in order to get a better understanding if

diverse damage occurs when helmets confront different levels of hitting/strike and puncture.
Finish the assessment on improvement, testing, evaluation on stabilization device of gondola.With the attention of refining gondola also improving its stabilization device to a more flexible, multifunction, plus convenient level, IOSH co-operates relevant field with reasons such as: practical demand from usage and assorted operating environment. IOSH also develops interrelatedsucker modules to aim for diverse wall design.Meanwhile, practical test to prove systematic function precisely fulfills needs of related industry has also been conducted.
Achieve the study on establishment of seismic design specifications for tower cranes. In this study, a draft named seismic design specifications for tower cranes is suggested to divide into two categories, which are call usual and special one. For the former one, tower cranes are designed with total base shear of 0.225W and elastic analysis and design are enough. As for the later one that cranes are mounted on a building with height greater than 75 meters, inelastic analysis combined tower crane and building together is required. When evaluating a case, IOSH consequently suggests case by case review; also, professional structure technicians analyze and approve the design before evaluation from of Examination Committee, CLA.
Complete the study to construct a seismic design code for high pressure gas vessels (II). After discussion plus counsel exchanging repeatedly, experts and scholars provided valuable amendment opinions on the draft of a seismic design code for high pressure gas vessels from this study. The draft has 14 regulations, which are divided into five chapters, plus supplementary in this article. These chapters are:

1. general requirement and definitions - which principally defines foundation as well as application of this code.
2. The capability of equipment when undergone seismic loadings.
3. Acceptable response analysis methods - which claims allowable seismic analysis of this code.
4. Structural stresses when subjecting the seismic loadings – solution and formula for different material when confront structural stresses during subjecting seismic loading.
5. The allowable stresses for various materials and loading conditions – it policies limitation as safety of seismic material under the allowable stresses. Furthermore, this plan also provides linking calculation examples for interrelated industry as reference check in order to have it well-recognized and applied more accurately.

Achieve the study on design &manufacturing of economic size of electric motion platform for prototype – merchandize. It reduces cost of simulate training system to increase its implementation convenience and popularity. This platform can be used as system of imitative discipline in near future as well.
Finish the study of computerized inspection of truss girder boom mobile crane. IOSH establishes a system on inspection construction intensity of mobile crane.This system

increases efficiency and liability of domestic portable mobile crane checking majorly through computerized the most complicated part of examination - construction intensity calculation – as a part of this software.In addition, this software integrates standard checking lists, related regulations, and forms in order to reach unification of criterion of inspection as well as help procedure with quality and efficiency examination. (as fig. 4)

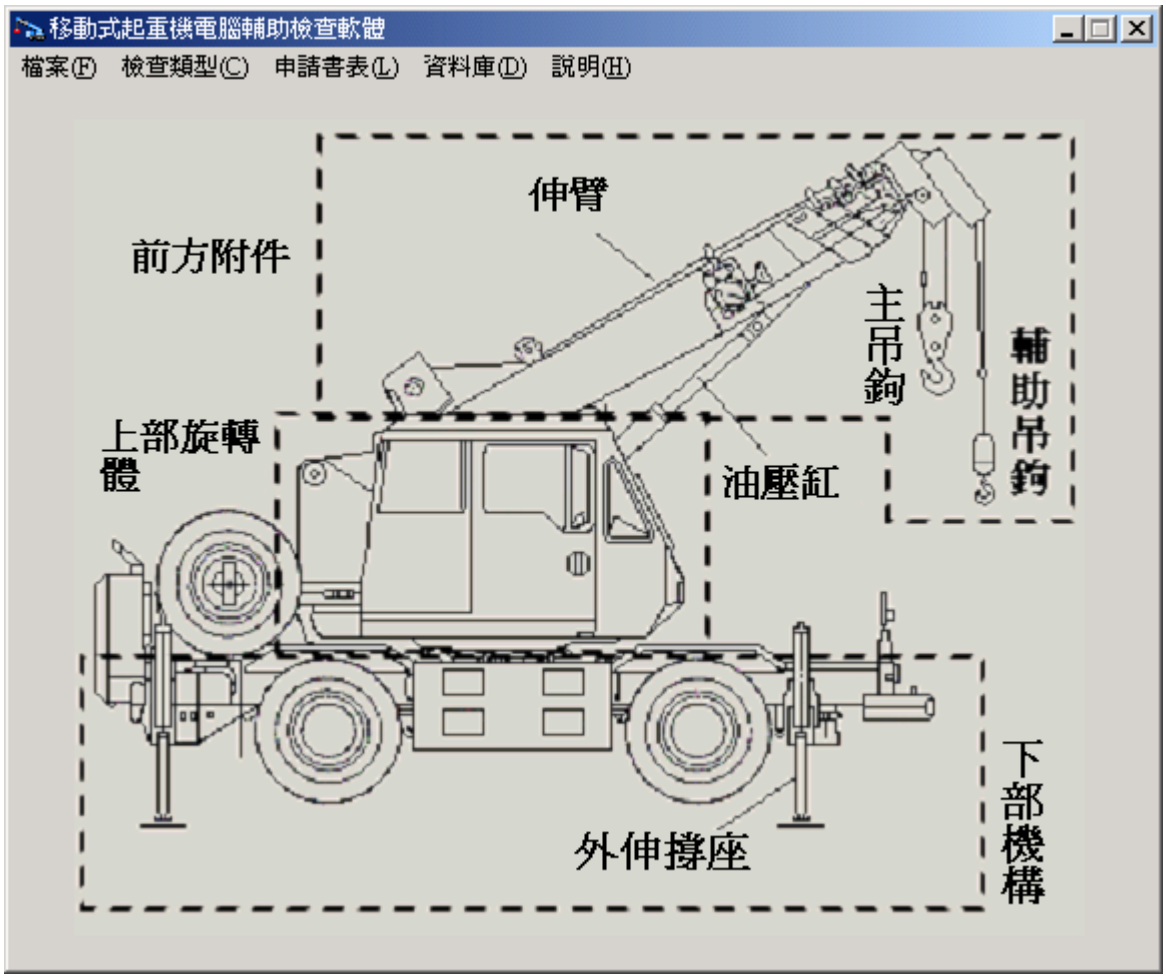

Fig. 4IOSH truss girder boom mobile crane system executive display screen

Complete the development of performance inspection system for safety devices on injection-molding machine to provide operation safety in injection-molding machine industry locally. Research result now has been under the processing of patent filing; furthermore, it tallies with safety regulations within developed countries as well.
Finish research on a design, fabricate, and function testing for plate lift clamp tool. With the purpose of providing cost effective yet better protection and simple structure, IOSH improves the tools by collecting, analyzing various design, safety standard, and merchandise module with local and international plate lift clamp tools.

B. Chemical Safety Research:
Complete the study on survey and prevention policy of industrial batch-process fires and explosions in the recent decade. During this research, IOSH collects 60 cases on industrial batch-process fires and explosions, assist investigation of occupational and

prevention strategy. The reasons of occupational incidents are analyzed and a safe guideline for batch-process is proposed. IOSH will provide achievement for chemical manufactory and inspection organization.
Accomplished study on safety investigation of transport of dangerous goods during loading/unloading process with loss prevention approach: flammable liquids.IOSH conducts safety investigation as well as establish detailed database of transport of dangerous goods during loading/unloading process to provide related business unit as one of applications.
Achieve the study for preventing capsizing accidents of roadtanker.IOSH compiles statistics and analyze reasons along with types from domestic and overseas chemical roadtanker accident collection data. Human causes have been found as the major reason, and fire is the main calamity type from this analysis. During this study, almost all concerns, information, and reasons have been collected, discussed in order to upgrade knowledge and capability of safety management, as well as transport risk management assessment for domestic transportation unit hazard goods highway.
Finish investigation of military chemical process hazards: high explosive manufacturing process. To proceed thermokinetic properties analysis of high explosives RDX and HMX, runaway thermal explosion hazard assessment of high explosive HMX in prescription tank, hazard criterion identify of operation temperature and incompatible hazard analysis of high explosive HMX. By aforementioned approaches that could suggest inherently safety performance conditions of high explosive HMX while its manufacture, storage, transportation and usage for related manufactured organization. Application of the above hazard assessment method, the usage safety of domestic petroleum chemicals, specific chemicals, energetic reactive materials and performance of batch process could be arisen.

C. Construction Safety Research:
Complete the study of construction safety hanging, launch, and fix the parapet. Long tunnel digging site is one of the dangerous working environments. Working related accidents as hanging, launch, fix the parapet happen due to changeable tunnel geology and time/budget limits although geology has always been investigated before start. In order to effectively increase construction safety hanging, launching, and fixing the parapet, IOSH brings together relevant occupational hazard information and collection of safety monitoring testing system, also analyzes cause and effect. Additionally, set up 1. harm evaluation through risk appraisal and management idea to draft precaution against accident measurements, 2. SOP, 3. emergency measure, and 4. contingency prevention related safety regulation suggestions.
Complete the study on safety of construction operations near water, river, or offshore. Since most assignments are fixed as relative location, its safety hygiene facilities become relatively static - no movement.However, when involved with working sites near water related places, it will not be in that case which makes construction operations near water, river, or offshore become dynamic circumstances. Starting with operation staffs, this research aims on framing SOP from application/safety of workers, protection appliances,

facilities, and ways of management.IOSH also finishes standard procedures of labor activity and crisis management in order to have related workers in accordance with, meanwhile, offer pre-education training material as reference for various assignments.
Completed the study on “The Evaluation and Test for Forming Monitoring System”. According to the statistics of CLA, the construction industry has the most safety incidents. The collapses of the scaffold system (as a supporting system or as a working platform) usually cause serious loss to lives of workers as well as damage to property. This research mainly builds an effective monitoring system that utilized wireless communication technology to prevent/improve the construction injuries.
The main items we have completed were as following:

1. Equipment set up and test in lab.
2. Monitoring system setup and test.
3. Reality experiment in work place
4. Load signal receiving and test.
5. Compare load signal and oil-pressured load reading.
6. Set up alarm level with structure analysis.
7. Monitoring system performance test and tuning.
8. Monitoring system functions enhance and improve.

Completed study on “The Evaluation and Test of the Safety Performance of the Scaffold”. This research includes the following: Collecting the sorts of scaffold and investigating states of the current situation, gathering and evaluating the occupational injuries and pointing out the improvement methods, using structure analysis software to evaluate the safety of the scaffold, setting up the test equipment according to CNS, scaffold lab test. Evaluate the validity of CNS and suggesting improvement. Based on the results of this study, suggestions will be provided to the national standard bureau and labor inspection agencies.
Complete the tripod anchorage connectors for confined space rescue systems.Collect design idea, safety regulation, and product specifications of tripod anchorage connectors from both domestic and international related fields in order to provide nationals a tripod anchorage connectors for confined space rescue system with cost effective, high quality, along with user friendly traits.

D. Electrical Safety Research
Complete the guideline of installation and practice for flameproof electrical apparatus. This project mainly conducts: firstly, the install guideline of explosion protected electrical apparatus is established. That includes itemized electrical apparatus specification, fitting selection, conduit sealing, and segregating principles, etc. Secondly, a multimedia film is manufactured for the detail practice guideline. That will be a helpful tool to make the consistence of installation, result in reducing explosion accident happening, and assuring safety of both working sites and employees.
Complete the study of temporary grounding for safe line working on de-energized power.

This study not only probes into varied temporary grounding for safe lines, but also analyzes influence onmagnetic field coupling; Besides, it provides feasibility safety strategy.Moreover, after examining relevant guidelines of Taiwan Power Company and Taiwan Railway Administration, we provides SOP suggestion of temporary grounding for safe line working on de-energized power as reference to related industry units.

5. Safety Management and Policy Research
Complete the study on norm for safety culture questionnative(SCQ) at construction industry in Taiwan.Total nine factors for SCQ at construction industry have been set. Sampling with 254 construction sites and 1,896 construction workers, the results show that variation between nine factors (organizational commitment, risk management, safety system, safety training, safety environment, safety acknowledge, safety motivation, safety priority, and safety involvement) and criterion variables（risk perception, unsafe behavior, micro-accident injury, and macro-accident injury） is co-related. These factors are found to predict organizational safety performance. Beside, the internal consistency coefficients of the nine factors are all above 0.7. It is evident that reliability, criterion-related validity and predictive validity of SCQ achieve the acceptable level. Therefore, IOSH develops the norms of SCQ, and illustrates how the concept of safety culture can be advocated and put into effect by way of safety assessment and safety improvement.

Accomplish research and development of expert system for decision maker on emergency plan (II). The champion design of accident preventing system is brought up in this study. IOSH expects to reduce, especially prevent misfortune caused by equipments effectively also offer relevant training and education material for emergency contingency.
Besides conducting research projects, the Occupational Safety Division had also performed the following activities in year 2003: 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 aspects of preventing the occupational accidents, IOSH announced 7 articles on occupational safety alertsto industries and vocational schools through 50 industrial park managing centers, the Ministry of Education, and the Ministry of Transportation and Communications. By doing above, IOSH helped avoid occupation accidents. It has beenestimatedthat each article was sent to over 4,000 addresses.

II. Research on Method Development and Analysis

A. Chemical hazard exposure survey
In year 2003, on going researches conducted on chemical hazard exposure survey - focuses on high risk exposure condition including: characteristics and exposure assessment of free silica for worker in casting industry, exposure assessment for aircraft maintenance workers exposed to polycyclic aromatic hydrocarbons (PAHs), survey of p-Dichlorobenzene exposure for manufacturing worker of insect repellent, exposure

assessment and control of toluene diisocyanate, biological monitoring of benzene exposure among petrochemical workers during annual maintenances, occupational exposure to dichloromethane in the paint stripping industry, characteristics of polycyclic aromatic hydrocarbons (PAHs) exposed to workers in bolts and nuts manufacturing industries, and characteristics of polycyclic aromatic hydrocarbons (PAHs) exposed to workers in carbon steel manufacturing industries.Results will be provided to business related industry for references in a technique manual of labor exposure-evaluation format.

Figure 5: Study on exposure assessment of free silica in casting industry

Safety and health consultation project for high benzene concentration work place in petrochemical industry had resulted in lower average benzene concentration in work place to less than 3 ppm (current regulation standard is 5 ppm). Some of the monitoring points still had benzene concentrations higher than the regulation standard; however, they were much lower than concentrations measured before consultation.

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

During year 2003, IOSH reviewed sampling and analytic methods of 16 kinds of chemical, such as magenta, and sent them to CLA as reference of official

announcement.In addition, the improvement of analysis method for sulfur dioxide in fumigation, the analysis and interference study for hexavalent chromium exposure of workers in stainless steel welding, arc furnaces steel refinery and chromium platting workplaces, and 4,4’-methylene bis(ortho-chloroaniline) sampling method establishment and preliminary study of occupational exposure assessment at hardening agent manufacturing plant. Above researches are also integrated with heavy metal ultrasound extraction techniques, then be analyzed applicability on industrial hygiene environment monitoring.

C. Development and evaluation of the performance of samplers and sampling media
IOSH enthusiastically processes R&D on particle and mist/spray sampling equipment. Static electricity happened during sampling and load of sample were two major problems when people used traditional hazardous substance particle sampler. IOSH therefore invented light weighted, low cost sampler with conductive plastics to solve above two concerns. This year, IOSHconducts research about effect of aerosol loading on cyclone performance for the sake of loading issue on cyclone particle hazardous substances sampler. Then it also develops one new reversed virtual cyclone sampler which is zero-load effect and with better sampling function based on research result. This new model therefore is more qualified on the curve of penetration efficiency of respirable dust as well as zero-load effect for regulations from ISO/ACGIH/CEN. IOSH also proceeds study on field application of new particle size distribution technique to the characterization of workplace aerosols」. In order to understand the real hazardous substances exposure condition of workers, workers hazardous substances exposure activity monitoring and continuous automatic monitoring technique was applied in confined space, and development of a new worker personal total exposure dosage alarm system prototype was completed (as in figure 6).

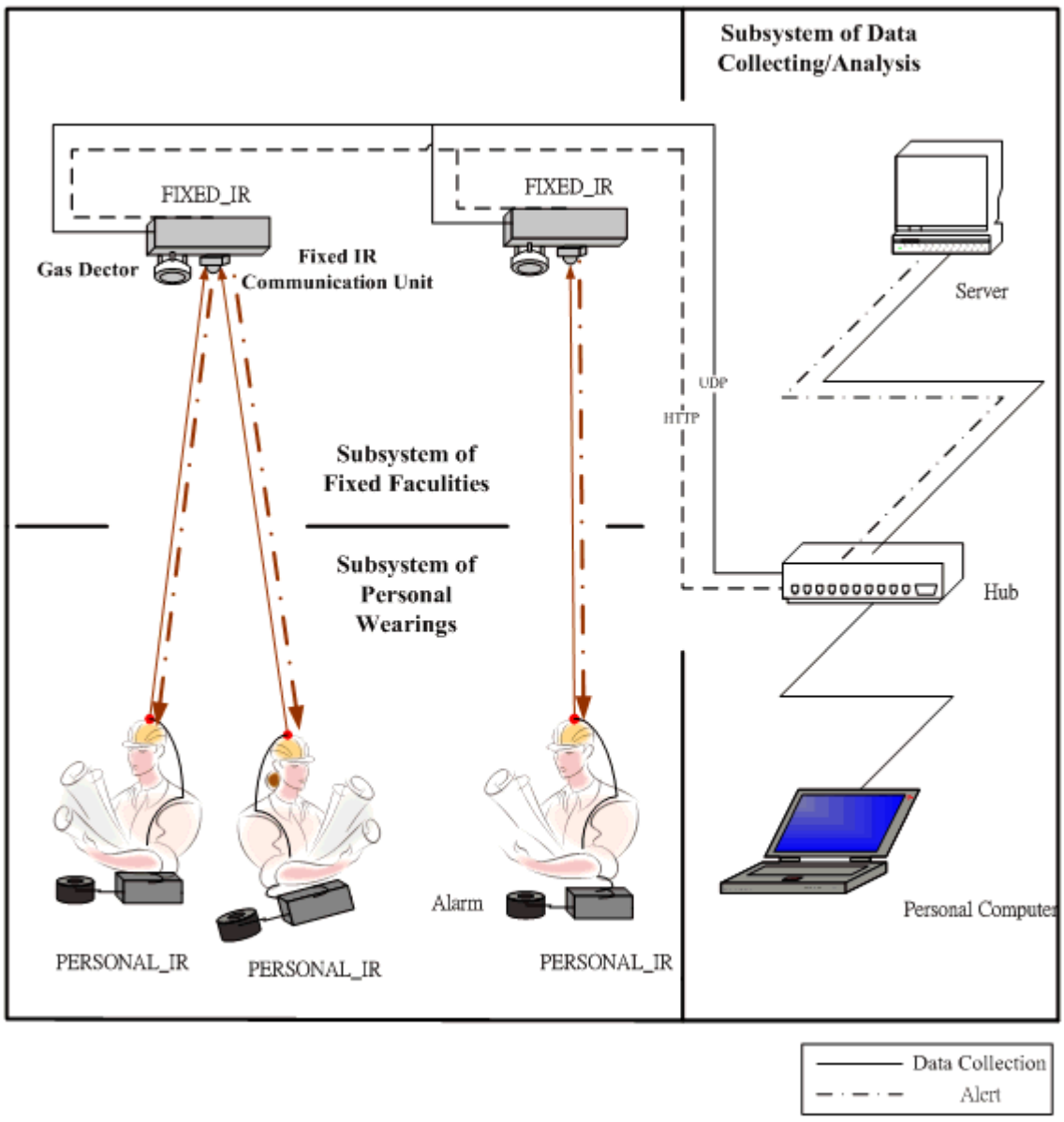

Figure 6: Illustration of Total exposure worker alarm system (TEWAS)

D. Development of occupational biological monitoring methods

Complete the following researches on Development of biological monitoringmethod of MOCA, dichloromethane, ethylene oxide and p-dichlorobenzene. IOSH conducts a fast, sensitive, and convenient electrochemical method based on screen-printed electrode for detection of lead ion (Pb2+) in blood, completes studies on the laborers from the sinter plant exposed to dioxin and on serum levels of polychlorinated dibenzo-p-dioxins and dibenzofurans in aluminum smelter workers – which investigates serum level of dioxins for laborers. IOSH will also have staffs write the biological monitoring of dioxin, toluene diisocyanate, MOCA exposure evaluating technical manual as for industry references.

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

IOSH designed a new exposure model based oncontinuous personal monitor and time-activity-pattern recorder to verify the ability of the second laboratory. This newly invented

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 is waiting for technology transfer.

F. Others
IOSH holds techniques of measurements seminars and workshopsfor method development/analysis service industries; meantime, edits environmental monitoring guideline e-book as one of the training materials for related industries. Additionally, IOSH also completes technical handbook of using PAPR by medical personnel caring for SARS patients in the quarantine ward in order to prevent and cure SARS effectively for DOH and medical staffs.More over, IOSH completes technical handbook of free silica exposure assessment for incinerator maintenance workers, and technical handbook of exposure assessment for lead battery manufacturing as reference to relevant business unit.

III. Research on Occupational Hygiene

A. Survey of occupational biological hazard exposure
IOSH conducts study of monitoring and control approaches to *Legionella pneumophila* in industrial cooling water recent years. It shows statistic significant co-relation from the testing result of cooling water using bacterial culture and PCR detection (Polymeraser Chain Reaction detection), which states that both ways are feasible to monitor/control *Legionella pneumophila* in industrial cooling water. Benefits from PCR detection include high sensitivity, quickness, and quantitative accuracy. Besides establishment of diagnostic test technique, it is also found from this research that (a.) content of chlorideion remaining, (b.) clean and maintaining condition, plus c. the addition of chemicals or biological inhibitor in the water sample from industrial cooling system are all related while it inhibits the growth of *Legionella pneumophila* in cooling water system.Furthermore, when talking about appraisal of standards of laminar flow hood, after analyzing/evaluating standards of biological safety cabinet and collecting appropriate SOPs of examination in different countries meanwhile base on domestic feasible principles, IOSH differentiates certificate-authorize, annual, or site testing clearly in order to have broad criteria for bio-safety cabinet related industries. This norm also offers various inspection instruments, inspection procedures, and form of documents. It can not only be used as a tool for new development but also as function and quality of safety evaluations for current products of safety cabinet. In addition, it offers mechanism of independent management and enhancement for high danger risk industries; especially it combined with physical labor inspection organizations, labor safety hygiene researches, labor safety hygiene counseling/guidance institutions, and labor safety hygiene experts to be related business units as lead, N,N-dimethyl formamide, toluene diisocyanate.From the information of working environment concentration and labor lead of blood from lead working environment, IOSH finds out that high lead of blood has been reduced 10%; meantime, N,N-dimethyl formamide, toluene diisocyanate working

institutes have also been decreased 10% of exposure concentration from allowable labor working environment after efforts from counseling groups.

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

In a study of push-pull type hood, perform velocity measurement on 17 specific models, in condition of various angles and liquid levels, to evaluate changes of flow fields, and the criteria and procedure for push-pull system design and operation are recommended. The suggested method is competitive on energy saving point of view as comparing with those by Japan and USA. During and after the SARS outbreak occurred in 2003, engineering techniques established in the past years formed the basis of strategies to reconfiguration and evaluation of infection control facilities in Taiwan, including negative pressure isolation wards and fever screening stations. Several technical documents have been adopted by Taiwan CDC as important infection control measures in the SARS outbreak to ensure an acceptable working environment for healthcare workers in local hospitals: 1. Recommended Guidelines for Inspection of Isolation Wards for SARS Patients, 2. Checklist for Reconfiguration and Inspection of Isolation Wards for SARS Patients, 3. Recommended Guidelines for Installation of Fever Screening Stations. With the above documents, we visited over 50 local hospitals with negative pressure isolation wards and inspected their hardware designs and settings. During study on pleated filter for respiratory devices, complete at least 18 sets filter testing rigs on design and manufacture, and establish technique and procedure for efficiency test of pleated filters; in period of SARS outbreak, testing results has been accessed to public for proper selection and wearing masks through press release; assist Department of Health on testing for mask filtration over sixty different kinds; presented to BSMI, in consequence establish CNS standards of filtration inspection on disposable masks. In addition, the study results showed that pleated filter quality is depending on not only the size of particle but also the pleat count of the pleated filter. Research observation, that optimal pleat count for filter quality was always higher than that for pressure drop by few pleats, may assist mask manufacturer on increasing product quality of protection.

C. Prevention of Physical hazardous factor

Current studies have been primarily conducted to prevent hazards in regard to noise and vibration. IOSH has developed a preliminary technique in sound field simulation and prediction of noise reduction on workplace, established performance testing skill and capable of absorption coefficient and transmission loss measurement for sound insulation materials. In addition, an approach was proposed to assist engineer in identifying dominant noise source, where multiple sources are operating simultaneously. A set of equations based on free-field assumption was used to formulate the problem. By measuring sound pressure level at couples of locations, and a computer code had been written to estimate sound power for each source. With help of sound power obtained, engineer would be able to evaluate noise contribution whenever re-layout workplace. As regards study on vibration, some of most popular standards adopted by European and

United States for evaluation of whole-body vibration were compared. Although these frequency weightings are not quite same, they all basically stipulate similar to ISO. According to our study, it showed that the allowable exposure time was reduced apparently in case of adopting the latest edition. In order to understand domestic testing environment of hearing protector, a background noise survey of domestic acoustic lab was conducted. With reference to United States, Japan, European, ISO standards and investigating results from four labs, a recommendation has been presented to BSMI in consideration of inspection standard revision.

D. Ergonomic application and hazard control technologies
Complete an interaction signal analysis software after developing the hardware as a mobile physiology signal collector which collects signals such as: muscle potentials, joint angle, acceleration, heartbeat, and images. This software can perform analyses on spectrum, wavelets, and general signal intensity & frequency. Meantime, it can also lead determining hazard factors of further ergonomic musculoskeletal in addition to provide reference as workplaceimprovement to business units.
When talking about prevention of falling/slip, the results showed that workers easily fall down while frictionfactor is higher than 0.5 with the incline surface greater than slope of 15º; or the frictionfactor only needs to be lower than 0.5 on the greasy or watery surface. This reminds us to pay extra attention on management and construction of recline surface in working environment. Study results also deliberate ideas when selecting safety shoes or general construction site rubber shoes. Next, in ergonomic database, there are updated present 1-D data, continuing 3-D data collection plus 20 illustrated plates in working place in order to draw up future suggestion on dimensions of facility. 7 packing workers in iron/steel factories – Kaohsiung area were targeted as research samples when IOSH investigated appliance of checking table - MSDs and BRIEF on domestic iron/steel industry. The result shows 57.8% of sample gets self-awareness of un-comfort. It also shows BRIEF gets higher sensitivity both from questionnaire base(54.3%) and biomechanics base (61.9%). Numerous of study results are not only submitted to CLA as reference when co-related regulations and strategies are modified but also composed into technique manuals or promotion brochures. Above research outcomes meanwhile will be presented both nationally and internationally in safety hygiene seminars, on periodicals, also applied for patent granted besides local administrative application.

IV. Research on Occupational Medicine

A. Surveillance and analysis of occupational injury, disease and health data
Resources of information this year were 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; plusaborigine disease.
During this year, IOSH maintains on going research on monitoring system of occupational hearing loss for labor.Approximately 20,000 data/person of hearing

examination was collected; statistic analyses of gender, age, and occupation were performed besides annual report of labors' hearing threshold surveillances system for noise workplace: year 2003 is finished.
Complete the study of health effect among asphalt blend workers. The results show that, in the asphalt manufactory, the average of total PAHs exposure of the workers mixing the asphalt is 2456.6 ng/m3, the workers operating machines is 1772.2 ng/m3, and the workers controlling the quality is 899.1 ng/m3. The average PAHs of dust of the workers mixing the asphalt is 150.28 μg/g, of the workers operating machines is 100.15 μg/g, and of the workers controlling the quality is102.53 μg/g. Among asphalt blend workers, the prevalence of musculoskeletal disorder in shoulder is the highest (26.67%), and lower back is the next (18.89%).
Accomplish the study of health outcomes among autobody repair shop workers (III). Working years and occupational exposure are related to respiratory disease of autobody repair shop workers.IOSH collects working history and self awareness of respiratory problem from self-filled up questionnaire, then objectively repeat 5 days of lung function measure in order to increase liability and stability of collected information. After conducted advanced biological statistic, it shows respiratory weakness among autobody repair shop workers does exist, especially for workers in metal processing and painting.
Finish study on occupational hazards of waste anesthetic gases in medical workers. It is clear from study result that reproductive and respiratory systems of medical anesthetic workers are co-related to occupational exposure. Results show harm on upper respiratory systems of anesthetic workers does exist while compare to other medical staffs. During the processing procedure, we also find out many anticancer drugs have more than normal influence on general medical staff.
Complete analysis on aborigines' health indicators: from labor insurance and national health insurance database. It indicates from the results:

1. The main causes of death of the aborigines are injury and poisoning, as well as diseases of circulatory system.Moreover, the age of death was generally less than 29 years old. The highest crude death rate was found in the subgroup of the age of death greater than 59 years old.
2. Aboriginal workers in construction and manufacturing industries had higher percentage. However, in total worker population, mining, quarrying and construction industries had higher aboriginal workers percentage. Most of the aborigines who gained the injury, illness or disability benefit payment were male. Most of them are between 25 and 44 years old. The main types of occupational injury and illness were rolling-up and fallowing down. The injury parts with greatest in number were fingers and hands. The media were loading, unloading, moving and powered machinery. In accordance with the Payment database of Labor Insurance, the occupational injure rate of any workers of the aborigines is higher than general population on average. It maybe relate to the higher danger of careers.

For the workers of the aborigines, the hospitalization and outpatient-visit rates (HOVR) were similar to the general aboriginal population. For the female workers of the aborigines, the HOVR were higher than the male workers of the aborigines. For the workers of the aborigines and the general aboriginal population, the HOVR were higher than the workers of the general Taiwan population and the general Taiwan population, respectively.

B. Occupational disease studies and occupational epidemiology
Finish the cohort study incinerator demolition. IOSH investigates the respiratory hazard in incinerator maintenance workers with long term exposure to crystalline free silica. The exposure to crystalline free silica and the silicosis risk were investigated. The result shows that the concentration of respirable particulates varied from 0.831 to 3.800 mg/m3, and 0.041~0.512 mg/m3 for crystalline free silica. Taiwan, ACGIH, NIOSH, and OSHA, regulations require the unqualified rate of TWA-PEL rate at 82.35%, 100.00%, 100.00% and 76.47%, respectively. For a worker exposed to such crystalline free silica for 45 years during incinerator maintenance, the risk for silicosis varied from 0.18 ´ 10-3 to 5.47 ´ 10-3. This study also inspected the correlation between incinerator maintenance workers' lung function index and crystalline free silica exposure. The result shows a significant correlation between cumulative exposure and FEV1/FVC%.
Complete health survey for the long-distance bus drivers. IOSH collects 229 valid questionnaires from 2 bus transport companies. Result shows average age of drivers in the survey is 41.7 years old, average working year is 7.7, and average driving hours per week is unexpectedly 58.9. It also reveals the average age of station administrator from this survey is 39.9 years old, average working year is 10.5. The prevalence rate of self-report musculoskeletal disorders reached 86.3%. Of the discomfort muscular symptoms, the body parts with the highest prevalence were neck (62.8%), low back (51.0%), left shoulder (36.6%) and right shoulder (33.3%). The prevalence rates of discomfort in other body system were 58.2% for eye & vision, 52.3% for respiratory system. Current smokers, alcohol users and betel-nuts-consumers, respectively, consisted of 64.7%, 6.8% and 20.9% of the study subjects. Drivers drinking tea, coffee and refreshing drink accounted for 78.5%, 70.6% and 39.9%, respectively, of the study subjects. Only 26.1% of the subjects routinely took exercise.
In contrast to company A, the drivers of company B were younger but had higher quality of sleeping is an important factor associated with the discomfort at various body system.
Accomplish the study on noise exposure and vibration of bus. Result from this study shows:

1. Hand-arm vibration exposure: Maximum accelerations are 5.9, 3.0, 2.1 m/s2 inTaipei and 4.3, 1.4, 1.0m/s2 in Hsinchu. Daily working hour of a bus driver is 8-9 hours, in accordance with national regulations: daily allowable exposure time is between 4 to 8 hours, maximum acceleration values for both vertical and horizontal no more than 4 m/s2. This result means there are 46.7%, 36.8% unqualifications in Taipei, Hsinchu.

2. Noise exposure: TWA of Taipei and Hsinchu bus drivers are 52.2 and 61.2 dB(A)s, Maximum of TWA are 83.7dB(A).Average value of dosage for individual noise exposure is 1.5% and 4.7%.250 Hz with average value of 64.7dB(A) represents the highest in spectrum analysis in Taipei, 125 Hz with 65.4 dB(A) in Hsinchu.
3. Questionaire: Total 287 questionnaires collected, which shows smokers in driver group and administrator group are 51.9%, 40.4%; numbers of alcohol drinker are 46.4%, 33.7%.
4. Health examination: BMI of two groups were little higher (26.0 and 24.2) (p=0.004), numbers of triglyceride dysfunction indicator are 20.8%, 12.5% (p=0.001) for driver group and administrator group. Both present statistically signification differences.
5. Concentration of NO2is 164.8 ± 42.9 ppb within 36 evaulable samples from Taipei City. 19.4% sample of NO2exposure concentration is higher than 250 ppb.

C. Occupational health promotion research

IOSH engages in multiple studies on labor health care for improving work environment and labor mentality health. Completed studies primarily focused on labor health improvement plan, relationship of chemical exposure and hearing loss, work characteristic and cardiovascular disease, as well as the health effect from workplace: humidity and temperature. Details are as following:

Finish the workplace health promotion program (IV). The program included: 1. Training program for workplace calisthenics instructor. 2. Popularize occupational drivers' calisthenics and evaluate its effectiveness. The latter program was a 10 weeks physical fitness training course conducts 3 times a week, 50 minutes a time.Items like body weight maintaining, waist size reducing, back muscle durability, waisttendernessflexibility, and cardiopulmonary functional capabilityincreasing, swiftness of body movement improvement, and energy consumption increasing are all showing a better improvement when comparing with the control group. Every participant enjoys the course and feels it is an interesting occupational exercise module, also worth to promote it nationally.

Accomplish the investigation of health promotion program in industries and the function of industrial health center. IOSH conducts this investigation for the sake to comprehend the priority order of health promotion program in different business size and evaluate manpower, facility, functions in health unit of business organization at the same time offer suggestions for current situation or flaws locally. It valid sampled 2,773 companies with 616 questionnaires back (total returning rate: 21.4%). After analyzing, the results indicate that most enterprisers have not pay attention to health promotion issues in workplace yet; IOSH therefore will reinforce on convincing enterprisers to commit execution of health promotion policy in working place. Results and suggestions from this study include:

1. In most enterprise, the main function of health center is medical treatment, not

health management; they often omit health education and promotion function it can provide.
2. Outpatient function in medical hygiene unit needs to be re-evaluated, especially to empower obligation of executing health promotion as from the statutes.
3. Incapability of health center subsidiary and high proportion of unqualified medical staffing again demand related regulations amending to fulfill actually requirements.
4. Function of union health center located in industry zones need to be invigorated.
5. Both health and labor administrative units have to establish integrated workplace health management module, also positively train and educate specialist for workplace health promotions.

Accomplish the research of special health examination and health management of potentially dangerous work in different countries. IOSH reviews special health examination items were given to special dangerous industries in different countries, such as USA, EU, British, and Germany with Taiwan.
Complete research on the work characteristic and cardiovascular disease. Reviewing Japanese documentary, IOSH disclosures that working hours and special working type are related working factors to cardiovascular disease. The research also concludes that working overtime, frequent business trip, irregular work and working in shifts all appear in working types of cardiovascular disease patient cases. Job stress and cardiovascular disease traditional risk factors interact to accelerate the development of CVD. Additionally, dynamic blood pressure and pulse monitor can be used as biological index of work pressure.
Finish the study on the health effect from workplace climate change: low humidity. Aim of this research is to understand fatigued and physical effects for workers under low humidity. Ways of information gathering are general self perceivable wearied symptom questionnaire and physical test for sample objects before/after work.Result shows staffs in dust-free room achieve high occurring proportions on dry mouth and difficulty to breathe 2 items than non dust-free room staffs from Ear, Nasopharyngeal self awareness symptom, it’s also statistic significant. Dust-proof room workers indicate higher prevalence besides Urticaria in all items of dermatology self perceivable symptom; especially this group reaches notable significance on skin itch, skin chap, and decortications. Both groups show high volume of fatigue and drain of eyes. Pain of lower back, upper legs and legs showed remarkable co-relation from the results of self awareness - muscle tired symptom which properly indicates the variation of job essential.Statistic meaning appears with 2 groups on flash threshold, grasping power, finger tip grasping power, back muscle power, and short distance estimation from physical diversion before and after duty. Both dust/non dust free room worker groups fall into general type of fatigue category.
Finish the plan of health promotion for laborers (II). In order to expend economy competitiveness, 3 kinds of calisthenic for personal computer users, occupational drivers, and standing workers have been designed to prevent occupation musculoskeletal injuries, promote healthy body, maintain energy level of working, and increase

productivity. Evaluation of working place health promotion establishes scientific statistics for health promotion plan module.
Complete research on the relationship of chemical exposure and hearing loss at workplace (II): Total 233 employees from 3 factories participated this study during March to November 2003. 216 persons left after detected with otitis disease, diabetes, and kidney disease. Information gathering includes 4 parts: a questionnaire on work history, occupational and nonoccupational exposures, the concentration of benzene, xylene, styrene in the working environment, and pure-tone audiometry (PTA). Total benzene exposure was assessed by the biological monitoring of trans, trans- muconic acid (t,t-MA) and Hippuric acid (HA). Total xylene exposure was assessed by the biological monitoring of o-, m-, p- methylhippuric acid (2,3,4-MHA). Total styrene exposure was assessed by the biological monitoring of Mandelic acid (MA). 216 people were divided into 4 groups: chemical substance with noise exposure, noise exposure, chemical substance exposure, and non exposure groups. The outcomes showed: hearing ability is still affected mainly by noise and aging. Some studies reported that benzene, xylene, and styrene exposure cause hearing loss, but employees are categorized within their current job title; average working year excesses 15 years, quite a lot people switch positions in the past sometimes Above reason made chemical substance exposure non significant differences.

D. Occupational biomedical monitoring
IOSH usedmethods in biomedical study to research on epidemiology and bio-index to reach the goal of early detection on prevention disease.
Complete a study of healthy effects on dichlorobenzene exposure. Investigations were conducted in four dichlorobenzene manufacturing factories located in northern Taiwan, Taoyuan, Miaoli, and Hsinchu.Forty-one workers were studied and 13 non dichlorobenzene exposure workers as comparison group, total sample number equals 54. Questionnaires showed there were 4 with hepatitis type-B, 3 with chronic hepatitis, abnormal liver function, fatty liver problems; under the self perceivable item, 6 workers had nasopharyngeal irritation, skin syndromes; non statistical significant variation showed even though exposure team contains many people than the contrast team.Body check result indicated 7 people with abnormal kidney function, 11 with abnormal lung function, plus the exposure group showed a higher population, statistical significant differences however were not reached.None of them were abnormal liver function nor positive index liver cancer from this research. Blood routine examination result presented that hemoglobin abnormal case in exposure team reached statistical significant variation ($p<0.05$); relatively lower mean corpuscular volume, significant difference ($p<0.1$); amount of Immunoglobulin IgA decreased when exposure increased, average value represents a high significant variation ($p<0.05$). Hemoglobin, hematocrit, and average hemoglobin abnormal proportion all reached significant variation for those who work more than 10 years or high exposure dosage workers; high average rate of urea nitrogen from kidney function test which reached significant variation ($p<0.1$). The outcomes showed most exposure team workers are with unwholesome hygiene habits, for

example, about 40% people didn’t wear protection shelter, 56% ate lunch in working place, 34.1% drank water or ate snacks there; all above indicate that hygiene habit in work place can be enhanced. Workers’ blood cell hyperplasia control may be affected by bad hygiene tendency, special body check up as: liver, kidney function, blood, and Immunoglobulin IgA therefore are suggested to be given with hygiene education promotion and working environment improvement.

Accomplish an investigation of healthy problems on spray painters about chemical exposure. Using questionnaire and body check to research co-relationship of disease of related spray painter health, IOSH also makes comparison with various spray painters for co-relationship of disease.Results show a high utility rate of protection shelter, aircraft and component spray painters are mainly using the eye masks, motor vehicle spray painters are the same.Vessel spray painters are mainly using arm or leg jackets, upper body apron is mainly used by vessel-painting workers. Aircraft spray painters with all 3 protections present the majority. Percentage of skin allergic is higher than respiratory hyper-reaction, number one is skin redness and itch (23.1%), 2nd is eye irritation (16%). Organic solvent contact analysis result doesn’t present relevant co-relation with respiratory and skin hyper-reactions. Variety of spray painter and symptom co-related analysis shows differences on both respiratory and skin hyper-reactions, especially on skin allergic symptom. Blood chemistry examination reveals that WBC counts are higher, plus RBC counts are the lowest than normal range which reaches statistical significant variation ($p<0.1$) in vessel painting spray group. When discussing about liver function related total bilirubin or SGOT, the study reveals that abnormal workers are mainly from aircraft spray painters and vessel-painting groups; statistical significant variation is also reached. Results from serum test for allergen demonstrates motor vehicle spray painters mainly reaction with 4-Diamino diphenyl methane, and 2-n-octyl-4-isothiazolin-3-one; aircraft spray painters have a positive reaction mainly on 4-tert-Butyl formalde; aircraft component spray painters are with 4-Diamino diphenyl methane, and 2-n-octyl-4-isothiazolin-3-one.All metal skin patches IOSH choose to test conduct the highest reaction ratios on aircraft spray painters positive, and cross-statistical analysis demonstrates Nickel and Gold skin patch test hits statistical significant variation.

Figure 7: Skin Patch Test

We complete the study on health hazard evaluation of arsenic workers in electro-optics industry. The management of occupational safety and health for the two companies of electro-optics industry needs to be improved. Especially, environmental engineering control and personal protection equipment should be amended. In addition, environmental monitoring and biological monitoring should be executed to evaluate the effectiveness of environmental engineering control. The Council of Labor Affairs, ROC has revised the Standards for PEL of inorganic arsenic, and organic arsenic in the air of workplace. But there are no Standards for the execution of air monitoring for inorganic arsenic, and organic arsenic in the air of workplace. Therefore, we suggest the CLA to add the execution of air monitoring for inorganic arsenic, and organic arsenic in the air of workplace into the Occupational Safety and Health Standards in order to protect the health of the workers of arsenic exposure group.

We finish the research on health hazard evaluation for coke oven workers exposed to polycyclic aromatic hydrocarbons. Results showed after adjusting factors like: age, BMI, level of education, alcohol consumption, betel chewing, and intake of vitamin, the topside-oven workers had a 4.27-fold higher ($100.63 = 4.27$, $p < 0.001$) mean urinary 1-hydroxypyrene concentration than sideoven workers.

This study also proves that individual urinary 8-hydroxy-2-deoxyguanosine concentrations were significantly positively correlated with urinary 1-jydroxypyrene concentrations. Multiple regressions indicated that a 10-fold increase in 1-hydroxypyrene was associated with a 1-fold increase in 8-hydroxy-2-deoxyguanosine. Thus, topside-oven workers are assumed as PAH exposure high risk group. IOSH therefore suggests

related industries to enhance working environment engineering control and individual protection equipment, meanwhile propose CLA to set up individual standards of permissible concentrations of polycyclic aromatic hydrocarbons in the workplace environment for air to make sure workplace standards. We also suggest the employer of the coke oven plant to put the 1-hydroxypyrene into the health examination item for health evaluation of workers exposed to polycyclic aromatic hydrocarbons.

V Emerging Occupational Health Related Research

Complete the development of a work evaluation system for individuals with disabilities (I). Within 3 years, IOSH plans to development a work evaluation system for mentally or physically disabilities. IOSH focuses on perceivable retarded as target during the first year, then expands to sense function disorder and other disabilities in the next 2 years. Working evaluation system is based on aptitude index of GATB.In addition, assembling, baking, items arrangement to rackets in supermarket, and cleaning work for perceivable retarded were all established locally as working samples by research team of IOSH during the past year.

Finish the development of a vocational evaluation instrument for people with visual impairment. Primary purpose of this research is to build up a vocational evaluation instrument for people with visual impairment as guidelines meanwhile to develop an occupation obtaining matching computer databank. Research group bases on ‘Dictionary of Occupational Title’ and ‘The Enhanced Guide for Occupational Exploration’ from USA plus ‘Occupational Handbook’ from CLA as chief references; furthermore, evaluates mental and physical disorder identities for mentally disability to frame content, ways of review, grade levels of a vocational evaluation for people with mentally impairment disorder. The group also investigates 50 professions suitable for visual impairment, analyzes the occupational characteristics of each profession with ‘Handbook for Analyzing Jobs’ then digitizes those information. It also shows success rates on the match from a computerized job match database.All outcomes from this research have been edited into vocational evaluation working handbook for people with visual impairment, match from a computerized job match database handbook, plus other 5 analyses handbooks in order to offer related professionals references as visual impairment case owner during the job obtaining assistance or guidance.

Accomplish the research on occupational hazard assessment in biotechnology industries (III). Based on the WHO standard, this research gives impetus to set up biosafety levels. This study also proposes to establish general contents for biological Safety Data Sheet (BSDS) to be used by biotechnology industries. In the meantime, initiates evaluation for risk management, evaluations in this plan include: hazard identification, potential of exposure, and risk management. This study also developed initial strategy for reporting system. This can be attached to the occupational hazard monthly report, and can be highly feasibly and general acceptable by the industries.

Complete study on health hazard surveillance of female worker focusing on medical professionals. Study reveals that 32.2% nursing staff experienced musculoskeletal disease caused incapability of working, but relatively rare courses are given in that field

which shows hospitals' inattentions here. Secondly, it is worth to pay extra thought that quite a lot nursing staff takes analgesic and hypnotics regularly. When discussing about mental health, 2 items from indexes of 'unhappy', and 'depression' show obvious reaction. Thirdly, after needle punching, not a few chooses to handle it privately even though knowing there is SOP in hospital only because afraid of dress down from chiefs of nurses. Situations like this happened even if they were with full awareness of the needles or razor blades which are contaminated. Finally, major stress of nursing staff is from heavy working load, 2nd is abnormal life pattern caused from irregular work shift, 3rd is future development, narrow social circle, and promotion system.
Completed study on "Factory Closure and Labors' Health".Age-standardized total death causes mortality is high in factory closure group. Factory closure in year 2000 group had a mortality rate of 3.20‰ in year 2000; factory closure group in years 2000 and 2001 are 2.37 ‰ and 3.33 ‰ in year 2001.On the contrast, age-standardized total death causes mortality for surviving unit and occupational union group in year 2000 are 0.87 ‰ and 2.88 ‰, year 2001 become 0.95 ‰和 3.00 ‰ respectively. Factory closure factor still co-relates to total death causes mortality after age, gender, insurance salary, size of business unit, and occupation classification controlling ($p<0.001$); suicide mortality however is not statistic significant.

RelatedActivities

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 2003, IOSH sponsored or jointly sponsored 7 academic conferences; presented 25 journal papers in local publications, 36 journal papers in foreign periodicals, 65 papers at local academic conferences and 3 papers at foreign academic conferences.In addition, 3 research projects received local or foreign research awards.

1. Academic Conferences

Table 3 Academic Conferences

Name of conference	Summary of activities	Date
2002 Presentation of Research Results on Machinery Safety	In order to reduce occurring rate of occupational hazard, IOSH promoted study results on machinery safety to related labor inspectors and workers. 220 participants attended within3	Taipei 2003/04/30 Taichung 2003/05/06 Kaohsiung 2003/05/09

	presentations	
2002 Presentation of Research Outcomes on Construction Safety	In order to enhance working site safety and reduce occupational hazard of construction, IOSH showed research outcomes on construction safety to business units, government related engineers, and labor inspectors. 220 participants attended in3 presentations	Taipei 2003/10/13 Taichung 2003/10/15 Kaohsiung 2003/10/17
2002 Workshop of Construction Safety Auditing	IOSH invited business units, government related construction and labor inspectors to present study results on construction safety auditing for the sake to enhance safety of building or construction and reduce occupational hazard ratio. Participants included engineers plus safety hygiene management staff from construction business unit, government inspection organization related staff, and construction project designers from construction consulting company total 109 participants.	Taipei 2003/10/22
2002 Presentation of Research Outcomes on Chemical EngineeringSafety	In order to reduce occurring rate of occupational hazard and develop better safety factorial environments, IOSH promoted study results on chemical engineering safety to business units, related labor inspectors, and people from academic institutions. 189 participants attended within2 presentations	Kaohsiung 2003/10/24 Hsin-Chu 2003/10/28
Seminar of Expert System for Decision Maker on Emergency Plane	For the sake of developing safety of factories and reducing damage loss, IOSH presents outcomes on ‘research and development of expert system for decision maker on emergency plane’ tosemi-conductor factories or chemical factories both in Hsin Chu and Southern Taiwan science-based industrial parks. Total 2 seminars held, in above science-based industrial parks, 90 participants attended.	Hsin Chu 2003/10/22 Tainan 2003/11/04
Workshop and Presentation of Research Outcomes onSafety & Health Workplaces for Disabilities	In order to enhance working environment safety for individuals with disabilities, IOSH promoted implementations for hearing/speech impairments on working environment safety and hygiene to government related organizations, public/private	Tainan 2003/11/27-28 Chang Hua2003/12/10-11 Taipei 2003/12/16-17

	welfare and job getting consulting organizations, general business units, safety hygiene volunteers, and relevant academic units or individuals. 370 participants attended within3 presentations.	
2003 Seminar on Techniques and Practices ofLabor Workplaces Measurements	New trend on both techniques and practice of labor working environment was discussed.	2003/08/28-29
The 2003 Presentation of Research Results on Occupational Medicine and Labor Health	6 speeches and 115 theses were given from local experts within this presentation. Contents include: discussion on policies of environment monitoring, researches on new method development and analyses, plus detection on environment pollution.	2003/09/26-27
The 2003 Conference on Aerosol Science and Technology	Agenda includes: academic researches and theses publish from issues on techniques of air pollution controlling, health risk appraisals, sampling analyses determining skills, nano-particles techniques, and air pollution.	2003/09/12-13
Workshop for Numeric Control Techniques to Local Exhaust Ventilation Systems	A 2-day workshop was offered to dozens of local HVAC system designers to improve their ability on performance control and monitoring of local exhaust ventilation systems by using numeric control techniques.	2003/4
Training & Monitoring Course on Safety of Operation Bio-safety Cabinet	For the purpose of enhancing capability of engineering control on biology safety of domestic biotech industries, IOSH promoted selection, measure, examining, and effect confirming techniques of bio-safety cabinet to business units. 1 day course was held in Chung Hsin zone of Industrial Technology Research Institute and Southern Taiwan science-based industrial park respectively.	2003/11
Workshop on Ergonomic Engineering	2 days workshop was held in Kaohsiung in order to promote prevention management of musculoskeletal disorders and on-site examine technique for business units	2003/09
Seminar on Perceptibility,	2 days seminar was held to promote various study results on high	2003/04

Appraisal, and Control of High Temperature Hazard	temperature hazard prevention in Chung Hua College of Medical Technology, TainanCounty.	
Seminar on Maintaining and Re-starting Negative-Pressure Isolate Ward	IOSH applied self created ventilation control system assisting hospitals equipped with Negative-Pressure isolate ward to battle on potential epidemic situations during winter. Over 200 persons attended and discussed with enthusiasm.	2003/10/02
Air Purifying Mask - How to Prevent Hazards from Bio-aerosol	IOSH presented this seminar with Center for Disease Control, Department of Health for the sake of dust-proof masks dealing with SARS. 150 medical staff and epidemic prevention personnel attended to discuss necessary technical support during initial stage of epidemic prevention.	2003/03/26
The 2003 Presentation of Research Results on Occupational Medicine and Labor Health	460 participants attended the workshop including safety and hygiene personnel, teachers, and researchers. Related topics in occupational epidemiology, prevention of occupational injury and disease, labor health and health care, plus occupational disease identification techniques were discussed.	Taipei 2003/09/04-05 Chang Hua 2003/09/18-19 Kaohsiung 2003/10/02-03
Forum on Physical Examination of Occupational Disease Prevention	In order to promote e-media reporting system on physical examination of occupational disease prevention from labor insurance, IOSH and Bureau of Labor Insurance, CLA held this forum together. Total 185 medical staff from 110 body check hospitals.	2003/12/24-25

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

Title	Publication	Authors
Analysis of Occupational Disease Surveillance Information Collected by IOSH	Institute of Industrial Safety and Technology Journal no.46	Chen CR*, Lin MC*, Yang RC*, Yeh WY*, Shih TS*, Tu TL*, Chang CP*
Hygiene Performance Index Discussion on Manufacture Industry	Institute of Industrial Safety and Technology Journal no.49	Yen WY*, Lee LH*
The Research of Occupational Safety and Healthy on Safety Construction Methods for Full-SpanPrecastedBridge	Institute of Industrial Safety and Technology Journal no.166	Chen WH, Chang KY, Chang CC*

The Biomechanical Evaluation and Application Study of Lower Back Pain Syndrome of a Shoemaking Factory	Journal of Occupational Safety and Health Vol. 11, No. 1	Cheng CK, Lin YH, Yeh WY*, Chen CY*
A Preliminary Investigation of the Causes of Musculoskeletal Fatigue in Semiconductor Workers	Journal of Occupational Safety and Health Vol. 11, No. 1	Yu CY, Chen YC, Yeh WY*, Lin YH*
The Brief Introduction of Diagnosis of Occupational Illness & Workers Compensation between Singapore & Taiwan	Journal of Occupational Safety and Health Vol. 11, No. 1	Chen YH, Su WL, Chiung YM*, Chen CJ*
The study of color discrimination in yellow lamp environment	Journal of Occupational Safety and Health Vol. 11, No. 1	Lin YH*, Lo YH, Yeh WY*, Yu CY
The Effects of Exercise Intervention on Stages of Exercise and Physical Activity for the Workers in the Worksite	Journal of Occupational Safety and Health Vol. 11, No. 1	Huang Y C, Kao YH, Chen CJ*, Hsu JH*
Communication Difficulties and Labors' Attitude toward Noise-Induced Hearing Loss	Journal of Occupational Safety and Health Vol. 11, No. 1	Chen HC, Tseng CH, Chen CJ*, Chang SJ*
Study on Mercury Vapor Exposure Assessment Techniques for Workers in the Fluorescence Lamp Factories	Journal of Occupational Safety and Health Vol. 11, No. 2	Hsieh CM*, Shih TS*, Lin YC*
The New Design of the Stabilization Device for Gondola	Journal of Occupational Safety and Health Vol. 11, No. 2	Lee SJ, Huang CH, Huang CC, Tai CF*, Gau CY*, Wang HL
The Development of a Database System of Computer-Related Assistive Devices for the Skeletal Impairment	Journal of Occupational Safety and Health Vol. 11, No. 2	Chi CF, Song JC, Huang YH, Wang YH, Yeh WY*, Lin YH*
Characteristics of Free Silica Exposures for Workers in the Refractory Material Manufacturing Industry	Journal of Occupational Safety and Health Vol. 11, No. 2	Su LF, Tsai PJ, Wang HP, Lin MH*, Yeh W Y*

Comparison of the Effectiveness of Different Health Promotion Exercise Programs for Work-related Shoulder and Neck Pain	Journal of Occupational Safety and Health Vol. 11, No. 2	Tsauo JY, Hsu JH*, Chen CY, Lee HY, Chen CJ*
The Relation of Carbon Disulfide Exposure and Other Workers' Factors to Urinary 2-Thiothiazolidine-4-Carboxylic Acid(TTCA) among the Workers in a Rayon Manufacturer	Journal of Occupational Safety and Health Vol. 11, No. 2	Chou TC, Shih TS*, Chang SJ*, Chang HY
Examination of the Correlation between Uptake Rate and Sampling Time of a Tubular Passive Sampler Using a Solid Phase Diffusion Model	Journal of Occupational Safety and Health Vol. 11, No. 3	Lu TS, Yu YC*
The Study of Workers' Musculoskeletal Disorders in Building Construction Sites	Journal of Occupational Safety and Health Vol. 11, No. 3	Lee CL, Lee YH, Huang JL, Chen CY*
The Evaluation of Simultaneous Determination of Heavy Metals in Fumes by Inductively Coupled Plasma/Atomic Emission Spectrometry(ICP/AES)	Journal of Occupational Safety and Health Vol. 11, No. 3	Chou CP, Hsieh CM*, Liu PH, Chung LC, Shih TS*, Lin YC*
Assessment of Hearing Loss among Workers in the Textile Manufacturing Industry	Journal of Occupational Safety and Health Vol. 11, No. 3	Chang SJ*, Chen CJ*, ChiouSK, Sung FC
Characteristics and Contents of Volatile Organic Compounds in the Atmosphere of a Toll-way Station	Journal of Occupational Safety and Health Vol. 11, No. 3	Chen MR, Lee CC, Tsai PJ, Shih TS*, Liou SH, Lai CH
A Study on dust Exposure in the Ceramics Manufacturing Environment	Journal of Occupational Safety and Health Vol. 11, No. 3	Lin MH*, Su YC, Wang JY, Yeh WY*
Modeling of Organic Solvent Permeation Through Protective Gloves	Journal of Occupational Safety and Health Vol. 11, No. 4	Chao KP, Wu MJ, Chang CM*
Slip Resistance and Muscular Activity of the	Journal of Occupational	Li KW, Chen CJ,

Shank in Clean Room Footwear/Floor Environment	Safety and Health Vol. 11, No. 4	Lin YH*, Yeh WY*
Inspection for Ventilation Proficiency in Negative Isolation Zone	VGH Nursing, 20(4): 397-340, 2003	WangSC*

3. Presentation of Papers – Foreign Publications

Table 5 Presentation of Theses – Foreign Publications

Title	Publication	Authors
A Cohort Mortality Study of Workers Exposed to Chlorinated Organic Solvents in Taiwan	Ann Epidemiol. 13(9):652-660	Chang YM.*, Tai CF*, YangSC, Chen CJ*, Shih TS*, Lin RS, Liou SH
A Follow-up Study of Haematological Effects on Workers Exposed to 2-Methoxy Ethanol	Occup Environ Med, 2003, 60:130-135.	Shih T.S.*, Hsieh A.C., Liao G.D., Chen C.Y., Chou J..S*, Liou S.H.
A Proportionate Cancer Morbidity Ratio Study of Workers Exposed to Chlorinated Organic Solvents in Taiwan	Ind. Health, 41(2):77- 87, 2003	Chang Y.M., Tai C.F.*, Lin R.S., Yang S.C., Chen C.J., Shih T.S.*, Liou S.H.
Accumulation of Urinary 2-Thiothiazolidine-4-Carboxylic Acid (TTCA) among the Workers Occupationally Exposed to A-week-long Exposure to Carbon Disulfide	Sci Tot Environ 2003; 308(1-3): 37-47	Shih T.S.*, Chou T.C., Chang H.Y., Wu C.C., Wang P.Y.
Aggravated Hearing Loss In Viscose Rayon Workers With Carbon Disulfide And Noise Exposures.	American Journal of Epidemiology, 157(11)：S74	Shu-Ju Chang*, Tung-Sheng Shih*, Tzu-Chieh Chou, Chiou-Jong Chen*, Ho-Yuan Chang, Fung-Chang Sung
Aggravated Hearing Loss in Viscose Rayon Workers With Carbon Disulfide and Noise Exposures	Environ Health Persp, 2003, 111:1620-1624	Chang S.J., Shih T.S.*, Chou T.C., Chen C.J., Chang H.Y., Sung F.C.
An On-Line Automatic Sample Clean-Up System for the Quantitative Detection of the Benzene Exposure Biomarker S-Phenulmercapturic Acid in	J Ana Toxicol, 2003, (in press)	Liao P.C., Li C.M., Lin L.C., Hung C.W., Shih T.S.*

Human Urine by Electrospray Ionization Tandem Mass Spectrometry		
Assessing and Predicting the Exposures of Polycyclic Aromatic Hydrocarbons and Their Carcinogenic Potencies from Vehicle Engine Exhausts to Highway Toll Station Workers	Atmos Environ, 2003, (in press)	Tsai P.J., Shih T.S.*, Chen S.L., Lee W.J., Lai G..H., Liou S.H.
Biological Monitoring of Carbon Disulfide: Kinetics of Urinary 2-Thiothiazolidine-4-Carboxylic Acid (TTCA) in Exposed Workers	Toxi Ind Health, 2003, (in press)	Chang H.Y., Chou T.C., Wang P.Y., Shih T.S.*
Concentration of Pyrene in Relation to Aerosol Size Distribution in Traffic Exhausts	Arch Environ Health, 2003, (in press)	Lai C.H., Liou S.H., Shih T.S.*, Tsai P.J., Chen H.L., Buckley T, Strickland P, Jaakkola JJK.
Determination of Uniformity of Filter Deposit	Aero Sci Tech. 2003, (in press)	Lai C.Y., Chen C.C., Huang J.S., Shih T.S.*
Diffuse White Matter Lesions in Carbon Disulfide Intoxication: Microangiopathy or Demyelination?	Acta Neurological Scandinavica, 2003, (in press)	Ku M.C., Huang C.C., Kuo H.C., Yen T.C., Chen C.J., Shih T.S.*, Chang H.Y.
Dopamine Transporter Binding Study in Differentiating Carbon Disulfide Induced Parkinsonism from Idiopathic Parkinsonism	Neurotoxicology (In Press, 2003)	Huang C.C., Yen T.C., Shih T.S.*, Chang H.Y., ChuN.S.
Elevated Triglyceride and Decreased High Density Lipoprotein Level in Carbon Disulfide Workers in Taiwan	J Occup Environ Med 2003; 45(1): 73-78	Lo C.C., Chang H.Y., Chang S.R., Chou T.C., Shih T.S.*
Exposure Prediction Rules as Statistical Instruments for Exposure Assessment: an Example on Whole-body Vibration in Taxi Drivers	Epidemiology 2003 (in press)	Chen J.C., Chang W.R., Shih T.S. *, Chen C.J., Chang W.P., Dennerlein J.T., Ryan L.M., Christiani D.C.
Exposure to Fine Particulate Matter (PM2.5) Among Highway Toll Workers in Taipei	Arch Environ Health. 2003, (in press)	Lai C.H., Liou S.H., Shih T.S.*, Tsai P.J., Chen H.L., Buckley T., Strickland P., Jaakkola JJK

Hearing Loss in Workers Exposed to Carbon Disulfide and Noise	Environmental Health October 2003,volume 111,Number 13	Shu-Ju Chang、Tung-Sheng Shin、Tzu-Chieh Chou、Chiou-Jong Chen*、Ho-Yung Chang、Fung-Chang Sung
Heat Stress Evaluation and Worker Fatigue in a Steel Plant	AIHA Journal 64:352-359(2003)	Mei-Lien Chen、Chiu-Jung Chen* 、Wen-Yu Yeh*、Ju-Wei Huang、 I-Fang Mao
Hematological Effects Among Silk-Screening Workers Exposed to 2-Ethoxy Ethyl Acetate	Occup Environ Med, 2003 (in press)	Loh C.H., Shih T.S.*, Liou S.H., Lin Y.C.*, Hsieh A.T., Chen C.Y.*, Liao G.D.
Immunological Findings in a Group of Coke-Oven Workers Exposed to Polycyclic Aromatic Hydrocarbons	J Occup Environ Med, 45(10): 1034-1039.	Wu, MT, Pan, CH*, Wu, TN, Huang, YL, Chen, CY, Huang, LH, Ho, CK
Measurement of information processing load and visual load on a dynamic information processing task	Behavior and information technology, 22(5), 365-374, 2003.	Chi, C.F., Lin, Y.H.*, Lan, W.S.
Partition Coefficients of Volatile Hydrocarbons in Blood And Saliva	J Toxi Environ Health A. 2003, (in press)	Chang H.Y., Lin W.C., Shih T.S.*, Smith T.J.
Predictor of Whole-body Vibration Levels Among Urban Taxi Drivers	Ergonomics, 2003, 46:1075-1090	Chen J.C., Chang W.R., Shih T.S.*, Chen C.J., Chang W.P., Dennerlein J.T., Ryan L.M., Christiani D.C.
Simultaneous Sampling of Vapor- and Aerosol-phase TDI With a Triple Filter System	J Air Waste Manage Assoc, 2003, 53:1265-1272	Tsai C.J., Cheng K.C., Shankar G.A., Shih T.S.*, Hung I.F.
Skin Absorption and Biological Monitoring of Occupational Exposure to N,N-Dimethylformamide	J Occup Safety & Health ; 2003	Tsai, C.Y., Lin, Y.Q., Shih, T.S.*, Chang, H.Y.
Sperm Function in Workers Exposed to N, N-Dimethylformamide in Synthetic Leather Industry	Fertility and Sterility. 2003 (in press)	Chang H.Y., Shih T.S. *, Guo Y.L., Tsai C.Y., Hsu P.C.
Study on Mercury Exposure Assessment Techniques for Workers in Fluorescence Lamp Factories	J Occup Safety & Health, 2003, 11:95-105.	Hsiech C.M.*, Shih T.S.*, Lin Y.C.*

The Association of Knee Pain and Long Driving: a Secondary Analysis of the Taxi Drivers' Health Study	Am J Public Health 2003, (in press)	Chen J.C., Dennerlein J.T., Shih T.S.*, Chen C.J., Cheng Y.W., Chang W.P., Ryan L.M., Christiani D.C.
The Effect of Personal Factors on The Relationship Between Carbon Disulfide Exposure and Urinary 2-Thiothiazolidine-4-Carboxylic Acid Levels in Rayon Manufacturing Workers	Sci Tot Environ (In Press, 2003)	Chou T.C., Shih T.S.*, Sheu H.M., Chang S.J.*, Huang C.C., Chang H.Y.
The Effect of the Size of Openings on Contaminant Contro; Between Two Adjacent Spaces With Differing Air Pressures	American Ind. Hyg. Assoc. J., 2003, 64(6):792-798	Chung, K.C., Yang, C.Y., Chen, C.W.*
The Effects of Co-exposure to Methyl Ethyl Ketone (MEK) on the Biological Monitoring of Occupational Exposure to N, N-Dimethylformamide (DMF)	Int Arch Environ Occup Health 2003, 76:121-128	Chang H.Y., Shih T.S.*, Cheng C.C., Tsai C.Y., Lai J.S., Wang V.S.
The Relation of the Degree of Carbon Disulfide Exposure and Other Worker's Factors to Urinary 2-Thiothiazolidine-4-Carboxylic Acid (TTCA) Among the Workers in a Rayon Manufacturing Plant	J Occup Safety & Health ; 2003 11(2): 95-105	Chou T.C., Shih T.S.*, Chang S.J., Chang H.Y.
Urinary 1-Hydroxypyrene-Glucuronide as a Biomarker of Exposure to Traffic Exhausts Among Highway Toll Station Workers	Arch Environ Health, 2003, (in press)	Lai C.H., Liou S.H., Shih T.S. *, Tsai P.J., Chen H.L., Buckley T.J., Strickland P., Jaakkola, J.J.K.
Urinary Biomarkers of Occupational N, N-Dimethyl Formamide (DMF) Exposure Attributed to The Dermal Exposure	J Expo Ana Environ Epi, 2003, (in press)	Chang H.Y., Tsai C.Y., Lin Y.Q., Shih T.S. *
Urinary Exceretion of 8-Hydroxy-2-deoxyguanosine and 1-Hydroxypurene in Coke-Oven Workers	Environ. Mol. Mutat., 42: 98-105.	WuMT, Pan CH*, Huang, YL, Tsai, PJ, Chen CJ*, Wu, TN
Using Urinary 1-Hydroxypyrene as an Indicator for Assessing the	Environmental Science & Technology, Accepted on Oct. 9, 2003	Tsai P.J., Shih T.S. *, Chen S.L., Lee W.J., Lai G.H., Liou S.H.,

Exposures of Booth Attendants of a Highway Toll Station to Polycyclic Aromatic Hydrocarbons		

Note: IOSH Staff remarked with *

4. Presentation of Theses – Local Academic Conferences

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An On-Line Automatic Sample Clean-Up System for the Quantitative Detection of the Benzene Exposure Biomarker S-Phenulmercapturic Acid in Human Urine by Electrospray Ionization	J Ana Toxicol, 2003, (in press)	Liao P.C., Li C.M., Lin L.C., Hung C.W., Shih T.S.*

Tandem Mass Spectrometry		
Assessing and Predicting the Exposures of Polycyclic Aromatic Hydrocarbons and Their Carcinogenic Potencies from Vehicle Engine Exhausts to Highway Toll Station Workers	Atmos Environ, 2003, (in press)	Tsai P.J., Shih T.S.*, Chen S.L., Lee W.J., Lai G..H., Liou S.H.
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Determination of Uniformity of Filter Deposit	Aero Sci Tech. 2003, (in press)	Lai C.Y., Chen C.C., Huang J.S., Shih T.S.*
Diffuse White Matter Lesions in Carbon Disulfide Intoxication: Microangiopathy or Demyelination?	Acta Neurological Scandinavica, 2003, (in press)	Ku M.C., Huang C.C., Kuo H.C., Yen T.C., Chen C.J., Shih T.S.*, Chang H.Y.
Dopamine Transporter Binding Study in Differentiating Carbon Disulfide Induced Parkinsonism from Idiopathic Parkinsonism	Neurotoxicology (In Press, 2003)	Huang C.C., Yen T.C., Shih T.S.*, Chang H.Y., ChuN.S.
Elevated Triglyceride and Decreased High Density Lipoprotein Level in Carbon Disulfide Workers in Taiwan	J Occup Environ Med 2003; 45(1): 73-78	Lo C.C., Chang H.Y., Chang S.R., Chou T.C., Shih T.S.*
Exposure Prediction Rules as Statistical Instruments for Exposure Assessment: an Example on Whole-body Vibration in Taxi Drivers	Epidemiology 2003 (in press)	Chen J.C., Chang W.R., Shih T.S. *, Chen C.J., Chang W.P., Dennerlein J.T., Ryan L.M., Christiani D.C.
Exposure to Fine Particulate Matter (PM2.5) Among Highway Toll Workers in Taipei	Arch Environ Health. 2003, (in press)	Lai C.H., Liou S.H., Shih T.S.*, Tsai P.J., Chen H.L., Buckley T., Strickland P., Jaakkola JJK
Hearing Loss in Workers Exposed to Carbon	Environmental Health October 2003, volume 111,	Shu-Ju Chang、Tung-

Disulfide and Noise	Number 13	Sheng Shin、Tzu-Chieh Chou、Chiou-Jong Chen*、Ho-Yung Chang、Fung-Chang Sung
Heat Stress Evaluation and Worker Fatigue in a Steel Plant	AIHA Journal 64:352-359(2003)	Mei-Lien Chen、Chiu-Jung Chen* 、Wen-Yu Yeh*、Ju-Wei Huang、 I-Fang Mao
Hematological Effects Among Silk-Screening Workers Exposed to 2-Ethoxy Ethyl Acetate	Occup Environ Med, 2003 (in press)	Loh C.H., Shih T.S.*, Liou S.H., Lin Y.C.*, Hsieh A.T., Chen C.Y.*, Liao G.D.
Immunological Findings in a Group of Coke-Oven Workers Exposed to Polycyclic Aromatic Hydrocarbons	J Occup Environ Med, 45(10): 1034-1039.	Wu, MT, Pan, CH*, Wu, TN, Huang, YL, Chen, CY, Huang, LH, Ho, CK
Measurement of information processing load and visual load on a dynamic information processing task	Behavior and information technology, 22(5), 365-374, 2003.	Chi, C.F., Lin, Y.H.*, Lan, W.S.
Partition Coefficients of Volatile Hydrocarbons in Blood And Saliva	J Toxi Environ Health A. 2003, (in press)	Chang H.Y., Lin W.C., Shih T.S.*, Smith T.J.
Predictor of Whole-body Vibration Levels Among Urban Taxi Drivers	Ergonomics, 2003, 46:1075-1090	Chen J.C., Chang W.R., Shih T.S.*, Chen C.J., Chang W.P., Dennerlein J.T., Ryan L.M., Christiani D.C.
Simultaneous Sampling of Vapor- and Aerosol-phase TDI With a Triple Filter System	J Air Waste Manage Assoc, 2003, 53: 1265-1272	Tsai C.J., Cheng K.C., Shankar G.A., Shih T.S.*, Hung I.F.
Skin Absorption and Biological Monitoring of Occupational Exposure to N,N-Dimethylformamide	J Occup Safety & Health ; 2003	Tsai, C.Y., Lin, Y.Q., Shih, T.S.*, Chang, H.Y.
Sperm Function in Workers Exposed to N, N-Dimethylformamide in Synthetic Leather Industry	Fertility and Sterility. 2003 (in press)	Chang H.Y., Shih T.S. *, Guo Y.L., Tsai C.Y., Hsu P.C.
Study on Mercury Exposure Assessment Techniques for Workers in Fluorescence Lamp Factories	J Occup Safety & Health, 2003, 11:95-105.	Hsiech C.M.*, Shih T.S.*, Lin Y.C.*
The Association of Knee	Am J Public Health 2003,	Chen J.C., Dennerlein J.T.,

Pain and Long Driving: a Secondary Analysis of the Taxi Drivers' Health Study	(in press)	Shih T.S.*, Chen C.J., Cheng Y.W., Chang W.P., Ryan L.M., Christiani D.C.
The Effect of Personal Factors on The Relationship Between Carbon Disulfide Exposure and Urinary 2-Thiothiazolidine-4-Carboxylic Acid Levels in Rayon Manufacturing Workers	Sci Tot Environ (In Press, 2003)	Chou T.C., Shih T.S.*, Sheu H.M., Chang S.J.*, Huang C.C., Chang H.Y.
The Effect of the Size of Openings on Contaminant Contro; Between Two Adjacent Spaces With Differing Air Pressures	American Ind. Hyg. Assoc. J., 2003, 64(6): 792-798	Chung, K.C., Yang, C.Y., Chen, C.W.*
The Effects of Co-exposure to Methyl Ethyl Ketone (MEK) on the Biological Monitoring of Occupational Exposure to N, N-Dimethylformamide (DMF)	Int Arch Environ Occup Health 2003, 76: 121-128	Chang H.Y., Shih T.S.*, Cheng C.C., Tsai C.Y., Lai J.S., Wang V.S.
The Relation of the Degree of Carbon Disulfide Exposure and Other Worker's Factors to Urinary 2-Thiothiazolidine-4-Carboxylic Acid (TTCA) Among the Workers in a Rayon Manufacturing Plant	J Occup Safety & Health ; 2003 11(2): 95-105	Chou T.C., Shih T.S.*, Chang S.J., Chang H.Y.
Urinary 1-Hydroxypyrene-Glucuronide as a Biomarker of Exposure to Traffic Exhausts Among Highway Toll Station Workers	Arch Environ Health, 2003, (in press)	Lai C.H., Liou S.H., Shih T.S. *, Tsai P.J., Chen H.L., Buckley T.J., Strickland P., Jaakkola, J.J.K.
Urinary Biomarkers of Occupational N, N-Dimethyl Formamide (DMF) Exposure Attributed to The Dermal Exposure	J Expo Ana Environ Epi, 2003, (in press)	Chang H.Y., Tsai C.Y., Lin Y.Q., Shih T.S. *
Urinary Exceretion of 8-Hydroxy-2-deoxyguanosine and 1-Hydroxypurene in Coke-Oven Workers	Environ. Mol. Mutat., 42: 98-105.	WuMT, Pan CH*, Huang, YL, Tsai, PJ, Chen CJ*, Wu, TN
Using Urinary 1-Hydroxypyrene as an Indicator for Assessing the Exposures of Booth	Environmental Science & Technology, Accepted on Oct. 9, 2003	Tsai P.J., Shih T.S. *, Chen S.L., Lee W.J., Lai G.H., Liou S.H.,

Attendants of a Highway Toll Station to Polycyclic Aromatic Hydrocarbons		

Note: IOSH Staff remarked with *

5. Presentation of Theses – Foreign Academic Conferences

Table 7 Presentation of Theses – Foreign Academic Conferences

Topic	Conference	Place	Date	Authors
Exposure assessment, health hazard evaluation, and control of ethylene glycol ethers	2003 William P. Yant Award Lecture. American Industrial Hygiene Conference and Exposition	Dallas, USA	2003/05/10-15	Shih TS.*
Effects of Combined Exposure to Carbon Disulfide and Sulfuric Acid on Occupational Hand Dermatitis in Rayon Industry	13th Annual Conference International Society of Exposure Analysis (ISEA 2003)	Stresa, Piemonte, Italy	2003/09/21-25	Chang, H.Y., Chou, T.C., Sheu, H.M., Wu, J.D., Shih, T.S.*
Urinary Biomarkers Of Occupational N,N-Dimethylformamide Exposure Attributed To Dermal Exposure	13th Annual Conference International Society of Exposure Analysis (ISEA 2003)	Stresa, Piemonte, Italy	2003/09/21-25	Chang, H.Y., Tsai, C.Y., Lin, Y.Q., Shih, T.S.*
Evaluations of Kinetic Parameters and Critical Runaway Conditions under the Reaction Condition of Nitric Acid Mixed with Acetic to Produce HMX in a Non-Isothermal Batch Reactor	Proceedings for the North American Thermal Analysis Society (NATAS)	Albuquerque, New Mexico, USA	2003/09/22-24	Peng DJ*, Chang CM*, Shu CM
Assessing Crystalline Silica Exposures to Municipal Waste Incinerator Demolition Workers.	2003 Conference for American Association for Aerosol Researchers (AAAR)	Anaheim, California, USA,	2003/10/20-24	Tsai P.J., Lu P.Y., Tang D.T., Tsai C.L.

Note: IOSH Staff remarked with *

6. Research Awards Received by IOSH Personnel

Table 8 Research Awards Received by IOSH Personnel

Award	Recipients	Thesis	Date
Executive Yuan Outstanding Research Award	Shih, TS Hsieh, CM Pan, CH Chen, CR Dai, KF Yang, RC	Health Hazard of Hexavalent Chromium Exposure of Construction Workers and Improvement Measures Studies	2003/08/29
Executive Yuan Outstanding Research Award	Shih, TS Dai, KF Yang, RC Chou, RS Chen, CY	Health Hazard of Ethylene Glycol Monomethyl Ether in Printed-Circuit Board Manufacturing Survey and Improvement Measures Follow-up Studies	2003/08/29
Executive Yuan Outstanding Research Award	Yeh, WY Huang, SH Chen, CW	Filtration Characteristics of Nanoparticles through Electret Filter Media	2003/08/29

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 2003, IOSH published 23 new publications (research reports excluded), which approximately 33,300 copies had been printed.

Table 9Publications for Fiscal Year 2003

Title	Type	Issues	Copies	Remarks
Institute of Occupational Safety and Health Journal	Quarterly	4	1100	Vol. 11, No. 1-4
IOSH Newsletter	Bimonthly	6	4600	No. 57-52
Technical Books	Irregular	13	100	Titles listed in appendix.

III. Information Services

1. Library

In conjunction with the development of the National Information Infrastructure, IOSH continuously expands its library collections and improves the quality along with quantity of both software and hardware. For the fiscal year 2003, the library had a collection of 6,426 books and 14 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	2002	Addition/ Subtraction in 2003	Total
Books	5,783	+643	6,426
Subscribed Periodicals	69	+45	114
Chinese	25	+8	33
English	38	+28	66
Japanese	6	+9	15
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 2003 are described as below:

1. Purchased new server hardware manufactured by Sun Microsystems, Inc.
2. Set up digital projectors and AV facilities in all IOSH's conference rooms.
3. Built an online service of "Occupational Safety and Health (OSH) Classroom Online", offered some useful OSH-related information and self-test questionnaires.
4. Built a special area for collecting SARS-related documents and information.

Besides, to give an impetus to national plan such as "National e-Learning Plan", we completed 30 e-books such as "Handbook of Preventing Hazards in Chemical Laboratories" and self-test questionnaires in the "OSH Classroom Online". There were 20,000 people who attended our e-learning courses in 2003. 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 including: research reports, introduction to research projects, Research Programs (abstracts in English), technical books series, “Journal of IOSH”, “IOSH Newsletter”, Annual Report (available in both Chinese and English) are available online for free download. In 2003, our website was visited over 1,980,000 times, and IOSH free download service was served 126,400 times.

IV. Technology Promotion and Services

For the year 2003, IOSH sponsored 3 exhibition, assisted in 24 investigations into suspected cases of occupational diseases, and offered calibration services for inspection instruments 1 times (refer to Table 11-13).

Table 11 Exhibitions

Topic	Summary of Activities	Location	Date
Monument to Labor Death Revealing and 2003 Conferenceof Labor Safetyand Hygiene	The conference was sponsored by Department of Labor Safety and Health, CLA. Some of OSH-related papers were presented. IOSH presented ashow was held in “Mobile Exhibition” in coordination with the conference. President Chen, Shui-bian hosted the unveiling ceremony of the Monument.	Labor Recreation Center, Labor Bureau of Kaohsiung City Government	2003/04/28
“Labor Health, Safety and Happiness Promotion” carnival	Both Tainan City Government and IOSH held this activity. Mayer Hsu and Chairperson Shih commenced the opening ceremony. More than hundreds union representatives attended.	Tainan City Baseball Stadium	2003/08/18
“Culture and Safety Exhibition Tour”	The exhibition was sponsored by IOSH, Taiwan Provincial Government and	Taiwan Provincial Government Information Hall	2003/09/19-10/26

	National Museum of Natural Science.More than 6,000 people visited during the exhibition.		

Table 12 Investigation into Suspected Cases of Occupational Diseases

Name of Organization	Items Investigated	Date
Petroleum refinery	Heat exchanger explosion	2003/01/22
Crab catching ship, Yeliou	Death caused from falling into sea	2003/01/09
Sanitary troop	Occupational hazard caused from falling	2003/02/18
Chemical factory, SinjhuangCity	Reactor explosion	2003/07/02
Ballast plant	Electrocution	2003/08/21
Plastic company, KaohsiungCounty	Electrocution	2003/08/25
Hot spring, Beitou	H2S intoxication	2003/10/23
Chemical factory, Chiayi	Explosion	2003/11/24
Foam rubber factory, Taoyuan	Explosion	2003/11/25
Firecracker/firework factory, Miaoli	Explosion	2003/12/17
Engineering company	Electrocution	2003/12/18
Worker Yeh	Slipped disc	2003/07
Worker Lu	Hearing loss	2003/07
Worker Chen	Carpal tunnel syndrome	2003/07
Worker Liu	Trigger finger	2003/08
Worker Hsiao	Hearing loss	2003/09
Worker Huang	Tuberculosis pulmonary	2003/09
Worker Huang	Hearing loss	2003/11
Worker Wu	Hearing loss	2003/12
Worker Wang	Hearing loss	2003/12
Worker Yao	Slipped disc	2003/12
Worker Chang	Lumbar spine fracture slippery	2003/12
Cement company	Pneumoconiosis syndrome	2003/02/16
Food industry	Carbon monoxide poisoning	2003/04/03
Moulding factory	Myocardial infarction	2003/12/10

Table 13 Inspection of Apparatus and Calibration Services

Name of Agency	Services	Date
Inspection Organizations	6 oxygen and flammable gas detectors; 25 industrial safety inspection apparatus	2003/10-2003/12

Patent application and technology transfer are now under way for some important research results of the IOSH, such as “Work Chair” and “ Industrial Safety Helmet” 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. Based on IOSH 2003 research results, total 6 patents were obtained (see Table 14).

Table 14 New Patents of IOSH

Patent No.	Invention	inventors
Invention 170,031	On-line monitoring and method of fluid machinery mechinary	Kao, TY* Wang, SL Pai, MH Chen, KH
New Utility Model 199,536	Over-load cutout device of Mobile Cranes	Dai, KF* Kao, TY* Wang, SL Yang, CH
New Utility Model 201,565	Airflow Capture Booth with Single-plate Windbreak	Huang, RF Chen, YK Yeh, WY* Chen, CW* Liu, CH
Invention 180,227	Automatic Mass Spectrometry Analytical System for the Quantitative Detection of Organic Toxicant Exposure in the Human Body	Liao, PC Lin, LC Lee, CM Shih, TS*
New Utility Model 211,101	Stabilization Device for Gondola	Dai KF* Kao, TY*

Note: IOSH Staff remarked with *

The IOSH’s Exhibition Hall, which takes up the area of 926 m2, was opened on September 19, 2002. It is currently the only one exhibition hall that is based on subject of occupational safety and health (OSH) in Taiwan.In order to introduce OSH-related knowledge to vocational school students, both CLA and Ministry of Education (MOE) sponsored an “out-of-school learning” program. MOE invited vocational school students

to visit IOSH's Exhibition Hall. The total amount of visitors (including workers, union representatives, students, etc.) was 15,000 in 2003.

In terms of exhibition activities, IOSH's Mobile Exhibition began its virgin voyage since March 29, 1999.During the year 2003, it had successfully toured through 24 exhibitions. Among these were schools of all levels, industrial areas, business districts and related join activities. It is estimated that 41,000 people had attended these exhibitions in 2003. 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. 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.

Appendices

I. IOSH Research Projects in 2003 (currently available in Chinese)

Project No.	Title
IOSH92-A101	A Study on the Laborers from the Sinter Plant Exposed to Dioxin
IOSH92-A102	The Development of a New Exposure-Based Personal Alarm System for Workers
IOSH92-A103	Effect of Aerosol Loading on Cyclone Performance
IOSH92-A104	Serum Levels of Polychlorinated Dibenzo-p-dioxins and

	Dibenzofurans in Aluminum Smelter Workers
IOSH92-A301	Characteristics and Exposure Assessment of Free Silica for Worker in Casting Industry
IOSH92-A302	Exposure Assessment for Aircraft Maintenance Workers Exposed to Polycyclic Aromatic Hydrocarbons (PAHs)
IOSH92-A303	Development of Biological Monitoring of Occupational Exposure to 4,4'-methylene-bis-(2-chloroaniline)
IOSH92-A304	Survey of p-Dichlorobenzene Exposure for Manufacturing Worker of Insect Repellence
IOSH92-A305	A Fast, Sensitive, and Convenient Electrochemical Method Based on Screen-Printed Electrode for Detection of Lead Ion (Pb2+) in Blood
IOSH92-A306	Follow up Survey and Control of Ethylene Oxide Hazard
IOSH92-A307	Promulgation Chemical Environmental Monitoring Program: Defense Industry
IOSH92-A308	Surveillance for the Techniques Resulted in Exposure Monitoring for Optoelectronics and CDR Industries
IOSH92-A309	Surveillance for the Compliance of Environmental Monitoring Program in 300-mm Wafer Semiconductor Foundry
IOSH92-A310	Improvement of Analysis Method for Sulfur Dioxide in Fumigation
IOSH92-A311	Occupational Exposure to Dichloromethane in the Paint Stripping Industry
IOSH92-A312	The Analysis and Interference Study for Hexavalent Chromium Exposure of Workers in Stainless Steel Welding, Arc Furnaces Steel Refinery and Chromium Platting Workplaces
IOSH92-A313	Improvement of Heavy Metal Analysis in the Airbone Dust: Study on Ultrasonic Extraction Sample Pretreatment Technique
IOSH92-A314	Characteristics of Polycyclic Aromatic Hydrocarbons (PAHs) Exposed to Workers in Carbon Steel Manufacturing Industries
IOSH92-A315	Biological Monitoring of Benzene Exposure among Petrochemical Workers during Annual Maintenances
IOSH92-A316	Characteristics of Polycyclic Aromatic Hydrocarbons (PAHs) Exposed To Workers in Bolts and Nuts Manufacturing Industries
IOSH92-A317	4,4'- Methylene bis(ortho-chloroaniline) Sampling Method

	Establishment and Preliminary Study of Occupational Exposure Assessment at Curing Aagent Manufacturing Plant
IOSH92-A318	Development and Evaluation of Particle Size Distribution Measurement Technique
IOSH92-A319	Exposure Assessment and Control of Toluene Diisocyanate
IOSH92-H101	Study of Monitoring and Control Approaches to Legionella Pneumophila in Industrial Cooling Water
IOSH92-H102	Design and Operation Guideline of the Push-pull Type Hood
IOSH92-H121	Evaluation of Applying Work-field Monitoring Technology to Investigate Repetitive Strain Injuries in Upper Limbs
IOSH92-H301	A Study on Design of General Ventilation in Biotechnical Industrials
IOSH92-H302	Study on Occupational Health Performance Indication (II): Department of Labor Affairs
IOSH92-H303	The Study of Hazard Exposure in the Work of Treating Cadaver in Undertaking
IOSH92-H304	A Feasibility Study on Establishing Occupational HealthServiceCenter System
IOSH92-H305	Study on Peated Filter for Respiratory Devices
IOSH92-H306	A Study on Design of Enforced Cross Draft Generators for Exterior Hoods
IOSH92-H307	A Study for Measurement of Airflow on the Opening of a Fume Hood
IOSH92-H308	Ranking of Noise Sources Contribution with Sound Pressure Measurement in Workplace
IOSH92-H309	Establishment of Testing Sound Insulation for Acoustical Material Using Sound Intensity
IOSH92-H310	Influence of Mechanical Properties of Inclined Surfaces on Walking
IOSH92-H311	Investigation of Helmet Size and Headform Classification
IOSH92-H312	Influence of Wearing Respirator on Visual Field
IOSH92-H341	Study on Consultation and Guidance System for DMF-Related Industry
IOSH92-H342	Study on Consultation and Guidance System for TDI-Related Industry
IOSH92-H343	Study on Occupational Hygiene Emphasis Program to Lead (II)

IOSH92-H344	Prevention and Management Research of Biological Hazards in Microbial Industry: Standard Establishment and Application of Biological Safety Cabinet
IOSH92-H345	Renew of Existing Indigoes Anthropometric Database and its Application in Establishing an Atlas for Workplace Dimension (I)
IOSH92-H371	The Study of Suitability on Ergonomic Checklists with Field Interventionin for the Steel Industry
IOSH92-H372	A Comparison Study on Evaluation of Whole-body Vibration
IOSH92-M101	Work Characteristic and Cardiovascular Disease
IOSH92-M141	The Relationship of Chemical Exposure and Hearing Loss at Workplace (II): the Synergic Effects with Noise Exposure
IOSH92-M142	Development of a Vocational Evaluation Instrument for People with Visual Impairment
IOSH92-M143	Development of a Work Evaluation System for Individuals with Disabilities (I)
IOSH92-M301	The Study of Health Outcomes among Autobody Repair Shop Workers
IOSH92-M302	Occupational Hazard Assessment in Biotechnology Industries (III)
IOSH92-M303	The Cohort Study of Incinerator Demolition Workers
IOSH92-M304	The Study of Health Effect among Asphalt Blend Workers
IOSH92-M305	Special Health Examination and Health Management of Potentially Dangerous Work in Different Countries
IOSH92-M306	Occupational Hazards of Waste Anesthetic Gases in Medical Workers
IOSH92-M321	Aborigines' Health Indicators: from Labor Insurance and National Health Insurance Database
IOSH92-M322	Health Survey for the Long-distance Bus Drivers
IOSH92-M323	Health Hazard Evaluation for Coke Oven Workers Exposed to Polycyclic Aromatic Hydrocarbons
IOSH92-M324	Factory Closure and Workers' Health
IOSH92-M341	Evaluation of a Health Promotion Program for Professional Drivers
IOSH92-M342	Study on the Health Effect from Workplace Climate Change: Low Humidity
IOSH92-M343	The Study on Noise Exposure and Vibration of Bus Drivers
IOSH92-M344	The Investigation of Health Promotion in Industries and the Function Planning of Their HealthCenter

IOSH92-M345	Health Hazard Surveillance of Female Worker Focusing on Medical Professionals
IOSH92-M361	An Investigation of Healthy Problems on Spray Painters about Chemical Exposure
IOSH92-M362	Health Hazard Evaluation of Arsenic Workers in Electro-Optics Industry
IOSH92-M363	A Study of Healthy Effects on Dichlorobenzene Exposure
IOSH92-S101	Safety Investigation of Transport of Dangerous Goods during Loading/Unloading Process with Loss Prevention Approach: Flammable Liquids
IOSH92-S102	The Study of Computerized Inspection of Truss Girder Boom Mobile Crane
IOSH92-S103	Tunnel Excavation Safety Management and Monitoring to Prevent Collapse and Inundation
IOSH92-S104	Wind and Seismic Effects during Construction of High-Rise Buildings Evaluation and Safety Guidelines
IOSH92-S305	Survey and Prevention Policy of Industrial Batch-Process Fires and Explosions in the Recent Decade in Taiwan
IOSH92-S306	Process Safety Analysis in Batch Reaction System
IOSH92-S307	The Study for Preventing Capsizing Accidents of Roadtanker
IOSH92-S308	Investigation of Military Chemical Process Hazards: Energetic Explosive Manufacturing Process
IOSH92-S309	The Guideline of Installation and Practice for Flameproof Electrical Apparatus
IOSH92-S310	Temporary Grounding for Safe Line Working on De-energized Power
IOSH92-S311	Study on Establishment of Seismic Design Specifications for Tower Cranes
IOSH92-S312	A Study to Construct a Seismic Design Code for High Pressure Gas Vessels (II)
IOSH92-S313	Safety of Construction Operations Near Water, River or Offshore
IOSH92-S314	Safety Analysis for High Place Inspection and Repair beneath Bridge
IOSH92-S315	The Degradation and Safety Evaluation on Safety Helmets for Work Site Use
IOSH92-S316	A Feasibility Study on Regulation of Safety Facilities for Road Worker

IOSH92-S317	The Tripod Anchorage Connectors for Confined Space Rescue Systems
IOSH92-S318	The Development of Performance Inspection System for Safety Devices on Injection-Molding Machine (II)
IOSH92-S319	Testing and Verifying of Injection Molding Safety Standards
IOSH92-S320	The Study of the Prevention for Industrial Casualties Caused by using Rolling Machine and Automation Machine
IOSH92-S321	A Design, Fabricate, and Function Testing for Plate Lift Clamp Tool
IOSH92-S322	Research and Development of Expert System for Decision Maker on Emergency Plane (II)

II. Technical Books Collection (currently available in Chinese)

Serial No.	Title
IOSH92-T-049	Handbook of Evaluation Methods and Checklists for Musculoskeletal Disorders
IOSH92-T-050	Guidance of Exposure Survey of Hazardous Substances in Workplace (VIII): Sulfur Dioxide
IOSH92-T-051	Guidance of Exposure Survey of Hazardous Substances in Workplace (IX): Free Silica
IOSH92-T-052	Technical Handbook of Using PAPR by Medical Personnel Caring for SARS Patients in the Quarantine Ward
IOSH92-T-053	Guidance of Exposure Survey of Hazardous Substances in Workplace (X): Lead Dust
IOSH92-T-054	Guidance of Setting up Emergency Eyewash and Shower Equipment
IOSH92-T-055	Handbook of Occupational Exposure Assessment to Organic Solvents during Paint Stripping and Paint Spraying Operations in the Aeronautical Industry
IOSH92-T-056	Guidance of Exposure Survey of Hazardous Substances in Workplace (XI): Formaldehyde
IOSH92-T-057	Guidance of Exposure Survey of Hazardous Substances in Workplace (XII): Heavy Metal Dust
IOSH92-T-058	Handbook of Occupational Calisthenics in the Workplace
IOSH92-T-059	Handbook of Safety Guidance in Fireworks Industry
IOSH92-T-060	Guidance of Occupational Biohazard Prevention for Medical Workers: Pathogenic Bacteria Infection through Air
IOSH92-T-061	Handbook of Labor Energy Expenditure