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Seoul, Korea for the 31st ICOH Congress

OCCUPATIONAL SAFETY AND HEALTH RESEARCH INSTITUTE

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A Korean Scrooge

It is said that one day, a stingy man by the name of "Jo-Reuk" saw a fly sitting on the paste sauce then flying away. Begrudging the sauce on the fly's legs, he chased after the fly for miles shouting "Stop that paste sauce thief!"

Whenever he brought dried, salted fish for dinner, he would hang the fish up on the ceiling so his family could only look at it while eating a bowl of rice. If somebody would look at the fish more than twice during the meal, he would yell out "Stop staring at it. It will make you thirsty."

Even though he was stingy on himself and his family, he selflessly and generously shared his entire life's savings with the people who were suffering from drought. In grateful commemoration of his generosity, people whom he help erected a monument with the engraving "A Selflessly Generous Man."

From Korean Folktales

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OSHRI and ICOH2015 Congress

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The Korea Occupational Safety and Health Agency(KOSHA) was established as a semi-governmental agency under the Ministry of Labor in 1987. KOSHA's key roles include providing technical assistance to workplaces, researching and educating occupational safety and health, certifying dangerous facilities and testing protective equipment. Labor inspectors from the Ministry of Labor conduct inspections at workplaces and enforce the regulations on occupational safety and health. The budget for KOSHA comes from the Industrial Accidents Compensation Insurance Fund, which is run by the government. The KOSHA is composed of headquarters, 24 local technical offices, a research institute and an education center.

This article will focus on providing information on the research institute, the Korean Societies for Occupational Health and their conjoint efforts to win the bid for ICOH2015 Congress.

Occupational Safety and Health Research Institute(OSHRI)

Introduction

The OSHRI was established to conduct researches on occupational safety and health in July 19, 1989, under the KOSHA. The OSHRI has succeeded the National Labor Science Institute, which was established in 1977 under the Ministry of Labor.

Since its establishment, the number of staff expanded from 66 to 154. The major responsibilities of OSHRI include conducting researches and performing various activities for the prevention of occupational accidents and diseases. OSHRI consists of eight units including Department of Research on Safety and Health Policy, Department of Research on Safety System, Department of Research on Occupational Environment, Center for Occupational Diseases Research, Center for Safety Certification Assessment, Center for Research on Safety and Health of Industrial Chemicals, Statistical Analytic Team and Administrative Support Team.

Research Projects

The OSHRI performed various research topics such as toxicology, epidemiology, biological monitoring, industrial hygiene, health statistics,

engineering control, safety engineering, and safety and health policy[1].

During the last 5 years, the OSHRI performed 355 projects in total; 158 projects were done by the OSHRI and 197 projects were given to academia and occupational safety and health agencies. From 2006 to 2008, 90 projects were performed by the OSHRI and 113 papers were published in peer review journals nationally and internationally. During this period, 300 papers were presented at the national or international scientific conferences. The results of research projects produced 47 practical guidelines for occupational safety and health called KOSHA code and eight cases of national patent. The extramural fund given to academia increased recently, where the number of projects reached 169 in the last 3 years (from 2006 to 2008).

Activities

The OSHRI conducts various activities related to occupational safety and health. The OSHRI produces basic occupational safety and health statistics such as Annual Statistics on Industrial Accidents and Diseases, Annual Investigation on the Cause of Industrial Accidents and Diseases, the triennial Survey on Trend of Work Environment, and the Survey on the Status of Work Environment every 5 years.

The OSHRI performs epidemiologic investigations in order to reveal the causal relationship between work environment and diseases under the Occupatimal Safety and Health Act. The Korea Labor Welfare Corporation, which is a compensation agency, requests the OSHRI to conduct epidemiologic investigations for the compensation claimed cases whether they were caused or exaggerated by work. Recently, the OSHRI performed numerous epidemiologic studies to clarify the underlying causes of death occurring from cardiovascular disease at a tire-manufacturing company and reveal the causal relationship between work environment and leukemia at semi-conductor industries.

The OSHRI conducts hazard evaluations to workplaces voluntarily requesting for the service, where unsolved problems by conventional work environmental measurements are arising.

The OSHRI operates four types of quality control program which are: the program for analyzing environmental samples, the program for analyzing biological samples, the program for measuring hearing threshold by audiometer, and the program for taking and interpreting chest X-ray for diagnosing pneumoconiosis.

The OSHRI provides Material Safety Data Sheet(MSDS) for 50,800 chemicals. MSDS was first produced and disseminated to employers and employees for their convenience in 1996. The

MSDS editing program was later developed in order to produce MSDS for mixed chemicals. The OSHRI has taken a lead in introducing and implementing the Globally Harmonized System of Classification and Labeling of Chemicals(GHS classification) among governmental agencies and their affiliations. It also plays an important role in responding to the Registration, Evaluation, Authorization, and restriction of Chemicals(REACH) regulated by the European Union(EU).

The OSHRI performs studies on retired workers who have been exposed to carcinogenic chemicals during their employment period. The health examination is conducted by the OSHRI or requested to the occupational health service agencies to be carried out. It also runs surveillance programs for specific diseases such as occupational asthma and mesothelioma. Participating clinicians are requested to report their case when suspected to be work-related.

International Cooperation

The OSHRI has closely collaborated with institutes in other countries and international organizations. The OSHRI has dispatched its researchers to the US National Institute of Occupational Safety and Health(NIOSH), German Federal Institute of Occupational Safety and Health(BAuA), Japanese National Institute of Occupational Safety and Health(JNIOSH), Finnish Institute of Occupational Health(FIOH) under the Memorandum of Understanding for mutual cooperation. Recently, the OSHRI has been contributing to the development of occupational safety and health in developing countries through International Labor Organization(ILO) and World Health Organization(WHO) projects. KOSHA became a member of WHO-collaborating centers(WHO-CC) in occupational health in 2008.

The OSHRI hosted the 9th International Symposium on Neurobehavioral Methods and Effects in Occupational and Environmental Health of the Scientific Committee of Neurotoxicology and Psychophysiology of ICOH in 2005, which brought 170 participants from 31 countries[2)].

The OSHRI also organized and hosted the 2nd International Meeting of National Institute of Occupational Safety and Health in Asia in 2007, after JNIOSH hosted the 1st International Meeting in Tokyo, Japan in 2004. The 3rd meeting will be held by the Chinese National Institute

of Occupational Health and Poison Control(NIOHPC) in Beijing, China in 2010. The participants of the 2nd Meeting of Institute of Occupational Safety and Health were JNIOSH, OSHRI, Chinese NIOHPC, National Institute of Occupational and Environmental Health(NIOEH) in Vietnam, National Institute of Occupational Safety and Health(NIOSH) in Malaysia, Occupational Safety and Health Center(OSHC) in the Philippines, Occupational Health Center in Indonesia, Center for Occupational Health in Thailand, and Center for Occupational Disease Research in Mongolia.

The KOSHA hosted the 18th World Congress on Safety and Health at Work together with ILO and International Social Security Association(ISSA) in 2008. The Congress brought 4,550 participants from 121 countries, which included many professionals in occupational health. The 18th World Congress adopted the Seoul Declaration on Safety and Health at Work[3] for the first time in its history at the Safety and Health Summit, where 46 high-ranking decision-makers of labor ministers, representatives from governments, employers, employees, social security institutions, and international professional organization like ICOH gathered together from around the globe.

Korean Society of Occupational and Environmental Medicine(KSOEM)[4]

The KSOEM was separated from the Korean Society of Preventive Medicine in 1988. The KSOEM hosted annual conference in autumn, which usually brings more than 500 participants and involves 150 presentations. The KSOEM has issued a peer-review journal called The Korean Journal of Occupational and Environmental Medicine. The journal has been issued four times a year and was accredited as a qualified scientific journal by the Korea Research Foundation.

The KSOEM has developed a four-year resident training program for the occupational medicine in 1995. The average number of new occupational medicine specialists is approximately 30 in every year. Most of them work at the occupational health service agencies while rest of them work at universities or at workplaces as a medical practitioner.

There are professional societies of industrial hygienists, nurses, ergonomists and safety engineers, which are the Korean Society of Occupational and Environmental Hygienists(KSOEH), the Korean Academic Society of Occupational Health Nursing(KSOHN), the Ergonomic Society of Korea, and the Korean Society of Safety.

International Commission on Occupational Health(ICOH) Congress

The first ICOH Congress was held in Milan, Italy in 1906 to exchange knowledge and experience on occupational health. The triennial Congress has been held around the world and brought professionals in occupational health; physicians, nurses, industrial hygienists,

ergonomists, epidemiologists, psychologists and occupational health managers together. During the last 25 years, the congress has been held in Ireland(1984), Australia(1987), Canada(1990), France(1993), Sweden(1996), Singapore(2000), Brazil(2003), Italy(2006) and South Africa(2009). The next ICOH Congress will be held in Mexico in 2012. Unfortunately, Asia, where 60% of global workforce is crowded, hosted only two congresses among 30 Congresses. The last Congress in Asia was in Singapore, 2000. Korea has never hosted the ICOH Congress during its centennial history although it is located in the center of North East Asia, with 30% of global workforce densely populated.

The KOSHA and the KSOEM proposed a bid for hosting ICOH 2015 Congress in Seoul, Korea for the first time in its history. The Korea-Japan-China Joint Conference, which has been annually held in each country in turn since 1989, also agreed to support Korean bid for ICOH2015 Congress.

ICOH2015 Congress : Why in Korea

There are several reasons why ICOH2015 Congress should be held in Seoul, Korea.

1. Highly qualified scientific topics : The ICOH Congress in Korea will be able to bring constructive scientific discussions from its diverse experience with broad industrial base. Korea's rapid industrialization occurred within 3-4 decades, where developed countries have gone through the industrialization for more than hundred years. As a consequence, Korea confronted variety of occupational health issues ranging from classic occupational diseases such as poisoning, respiratory diseases including pneumoconiosis, noise induced hearing loss, occupational cancer, and skin diseases to work-related diseases such as musculo-skeletal disorders, illnesses caused by job stress, and mental diseases. Currently, Korea is encountering rapidly aging society and increasing migrant workers, where most of them work in small-scaled enterprises. Korea is well-known for its advanced IT technology including semi-conductor industry. Nano-industry is also being developed, where its influence on workers' health will be foreseen in the near future.

2. Harmony among global professionals : It is getting more expensive to participate in the ICOH Congress, especially for those coming from developing

countries due to high registration fee and travel expenses. Registration fees in recent Congresses exceeded 1,000 USD. Korea offers affordable registration fee, which is less than two thirds of the previous fees. Korea will also offer 50% discounted registration fee to those coming from ICOH membership discounted countries and young scientists under 36 years of age. Lowered registration fees will not only help bridge the gap between developed and developing countries, but will also help to make harmony between old and young generations. Full scholarships covering airfares, accommodation and registration fee will be provided to participants coming from developing counties and countries with economies in transition based on the number of foreign pre-registration.

3. Excellent convention venue with world-class facilities : COEX(Convention and Exhibition Center) is one of the world's top 10 convention centers, with its convention hall accommodating up to 7,000 people. Parallel conferences and seminars will be able to be held simultaneously in 61 various sized rooms. COEX's capabilities to host large-scale international conferences have been proven at the 18th World Congress on Safety and Health at Work held from June 29 to July 2 in 2008.

4. Easy accessibility and comfortable accommodation : Incheon international airport connects Seoul to 160 cities with 70 airlines. COEX can be reached in an hour by bus from Incheon international airport. Seoul has convenient public transportations including nine metro rail routes, many bus lines and affordable taxi. A wide range of accommodation is available from affordable to luxurious hotels with the price range of 50 to 250 US dollars.

5. Unique cultural experience : As a 600-year-old capital city since Joseon Dynasty, Seoul has many world cultural heritages designated by the UNESCO and historic sites.

1) Kang SK, Ahn YS, Kim KJ. Recent advances in occupational health research in Korea. Ind Health. 2004; 42(2):91-8

2) Kang SK, Kim KJ. The ninth international symposium on neurobehavioral methods and effects in occupational and environmental health in gyeongju, September 26-29, 2005. Neurotoxicology. 2007; 28(2):204.

3) Kang SK Seoul Declaration on Safety and Health at Work. Ind Health. 2009; 47(1):1-4

4) Kang SK. History of Occupational Health Association in Korea in The Origins of Occupational Health Associations edited by Grieco A. Elsenvior. 2003

New Paradigm for OSH in Korea

Recently, there have been rapid and considerable changes in industrial environment such as economic slump, industrial structure, and employment type in Korea. For this reason, it is necessary that we prepare a new paradigm for the prevention of industrial accidents. Accordingly, in this article, we are going to review the recent change made to industrial accidents, strategies for prevention of industrial accidents and the detailed causes of stationary industrial accident rate of 0.7% since 2000 and its countermeasures to overcome this stagnant rate.

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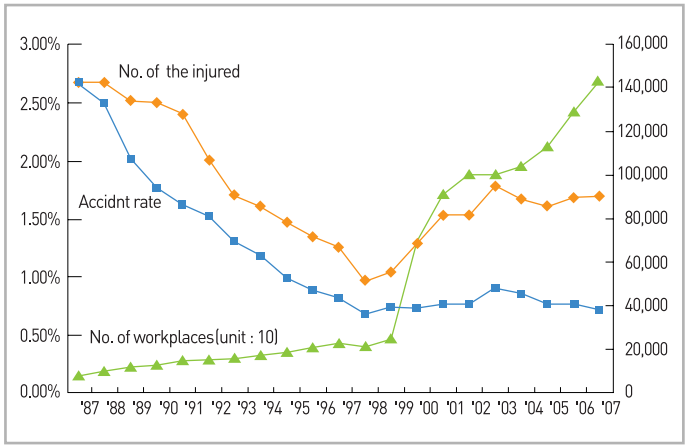
Trend of industrial accidents and changes in the surrounding environment

As for the incidence rate of industrial accidents in Korea, it was 2.66% in 1987 and sharply decreased down to 0.68% in 1998 and then stationary to 0.7%. Added to that, the number of workplaces and victims of industrial disasters has suddenly increased after the year of 2000. We think that this increase is owing to the expansion of protection coverage for workers such as the expansion of subscription for industrial accident insurance of workplaces with less than 5 workers starting from July of 2000, preparation of the base of musculoskeletal disorders on Occupational Safety and Health Act in July of 2003, and inclusion of accidental lumbago in occupational disease in 2006.

The rate of occupational accident is stationary at the level of 78,000 workers/year after 2003. In case of occupational disease, it is tending upwards continuously for the past 10 years making increase over 6 times compared to the rate in 1998 and incidence of 11,472 workers in 2007.

In the meantime, the industrial accident rate in workplaces with less than 5 workers has doubled the industrial accident rate in workplaces with more than 5 workers and share of the number of

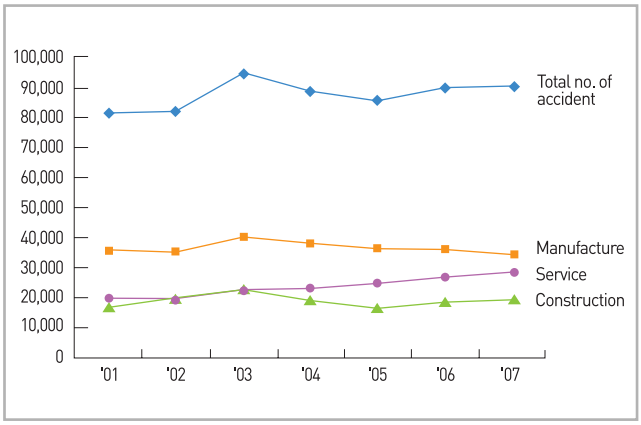


[Figure 1] Changes in industrial accident rate and no. of victims

- Number of workplaces: 250,000 workplaces (1999) -> 1,430,000 workplaces (2007), 570% increase
- Number of workers: 7,500,000 workers (1999) -> 12,500,000 workers (2007), 67% increase
- victims of industrial incident: 50,000 workers (1999) -> 90,000 workers (2007), 80% increase

workplaces of service industries is 63.3%, share of the number of workers in service industries is 42.0%, and share of the victims of industrial disasters is 31.2% out of the whole industry in 2007. In view of these facts, we found that the center of industrial environment has been considerably moved from manufacturing industry and construction industry to service industry.

Moreover, there have been considerable and many changes in employment environment as well. There are 9,890,000 regular workers, 5,460,000 non-regular workers out of total 15,350,000 of salaried workers and the share of non-regular workers is approximately 36% as of 2007. It seems



[Figure 2] Changes in no. of accidents by industry and year

(Unit : Workers)

workers	2001	2002	2003	2004	2005	2006	2007
Total	81,434	81,911	94,924	88,874	85,411	89,910	90,147
Manufacturing industry (Share)	35,506 (43.6%)	34,919 (42.6%)	40,201 (42.4%)	37,579 (42.3%)	35,999 (42.1%)	35,914 (39.9%)	34,117 (37.8%)
Construction industry (Share)	16,771 (20.6%)	19,925 (24.3%)	22,680 (23.9%)	18,896 (21.3%)	15,918 (18.6%)	17,955 (20.0%)	19,050 (21.1%)
Service Industry (Share)	19,698 (24.2%)	18,864 (23.0%)	22,399 (23.6%)	22,925 (25.8%)	24,364 (28.5%)	26,694 (29.7%)	28,137 (31.2%)

- Industrial accident rate in workplaces with less than 5 workers: 1.44% in 2001 -> 1.51% in 2007, 5% increase
- Share of workplaces of service industry (number of workplaces): 59.1% (537,261 workplaces) in 2001 -> 63.3% (905,585 workplaces) in 2007
- Share of workers of service industry (number of workers): 37.7% (3,990,589 workers) in 2001 -> 42.0% (5,264,383 workers) in 2007
- Share of victims of industrial disasters of service industry: 24.2% (19,698 workers) in 2001 -> 31.2% (28,137 workers) in 2007

that it is because of increase of employment of non-regular workers such as day laborer in service industry and small sized workplaces. Statistics shows 60% of non-regular workers are employed in other industries such as service industry and above 70% of non-regular workers are employed in small sized workplaces with less than 30 workers. The ratio of the number of deaths is high at 54.8% considering the percentage of non-regular workers out of the total workers is 36%. In this respect, we think that the labor environment of non-regular workers is poor comparing to that of regular workers.

- Non-regular workers were 612 workers out of 1,116 workers of deaths on-the-job in 2007(54.8%).
  <Source: Korea National Statistical Office, survey on economically active population, additional survey, 2007 >

In view of these facts, it is necessary that we prepare new paradigm of strategies for prevention of industrial accident in accordance with the changes in industrial environment such as industrial structure, employment type, and etc.

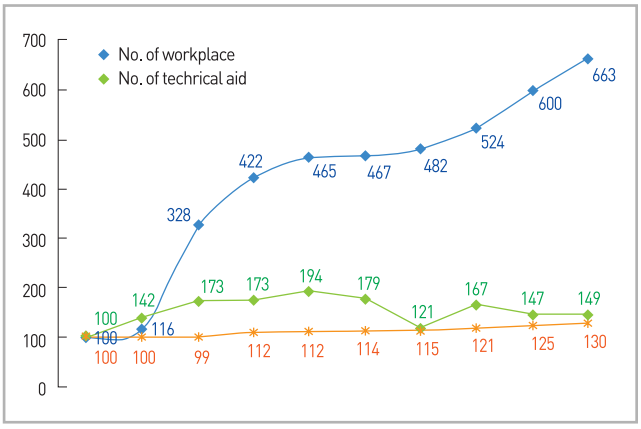
Awareness of issue, introspection, and implications

To catch the causes of stationary industrial accident rate ever since 2000, we need to analyze and diagnose correctly and in details the correlation between industrial environment and strategies for prevention of industrial accident, success and failure cases, and so on. In this article, we are going to check for four main issues to take measure to meet the situation.

Firstly, we can point out lack of proper countermeasures against rapid increase of workplaces. Since the inclusion of workplaces with less than 5 workers on Industrial Accident Compensation Insurance Act, the number of workplaces increase 200,000 every year from 250,000 workplaces in 1999 and the victims of industrial disasters at work with less than 5 workers increase 2% every year. However, resource for industrial accident prevention has been slightly increased and the project conducting method has simply dealt with the quantity of projects only without epoch-making improvement.

Secondly, we can point out lack of effective strategies for prevention of industrial accident in accordance with changes in industrial environment. We should have prepared proper strategies for prevention of industrial accidents considering various changes in industrial environment such as decrease in the weight of manufacturing industry and increase in the weight of service industry, the march of aging society, increase of migrant workers and non-regular workers. Furthermore, we also failed to take countermeasures against gradual expansion tendency of disease recognition criteria of musculoskeletal disorders and cerebrocardiovascular disease (CVD), and increase tendency of the amount and kinds of chemicals used. Added to that, we reflect that the project capacity of the Agency was not enough.

Thirdly, we have reached the limit of technical assistant performance by traditional method based on engineering-oriented improvements. There was a limit with the temporary remedy to the rapid increase of workplaces with less than 5 workers and the increase of industrial accidents in service industries and with the technical assistant methord for which staff of Korea Occupational Safety and Health Agency directly visit a site to improve hardware. We have recognized that the prevention performance for production lines and construction sites in where there are frequent changes in equipment also had a limit in preventing accidents owing to rapid technical progress and reduction in life cycle.



Fourthly, we can point out that performance-oriented focusing strategy was not appropriate for the varying situations of different areas. Regimental establishment, management, and execution of project plans with priority given to Ministry of Labor and Korea Occupational Safety and Health Agency has caused the lack of differentiated technical aid of front-line institutions for the groups with frequent occurrence of industrial accidents. We also failed to provide prevention-oriented examination and analysis of the cause of industrial accidents. Additionally, the performance method of projects did not properly adopted focusing strategy.

Added to the above-mentioned four implications and awareness, we would like to simply compare our changes in the policies on industrial accident prevention in Korea to the policies on safety and health of Health Safety Executive in UK (HSE), one of remarkable industrial accident prevention cases in foreign countries. In case of Korea, there was influx of vulnerable class in industrial accidents into the social system owing to expansion of Occupational Safety & Health Act,

Year	1998	1999	200	2001	2002	2003	2004	2005	2006	2007
No. of workplaces (workplaces)	215,539 (100)	249,405 (116)	706,231 (328)	909,461 (422)	1,002,263 (465)	1,006,549 (467)	1,039,208 (482)	1,130,094 (524)	1,292,696 (600)	1,429,885 (663)
No. of technical aid (workplaces)	50,296 (100)	71,617 (142)	87,010 (173)	86,938 (173)	97,571 (194)	90,119 (179)	61,079 (121)	83,885 (167)	73,917 (147)	74,846 (149)
Staff of KOSHA (persons)	1,055 (100)	1,055 (99)	1,046 (112)	1,184 (112)	1,184 (114)	1,199 (115)	1,212 (121)	1,273 (125)	1,319 (130)	1,376

[Figure 3] Changes in no. of workplace, manpower, and technical aid by each year

* In case of workplaces for technical aid, national funded vicarious services are excluded.

- Total number of workplace: 250,000 workplaces in 1999 -> 1,430,000 workplaces in 2007 (570% increase)
- Staff in Korea Occupational Safety and Health Agency: 1,055 staff in 1999 -> 1,319 staff in 2007 (25% increase)
- Number of workplaces applied for: 71,617 workplaces in 1999 -> 97,571 workplaces in 2002 -> 74,846 workplaces in 2007

industrial accident compensation and application since 2000. However, restraint of law & system is lightened and there was just small increase in resources committed to industrial accident prevention and policies on industrial accident prevention focused on manufacturing industry and construction industry for the past 20 years resulting in failure in taking flexible measures against environmental changes. On the contrary, HSE in UK has embodied and presented clear reduction goal and performance method for industrial accidents like the establishment of national strategy for prevention of industrial accidents. They have approached industrial accident prevention by each field and business type to promote voluntary activities of employer organization to prevent industrial accidents.

New strategy to overcome stagnant industrial accident rate

Considering all these situations and conditions, we'd like to take a good look at measures to overcome the stationary industrial accident rate.

Korea Occupational Safety and Health Agency(KOSHA) held the XVIII World Congress on Safety and Health at Work in COEX in Seoul from the 29th June to 2nd July of 2008, discussed “basic human rights and occupational safety and health as a means of economic development”, and adopted 「Seoul Declaration on Safety and Health at Work」 to induce the attention of the world to occupational safety and health. In the declaration, it is described that each of governments, employers, and workers take responsibility of raising occupational safety and health to a higher level and all constituent member of a society must do their best to reflect occupational safety and health in national agenda prior to everything and to preserve safety and health prevention culture to achieve this goal.

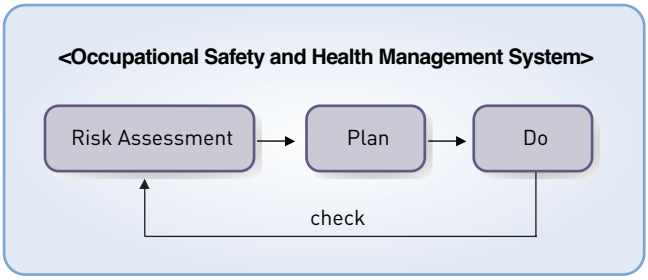
Accordingly, we think that there should be considerable changes in establishment of strategies to prevent industrial accidents with this as a momentum of 「Seoul Declaration on

Safety and Health at Work」. To establish strategies for prevention of industrial accidents, first of all, we have to change the support method to make employers to voluntarily introduce Occupational Safety and Health Management System by enacting introduction of this System to all workplaces in order to pursuit autonomous and consecutive improvement. At the same time, we should develop and distribute various assessment tools for each business type and size to makes employers to conduct risk assessment by themselves.

Added to that, we should foster an atmosphere in which priority should be given to national culture for safety and health prevention to respect the right to work at a safe and pleasant workplace. To achieve this goal, all of government, employer, and workers should take their clear and accurate right, duty, and responsibility to secure safe and pleasant work environment. The followings are the details;

Firstly, we should change policiy to make employers to voluntarily introduce Occupational Safety and Health Management System.

The regulatory system at work performed so far must be changed to self regulation type from prescriptive regulatory system to make employers adopt the Occupational Safety and Health Management System.



Secondly, we should change safety and health inspections in method and timing to provide comprehensive and on-time support.

An employer usually seriously aware the importance of industrial accident prevention right after incidence of industrial accidents. However, their safety awareness and their investment in safety are reduced after some while. Therefore, right after the incidence of industrial accident is the right time to get the highest outcomes on prevention measurers. At this time comprehensive support method (training, technology, fund, etc.) is required for maximizing the effectiveness of industrial accident prevention.

Thirdly, we must establish safety and health culture focused on prevention principle.

To foster an atmosphere in where priority is given to prevention principle at work by promoting 「Seoul Declaration on Safety and Health at Work」 that was adopted during XVIII World Congress on Safety and Health at Work, we should promote direct cost support projects required to expand industrial accident prevention and safety and health culture associated with employer organization, organization of each area and business type, labor union organization of each industry, local autonomous entity followed by campaign and promotion activities all the year round with the press.

Fourthly, select targets with high industrial accident group as Safety Zone to focus assistance capacity

There is a big deviation between each area and business type owing to the characteristics of incidence of industrial accidents of each field. In this sense, selection of Safety Zone including workplaces of similar or same business type, scale, and area is required to set up technical aid, education and information support plan suitable for each Safety Zone and to bring them into focus.

In addition, we can promote the operation of employer and safety staff's organization and technical advisory committee on safety and health and the operation of safety and health institution, organization, and council to support Safety Zone during promoting of activities to prevent industrial accidents by establishing and operating major operational groups for each Safety Zone.

Fifthly, strengthening education & training to raise safety awareness and fostering Infra

First of all, education on prevention of recurrence of similar industrial accidents and instill of attention is required for an employer in a workplace with frequent industrial accidents to raise safety awareness. Added to that, education for employers on knowledge on occupational safety and health is required for preliminary founders associated with Ministry of Knowledge Economy, Small and Medium Business Administration. In case of small sized workplace employers, for the effectiveness of the projects, exemption from periodic training of workers in the relevant workplace is required by conducting scheduled education and educational performance to instill safety and health awareness into employers and to lighten the burden.

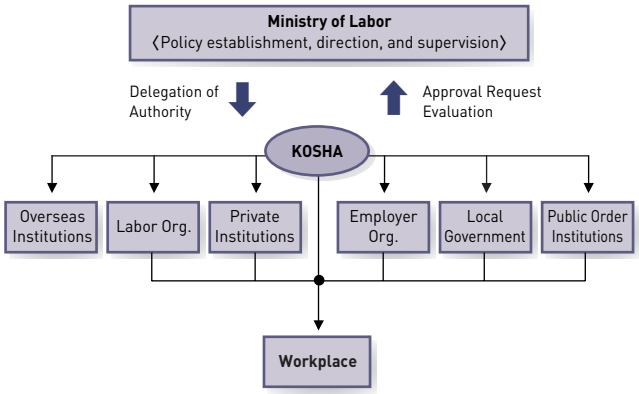
After that, we must have a plan to increase the ratio of education & training of vulnerable workers who suffer from higher rate of industrial accident and receive rare safety education. In case of the workers who completed a safety education, we can think about the introduction of certificate system to exempt them from responsibility of "education on employment" when they are re-employed in the same kind of occupation within a specified period (3 years).

Additionally, we must provide enough support to build self-regulating education system by inducing educational

quality management and private educational institutions to foster private educational institutions and educational Infra in workplaces.

Sixthly, promotion of cooperation between each social stakeholders for prevention of industrial accident

For industrial accident prevention with each of social stakeholders, we will establish cooperation system and complementary role sharing with Safety Partners. Korea Occupational Safety and Health Agency as a hub institute for industrial accident prevention will conduct cooperative partnership with private institutions, employer organization, local government, labor organization, and public ordering institutions.



System improvement to secure the effectiveness of industrial accident prevention

To secure effectiveness in reducing industrial accident, we must ask employers for corrections for the result of technical aid conducted by Korea Occupational Safety and Health Agency. When the case of no correction, we should consider strengthen administrative measure of Ministry of labor and so on.

Added to that, scientific and concrete investigation into the causes of industrial accidents must be conducted directly by Korea Occupational Safety and Health Agency right after any incidence of industrial accidents to prevent further accident. The agency should conduct technology and training support(employer and workers) based on risk assessment to secure statistical reliability of industrial accident and to raise the effectiveness of industrial accident prevention.

Since the effectiveness of industrial accident prevention is still poor because only part of responsibility for safety and health is burdened on employers exempting all the other relevant articles even though Industrial Accident Compensation Insurance Act is expanded for workplaces with less than 5 workers, it is necessary that we receive workplaces with less than 5 workers into the system and we restore penal education system to renew the foundation to settle down the safety culture at work.

Additionally, we must consider the provision of economic incentive by connecting safety level of workplaces(introduction of Safety Management System, deployment of new activities for safety and health, Non-disaster certificate, etc) with industrial accident insurance rate. We can consider the increase of deduction rate of income tax and corporate tax for investment amount on Restriction of Tax Reduction and Exemption Act in case of investment in industrial accident prevention to induce autonomous participation.

Added to that, we must do our utmost best for advanced constituent system of the current Occupational Safety and Health Act to secure the effectiveness of introduction of comprehensive prevention responsibility system and law-observance based on risk assessment by expanding protection range on Occupational Safety and Health Act and by strengthening responsibility for safety and health management of contracting employers.

Developing a Nationwide Occupational Disease Surveillance

At present, we have various data for occupational health services available though they are not well equipped for different occupational disease surveillance and their purposes. If we acknowledge the values of those data, support them on the governmental basis and complement the existing data such as special medical examination and industrial accident compensation insurance, the quality of those data will be enhanced and used widely.

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Introduction

To make policies and prioritize them, it is important to identify how many and big problems a country has now. In Korea, the Ministry of Labor and the organizations involved have established a lot of systems such as working environment surveys, special medical examination and industrial accident compensation insurance and they have shown their interest and efforts in making use of the data related to these systems. Although the data are limited for use in policy-making decisions due to the survey methods and reliability, it is used for a basic data to identify the present conditions of occupational health.

Sometimes, the results of working environment surveys contribute to improving the working environments and deciding the occupational health policies for taking control of the working environments. In special medical examination, it is possible to identify occupational diseases resulting from hazardous elements. Particularly, our data on pneumoconiosis or noise induced hearing loss(NIHS) can lead to more systematic and reliable data than the data from England or USA, which have no system of special medical examination. In addition, we can identify the present

conditions of occupational diseases from the data on approval of occupational health nursing. Seen from the perspective to discover occupational diseases or identify their sizes to establish the policies for preventing and managing those diseases. However, the special medical examination has many limits due to inconsistency of disease occurrences and screening period, lack of staff and methods to check occupational diseases, insufficient occupational health service system to know the number of occurrences of occupational diseases if taking the special medical examination at non-governmental medical centers, resistance from employers on the results and irrationality of administrative measures against the results. Also, the data on approval of occupational health nursing focuses on compensation rather than on prevention. So it is difficult to investigate the truth of occupational diseases and put them to use for preventive projects.

Since occupational disease surveillance was introduced in Korea ten years ago, we have operated the surveillance by diseases such as occupational asthma, skin diseases and musculoskeletal disorders, by types of business such as people working in the construction fields and chemical industrial complex and by region. However, the new surveillance has problems with difficulties to connect information mutually to occupational health services and industrial developments, incomplete sub-structures for occupational health management, insufficient qualified experts, vulnerable reporting system and limits to have access to the working places. Above all, this area is put aside in the priorities of occupational health projects on the nationwide basis.

At present, we have various data for occupational health services available though occupational disease surveillances are not well equipped for their purposes. If we acknowledge the values of those data, support them on the governmental basis and complement the existing data such as special medical examination and industrial accident compensation

insurance, the quality of those data will be enhanced and used widely.

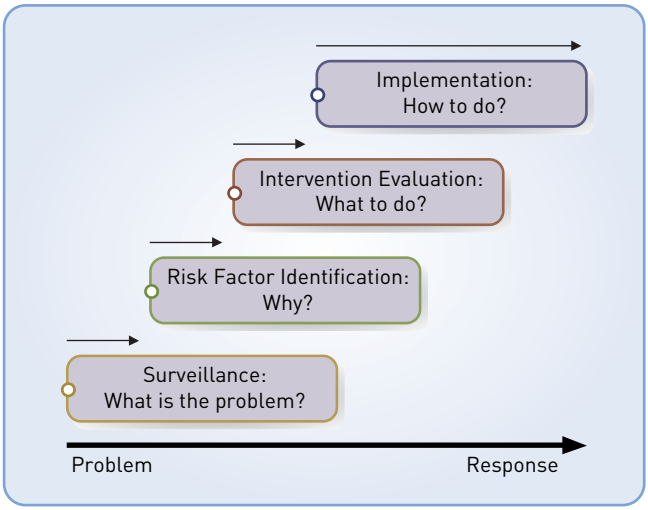
Concept and necessity of occupational disease surveillance

Occupational health services are intended to prevent occupational diseases and improve workers' health. Proper prevention of diseases begins by understanding how they break out. To do so, it is necessary to carry out surveillance which means collecting all forms of data [Figure 1]. At present, our formal system to discover patients with occupational diseases is the special medical examination based on Occupational Safety and Health Act, and the other is the process to approve occupational accidents based on Occupational Accident Compensation Insurance Act.

Occupational disease surveillance is defined to collect, analyze and evaluate the data of occupational diseases continuously and systematically. The results are used to make plans for preventing these diseases and applying them for intervention. They are also used for evaluating these processes. The concrete purpose of surveillance is summed up as follows: i) Assume the scales of the problems, ii) Identify the trends of diseases, iii) Derive a subject of

research, iv) Have a goal for preventive projects, v) Provide the decision-makers with information needed to decide the policies for interventions.

In the surveillance, sometimes you need to find out concrete diseases by types, severity and prevalence rate, or you have only one goal to identify the trends of diseases. If you find out concrete diseases, you have to collect not only individual information but also all the cases. On the other hand, in the surveillance to identify the trends, you don't need that individual information, and you don't have to collect all the cases without any failure. Though they are not reported wholly, if they aren't omitted selectively, you can get good results on surveillance. For example, when you find out a death from occupational diseases such as AIDS, you have to identify the concrete information on individual cases as well as the whole trends to make intervention or follow-ups as needed. However, the surveillance on measles, damages, vaccination and blood lead level is arranged only to identify the trends. So even though you are reported and you don't have individual concrete information, they can be effectively used for making preventive measures.



[Figure 1] Surveillance of occupational disease in the approach on the Public Health Research

<Table 1> Operations of Occupational Diseases Surveillance in Korea

Name of Subjects	Doctors in Charge and Hospitals	Periods
Occupational Disease Surveillance for Incheon	Won, Jong Wook from Yonsei University Severance Hospital	2001 ~
Occupational Disease Surveillance for Busan	Kim, Jeong Won from Inje University Paik Hospital	2002 ~
Occupational Asthma Surveillance	Song, Jae Chul from Hanyang University Hospital	1998, 2004 ~
Malignant Mesothelioma Surveillance	Jung, Soon Hee from Wonju University Hospital	2002 ~
Occupational Lung Cancer Surveillance	Lim, Jong Han from Inha University Hospital	2006 ~
Occupational Hematopoietic System Cancer Surveillance	Park, Byung Chan from Dongguk University Hospital	2007 ~

* Suspended surveillance: Petrochemical Comple(1999), Construction Workers(2002), Gumi Region(2002-2004), Changwon Region(2004)
Occupational Musculoskeletal disorders(2001-2004), Occupational Skin Diseases(2001)

The typical data on occupational diseases surveillance in Korea is the results of special medical examination. It is very effective in tracking the occupational diseases without symptoms with findings such as pneumoconiosis or NIHS, but not effective in tracking the diseases with advanced clinical symptoms such as diseases without findings with symptoms or musculoskeletal disorders. In this way, the scales of pneumoconiosis or NIHS as shown in the statistics of our occupational diseases are relatively accurate, but in case of other occupational diseases, it is difficult to presume how widely they are spread. The data on occupational health nursing is used for a supplemental data of the results of special medical examination, but due to its restrictions, it doesn't reflect the current status of occupational diseases with precision. Therefore, it is difficult to say that the preventive programs on occupational diseases on the basis of this data are not well established. So the policies have a high potential of being flowed unexpectedly.

Occupational disease surveillance is defined to collect, analyze and evaluate the data of occurrences of occupational diseases continuously and systematically.

The results are used to make plans for preventing these diseases and applying them for intervention. They are also

used for evaluating these processes.

In a country like Korea where uniformly medical checkups are not provided, it is very difficult to properly identify the occupational diseases without symptoms with findings, but other countries have made a lot of efforts to identify the scales of the diseases. Most countries identify them by using sample surveys or the statistics of occupational diseases, but due to restrictions of each data, they try to presume the scales of the diseases by utilizing the voluntary surveillance.

If you have any limits to special medical examination or statistics of occupational accidents in identifying the scales of some occupational diseases, you can find out the actual conditions of the diseases. One of them is to establish the surveillance using the reports on patients by clinical investigators. Generally, people go to the medical specialists in accordance with their symptoms. For advanced occupational diseases, you have to put those specialists into the surveillance to identify the scales of the diseases. USA and England have already used this method, and in Korea, the occupational asthma and cancer surveillance have made the attempt.

Occupational disease surveillance in Korea

Korea has had various forms of surveillance data before the occupational disease surveillance was introduced on a full-scale, but for the last ten years when the concept of surveillance was fully introduced, this system has made a remarkable growth in its theory and practice. This surveillance service has played an important role in showing the spread and conditions of a variety of occupational diseases in a very short time as a part of making up for the weak points of special medical examination or industrial accident compensation insurances with a long history. As shown in <Table 1>, the researches on pure occupational

<Table 2> Number of Report Cases for Each Surveillance

(Unit: Case)

Kinds of Surveillance \ Years	2000	2001	2002	2003	2004	2005	Total
Total	629	1,155	1,039	899	407	613	4,742
Regional Surveillance							
Incheon	146	154	135	266	-	150	851
Gumi	-	287	127	122	-	-	536
Busan Ulsan Gyeongnam (B U G)	-	193 (B U G)[2]	205 (B U G)	120 (Busan)	366 (Changwon)	369 (Busan)	1,253
Occupational Diseases Surveillance							
Skin Diseases	115	-	-	-	-	-	115
Other Musculoskeletal Disorders	113	206	115	106	-	-	540
Carpal Tunnel Syndrome	255[1]	235	439	263	-	-	1,192
Malignant Mesothelioma	-	80	18	22	-	40	160
Asthma	-	-	-	-	41	54	95

1) 90 patients out of a total of 225 patients of carpal tunnel syndrome were found to be related to their occupations.

2) BUG : Busan, Ulsan, Gyeongnam.

※ Source : Ahn Yeon soon, et al. Operations of Occupational Diseases Surveillance in Korea, KOSHA, 2006.

<Table 3> Cases Reported Through Occupational Disease Surveillance(Regions and Disease Surveillance)

(Unit: Case)

Kinds of Surveillance \ Years	2000	2001	2002	2003	2004	2005	Total
Total[1]	629	1,155	1,039	899	407	613	4,742 (100.0)
Musculoskeletal disorders	435	806	867	680	346	168	3,302 (69.6)
Asthma	33	61	39	32	45	68	278 (5.9)
Skin diseases	128	125	46	38	8	20	365 (7.7)
Cancers	2	30	24	65	-	278	399 (8.4)
Malignant Mesothelioma	-	80	18	22	-	42	162 (3.4)
Liver diseases	21	38	27	25	-	1	112 (2.4)
Others	10	15	18	18	8	36	124 (2.6)

1) As the cases reported repetitively from disease surveillance and regional surveillance are calculated individually, the total number of actual cases of skin diseases, asthma, mesothelioma and musculoskeletal disorders is less than the number as shown above.

2) The number in round brackets is percentage base.

※ Source : Ahn Yeon soon, et al. Operations of Occupational Disease Surveillance in Korea, KOSHA, 2006.

<Table 4> Types of SENSOR[1] and the Participating States

Types	Name of Surveillance	Participating States
Occupational Diseases Surveillance	Silicosis	Texas, Ohio, North Carolina, Wisconsin, New Jersey, Michigan, Illinois
	Noise-induced hearing loss (NIHS)	Michigan
	Agrichemical poisoning	Texas, New York, Oregon
	Occupational skin diseases	Ohio, Oregon, Washington
	CTS	Massachusetts, Wisconsin
	Carbon Monoxide Toxicity	Colorado
	Asthma	California, Michigan, Massachusetts, New Jersey
	Tuberculosis	California, New York, New Jersey
	Burns	Oregon, Colorado
Injury Surveillance	Accidental amputation	Minnesota
	Pediatric injuries	Massachusetts
Exposure Surveillance	Cadmium	New Jersey

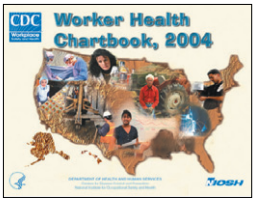
1) SENSOR(Sentinel Events Notification System for Occupational Risks).

diseases surveillance operated by services of Occupational Safety & Health Research Institute(OSHRI) starting from 1998 amounts to a total of 38 subjects by 2007, and OSHRI is contributing to settlement of this surveillance.

As shown in <Table 2 and 3>, a total of 4,742 occupational diseases reported through the surveillance from 2000 to 2005 was divided into 3,302 musculoskeletal disorders(69.7%), 399 cancers(8.4%), 365 skin diseases(7.7%) and 278 asthma(5.9%). As it reports a variety of musculoskeletal disorders, cancers, asthma and skin diseases which are difficult to find in the special medical examination, it provides a lot of useful information to reveal the spread of occupational diseases of workers in Korea. Given that these results are used simply to find out the aspects and scales of occupational diseases, it can be said that they are very useful in the aspects of cost-effectiveness, compared to special medical examination. 4,742 cases reported to occupational disease surveillance were 15 times larger than 270 cases(except for pneumoconiosis and NIHS) discovered by special medical examination during the same period. So it is very effective to discover occupational diseases, compared to special medical examination. The occupational disease surveillance in Korea contributed to identification of occupational diseases in a short period, and the data thereby has been of great help in establishing the preventive policies.

Foreign occupational disease surveillance

Occupational disease surveillance of USA



[Figure 2] Worker Health Chartbook in USA

Regardless of the contents of the reported diseases and surveillance, most of the occupational disease surveillance in USA are operated by NIOSH. Furthermore, this data is integrated for management. In recent days, 'Worker Health Chart Book' [Figure 2] is published to enable us and the people from industrial safety and health to understand the occurrences of occupational diseases and their conditions at a glance.

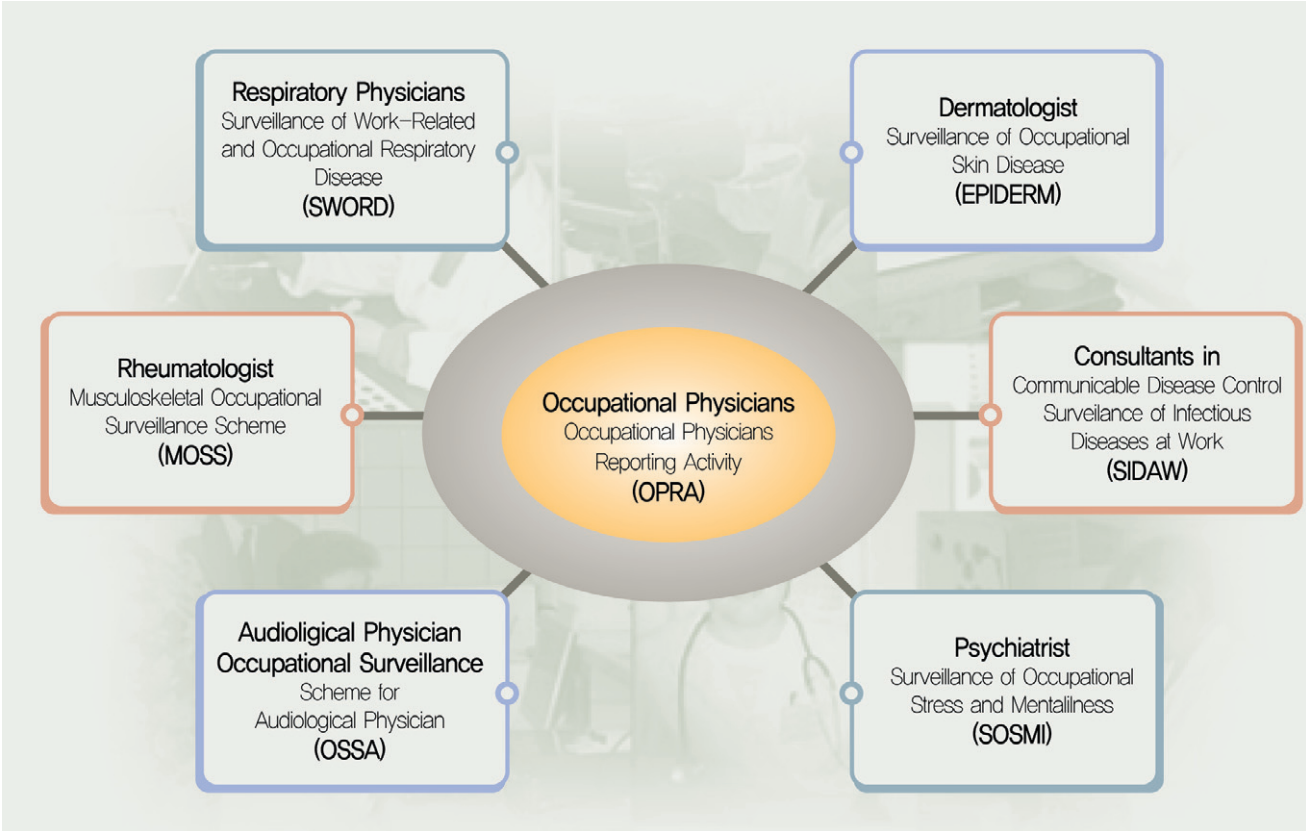
In USA, the federal and state governments require the organizations concerned to report blood lead level, silicosis, acute agrichemical poisoning, etc., and the federal government operates a variety of occupational disease surveillance under NIOSH. The surveillance operated by NIOSH at present are ABLES (Adult Blood Lead Epidemiology and surveillance), SENSOR(Sentinel Events Notification System for Occupational Risks) <Table 4>, NOMS(National Occupational Mortality Surveillance), BLS(Bureauof Labor Statistics), NOES(National Occupational Exposure

surveillance), OHNAC (Occupational Health Nurses in Agricultural Communities) and FACE(Fatality Assessment and Control Evaluation program).

Occupational disease surveillance of England

In England, the data collected by the government and the surveillance system operated by universities are used for data of occupational disease surveillance. As statistical data collected under the government, the reports of employers on occupational injuries and diseases on the basis of RIDDOR 1995(Reporting of Injuries, Diseases and Dangerous Occurrences Regulation, 1995), Self-Reported Work-Related Illness(SWI), the data on industrial accident compensation and mortality are used for national statistical data. RIDDOR 1995 established a law in 1995 that the employers should report the diseases from their working places to Health and Safety Executive(HSE) immediately, and this law started to take effect as a mandatory requirement from the following year and it has been dealt with as a formal statistics.

The occupational disease surveillance run by each medical society was separated by doctors of occupational and environmental medicine in 1996. They established OPRA(Occupational Physician's Reporting Activities) in which all the occupational diseases treated by them should be reported, and they made a reporting system for each medicine area. At present, they built THOR(The Health and Occupation Reporting Network) in which six occupational diseases should be reported from a total of seven surveillance system such as the reporting system for experts and the integrated surveillance system for occupational physicians toward occupational diseases, and they have it operated by the Centre for Occupational and Environmental

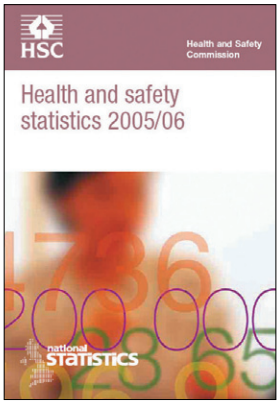


[Figure 3] Surveillance of occupational diseases in the approach on the Public Health Research

Health(COEH) of University of Manchester [Figure 3]. THOR program is supported about £250,000 for every two years by HSE for the expenses of 3~4 staff and consulting doctor. The report for each surveillance is sent via mail with return postage. The results of data analyzed are reported to the doctors every three months and HSE in England once a year. These data is dealt with again to be published in the Health and Safety Statistics along with the data of mandatory reports by employers. The Health and Safety Statistics includes the incidences of each disease during a specific period, the comparison with data of OPRA and the special features, and the data is reported with an estimate converted with the whole number of doctors of clinical medicine and occupational and environmental medicine [Figure 4].

Patient with malignant lymphoma

The program which has been operated until now since its first start in England to identify the occurrences of occupational diseases is SWORD(Surveillance of Work-Related and Occupational Respiratory Diseases), and since 1989 it has been utilized as a primary data with which the doctors in the field can identify the occurrences of occupational diseases. SWORD monitors the occurrences of respiratory diseases resulting from respiratory cancers, pneumoconiosis, asthma, chronic bronchitis and lung injuries from inhalation. The doctors of occupational and environmental medicine and respiratory medicine join in this process. The data of skin diseases, musculoskeletal disorders, hearing difficulty and mental stress other than SWORD are collected from skin medicine, rheumatology, otolaryngology, mental medicine and occupational and environmental medicine. The doctors participating in the reports at present are estimated to be about 60-70% of the corresponding medicines. Though they show some discrepancy in the reporting methods, the general participating doctors (selected) send their data by choosing a month of the year and the key participating doctors report their results every month.



[Figure 4] Health and Safety Statistics of UK

This surveillance receives only minimum information for statistics instead of getting private information, for the doctors request the data created during medical examination.

Unlike USA, England has the occupational disease surveillance operated by university except for mandatory reports. However, most of data management and operation of a variety of surveillance are operated by HSE in the form of having them completely in charge. Also, the statistics are dealt with and edited by the universities which operate the integrated surveillance system [Figure 4].

Problems of occupational disease surveillance in Korea

The project of occupational disease surveillance which has been operated for about 10 years greatly contributes to identification of discovery and scales of occupational diseases, but it has showed a lot of problems in the processes. The comments suggested in the final reports of occupational disease surveillance and the problems raised by the doctors are as follows:

With the problems in process of information acquisitions, they miss their reports out due to insufficient minds of the doctors and workers towards occupational safety and health, their reports are incomplete, and they have not insufficient exchange of information between different surveillance systems. In addition, it is difficult to make use of data of Korea National Health Insurance Corporation, data of special medical examination, data of occupational diseases and data of mortalities due to access problems to public information. For data of diseases, we can get good information from the governmental data related to our health, but it is impossible to utilize the integrated data due to the effectuation of privacy policy and no cooperation system among the governmental ministries. Furthermore, the statistics of occupational safety and health are independently arranged by the governmental ministries. So it is difficult for users of statistics to make use of the statistics.

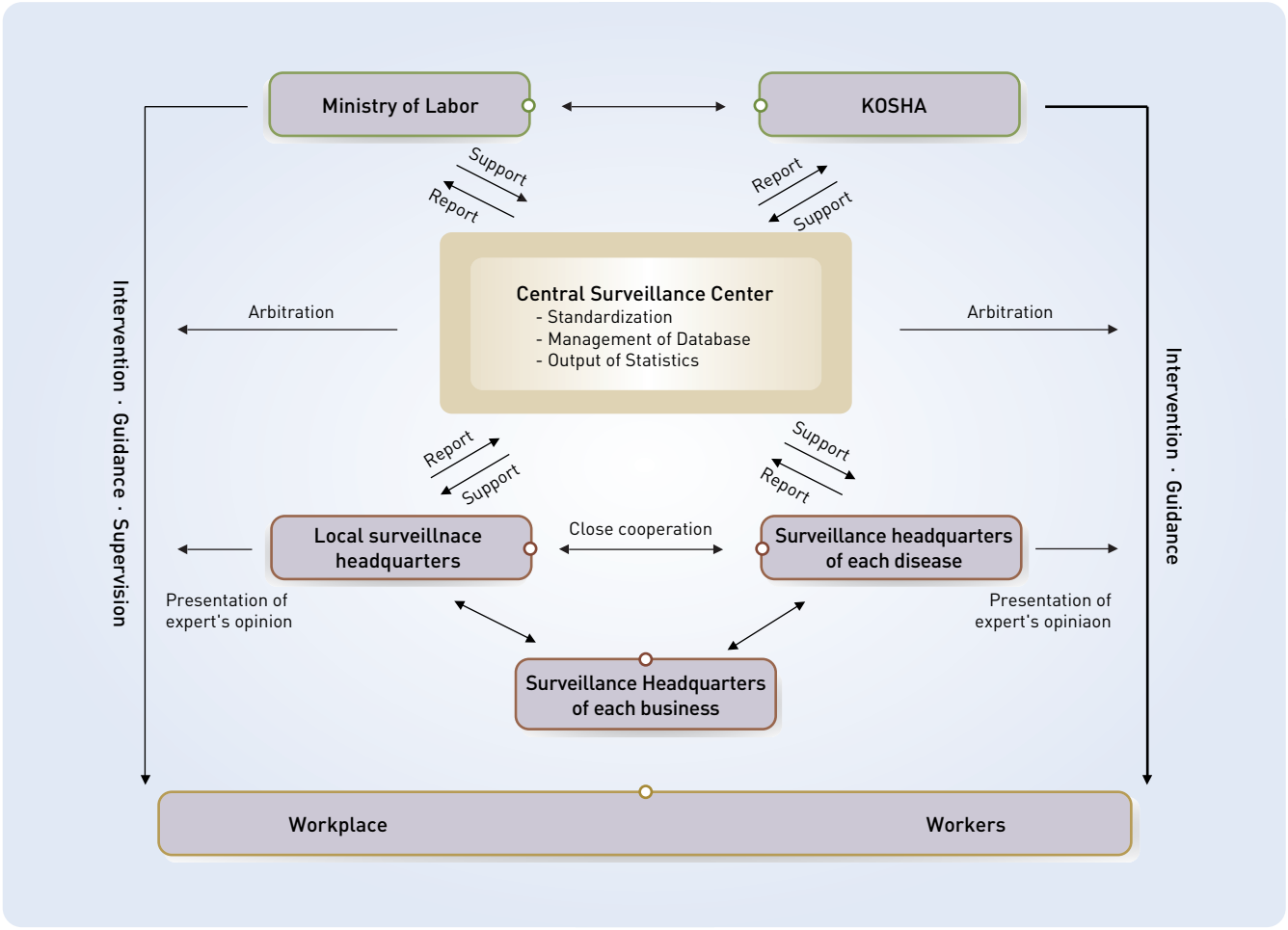
Development of occupational disease surveillance in Korea

When we examine the operations of domestic occupational disease surveillance and inquire into the foreign surveillance methods, we can draw a plan for maintaining and improving our current occupational disease surveillance. To develop the surveillance system, we need an organization of central surveillance to standardize the data of surveillance performed by region and disease, collect, analyze and distribute them systematically. Also, we have to develop a variety of surveillance models such as a surveillance model to high risk group, etc. from the analysis on domestic industrial characteristics, and we need to find out how to make use of public information to enhance the usefulness of surveillance information on occupational diseases, accidents and hazardous elements, and finally, we need some strategies for each surveillance headquarters to display its capacity.

Establishment of tentatively named ‘Central Surveillance Headquarters of Occupational Diseases’

The Central Surveillance Headquarters(CSH) supported by the government should set the goals of occupational disease surveillance and take control of arbitration of governmental efforts to accomplish the goals, and CSH should make its effort aggressively in individual surveillance management, policy development, individual surveillance support, fund raising, information offerings and education [Figure 5]. In addition to it, it is very important of facilitate sharing information among different governmental ministries controlled separately, guarantee the legal positions of each surveillance headquarters and support the safe operations of surveillance.

To mention the roles of the central surveillance headquarters is to i) set the goals of occupational disease surveillance by stages and set the organic and supplemental relations with regional and surveillance, ii) decide the priorities of the diseases for surveillance, iii) develop a guide on how to operate surveillance system, iv) educate the persons in charge of occupational disease surveillance and develop some materials for advertisement, v) establish a way to distribute and provide information, vi) have a pool of national resources for surveillance, vii) establish a control system of existing occupational and environmental materials and surveillance materials, viii) play an arbitration role for



[Figure 5] Composition of Central Surveillance Center for Occupational Disease(plan) (Eun-hee Ha, etc, 2006)

policy development and intervention by making use of the surveillance results(Goh Sang Baek, et al. 2006).

Diversification of surveillance models

Korea operates diseases surveillance and regional surveillance at present. However, the surveillance on the population including occupational categories, jobs and specific groups is the essential surveillance model for identifying the occurrences of occupational diseases of workers for each occupational category and the discovery of new occupational diseases. Particularly, some of occupational diseases have high risk elements on injuries and occupational diseases, so we should pay attention to their preventive measures through surveillance. Workers from agriculture, construction and mining sectors take up most of the victims of occupational diseases and injuries, but there is not a systematic surveillance program for them. And the doctors has a high potential of being exposed to the factors such as hazardous elements of blood transmitted germs, latex and musculoskeletal disorders and non-fatal injuries and diseases are also growing in the doctors involved. In addition, middle-aged and old workers, female workers or foreign workers show high sensitivity to some hazardous elements. As a new approach, it would be a very useful surveillance model if the hospitals over the country engage in exposure surveillance through sample analyses in

their labs by using biological samples or if they include a questionnaire on jobs and labor losses in 'National Health and Nutrition Survey' in cooperation with Ministry for Health, Welfare and Family Affairs.

Improvement of industrial accident compensation data

If we come by good industrial accident data, we can use them to identify the occurrences of occupational diseases and look into their causes as a very useful surveillance data. However, despite the diversity of occupational diseases, the data created during approval of industrial accidents are very simple, so they are of no value other than as basic information. Though tremendous cost is spent on industrial accident compensation and medical treatment, this data cannot be used for information to prevent occupational diseases. Therefore, we need to develop a kind of survey form for each occupational disease so as to identify the causes of the disease from the application for approval of industrial accident and understand the process of disease occurrence. To make it possible, we have to have the close relationships with Korea Worker's Compensation & Welfare Service.

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A Research on Services to Prevent Occupational Accidents in the Service Sector

Since the economic crisis in 1997, the focus of the industrial landscape in Korea is rapidly shifting from manufacturing and construction to service sector. And in 2005 the rate of victims from the service sector amounted to 31%, which is about 8 times higher than as 4% in 1987. As a result, we'd like to help the Ministry of Labor, KOSHA, private organizations of disaster prevention, other councils and groups make plans to focus on the service sector with a growing number of occupational injured to find out how to deal with occupational accidents and develop effective projects to prevent the accidents.

Introduction

When KOSHA(Korea Occupational Safety and Health Agency) was established in 1987, the industrial sectors in Korea were distributed mainly into manufacturing(57%) and construction(24%), and the rates of occupational victims were 59% in manufacturing and 22% in construction. The governmental projects to prevent occupational accidents have been developed around these sectors. Thanks to these projects, Korea's rate of occupational accidents was reduced to 0.77% in 2006 from 2.66% in 1987. Having reached an all time low of 0.68 in 1998, the occupational accidents rate remained of 0.77% level until 2006. Accordingly, to lower this rate to less than 0.5% to match that of the developed countries, it is necessary to shift the focus of our projects aimed at occupational accident prevention mainly focused on manufacturing and construction sectors.

Since the economic crisis in 1997, the focus of the industrial landscape in Korea is rapidly shifting from manufacturing and construction to service sector. And in 2005 the rate of victims from the service sector amounted to 31%, which is about 8 times higher than as 4% in 1987. Therefore, we cannot expect that our

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occupational disasters will be reduced without reduction of accidents in the service sector. <Table 1 and 2> show the accidental deaths and the number of victims for each sector in 2004 and 2005. In the breakdown of occupational accidents by each sector on the basis of having the whole industry divided largely into six sectors of mining, manufacturing, construction, electricity · gas · water, transportation · warehousing and service sectors, the other sectors other than manufacturing and construction account for 49.54%, nearly half of the entire 2,493 accidental deaths. And in comparison with the previous year, the number of the victims in manufacturing and construction is reduced. However, with the service sector found to have the victims increased up to 6.14%, it is urgent to take actions against occupational accidents in the service sector and it is also required to develop plans to prevent occupational accidents in accordance with the occupational features and the common types of accidents occuring in the service sector.

In addition, the governmental actions against occupational accidents have focused on manufacturing and construction sectors, so it was impossible to make any systematic researches and examinations for accidents in the service sector.

If we don't establish how to deal with the occupational accidents in the service sector, there might be some problems in the future with regards to the governmental projects' effectiveness them. Therefore, this research examines and makes suggestions for the Ministry of Labor, KOSHA, private organizations of disaster prevention, other councils and groups to make plans to focus on the service sector with a growing number of the establishments, workers, and victims to find out how to deal with the occupational accidents in the service sector and develop effective projects to prevent the accidents.

<Table 1> Comparison of Fatality for each Sector

(Unit: Case)

Classification		Whole Industry	Mining	Manufacturing	Construction	Electricity Gas Water Supply	Transportation Warehousing Communication	Service Sector
Number of Workers		11,059,193	16,014	3,053,545	2,127,454	52,842	669,107	5,140,231
Number of deaths		2,493	421	649	609	7	184	623
Component ratio (%)		100.00	16.89	26.03	24.43	0.28	7.38	24.99
Accident rate	2004	2.70	270.22	2.29	3.88	1.58	3.24	1.49
	2005	2.25	262.89	2.13	2.86	1.32	2.75	1.21
	Results(%)	-16.67	-2.71	-6.99	-26.29	-16.46	-15.12	-18.79

* Source: Analysis of Occupational Accidents of 2005, published by the Ministry of Labor

<Table 2> Comparison of Occupational Injured for each Sector

(Unit: Person)

Classification	Whole Industry	Mining	Manufacturing	Construction	Electricity · Gas · Water Supply	Transportation Warehousing Communication	Service Sector
2004	88,874	2,289	35,579	18,896	129	5,099	24,882
2005	85,411	2,258	35,999	15,918	126	4,700	26,410
Results(%)	-3.90	-1.35	-4.20	-15.76	-2.33	-7.83	6.14

* Source: Analysis of Occupational Accidents of 2005, published by the Ministry of Labor

Analysis of priorities regarding demand for services to prevent occupational accidents in the service sector

The service sector shows much less demand for occupational accidents prevention services, compared to manufacturing and construction sectors. And it is difficult to identify how much these services are needed due to a variety of sectors and sub-sectors. As a result, we selected, above all things, the sectors within the service industry which have higher degree of danger of occupational accidents or which need urgent preventive services, or the sectors which will benefit from the effective services for occupational accident prevention when provided through some improvements or supplements as they are similar to the characteristics and services provided by KOSHA.

In this way, we selected 10 sectors with priorities on the demand of services. To do it, we used the analyses on occupational accidents for each year provided by KOSHA, the graded list of occupational accidents from the businesses with less than 50 workers for each sector or the list of features and types of the accidents, and selected after consultation with KOSHA the sectors which are considered effective for occupational accident prevention in demand of these services.

In details, to select the right sectors prioritized in demand, we analyzed the occupational accidents for 2002~2005 from a total of 51 sectors belonging service sector. As items for analysis, we included the number of workers, the injured workers, the patients, the accidental deaths, the sickness deaths, the accident rates and the number of victims per business.

In this way, we analyzed the sectors which have higher risk of inducing occupational accidents, and selected 10 sectors with a lot of occupational accidents as shown in <Table 3>.

<Table 3> 10 Sectors with A Lot of Occupational Accidents for Recent Four Year with in the Service Sector

Ranks	10 Sectors with A Lot of Occupational Accidents
1	Sanitation and Similar Activities
2	Integration Management for High-rise Buildings, etc.
3	Passenger Traffic with vehicles
4	Light-Duty Vehicle Transportation such as Taxis
5	Restaurants and Hotels
6	Wholesale-Retail Trade, Repair Motor Vehicles, Moto Cycles and Personal and Household Goods
7	Land Freight Handling
8	Port Stevedoring
9	Rental & Business Services
10	Construction Equipment Management Services

<Table 4> Ten Sectors and Their Sub-Sectors for Priorities on the Demand of Services for Occupational Accident Prevention on the Other Industries

	10 Sectors	Sub-Sectors
1	Integration Management for buildings, etc.	Integration Management for high-rise buildings, etc.
2	Sanitation and Similar Activities	Sanitation and Similar Activities
3	Port Stevedoring and Freight Handling	Land Freight Handling and Marine Stevedoring Port businesses and Port Stevedoring
4	Rental & Business Services	Rental & Business Services
5	Passenger Traffic with vehicles	Passenger Traffic with vehicles and Light-Duty Vehicle Transportation such as taxis
6	Trucking	Line Freight, Local Freight, Other Freight and Special Freight
7	Construction Equipment Management Services	Construction Equipment Management Services
8	Golf course and Horse-racing Track Operations	Golf course and Horse-racing Track Operations
9	R&D	R&D
10	Warehousing	Warehousing and Other Storages

The final selection of the sectors with priorities on the demand of services was made on the basis of four sectors with a lot of occupational accidents which KOSHA checked and the Ministry of Labor thought needed the service for occupational accident preventions, and those sectors are shown in Table 4 below including the sectors which require this service and show high rate of occupational accidents.

Survey on the service of occupational accident prevention in the service sector

We visited the places of business from ten sectors prioritized in demand in the service sector examined the conditions of the service of occupational accident prevention and made a survey and analysis on the requirements of these places to prevent occupational accidents effectively. Also, we added a feasibility survey to find out the effectiveness of this service and improvements to be done by KOSHA.

For a survey on the conditions and requirements of the service for occupational accident prevention, we classified the content of the survey largely into five items including general status, safety, preventive actions and problems, worker trainings and application. For the feasibility survey, we examined the target businesses of KOSHA, the effectiveness of service and improvements as well.

For samples businesses of the survey, we selected and examined the businesses by considering their distribution by sector, region and size. And we surveyed the whole 1,022 businesses for the conditions and requirements of the service for occupational accident prevention, and 231 businesses for feasibility of this service.

Survey on the current conditions and requirements of the service for occupational accident prevention

In case of the businesses in the service sector, about 80% of the respondents replied that their business was safe. This survey shows that they think the possibilities of occupational accident and disease occurrences in the places of business is very low.

In case of the surveyed sectors, they were classified into the businesses which have very high possibilities of occupational accident occurrences and are prioritized on demand of the service after analysis of occupational

<Table 5> General Status of the Businesses on the Other Industries

Classification	Regular Employees	Irregular Employees
Formation of Employees	24,471 (73.1%)	9,025 (26.9%)
Joining the Industrial Accident Compensation Insurance	92.0%	70.6%
Labor Union	Organized 9.6%	Not organized 90.4%
Dealing with Industrial Safety and Health	Yes 84.7%	No 15.3%

<Table 6> Conditions of Activities for Occupational Accident Prevention of the Businesses on the Other Industries

(Unit: %)

Degree of danger on the places of business	Very dangerous (1point)	Dangerous (2points)	Moderate (3points)	Safe (4 points)	Very safe (5points)
	—	5.1	27.0	52.6	12.3
Primary methods for safety management	Trainings for workers	Supplying private protective equipments	Building safe facilities	Others	
	80.2	12.9	5.4	1.5	
Trainings on industrial safety and health	Provided regularly every month	Provided for every new workers	Provided for special cases		
	69.1	85.6	42.8		
Methods for trainings on occupational accident prevention	Provided for their works in meetings	Provided in groups	Provided with prints	Provided by outsourcing agents	
	52.1	37.3	6.0	3.1	
Businesses to be effective for occupational accident prevention	Resources for training and skills	Visiting the places of business and supporting skills	Financial support for 'CLEAN' Project, etc.	Supporting class trainings for workers	
	44.4	17.8	14.6	13.8	

accidents before the survey, but they were not well aware of the dangers by themselves.

They only provided the workers with simple trainings for preventing occupational accidents, but most had no managers for safety and health to make their efforts effective. In addition, compared to the other sectors, their demand of resources for training and skills was 44.4% high, and their demand of visiting the businesses and supporting skills was 17.8%. So it seems that they are in a need of the basic resources for safety and health desperately < Table 6>.

Feasibility of service for occupational accident prevention

These days, the demand of training supports for employers and workers was 37.7%, the highest in the related sectors in the service sector. This means that a lot of businesses give trainings in their places but their insufficient trainings need more systematic and effective methods. Furthermore, the preventive programs for brain and cardiovascular diseases were done 32.5% and those for musculoskeletal disorders 23.8% high. So they need more supports and trainings on healthcare to reinforce the standard of health and healthcare of workers.

Even the businesses that benefited from these programs, replied that they faced difficulties with application procedures and documents for the service. And due to insufficient advertisement of the programs by KOSHA, they cannot apply for it as they don't know how to apply even though KOSHA supports these preventive programs needed for the businesses. So it is required for KOSHA to take corrective actions against such background.

Survey on elements of industrial-related accidents by visiting the businesses of the other industries

It is necessary to identify the attributes of the sites to accomplish the purpose of occupational accident prevention.

<Table 7> A Survey of Feasibility of Service for Occupational Accident Prevention

(Unit: %)

Projects being supported or wanting supports	Projects for regional characteristics	Projects against musculoskeletal disorders	Skills against brain and cardiovascular diseases supported	Education of employers and workers	Resources of technical materials provided	None
	11.7	32.5	23.8	37.7	19.5	0.4
Effectiveness of preventing occupational accidents and diseases through the projects	Never helpful	Not helpful	Moderate	Helpful	Very helpful	-
Preventing occupational accidents	2.2	6.5	35.5	50.2	5.6	-
Preventing occupational diseases	1.7	7.8	39.4	45.9	5.2	-
Improvements of the current projects of KOSHA	It needs no improvements at all.	It needs few improvements.	Moderate	It needs a few improvements	It needs many improvements.	-
	0.4	8.2	32.5	47.2	11.7	-
Areas for improvements of the current projects of KOSHA	Insufficient advertisements on the projects	Standardized projects	Diversity of projects	Insufficient qualitative preventive trainings	Insufficient effective system	Complexity of application procedures
	28.6	24.2	17.7	11.3	8.7	6.5

In case of the service sector, unlike the manufacturing and construction sectors which operate their own preventive programs, they fell short of the sense of safety on the whole and thought that the occurrence of occupational accidents was relatively low. So while we examined the conditions of the businesses and their requirements in this research, an expert made an evaluation of dangers on the places of business to find out what equipments, tools and materials they have used and what the dangerous elements there have been accordingly. In other words, we inquired into the way the occupational accidents take place, why they occur and the dangerous elements which can lead to occupational accidents.

So we had the following results from the survey of 10 sectors prioritized on demand of service to prevent occupational accidents of the other industries:

1) In case of the sectors prioritized on demand of service surveyed, the level of safety awareness was very low, calling for campaigns safety and trainings to promote safety awareness.

What is worse, they were not fully aware of the accidents in spite of a lot of safety accidents including major injuries, and almost all the sectors were not equipped with basic safety system in their places. So it is necessary to take countermeasures for safety trainings and warnings. Basically, the respondents didn't make use of safety belts and private protective equipments, resulting in serious accidents.

Particularly, most of the accidents took place in the sectors of sanitation and similar activities, integration management for building, etc. and port stevedoring & freight handling. So these sectors need to improve their safety awareness.

2) It is necessary to support the healthcare areas for preventive programs such as musculoskeletal disorders and brain and cardiovascular diseases along with safety trainings.

Though they have some differences, they want a lot of preventive programs to avoid accidents from human errors and keep their health as well as to develop their sense of safety through trainings and advertisements. At present, the preventive programs are provided for the sectors of sanitation and similar activities, integration management for building, etc., port stevedoring & freight handling, rental & business service and passenger traffic with vehicles. If they increase their budget and staff for the programs, they will get better results.

3) In the long term, it is necessary to introduce and develop voluntary safety control programs appropriate

for each sector and examine the dangers.

OSHA from USA introduced VPP (Voluntary Protection Program) for the construction sector. In Korea, the sector of construction equipment & management is classified into the service sector, but it is also considered to be a part of construction. So we should check if this kind of voluntary program can work for safety control in Korea.

And to develop a service of occupational accident prevention on the other industries, we made a field survey to sanitation and similar activities, integration management for building, etc., port stevedoring & freight handling, rental & business service, passenger traffic with vehicles, trucking, construction equipment & management, R&D, golf course and horse-racing track operations and warehousing. There were a variety of causes for occupational accidents. So the countermeasures should be developed to be appropriate for features of the sectors. In addition, demand on safety and health of the businesses of the service sector should be taken into account for occupational accidents prevention services.

Foreign programs of occupational accident prevention in the service sector

Unlike USA, Japan and EU countries which experienced industrialization, our system for occupational accident prevention leaves much earlier to be desired. And the programs are focused on the manufacturing and construction sectors. The entire prevention system is not well equipped over the whole industry. Also, in the developed countries, the rate of accident reduction is to an extent, due to their policies on occupational accident prevention, but we haven't had any tangible results yet. So we examined and analyzed foreign policies and their effective preventive system to find out what is appropriate for our environment. There may be some differences in the features and background of each country, but we already have our own preventive system established. The survey results from each sector are as follows.

In case of integration management for building, etc., we can take into account the introduction of FACE (Fatality Assessment and Control Evaluation) program from USA. If we positively apply the FACE program which is run by NIOSH of USA for high-rise building management, we will get good results for occupational accident prevention from different service industries including the sector of high-rise building management. Among the results from 'the items for survey at the survey site', we dealt with the companies and victims anonymously to make the results shared through the website of NIOSH or in the form of records or resources and enable the other companies to make use of them for their prevention activities.

In addition, Japan focuses on the occupational accident prevention through risk assessment of the cleaning service, an area of integration management for building, etc. The labor unions of a variety of public sectors including the service sector give 'Right to Know' trainings to the employers of building cleaning and maintenance services. It is necessary to apply this strategy to our working environments with the organizations concerned as well. 'Right to Know' is as follows:

- The employers should examine many kinds of harmful elements from the cleansing services and provide their employees with the results.
- The employees should consult their own safe and health problems with the persons in charge of industrial safety and health of the labor union.
- When dealing with a variety of hazardous chemicals related to cleansing, they should put on their private protective equipments.
- They should keep the temperature for their working environment.
- They should check if tools such as electric devices are safe for cleansing.
- They should arrange safety countermeasures against many violent activities that can occur during cleansing.

If we inform the employees of accurate safety information through this risk assessment and the employees cope with the problems, we can prevent occupational accidents.

It is desirable to publish and distribute a guide on trips and slips mapping to prevent accidents from these problems which take place a lot in the other service sector.

In the guide, they should draw the rough sketches of the plot plans of the working places to help workers easily understand how to use the tool of this mapping, and they should investigate the places of 'Near Miss' for the last 12 months and put 'X' marks on them. And they should also ask the workers to bring up the countermeasures against trips and slips after going into the reasons of 'Near Miss', indicating the reasons and identifying the elements of danger for each place.

After finishing mapping trips and slips, they should check the problems through consultation with management and make decisions on their countermeasures to keep the dangerous areas in control. Finally, they should give out checklists for the persons in charge of safety and health to prevent slips and trips by checking out if there are any oils and solutions leak and if they have selected the adequate floor mats and wear safety shoes, finding out how old the factories are or if they keep the pedestrian passages wide enough and keep monitoring 'Near Miss'.

They should make a risk control for management to make use of by introducing the risk assessment system to the other industries on the whole and making a checklist for it. In Japan, the waste disposal business belongs to the 3rd industry, therefore risk assessment is a recommendation of the minister. And the corresponding organizations make a safety and health management for this business. The ware housing business and the cleansing business which is apart of integration management for supermarket sand buildings focus on occupational accident prevention through risk assessment.

This is intended to reduce risks through risk assessment and create safe and convenient working environments as shown in the manufacturing and construction sectors. In other words, to keep the safety and health management to reduce risks in the working places, it is good to take risk assessments on the basis of management cycles such as plan-application-assessment-improvement in cooperation with employers and workers, take actions to reduce the risks and introduce a system of labor safety and sanitation management to enhance the efforts for safety and health. Developing and applying this method of risk assessment to our workplaces will have good results.

Survey of feasibility of liaison with organizations or groups which can bring occupational accident prevention of the service sector to practice

If any organizations and groups involved in the businesses of the other industries when bringing occupational accident prevention to practice, it is expected to have better results such as expert supports for each business when making use of staff and budget of KOSHA.

It seems to work better when they start training and advertisement programs in connection with the

organizations related to integration management of building, etc., port stevedoring and freight handling and construction equipment & management. As projects for regional characteristics, some regional places of KOSHA provide training programs for the workers from integration management of building, etc. and port stevedoring, but if these programs are extended to more businesses in connection with the organization concerned, in case of construction equipment & management, they will take good effect.

In Japan, for example, they introduce a system of labor safety and sanitation management consisting of 4 steps of plan-application-assessment-improvement and recommend safety and health management through risk assessment on their service industry. Therefore, it is desirable for us to educate employers and workers to be well aware of risks.

For the sectors of sanitation and similar activities, rental & business services, passenger traffic with vehicles, trucking, R&D and warehousing, it is good for them to extend the projects for regional characteristics to their businesses.

In these projects, the trainings of safety and accident prevention for sanitation and similar activities, rental & business service, cleaners, commercial drivers and forklift operators are provided appropriate for each instructor's characteristics.

If they are provided to more businesses, it will contribute to reducing accidents on the other industries. As budget and staff of KOSHA are limited, however, it should be dealt with in advance.

In case of the sectors of golf & horse-racing track operations and R&D, it is difficult to work in connection with the related organizations. So they are considered to be less important than the other sectors.

As the other industries include a variety of sectors compared to the manufacturing and construction, you

cannot introduce the programs of occupational accident prevention with ease. In addition, the existing manufacturing and construction sectors have invested in a lot of equipments and trainings on safety and health and have safety mind relatively higher than the people working in the other industries. So taking them into account, it is desirable to start trainings and advertisements focusing on safety and health.

Results and future plans

We visited to the businesses within the service sector which are vulnerable to occupational accidents and made a survey to find out the conditions of the working places and

the requirements of service for occupational accident prevention.

With this survey, we found out the present conditions, safety and preventive measures for each business in the service sector, and we suggested different services for each business after investigating trainings, health management for workers and budget related to occupational accident prevention.

Also, we have conducted a feasibility survey on services of occupational accident prevention run by KOSHA and analyzed the problems of KOSHA projects, their effectiveness and requirements for improvement to suggest new service for each business.

In this survey, we focused on the factories with a lot of occupational accidents to find out what kinds of service are really needed for them.

And we collected some services and system of occupational accident prevention from foreign countries which are appropriate for our present conditions and suggested some of good foreign services for our businesses.

Finally, we examined the organizations which can help the service of occupational accident prevention for each sector of the other industries and we found out the persons in charge of this service to make it possible to provide systematic and effective services to the sectors concerned.

On the basis of the results on the businesses of the other industries which are vulnerable to occupational accident, we hope that KOSHA will make use of them to plan its projects and system for occupational accident prevention.

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Study on Blood-Born Diseases of Healthcare Workers

Healthcare workers are often exposed to a variety of infection sources in their hospitals. However, different policies and measures of hospitals make proper preventive measures impossible. So in this report, the current conditions of blood-born diseases, countermeasures found in other countries and the future policy perspectives of Korea will be discussed.

Introduction

Hospitals have patients with a various kinds of infectious diseases. So healthcare workers are frequently exposed to infectious agents while taking care of the patients. Influenza, rubella or tuberculosis, etc. consisting of infectious agents are often spread in our respiratory system through air or splashes, and hepatitis B and C and HIV are spread through blood and body fluids. These days, the antibiotic-resistant bacteria that hospitals have troubles with are often spread through contacts and the health care workers become the carriers.

Though their exposure frequency to those various infectious diseases is different, most of them are exposed to blood-born disease. More than 80-90% of the exposure occurring in most health care workers working at the general hospitals is found to have been afflicted with blood-born diseases. Of course, being exposed to infectious agents doesn't directly translate into infections. The infections develop differently in accordance with the individual's immune function. And some infectious diseases can be blocked in advance by means of vaccination or antibiotics administration. However, there is an infectious disease such as hepatitis

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C which has no proper precautionary measures. While healthcare workers are always exposed to risks of these kinds of blood-born diseases, sometimes they don't get proper precautionary measures on the basis of policies and efforts by different hospitals. This explains that it is necessary to complement the related regulations and policies on the nation-wide basis in order to prevent them becoming infectious. Therefore, I'd like to introduce the current conditions of exposure to blood-born diseases out of risks from a variety of infectious diseases they face with, the countermeasures of different countries and the policy directions of Korea.

Current conditions of blood-born diseases

There are many paths that healthcare workers are exposed to blood-born diseases, but percutaneous injury is one of them. In this case, viruses can flow directly into the blood of the exposed workers, so it has the highest risk for infection. If any proper preventive measures against it is not taken, infections may take place with hepatitis B with about 10~60%, hepatitis C, 1~3 % and HIV infection, less than 1%.

Secondly, there is an infection through mucosa. We have blood vessels on the surface of mucosa. If we are in contact with a lot of blood and body fluids, infectious agents can penetrate into the body. Though it has less risk for infection than through percutaneous injuries, it has at least some risks. Thirdly, there is an infection through damaged skins. Its risk for infection is not very significant, but its infections take place at rare intervals.

The oldest case of blood-born diseases after percutaneous injuries by healthcare workers is the death of two workers at a college of medicine in Vienna from streptococcal septicaemia in the 1940s after they were stricken with percutaneous injuries. After the 1940s, the infectious diseases became a big issue among healthcare workers. In 1984, the first report was made on the case of needle stick injury and HIV infection. And in 1987, hepatitis C was reported to have occurred from needle stick injury.

Up to date, more than 30 microorganisms in percutaneous exposures have been reported to lead to blood-born infections on healthcare workers. Among them, epidemic hemorrhagic fever virus, bacillus anthracis and prion have been mentioned. Prion has some potential to blood-born infections though its infection has not been reported yet. Microorganisms which can be the agents of blood-born infection on health care workers are distributed over a wide area, more than we are often informed of, and they may lead to rare infectious diseases. However, the diseases that are regularly taken care of with their standardized guides are only HIV infections, hepatitis B and C, and the other blood-born diseases are recommended to be dealt with individually in accordance with their cases.

Process of blood-born infectious disease exposures

Exposures to blood-born diseases are due mostly to percutaneous injuries from sharp instruments. According to NIOSH (2004), the injuries from sharp instruments like needle sticks take up 82%, which records the highest frequency in reported cases. Other than that, the injuries from exposures to eyes, noses and mouths amount to 14%, the injuries from exposures to damaged skin to 3% and the injuries from patients' bites to 1%. According to survey of EPINet (2003), the victims from sharp instruments or needle sticks stained with body fluids out of 7,239 workers from 48 hospitals was reported to amount to 1,728 (23.9%).

We don't have many data reported yet, but in 2005, a university hospital in Seoul made a survey regarding needle stick or sharp instrument injuries or exposures of blood and body fluids to skin and mucosa on 500 healthcare workers.

For six months before this survey, 48.7% workers experienced needle stick or sharp instrument injuries more than once. 49.7% of victims had undamaged skin and mucosa exposed to blood or body fluids. Exposures to damaged skin and mucosa amounted to 87%. In this survey, the frequency of exposures to damaged skin and mucosa was higher than that of foreign countries. The foreign surveys focused on the cases reported, but the domestic surveys were made with all the respondents answering in the form of self-responses, so there must have been some differences in their frequency of exposures and paths.

Exposures to skin and mucosa other than injuries from sharp medical instruments in the surgery room can be a bigger problem. Another university college made a survey on the injuries from exposures to blood and body fluids to the workers in the surgery room. In this survey, 20.4% workers were found to be exposed to them. Among them, exposures to damaged skin were 1.9% and exposures to conjunctivas were 6.6%. So they were exposed to high risks for infection.

Frequency of exposures to blood-born infectious diseases, and their epidemiological characteristics

Since the University Hospital of Wisconsin in USA reported the occurrences of percutaneous injuries in 1988, many studies over the world have reported the epidemiological characteristics by applying the frequency of exposures to blood-born infections and many different study methods for them. Estimation on the frequency has been reported with a variety of methods such as the occurrences by number of workers, beds and medical instrument used, so it is necessary to check if they are the same estimation methods when you compare them with others countries or hospitals.

<Table 1> Comparison of Occurrences of Percutaneous Injuries by Health Care Workers

Countries	Italy	Japan	USA	Korea
Years of Report	1998	1996	1998	2006
Occurrence/100 Beds	14.0	3.3	32.8	6.1
Average Days of Hospital Treatment per Patient	7.4	31.5	5.5~6.0	-

<Table 1> is the comparison by countries on some results of the occurrences of percutaneous injuries which show the highest frequency of occurrences out of exposures to blood-born infections. Though USA shows the highest frequency, it is assumed that the report rates, the clinical technology and the preventive programs were different from countries. When you compare the days of hospital treatment among countries, it makes a big difference. American patients with short days of hospital treatment are thought to have more intensive care and treatment, compared to Japanese patients with long days of hospital treatment. Therefore, it is estimated that the healthcare workers must have used sharp medical instruments a lot more during the days of hospital treatment. Korea has higher occurrences of percutaneous injuries than Japan but remarkably lower than USA and Italy. However, you should take into account our insufficient reporting system which leads to high rates of non-reports.

The epidemiological characteristics of occurrences of percutaneous injuries are often classified as the occupational categories of the exposed workers, the places of injuries and the medical instruments causing the injuries, etc. Most of the reports show that nurses took up highest among the exposed workers, and the places of percutaneous injuries were the patient wards, the surgery room including convalescent wards, the wards outside the patient wards and the outpatient wards. Most of the causes of percutaneous injuries were the disposable syringes, the butterfly needles and the catheters for intravenous injections. Other reports

have showed the similar results. Surgical knives or instruments other than syringes were most of surgical needles, scalpels and lancets, and the glass instruments such as vacuum tubes and disposal containers, etc. were the main causes of the percutaneous injuries.

On the whole, the epidemiological characteristics of healthcare workers' exposures to blood-born infections are similar by hospital, region and country, but sometimes, they are significantly different in accordance with regional features, related regulations, kinds and frequency of medical instruments, behaviors of healthcare workers. To prevent exposures to blood-born infections, it is necessary to find their causes. So you have to find the preventable methods before everything after examining the epidemiological characteristics by hospital, region and country.

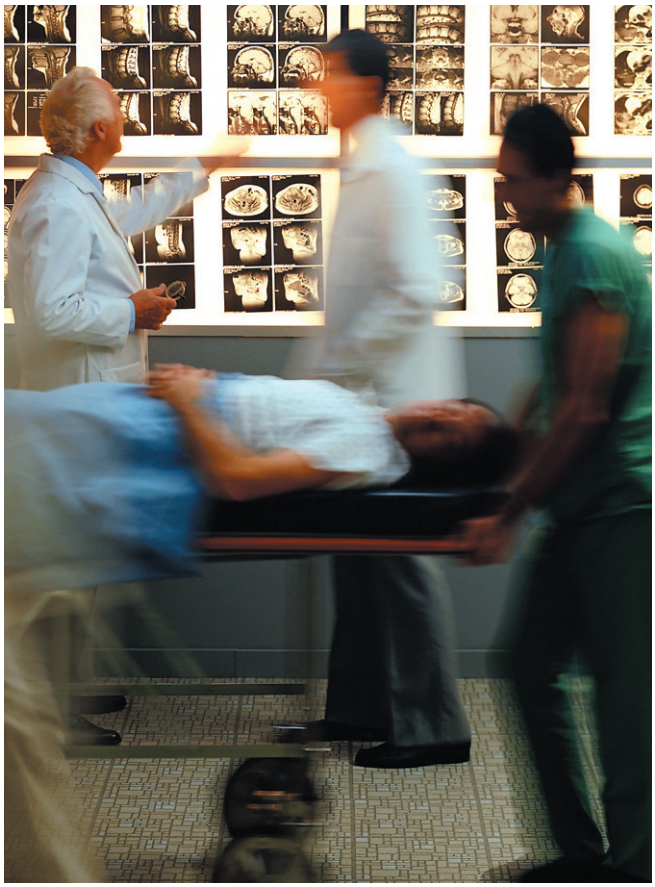
Measures on prevention of blood-born infectious diseases

To prevent healthcare workers from blood-born infections, it would be favorable to apply a variety of methods such as monitoring of infection occurrences, trainings, rapid follow-ups, uses of safe medical instruments(specially devised instruments for not causing accidental prickings). Many countries have monitored the exposure injuries regularly to examine the risk elements and the conditions of their changes and to make the related regulations and rules.

Monitoring of exposures to blood-born infections by county, and the related regulations

As a system for monitoring the exposures of healthcare workers to blood-born infections, EPINet™(Exposure Prevention Information Network) developed in 1991 by Janine Jagger of International Healthcare Worker Safety Center from University of Virginia USA has been used most over the world. This program provides the standardized forms for injuries from exposures to blood and body fluids and percutaneous injuries and the computerized program allowing the data analysis. It has been used by 1,500 medical centers over the country, and up to date, more than 40 countries have used it after translation.

In USA, since 1998 the Centers for Disease Control and Prevention(CDC) has monitored a variety of exposure injuries including blood-born infectious diseases of health care workers through 'National Surveillance System for Health Care Workers(NaSH)'. Based on these data, 'Needle Safety and Prevention Act, P.L. 106-430' was passed in November 2000 to stipulate the uses of safe medical instruments in the medical centers including safe needle sticks.



Taiwan uses EPINet supported by the Institution of Occupational Safety and Health(IOSH), and it is establishing the national surveillance system and the mandatory reporting system. From May 2006, the medical insurances allowed special compensation on treating blood-born infectious diseases such as highly infectious AIDS, hepatitis and SARS, etc. and using catheters for safe intravenous injection, and at present, they are said to examine 'the Act of Mandatory Uses of Safe Medical Instruments'.

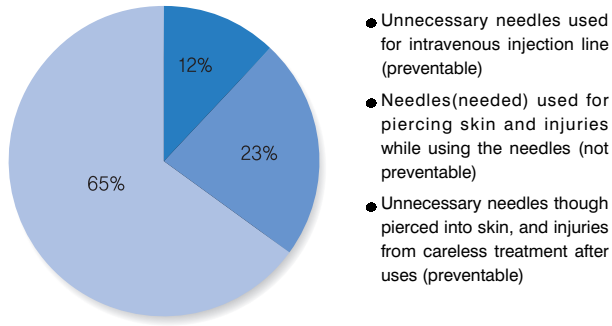
Japan runs the system of percutaneous injury report for each hospital, and more than 800 hospitals have used EPINet. Since 2004, Japan has recognized special compensation by classifying the general intravenous injection and the safe intravenous injection. From 2005, a recommendation to use of safe medical instruments is included in the administrative guide of its Ministry of Health and Welfare), and the use of safe medical instruments is also included in the items of the percutaneous injury prevention revised in 2005 by Japan Council for Quality Healthcare, which is the organization for accreditation of healthcare centers.

France and England make it clear the necessity on how to use safe medical instruments and how to train healthcare workers on how to use such instruments, and the two countries provide the guides on how to prevent percutaneous injury for individual health care workers and hospitals. These guides are taken care of Occupational Safety and Health Division and Committee of Infection Management for each medical center to comply with.

In Korea, infection management was introduced in early 1990s, and the hospitals with infection managers established a system of percutaneous injury reports, and managers were given training and instructions on preventive measures. In the survey of occurrences over the country, managed by Korean Association of Infection Control Nurses(KAICN), the occurrences of percutaneous injuries and their epidemiological characteristics from 38 hospitals in the country were first monitored using Korean EPINet which was translated from the American EPINet for nine months from 2005 to 2006. This data was limited, but it contributed to compiting data which can be comparable with foreign surveys or reports.

From the 2000s, the Ministry of Labor(MOL) and KOSHA started to pay attention to safety and welfare of healthcare workers. MOL published "Health Guide for Health Care Workers" in August 2005 and Occupational Safety & Health Research Institute made a survey on infectious disease conditions of healthcare workers in 2005. Based on this data, KOSHA published "A Guide to Infectious Disease Control of Health Care Workers" in June 2007 and distributed it to medical center over the country. In

addition, MOL revised “Occupational Safety and Health Law” which regulates biologically hazardous elements and includes the regulation for preventing exposures of healthcare workers to blood and body fluids. In spite of these efforts by the government and academic world, we don’t have enough data on the concrete occurrences and their causes that can be used in coming up with a preventive measure, and also we don’t have proactive measures fuelling the changes of medical centers.



[Figure 1] Preventability of Percutaneous Injuries from Needles through Safe Medical Instruments

Prevention of percutaneous injuries, and safe medical instruments

To prevent from exposures to blood-born infections including percutaneous injuries, the healthcare workers from over the world have been provided with a lot of trainings to comply with the Universal Precautions(UP). However, UP didn’t have good effects on prevention from exposures to blood-born infections. Most of people thought that they are free from risks, or they neglected to wear the devices or equipments for UP. Particularly, we don’t have sufficient conditions and systems to comply with UP in Korea.

The most effective method that USA or other countries suggest is the application of safe medical instruments. A variety of the instruments have already been developed and widely used.

Janine Jagger reported through her EPINet study from 1993 to 2000 that 12 kinds of medical instruments resulted in 89% of percutaneous injuries. Based on this result, she suggested two goals of applying safe medical instruments.

The first goal is to remove unnecessary needles and sharp instruments from the hospitals. It means that the needles used in intravenous injection lines or arteriovenous blood-taking should be replaced with needless system or blunt needles, and surgical needles with blunt-tip should be used in surgery.

The second goal is to prioritize the surgery that uses safe medical instruments. The top priority should be placed on the uses of blood-taking or intravenous injection-related instruments among them, for in this surgery it is very likely to be exposed to a lot of blood. So it increases the risks of infection spread when exposed. In other words, when you are exposed to the medical instruments with hollow bores or the needles full of blood, it creates higher risks of injuries which has higher possibility of infection than intramuscular injection.

Janine Jagger analyzed 1,076 cases from EPINet in 2000 and told that 77% of percutaneous injuries from hollow bore needles can be prevented [Figure 1]. Seen from the results on the uses of safe medical instruments reported recently, it is very effective in preventing healthcare workers from percutaneous injuries.

In France, a study was made for effective uses of safe medical instruments to 1,506 subjects from 102 departments of 32 hospitals for a year from April 1999. In this data with 100 cases of percutaneous injuries included, when you use safe medical instruments when taking blood, 74% of percutaneous injuries were reduced. And the number of average percutaneous injuries was 4.72 per 100,000 cases, which shows that it was decreased by 75%, compared to that of 1990. It means that using safe percutaneous injuries can be one of the methods that can remarkably reduce the

occurrences of percutaneous injuries.

A hospital(427 beds) in Manhattan, USA compared the effect on uses of safe medical instruments before(1998~2000) and after(2001~2002). Safe medical instruments are applied to a variety of instruments which allow infusion, transfusion, therapeutic injection and muscle or subcutaneous injection. Percutaneous injuries from sharp instruments decreased to 83.5% and injuries from catheter decreased to 88.2%.

According to the kinds and usages of safe medical instruments and the conditions of hospitals, several studies have been reported that though they have some differences in frequency of exposures of blood-born infections, the safe medical instruments are useful in preventing percutaneous injuries if you compare them with the previous trainings and the UP applications. Recently in Korea, safe medical instruments started to be restrictively used in the emergency room or the AIDS wards. However, there are no data reporting the changes and relevancies of frequency of exposures to blood-born infections.

The biggest problem about medical instruments for safety in Korea is cost. For example, safety syringes are two to five times as expensive as the existing syringes, so it is difficult to have safety syringes used widely over the country.

Prevention of mucosa and skin from exposures to blood-born infectious agents

To prevent mucosa and skin from being exposed other than percutaneous injuries from blood-born infectious agents, it is good to wear gloves, safety glasses, gowns and covered shoes.

According to the domestic reports which studied the cases of exposures to blood or body fluids while in surgery, only 15.8% of the anesthetists and their related staff and the circulating nurses wore their gloves when they are exposed to them, and 2% of the surgery assistants and scrub nurses wore their safety glasses. On the whole, 68.9% were reported to wear no protective equipment.

In the report of EPINet, when their eyes are exposed to blood or body fluids, 75% of healthcare workers didn't wear their safety glasses. It is reported that when you wear double gloves in surgery, exposure to blood can be reduced by 70%, and vinyl or latex gloves can reduce exposure to blood in percutaneous injuries. Even waterproof gowns and over-gowns can prevent your arms, legs and body from being exposed to blood-born infectious agents. Safety glasses can be said to be the most neglected medical instrument. To prevent the mucosa of your eyes from being exposed to body fluids, it is necessary to wear the glasses in medical treatment in which you are expected to be exposed to them.

Conclusion

On the basis of the data above, the countermeasures have been summed up to reduce the frequency of exposures to blood-born infectious agents by healthcare workers in Korea as shown below.

First, to understand the frequency of blood-born infections and their current conditions, it is necessary to make a nationwide occupational disease surveillance system which enables you to compare with foreign systems. As most of data of individual hospitals are difficult to be made public, the government and the institutions concerned should build multi-organization's joint research and surveillance system to solve this problem.

Secondly, you should keep the current regulations and rules in order and examine them in the perspective of effectiveness. The regulations are relatively clearly provided in Occupational Safety and Health Law and its enforcement rules, but it is impossible to check if each medical center complies with them. In addition, many of the penalty regulations are not applied in reality if they are not not enforced. Therefore, the management of medical centers should keep their eyes on compliances of the regulations to keep their workers in good health.

Thirdly, the institutions and organizations concerned each medical center should provide trainings to healthcare workers and urge them to use safe medical instruments. If they use these two methods properly, it is known to prevent more than 2/3 of exposures to blood-born infections.

Finally, you should establish the system to continuously evaluate that exposure to blood-born infections of healthcare workers decrease while taking the countermeasures as specified above. This will make a difference though it is related to what is suggested at the first step.

Traditionally, healthcare workers neglect their own protection while taking care of their patients. In addition, they don't take their injuries seriously and think that they can deal with them by themselves. We cannot deny that their health and safety are neglected due to the significant issues of the other establishments. So our policies and system for healthcare workers should be made taking their characteristics into account. The government, the organizations and the institutions concerned and the stakeholders should pay good attention to them to solve their problems.

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Research on Chemical Control for Female Workers

That the female workers participate in the economic activity in the male-centered industrial structure increases an exposure to chemicals relatively because of vulnerable employment system. If these workers get pregnant or exposed to the chemicals on the pregnancy, the embryo can be seriously influenced. Therefore, this research would review the chemicals' influence of the reproductive toxicity on the female workers and the exposure and the control status, it would present the control method of the chemicals with a work group and working environment in which a lot of female workers are engaged.

Purpose

In the early 1996, 33 workers(female 25, male 8) in switch assembling line in a factory in Korea were poisoned by organic solvent(solvent 5200, 2-Bromopropane).

This accident gave rise to an social interest to the chemicals and the female workers and raised the necessity to control the chemicals with reproductive toxicity. However, since ten years after that accident, the poisoning accident by chemicals like a poisoning by Nomal Hexane of the Thai female workers in 2005 had broken out and this occupational disease has become the social problem.

The research about the problem of female workers' who are the socially weak. The health management of the female workers who engage in the small size workplace has been processed for a long time but the control method to the chemicals considering the female characterstics are relatively insufficient in research.

Therefore, this research would review the chemicals influencing the reproductive toxicity of the female workers, the exposure, and the control status to present the control method of the chemicals based on considerations of work groups and working environment in which a lot of female workers are engaged.

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Method and result

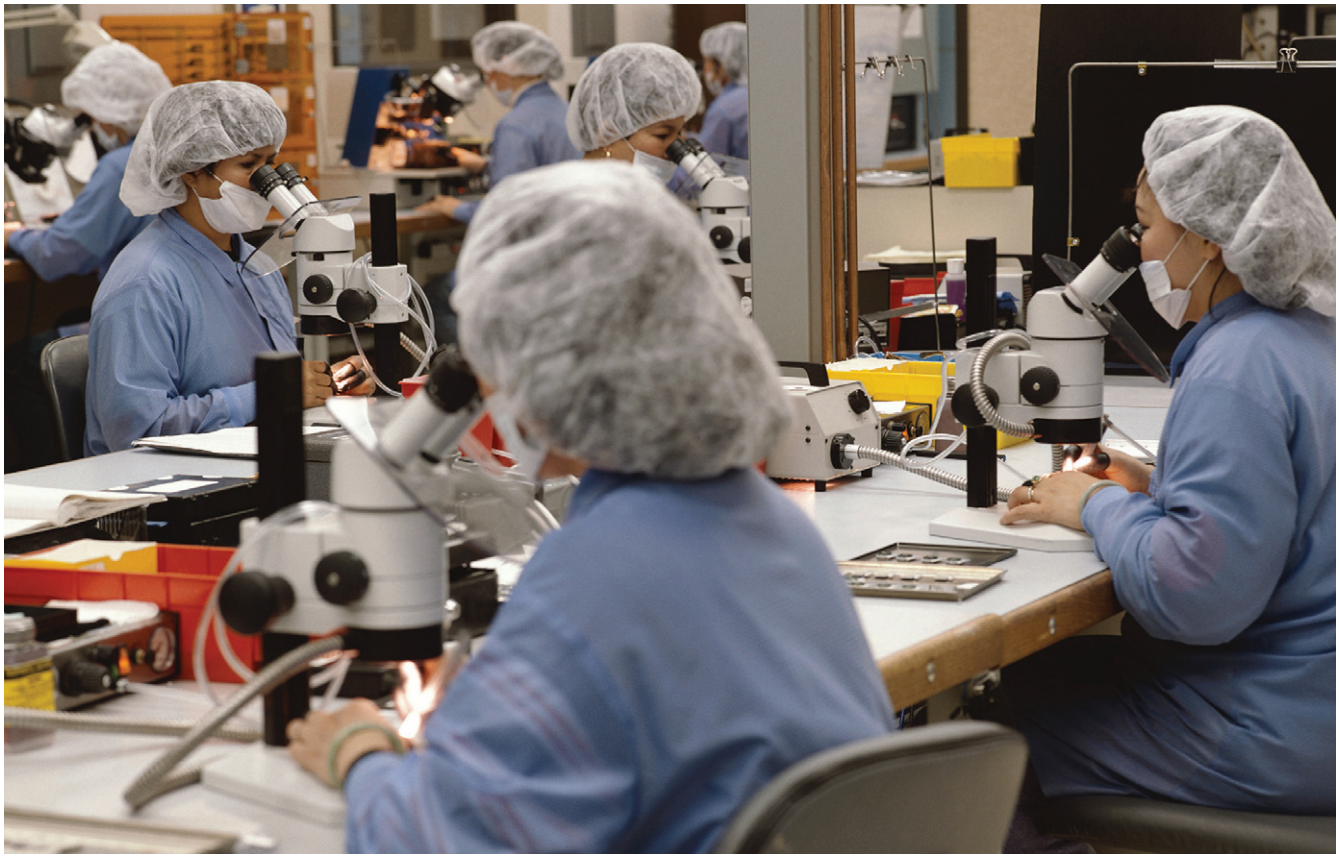
Above all, through the documentary survey and the internet data survey, grasping the chemicals control system of each country, the list of the reproductive toxic chemicals has been made. Using the MSDS (Material Safety Data Sheet) and the information of chemicals available in the websites, the properties of the reproductive toxic chemicals has been identified and, by them, the reproductive toxic chemicals to be managed have been selected.

In addition, using the list of the reproductive toxic chemicals, the control of chemicals and the health management of the female workers have been surveyed for the 61 companies among the all manufacturers in the country and the control status of the chemicals and the maternity protection system for the female workers has been surveyed.

Chemical control system in every nation and healthcare system of female workers

Investigating the control systems of Europe, U.S., Japan and Korea, there is no country which is equipped with the healthcare system of the female workers and manages separately only the chemicals to influence on the health of the female workers but there is a case which divides and manage separately the reproductive toxic chemicals.

Europe has introduced the REACH(Regulation, Evaluation and Authorization of Chemicals) and operates it, and carries out the license system to the PBT substances and CMR substances to have a hazardous concern. The CMR substances mean the substances to have the carcinogenic, mutagenic and reproductive toxicity, stipulated in the Act of Division Indication of EU and divided into classes 1 and 2.



<Table 1> List of Reproductive Toxic Chemicals

Classification	Chemical	Classification	Chemical	Classification	Chemical
Gaseous Subtance (7)	Ethylen Oxide	Other Mixing Substance (21)	Warfarin	Organic Compound (38)	Cyclohexane
	Hydrogen Cyanide		Phosphorus(Sulfur)		Aniline and its homologue
	Chlorine		Thallium(soluble compound)		Acrylonitrile
	Ozon		Four phenyl spin		Acrylamide
	Nitrogen Dioxide		Phorate		Allyl Glycydil Ether
	Sulfur Dioxide		Formamide		Ethyl Benzene
	Carbon Monoxide		Polyvinyl Chloride(PVC)		Ethanolamine Ethylene Glycol
Metal (9)	Lead and Lead inorganic compound		Hexamethylphosporamide		
	Nickel Carbonyl		Heptachlor		Epichlorohydrin
	Mercury(metal)and mercury compound(aryl, inorganic)		Toxaphene		Isopropyl Alcohol
	Zinc Chloride	Acid/ Alkali Substance (4)	Form acid		Carbon Disulfide
	Vanadium Pentoxide		Hydrogen Fluoride		Xylene
	Cadmium(metal) and cadmium compound (including cadmium oxide)		Potassium Hydroxide		Toluene
			Trichloroactic acid		Trichloro Ethylene
	Cobalt(metal)	Organic Compound (38)	1,3-Butadien		Perchloroethylene
	Chromium compound		1-Bromopropane		Phenol
	Iode		2,3-epoxy-1-propanol		Pentachlorophenol
Other Mixing Substance (21)	2,4-Di(butyric acid)		2-Methoxyethanol		Hydrazine
	Normal-prophylalcohol		2-Methoxyethylacetate		N,N-Dimethylacetamide
	Nicotine		2-Ethoxyethanol		o-Dichlorobenzene
	Di(2-ethylhexyl)phthalate		2-Ethoxyethylacetate		p-Nitroaniline
	Lithium Hydride		Nitroglycerin		p-Nitrochlorobenzene
	Benomyl		Dinitrotoluene		sec-Butyl Alcohol (sec-Butanol)
	Benzopyrene		Dimethylformamide		Form Aldehyde
	Butanethiol		Methylchloride	Organic Compound (38)	Benzotrichloride
	Cyclohexylamine		Benzene		Arsenic and arsenic inorganic compound
	Ethanol		Carbon Tetrachloride		Vinyl Chloride(VCM)
	Endrine		Styrene(SM)	Sum	82 kinds

The U.S. has the toxicity screening system for the new chemicals systemized by the Toxic Substances Control Act(TSCA) and the EPA(Environmental Protection Agency), since operating the TSCA, has carried out the regulation of the 6 chemicals including the asbestos, CFC, dioxides, hexavalent chromium, metal-working fluids, PCB. Now, there is no general governmental provision to the reproductive toxic chemicals and the U.S OSHA presents a minimum legal standard about 3 substances(lead, 2-bromochloropropane, ethylene oxide). Also, the Article 65, Proposal of California includes carcinogens, toxicity occurs, list of reproductive toxic chemicals, warning to exposure, ban of discharge and execution, etc,.

The chemicals control system in Japan and Korea are very similar and have the Chemicals Control Act in a general environment and the Chemicals Control Act within

<Table 2> 1st class Reproductive Toxic Chemicals

Chemicals	Class	Biological Monitoring	Chemicals	Class	Biological Monitoring
1,3-Butadien	1 1	Butadiene epoxides(blood) Butadiene metabolites(urine)	Acryleamide	1 1	N-actyl-S-(3-amino-oxypropyl)- cysteine(urine)
1-Bromoprophane	1	1-bromopropane levels(urine)	Ethanol	1	Patients to show symptom ethanol concetration(blood)
2-Methoxyethanol	1	2-methoxyacetic acid (MAA)(urine)	Ethylbenzene	1	None
2-Methoxyethylacetate	1	Methoxyacetic acid (MAA)(urine)	Vinyl Chloride	1	None
2-Ethoxyethanol	1	Ethoxyacetic acid(urine)	Carbon Bisulfide	1	2-thiotiazolidine-4-carboxylic acid(TTCA)(urine)
Lead	1	Lead(blood, urine)	Carbon Monoxide	1	Carboxyhemoglobin(blood)
Dinitrotoluen	1	Dinitortoluene(urine)	Cadmium and its Compound	1	Cadmium(blood, urine)
Methylchloride	1	Methychloride(urine)	Xylene	1	Methylhipuric acid, xlyene(urine)
Benzene	1	Phenolic compounds(urine) including phenol, quinol, catechol	Toluene	1	Hipuric acid(gathering when work fishes)(urine)
			Trichloroethylene	1	Total trichloride, trichloroacetic acid(gathering when weekend work fishes)(urine)
Arsenic and Arsenic inorganic compound	1	Inorganic arsenic and methylated metabolites(urine)	Perchloroethylene	1	Pentachlorophenol (gathering when work fishes)(urine) glass pentachlorophenol (gathering when work fishes)(blood)
Carbon Tetrachloride	1	None	Phenol	1	Phenol(urine)
Ethylene Oxide	1	Ethylene oxide(urine)	Pentachlorophenol	1	Pentachlorophenol (gathering when work fishes)(urine) glass pentachlorophenol(gathering when work fishes)(blood)
Mercury and Mercury Compound	1	Mercury(urine, blood)			
Styrene(SM)	1	Styrene(blood, urine) mandelic & phenylglyoxylic acids(urine)	Formaldehyde	1	None
			Heptachloro	1	None
Acrylonitrile	1	Mercapturic acids(urine)	N,N-dimethylacetamide	1	Unmodified DMA and NMA (urine)

the law related to labor. The examples are the Act of regulation of screening chemicals and manufacture and the Occupational Safety and Hygiene Act in Japan and the Hazardous Chemicals Control Act and Industrial Safety and Health Act in Korea. However, both countries don't have a special control system to the reproductive toxic chemicals.

Divisions of reproductive toxic chemicals in each nation

The U.S. has divided the reproductive toxic chemicals in the Article 65, Proposal of California and the Europe has divided the reproductive toxic chemicals into 1 and 2 class and managed them. In Japan, the Regulation of Screening Chemicals and Manufacture Act has divided them but they have been divided into the Properties to be accumulated in the environment rather than the substances to be mainly used in the workplaces and they are excluded in the list. In Korea, the list of the reproductive toxic chemicals to be able to break out the health defect to the infant or suspicious of it, from the 310 model substances data of the Globally Harmonized System about the division/mark of chemicals which the KOSHA offers <Table 1>.

As each nation's situation and legislative purpose is different, the chemicals to be set as the reproductive toxic substances are a little different in each nation. For example, drugs or agricultural chemicals to be used in the living

environment include diverse kinds of reproductive toxic chemicals but duplicate substances are few. 2-Bromopropane, carbon monoxide, 2-ethoxyethyl acetate(ethylenglycol mono-ethylether), a kind of ethylenglycole mono-methylether, mercury and lead have been designated into the reproductive toxic chemicals in the U.S., Europe and Korea.

Properties of reproductive toxic chemicals

Using the MSDS data of the KOSHA, the searching data of chemicals of the Toxnet (http://toxnet.nlm.nih.gov/), the data of the HAZ-MAP(occupational exposure to Haz), the use and exposure and the toxicity and the reproductive toxicity are researched and, to survey the result of research in the human body, the Pubmed has been searched for. Also, applying the bio-indicators for monitoring, the result of research has been set like following: if the reproductive toxicity has been found in female, 1st class, if it has been found in male, 2nd class, and it has been found in animal, 3rd class.

At the result of research of 82 kinds of chemicals to be expected to have the reproductive toxicity, 32 kinds of chemicals broke out the reproductive toxicity to the female. This research has set these substances as the 1st class reproductive toxicity chemicals <Table 2>. As this has set the substances to have the result of the laboratory or epidemiological research as a standard rather than the size or hazard of toxicity, it is a little difficult to use them as a standard to judge the degree of hazard of the reproductive toxicity. However, as these substances does not have an information about a relation of volume reaction but certainly break out the reproductive toxicity in the female, it may be necessary to control them for the precaution. For those times, Benomyl, endrin and toxaphene known for the Endocrine disruptors in the animal are the 3rd class in the reproductive toxicity. These substances have the results of experiment in animals and most of them have a properties impossible for a biological monitoring in the human body. Until now, diphthalic acid(2-ethylhexyl), ethylen glycol, epichlorohydrin, ozon etc. are known for the reproductive toxicity only in the male workers. As there is a reproductive toxicity in male, it cannot be said that the same is in female, but in the future, it should be confimed through the epidemiological research or experimental study.

There are substances with no data concerning the reproductive toxicity and the reproductive toxicity has not been found in the chemicals that pregnant woman are banned from dealing with, such as chromium, fluorine, chlorine, hydrogen cyanide, potassium hydroxide. However, it is judged that aniline has a mechanism to incur methemoglobinemia and cause the reproductive toxicity. Later, these substances should be investigated and researched as for reproductive toxicity and shall be reflected on amending the Labor Standard Act.

Examination of chemical control to female workers

By using the material of the examination on working environment of manufacturers in Korea in 2004 and the material of address book of the Industrial Disaster Insurance in April, 2007, the research subjects had been set, the questionnaires had been delivered to them, and a week later from then, the reminder postcards had been sent out. 50 out of the total 421 workplaces had replied and the reply rate was 11.9%. Besides, for the 61 workplaces, the survey had been made to the persons who are in charge of health management.

The workplaces to have female workers who dealt with the lead, mercury, cadmium, chromium, benzene, arsenic, fluorine, chlorine, hydrogen cyanide, vinyl chloride, phenol, 2-bromopropane, toluene, isoprophylalcohol, ethanol, trichloroethylene, potassium hydroxide, xylene, polyvinyl chloride, styrene, ethoxy ethanol, ethoxymethylacetate, ethoxymethanol, ethylenglycol, ethoxyethlyeacetate, reproductive toxic chemicals were 31 workplaces(50.8%) and the number of female workers are

<Table 3> Female Worker's Use of Chemicals

Use of Chemicals	Reply	Percentage
None	1	2.4
Use in overall process	8	19.5
Use in partial process	30	73.2
Not known	2	4.9
Sum	41	100.0

Use of Chemicals	Reply	Percentage
Use in person	29	72.5
Not use in person	11	27.5
Sum	40	100.0

Use of Chemicals	Reply	Percentage
Below 2 hours	10	25.0
2~4 hours	10	25.0
4~6 hours	0	0
6~8 hours	7	17.5
Over 8 hours	13	32.5
Sum	40	100.0

<Table 4> Reproductive Toxic Chemicals used by Blue Collar Female Workers

Reproductive Toxic Chemicals	Number of Female Workers to use	Percentage
ethanol	19	42.2
isoprophylalcohol	13	28.9
formaldehyde	12	26.7
toluene	11	24.4
chlorine(acid)	11	24.4
xylene	9	20.0
benzene	8	17.8
mercury	7	15.6
phenol	5	11.1
ethylbenzene	5	11.1
lead	4	9.9
potassium hydroxide	4	9.9
cadmium	3	6.7
carbon monoxide	2	4.4
sulfur dioxide	2	4.4
nickel	2	4.4
hydrogen cyanide	1	2.2
Sum	118	100

total 489 persons.

Examination of work environment to female workers

The examination of the exposure and work environment of the female workers who dealt with the reproductive toxic chemicals had been made to the 18 manufacturers and 1 hospital in Incheon. The female workers of 13 manufacturers of those surveyed replied, and by using the field examination and the result of measure of work environment, the exposure has been investigated. Except for the hospital, other workplaces are the ones which have 50~300 workers and the survey had been made to the blue collar female workers who dealt with the chemicals and the white collar female workers who do not. The blue collar female workers mainly work in the adhesion, washing, packaging or finishing process and, in the laboratory or hospital, there were many cases that they mainly dealt with the reagents. In some manufacturers, there were the ones which they marked and painted by means of soldering or pigments. 73.2% of the blue collar female workers who dealt with the chemicals have used them in the partial process <Table 3>.

In addition, 32.5% of the female workers used the chemicals over 8 hours. As the exposure time is an important factor for the health of the female workers, it is known that the management to the work time is necessary. The reproductive toxic chemicals used are like the <Table 4> and there are no female workers who dealt with 2-bromopropane, ethylene and glycol. In the measure of work environment, most female workers do not use benzene but some replied that they do. This difference is thought that the female workers who use organic solvents use them with benzene which is the representative chemical of the organic solvents.

At the survey about the MSDS system and the use of chemicals of the blue collar female workers, only 12.2%

knew the MSDS system and the female workers who received the education about it were a mere 43.2%. This means that the female workers have used them, not recognizing the hazard of them.

The blue collar female workers who had heard about the reproductive toxic chemicals were 36.6%, the path which they knew was that the case to know it through the TV or mass-media was 26.8% and the case through the education of the workplaces was only 7.3%. Now, the female workers who used the reproductive toxic chemicals in the workplace were 19.5% and 66.7% for them used them, not knowing that they had reproductive toxicity.

Conclusion

Even the female workers are not all homogeneous group. As the type of employment, type of business, work contents and company size need to be considered to make a generic management method, to make a guidance of health management for the female workers or to propose one management method or policy has its limits. Therefore, the concrete safety guidance to be fit into a real working field should be made considering the social-environmental and vocational factors, rather than making a policy or management method simply comparing the female workers with male workers.

It is also very important matter how to define, policy-wise the female workers. The target group will be subject to changes according to whether the definition of female workers will be based on economically active population or regular workers. In addition, preferentially treating the female workers in areas of indestrial safety and health with no clear grounds may even pose threats to the job security of female workers and in this side, for the female and male occupational safety and health problem, we need to approach the issue considering the speciality of the corresponding business and type of business rather than to think it as a simple difference of sex.

For the female workers who deal with the chemicals, the chemicals to protect first can be the reproductive toxic chemicals associated with the pregnancy and birth of the female workers and in this part, there will be no objection in that the female workers should receive special protection. As the word itself “Protection of Female Workers” includes discriminatory meaning, it is desirable to investigate the control method of chemicals, focusing on the health protection of the female workers through the control of the reproductive toxic chemicals.

Pregnancy from beginning to 8 week is a formative period of embryo, the influence by the chemicals is substantial, and it is necessary to protect the pregnant women in the workplace. Especially, to protect the health of

the female workers who deal with chemical in the manufacturing sector we need to select the reproductive toxic chemicals requiring research/control and come up with measures to prevent poisoning accidents.

Suggestion

Research on the selection of the reproductive toxic chemicals

Although, in defining the reproductive toxicity, it differs in each nation and it is difficult to actually conduct experiments, the research about the selection of the reproductive toxic chemicals should be preceded under the Globally Harmonized System(GHS) about the division/mark of chemicals. In carcinogen, to be exposed or not is very important but in other chemicals including the reproductive toxic chemicals, the type of exposure, the time of exposure and toxicity is more important, it is necessary to research effects.

Control of the reproductive toxic chemicals and education

A mark to the reproductive toxic chemicals should be made clear and in compounds, the health manager should notify the existence or not to include them. Worrying that the female workers react sensitively to them and avoid works, some companies do not notify an accurate information and give an education, so it is necessary for the measure to it.

Health management handbook for reproductive toxicity

To the volunteer to plan a pregnancy, the health management handbook will be issued to the female workers who work in the workplaces which deal with the reproductive toxic chemicals. If they apply for and receive the handbook to the Obstetrics and Gynecology or Health Center in which they are diagnosed, effects from the chemicals to affect the reproductive toxicity will be systematically studied and the health of the female workers will be protected.

Special health examination for female workers who deal with reproductive toxic chemicals

Now, in Korean special health examination, a section about the reproductive toxicity or inspection of Obstetrics and Gynecology associated with it has not been included, a few glycol derivatives or carbon disulfide, in the special health examination, has been divided into a factor related to it and a caution is only needed on asking the patients about his/her condition. But, only with a medical examination by interview, there are many cases not to know the causal relationship and we don't know it can be well carried out. To let the workplaces to deal with the 1st class substances first be particularly careful by the class made in this research, a bio-monitoring of the reproductive toxic chemicals should be added in the special health examination. Later, through a study, it is desirable to expand the subject gradually to the 2nd and 3rd class.

Suggestion about amendment of Occupational Safety and Health Act

Currently, the type of occupation, which the work is banned to the pregnant and nursing female workers, which the Labor Standard Law elucidates, connecting with the special health examination and the measure of work environment, should be utilized in protecting the health and safety of workers and, to do this, it is necessary to establish a legal concept about the "reproductive toxicity."

Introduction of the New Safety Certification and Safety Inspection System

The government unifies the current inspection(design, performance and completed test) system and official approval system to recognize only the safety performance to the each goods and will carry out the Safety Certification & Safety Inspection System to examine safety performance of goods and QC system simultaneously from the manufacturers from Jan, 01, 2009.

Preface

As it is important to make comfortable work environments and secure safety of productive facilities to protect the workers from occupational disasters, the Ministry of Labor has carried out the inspection & official approval system to secure the fundamental safety of the hazardous machinery & instruments, the protection apparatus and the protective equipments until now, starting the official approval of protective equipment in 1984.

The Occupational Safety and Health Act ensures inspection in the design, manufacture and operations of the products, to secure the fundamental safety of the hazardous machinery & instruments and facilities. In addition, it makes it a duty that the protection apparatus must be installed for the hazardous instruments and facilities which is operated by power or necessary for the protection apparatus and the protective equipment necessary for the safety of workers. The work must receive an official approval of performance by a form of new, collection and re-approval.

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Problems and limites of the current system

The introduced inspection and official approval system has contributed largely to the development of industrial safety including reduction of incident rate and improvement of human resource expertise associated with them. However, the current inspection and official approval system has some problems where it has limit to secure the safety of products and causes inconvenience to both manufacturers and users.

First, it shows a limit to secure the safety of products and continue them afterwards. As the current inspection and official approval system is a way to recognize the performance of productions, it is hard to fundamentally block the inferior products. The reason is that a manufacturer produce products different from the ones passed in the inspection and s/he does not properly manage the manufacture process. You know it by seeing the examples of approval cancellation, and among 2001~2005, it showed that the defective rate of hazardous machinery and instruments accounted for 3.8%, the rejection rate of approval after collecting the protection apparatus was 2.6% and the rejection rate of approval after collecting the protective equipment was 15.1% annually.

Second, it is on the burden of manufacturer. As the product inspection and official approval is not re-adjusted for a long time, the products which have low hazard or generalized technique of manufacture have been included in the subject without a grade. It is a time to investigate the current hazard and technique of manufacture of the subjects to inspect and officially approve and re-adjust them.

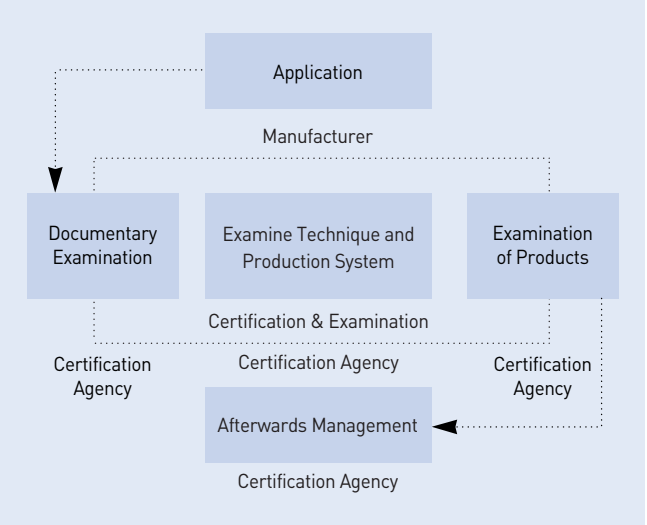
Third, it is on the burden of workplaces which use the hazardous machinery and instruments. As now the workplaces must carry out the regular inspection and self-checking of similar property all together, a burden of inspection of users is significant. Besides, the same inspection not considering the capacity of self safety management of workplace has been carried out, they are compelled to receive the regular inspection although the self safety management is possible.

To solve this problem, the government unifies the current inspection system(design, performance or complete test) and official approval system to recognize only the safety performance to the each goods, will introduce the Safety Certification System to examine simultaneously, safety performance of goods and QC system of manufacturer, and determine whether to certify or not and will carry out it from Jan. 01, 2009. Besides, to raise the effectiveness of the current regular inspection and observance rate of self-checking, it will carry out the safety inspection system to combine & unify both systems from Jan. 01, 2009.

Introduction of system

Safety certification system

The Safety Certification System is a system to examine collectively the safety performance of machineries and instruments, protection apparatus, protective equipment and the QC system of manufacturer. Safety of the corresponding products and the procedure is shown in [Figure 1].

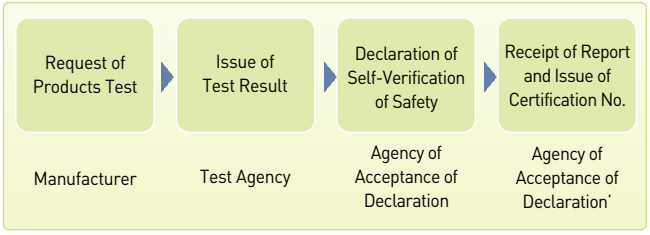


[Figure 1] Procedure of safety certification

- Documentary Examination: Examine the models whether the technique document of production fits into the certification standards.
- Examine Technique and Production System: Examine whether to secure the system to keep and guarantee the safety performance of products.
- Examination of Products: Examine whether the technique document accords with its products and whether the results of performance tests fit the certification.

Declaration of self-verification of safety

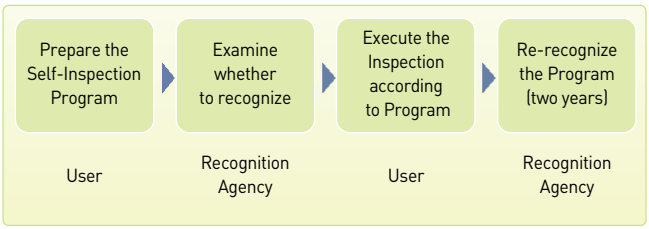
The Declaration of Self-Verification of Safety is a system that as the production technique is developed, a manufacturer verifies that the products such as the hazardous machinery and instruments, protection apparatus and protective equipment to be judged that the safe performance will be secured only by the test of them fit into the standard set by the Minister of Labor, declare it to the corresponding agency and produce them. The difference with the Safety Certification System is that the safety certification certified by the nation and the Declaration of Self-Verification of Safety is verified by the manufacturer. The Self-Verification of Safety procedure is shown in [Figure 2].



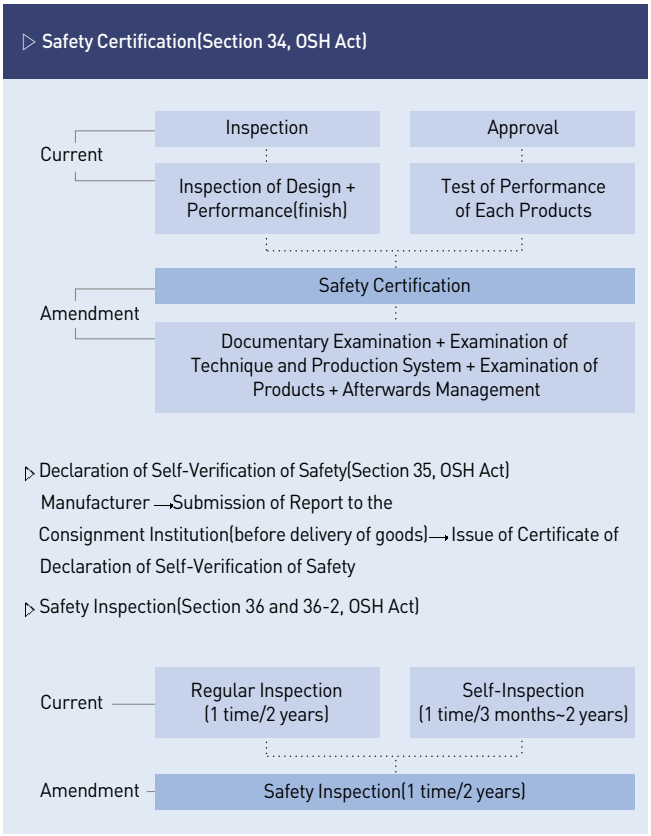
[Figure 2] Procedure of the declaration of self-verification of safety

Safety inspection system

The owner who unifies the current regular and self inspection and uses the hazardous machinery and instruments must take the safety inspection which the Minister of Labor executes. However, in case where an owner discusses with a representative of workers, 'Self-Inspection Program' must be prepared including the period and method of inspection. The safety inspection is now exempted and its procedure is illustrated in [Figure 3].



[Figure 3] Procedure to recognize the self-inspection program



[Figure 4] Safety certification · safety inspection

Comparing the current inspection and official approval system with the newly introduced Safety Certification and Safety Inspection as a whole, it is as the following [figure 4].

The products subject to the Safety Certification and Self-Verification of Safety and Safety Inspection <Table 1>.

<Table 1> Machine subject to the safety certification, self-verification of safety and safety inspection

Item	Machine subject to Safety Certification	Machine subject to Self-Verification of Safety	Machine subject to Safety Inspection
Machine Instrument Facility	① press ② shears ③ crane ④ lift ⑤ pressure vessel ⑥ roller ⑦ injection molding machine ⑧ aerial work platform	① centrifuge ② air compressor ③ gondola	① press ② shears ③ crane(excluding mobile crane and hoist below 2ton of rated load ④ lift ⑤ pressure vessel ⑥ gondola ⑦ local ventilation equipment(excluding mobile-type) ⑧ centrifuge(only for industry) ⑨ chemical facilities and its affiliated facilities ⑩ drying machinery and its affiliated facilities ⑫ roller (excluding sealed type) ⑬ injection molding machine
Protection Apparatus	① protection apparatus of press and shears ② protection apparatus of overload for lifting machinery ③ safety belt for release of pressure of boiler ④ safety belt for release of pressure of pressure vessel ⑤ protection equipment for insulation and instrument for work on live wire ⑥ electrical machinery · instrument and parts with explosion proof ⑦ temporary construction equipment and material(pipe support) ⑧ rupture disk for release of pressure of pressure vessel	① cutout for acetylene welding equipment ② automatic electric shock prevention apparatus for alternating current arc welders ③ emergency stop device of roller ④ cover of grinder ⑤ repulsion prevention and prevention apparatus of blade contact ⑥ prevention apparatus of blade contact of hand-operated plane ⑦ robot safety mat for industry ⑧ temporary construction equipment and material(assistance support)	
Protective Equipment	① safety helmet(for prevention of falling down · electric shock) ② safety boots ③ safety gloves(for prevention of electric shock and for organic compound) ④ dustproof mask ⑤ gas mask ⑥ air supplied respirator ⑦ garment(for organic compound) ⑧ safety harness ⑨ sunglasses(shielding and for prevention of danger of missile) ⑩ protection mask for welding ⑪ earplug or ear cover for sound isolation ⑫ electric breathing reserve	① safety helmet(for prevention of falling · flying object) ② sunglasses(for prevention of missile) ③ protection mask(general) ※ excluding the protective equipment subject to safety certification	

Expectation

We expect that, by executing the Safety Certification and the Declaration of Self-Verification of Safety, the fundamental safety of the hazardous machinery and instruments, protection apparatus and protective equipment will be secured and it will contribute to the reduction of industrial disaster. Also, the Declaration of Self-Verification of Safety makes a manufacturer confirm the safety of the machinery and instrument and has an advantage to induce the good quality productions.

The technique of manufacture for the manufacturer will be improved and the external competitive power will be intensified. Like security of compatibility with the advanced

system, we will have advantage over coping with the era of international certification, block the import of the foreign products to be relatively inferior of safety and be able to secure the domestic consumption market. In addition, we will be able to improve gradually the certification system of the hazardous machinery and instrument, protection apparatus and protective equipment to fit into Korean conditions.

According to the capacity of self-management of workplace safety through the unification of the regular and self-checking collaborates labor and management. We expect that the workplaces will be able to solve the problem including the burden of inspection of user company brought in the level of release of corporate regulation and simultaneously, to secure the safety of facility, and strengthen the activity of safety management. And it is judged that it will raise the effectiveness of inspection and the observance rate and contribute greatly to the reduction of industrial disaster from using hazardous machinery and instrument.

In the future

The Ministry of Labor has constituted the research service and TF and exerted in various ways to supplement the problem of the current inspection and official approval system and reduce the industrial disaster, and, at the result of it, induced the Safety Certification and Safety Inspection System. To improve this into a better system, collecting many opinions from all sorts of professionals and continuous investigation will be necessary. However, it is thought that as we change the big frame of the system which have been used for about 20 years, there can be some trial and errors or side effects. Therefore, it is judged that we should contribute the maximum efforts for an early settlement of this system such that we will anticipate the problems to occur from execution of it and solve them previously.

For an early settlement of the Safety Certification System, it is important that a civil appeal will not break out on certification and we will make an observance of market thoroughly that the products are distributed and used with a certification by fraud or without a certification. Besides, we plan to continuously provide education and support of technique so that the workplaces to manufacture the related products can properly understand the changed system and follow it. And for an early settlement of the Safety Inspection System, we plan to concentrate the administrative power on the Safety Inpection of the small size workplaces.

Also, we plan to operate complexively the safety inspection, other education and support of technique to the small size workplaces where most disasters occur and lacks of satisfactory safety management and reduce the disasters.

Medical Screening System for Occupational Disease : A 6-Year Experience in Korea

In 2009, Korea started providing free medical screening services to the companies with less than 10 workers. From this service, 110,000 workers will be provided with free medical examination, fully supported by the government. It will expand to all workers exposed to worksite hazards by 2012, which is estimated to cost KRW32 billion or USD32 million.

History

Periodic medical screening program has been proposed as one of the workers' health protection strategies in many countries. In 1954, the Korean Government newly enacted the Labor Standards Act stating that the employers should provide the workers with medical screening. This program was first operated in 1963, accompanied by other few test items allocated for the companies hiring more than 16 workers.

Nine years later, in 1972, the medical screening divided into general and special medical examinations <Table 1>. General medical examination provided general health status screening which is not directly related work environment, such as hypertension, hyper-lipidemia, obesity etc. On the contrary, special medical examination provided specific test items in accordance to the specific worksite hazards exposed to the workers.

Since Occupational Safety and Health Act was legislated in 1981, the request for workers' medical screening increased. As a result, the coverage of this program expanded to the companies hiring less than 5 workers in 2002. This indicated that

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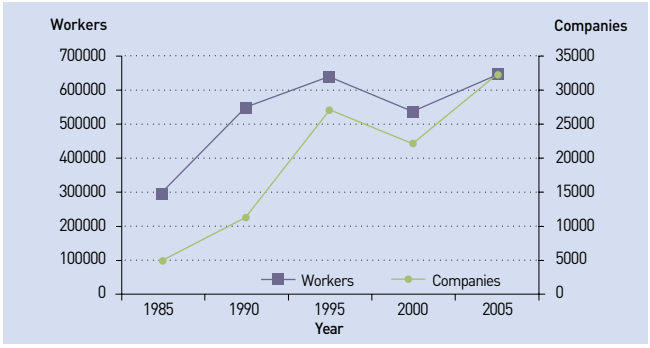
<Table 1> History of workers' medical screening system

1953	Labor Standards Act-regular mandatory medical examination for the factories with more than 16 workers
1956	Distribution of Guideline for 1st workers' medical examination
1961	Types of Medical examinations, test items, target population, period
1972	Categorize to general and special examination
1975	Biannual medical examination for special examination
1983	Enact the detailed rule for Workers' Medical Examination
1992	Quality assurance program for analytic chemistry
1993	Include agriculture and fishing industries
1996	Quality assurance program for diagnostic radiology/PFT, and NIHL
2002	Include the factories with less than 5 workers



[Figure 1] Number of workers and companies in workers' medical screening program

<Table 2> Diagnostic scheme for workers' medical examination

Categories		Scheme
A		Health state (no need to follow up)
C	C1	Suspected to develop occupational disease, need to follow up (occupational disease, observable)
	C2	Suspected to develop general disease, need to follow up (general disease, observable)
D1		Having symptoms or signs related to occupational disease, need to follow up with care (occupational disease)
D2		Having symptoms or signs related to general disease, need to follow up with care (general disease)

all the workers have been included in this program [Figure 1]. Finally, in 2006, the system provided special medical examinations to 754,932 workers, where the expenses were paid by the employers.

The diagnosis scheme in this program aims to categorize the health status. There are three categories for the diagnosis: A(normal), C(observable), and D(disease). Categories C and D are sub-divided into C1 and C2 or D1 and D2. "1" means symptom or sign not related to work environment, "2" means occupational or work related <Table 2>.

Because this program is no more than a "screening", detailed and more precise diagnosis cannot be provided. Therefore, when a worker is suspected to have an occupational disease, he or she is further categorized into "D1 or D2," and then transferred to the specific professional clinic for more detailed diagnosis.

Focusing on chemical and physical hazards

In Korea, industrialization began in the 1970s, where many incidents of occupational intoxication occurred in correlation with increasing use of various chemicals at worksites and labor movement for workers health protection in 1980s and early 1990s. For this reason, medical screening program was focus on acute chemical intoxication.

Employers whose employees are exposed to hazard substances are obliged to provide annual medical screening (called 'special medical examination') to the workers for earlier diagnoses and prevention of occupational diseases.

By critically reviewing the efficiency of the system, reformation had been conducted twice(1999 and 2006). Nowadays, 177 chemical and physical agents(108 organic compounds, 19 metals, 8 acids and bases, 14 gases, 13 carcinogens, a mineral oil, 6 dusts, 8 physical agents) are monitored in the annual or biannual medical screening.

In most worksites, not only a chemical is used in the process, but a cocktail of chemicals are used simultaneously, exposing most workers to multiple chemicals. This phenomenon is reflected in the number of agents which a worker is examined for. Only 46~62% and around 40% of the workers were examined on 1 agent and more than two hazards respectively <Table 3>. From 2000 to 2005, a total of 150

agents(86 organic compounds, 18 metals, 7 acids and bases, 14 gases, 13 carcinogens, 5 dusts, 6 physical agents, and a mineral oil) were tested on 3,162,304 workers.

Physical agents were most frequently examined agent (57.5~65.0%), followed by dust(22.8~27%) and organic compounds(24.5~28.4%). The most common items from physical agents and organic compounds were noise and toluene respectively <Table 4>.

An average D1 rate was 0.18%(0.16%~0.23%) during the 6 years. The diagnostic rate of occupational disease(D1 rate) decreased from 2.37% in 1985 to 0.37% in 2005 [Figure 2].

Occupational diseases were diagnosed from the tests on 24 factors(3 dusts, 8 organic compounds, 7 metals, 2 physical agents, 1 gas, 2 carcinogens, and an oil mist). D1 rate recorded the highest in physical agents(0.43%) followed by dust(0.09%) <Table 5>.

From the test results on 126 agents during the 6 years, we didn't observe any occupational disease. Test results for 86 organic compounds diagnosed only 31 occupational diseases.

The comparison of D1 rates and a total number of tests performed for each hazard are illustrated in table 6. The table indicates that 31.3% of medical examinations were conducted for noise which had the highest D1 rate for occupational disease(0.47%). General dust accounted for 12.2% of the screening where 0.09% of them were diagnosed for occupational disease. During 2002~2006, more than 80% of D1 accounted for noise induced hearing loss(NIHL), and 7% to 29% for pneumoconiosis. Others such as metal or organic compound intoxication were very rare, although their medical examinations accounted for 24.5~28.4% of the total test numbers.

Thus, main outcomes of the present workers' medical examination program in Korea comes from screening noise and dust related occupational disease such as noise induced hearing loss and pneumoconiosis. Chemical intoxication has

<Table 3> Number of agents per worker

Year	Workers	Number of agents					
		1	2	3	4	5	=< 6 [1]
2000	527,530	59.8	23.4	7.2	4.1	2.1	3.4
2001	515,310	62.6	21.6	7.0	3.5	2.2	3.2
2002	546,784	59.4	23.3	7.3	4.7	2.6	2.8
2003	519,795	52.5	26.8	8.6	4.9	3.3	4.0
2004	600,160	48.6	27.9	8.9	5.4	4.2	5.1
2005	646,892	46.6	27.9	9.7	5.5	4.0	6.3

1) 6-23

<Table 4> Annual percent of tested workers by hazard group

Year	Workers	Physical agents	Dust	Organic compounds	Metal	Acids and bases	Gas	Carcinogens
2000	527,530	61.9	27.0	24.5	17.2	7.0	4.2	0.7
2001	515,310	57.5	22.8	25.9	18.7	6.0	5.0	1.1
2002	546,784	62.9	24.1	25.0	17.6	6.1	4.2	1.5
2003	519,795	62.9	24.9	27.9	18.8	7.0	4.4	1.6
2004	600,160	65.0	27.2	26.9	20.4	7.3	5.0	2.2
2005	646,892	63.8	26.3	28.4	21.1	7.8	6.0	1.9

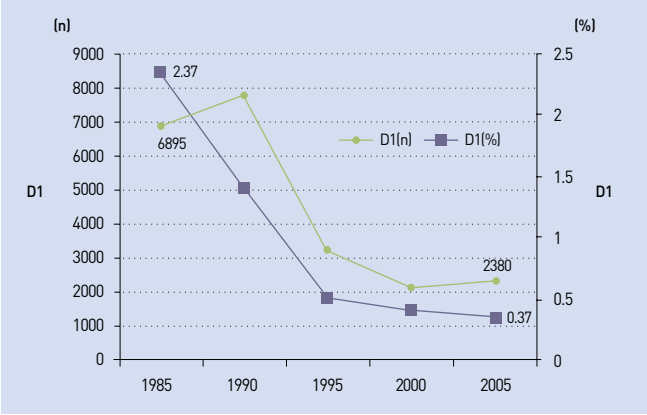
rarely occurred in Korea nowadays, but blind spots for workers' health protection are still being existed, especially in foreign or temporary workers.

Even thaugh D1 rate for organic compound is very small, it is an important item on workers medical examination scheme in Korea. Until now, 108 organic compounds have been enacted to be tested, and more substances may be added in the future if new chemical hazard is used in the worksite.

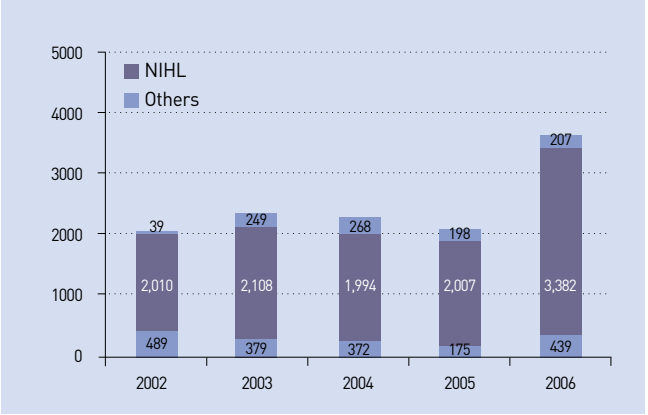
One of the reasons for such low D1 rate for organic chemicals is non-specific test method. Current medical tests have been designed for screening, not for accurate diagnosis. As a consequence, the test methods are non-specific and include routine ways such as simple chest X-ray or liver function tests which are more suitable for diagnosis of acute or sub-acute illness with severely high exposure. For the evaluation of chronic and subclinical effects of chemicals such as chronic toxic encephalopathy, systemic improvement is necessary.

Special medical examination to be provided to all workers by 2010

Since 2005, occupational health professionals in Korea began to discuss about the revision of workers' medical



[Figure 2] Occupational disease rates from special medical examination



[Figure 3] Diagnosed diseases as "D1" during 2002~2006

<Table 5> D1 rate by hazard group

Hazard group	Hazard diagnosed with D1		Agents never diagnosed with D1		Total test number	Diagnostic rate of D1 (%)
	Number of Agents	Tested Workers	Number of Agents	Tested Workers		
Mineral oil	1	6413	0	0	6,413	1(0.02)
Acids and bases	0	0	7	328,497	328,497	0(0.00)
Dust	3	847,993	2	6,770	854,763	805(0.09)
Gases	1	110,453	13	86,782	197,235	1(0.00)
Metals	7	806,487	11	52,977	859,464	124(0.01)
Organic compounds	8	661,879	78	989,784	1,651,663	31(0.00)
Physical agents	2	2,130,988	4	224,518	2,355,506	9,808(0.42)
Carcinogens	2	20,536	11	29,791	50,327	2(0.00)
Total	24	4,584,749	126	1,719,119	6,303,868	10,772(0.17)

screening program. The prime purpose of this program was to protect workers health, focusing on early diagnosis of occupational disease. It worked for a short period of time when the chemical exposure at worksites was relatively high. However, recently Korean economy and occupational health have improved, continuously lowering the chemical exposure level at worksites and changing the industrial structure with rapid growth in service sector overpowering manufacturing industries.

On the other hand, small and medium sized companies and foreign and temporary workers may still be exposed to high concentrations of chemicals. Thus, most public efforts to control the occupational diseases should be focus on these sectors.

In 2009, Korea started providing free medical screening services to the companies with less than 10 workers. From this service, 110,000 workers will be provided with free medical examination, fully supported by the government. It will expand to all workers exposed to worksite hazards by 2012, which is estimated to cost KRW32 billion or USD32 million.

<Table 6> D1 rate of each hazard by the group

Hazard Group	Agents	Test number	% of test number[1)]	D1	
				Number	D1 rate (%)
Organic compounds	Toluene	439,803	6.73	16	0.00
	N,N-DMF	43,134	0.66	7	0.02
	Styrene	34,075	0.52	3	0.01
	Benzene	62,339	0.95	1	0.00
	TDI	24,045	0.37	1	0.00
	Dichloromethane	17,636	0.27	1	0.01
	Formaldehyde	40,277	0.62	1	0.00
	Methyl bromide	570	0.01	1	0.18
Metal	Lead	205,823	3.15	45	0.02
	Ferrous oxide	146,482	2.24	22	0.02
	Chromium	154,120	2.36	41	0.03
	Manganese	283,316	4.33	11	0.00
	Cadmium	11,292	0.17	1	0.01
	Mercury	3,664	0.06	2	0.05
	4-alkyl lead	1790	0.03	2	0.11
Gas	Carbone monoxide	110,453	0.77	1	0.00
Carcinogens	Asbestos	14,179	0.22	1	0.01
	Coal Tar pitch volatiles	6,357	0.10	1	0.02
Mineral Oil	Oil mist	6,413	0.10	1	0.02
Dust	General dust	799,708	12.23	803	0.10
	Cotton	46,811	0.72	1	0.00
	Wood dust	1,474	0.02	1	0.07
Physical agents	Noise	2,045,592	31.29	9,713	0.47
	Vibration	85,396	1.31	96	0.11

1) % of total test number during 2000-2005

The Past and Future of Work Environment Evaluation System

Incidence of occupational disease by chemicals and the workplaces exceeding exposure limit

A. Incidence of occupational disease by the chemicals

In Korea, there are about 500,000 workers who deal with the chemicals. To prevent occupational disease caused by the chemicals, Korea has operated the health management system for workers based on work environment evaluation system and special medical screening. The incidence of occupational disease, however, by chemicals was 184 cases in 2007, increased by 111% compared to 2006, and the number of mortality was 29 persons in 2007 which had increased every year since 2004. For particle, the accident of acute poisoning by the DMF and TCE had occurred repetitively, and the employer and workers of these workplaces had low recognition of the hazard and danger of the corresponding chemicals. It is necessary, therefore, to construct an information delivery system on the chemical hazard and the health management system for workers.

B. Incidence of workplaces exceeding the exposure limit

In Korea, the number of workplaces exceeding the exposure limit is about 30,000 workplaces and the evaluation target workplaces are about 6,000. In the last 5 years, the ratio of the workplaces exceeds the exposure limit has been repetitively increased and decreased by 20%.

In addition, comparing the first half of 2006 with the first half of 2002 by hazardous factor, 155 workplaces of the dust (56.4%), 32 workplaces of the chemicals (20.5%) and 7 workplaces of others (36.8%) decreased but noise held 97.4% (the first half of 2006). Particularly, it shows that the workplaces exceeding the exposure limit of noise increased by 514 from 6,041 in the first half of 2002 to 6,555 in the first half of 2006.

Recently, there are many changes in the system of the work environment management and now the amends of the relevant regulations are under way. The

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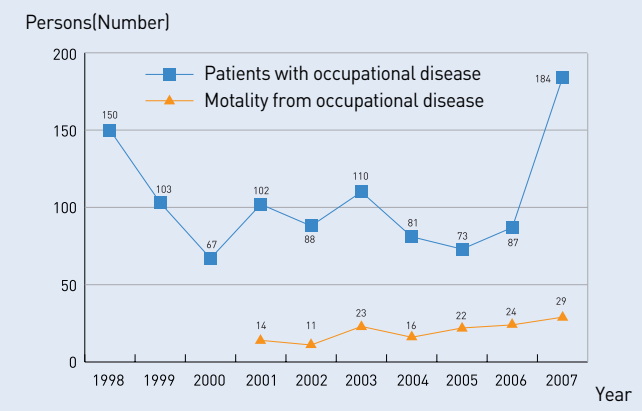


[Figure 1]

major contents of the system improvement amended are the article on the work environment evaluation system, clearing the purpose of the work environment evaluation, the article on the system improvement toward securing the credibility of the evaluation results, the article on the introduction of the system of the permission limit of the hazardous factors, the article on the education for material for MSDS, and the article on the ban of manufacture and use of the asbestos products.

Changes in the work environment evaluation system

A. 1960's~1980's

The work environment evaluation in 1970's before establishing the Occupational Safety and Health Act in Korea had been carried out by the special medical screening institutes including the Korea Industrial Health Associate, Catholic Medical College, Korea Medical College and Yonsei Medical College. The evaluation by the civil institutes had been carried out with the special medical screening and the result of it had been utilized in selecting the objects for the special medical screening rather than contributing to improvement of work environment.

At that period, it was an elementary level of evaluation simply sorting the hazard and direct reading equipment with very low precision was used. Since there was a no legal compulsory measure, just few workplaces had participated in it.

Ministry of Labor installed an evaluation room and a laboratory analysis room at the National Labor Scientific Research Center with instruments for work environment evaluation. In addition, technical supervisors in the field of health, electronics, machine and chemical engineering (keeping 40 persons in the middle of 1970's) were assigned in the local labor offices to carry out the yearly inspection of workplaces in poor work environment. The work environment inspection by the technical supervisors was to evaluate permissible limit and to correct when the result was not within the permissible range.

B. 1981~1986

The work environment evaluation system in Korea

<Table 1>

(Unit: Number of workplace)

Year	Division	Workplaces subject to measure	Workplaces measured	Excess of exposure standard		Workplaces exceeding by hazardous factor				
				number	ratio(%)	sum	noise	dust	chemicals	others
'02	upper	28,745	27,549	6,267	22.7	6,685	6,041	430	188	26
	low	31,663	30,904	6,403	20.7	6,698	6,075	387	211	25
'03	upper	33,598	32,815	6,547	20.0	6,875	6,312	367	181	15
	low	31,915	30,749	6,333	20.6	6,543	6,056	339	135	13
'04	upper	29,352	28,962	6,694	23.1	7,028	6,495	388	128	17
	low	31,521	30,775	6,491	21.1	6,791	6,333	313	124	21
'05	upper	31,876	31,204	6,543	21.0	6,820	6,339	313	150	18
	low	27,768	26,963	6,624	24.6	6,843	6,448	263	123	9
'06	upper	28,967	28,434	6,732	23.7	7,005	6,555	275	156	19
	low	29,116	28,551	6,980	24.4	7,273	6,727	319	208	19

acquired legal ground when Occupational Safety and Health Act was established on Dec 31, 1981 and the system was specified in Chapter 4 of Health Management for Workers in Occupational Safety and Health Act. In October of 1982, the evaluation targets and qualification of the evaluator were regulated and the work environment evaluations were conducted based on workplaces. Added to that, six relevant workplaces including the dust, noise, organic solvent, special substance, lead and lack of oxygen were selected as the targets for the work environment evaluation on the Article 39, Enforcement Regulation, Occupational Safety and Health Act. Medical screening agencies and staff who were in charge of industrial health were designated for the environment evaluations.

Since measuring apparatuses such as personal sampler to evaluate the personal exposure density were not popular at that time, the purpose of work environment evaluation was to manage the work environment and the evaluation method was simple for easy and convenient measuring by employers.

Owing to lack of the measuring equipment and the specialized human resource, the actual work environment evaluation was still made by the special medical screening institutes. Furthermore, with the lack of promotion to the employers and workers and the social atmosphere at that time, the interest in work environment evaluation was very low. The range of evaluation targets was very narrow because Ministry of Labor set the permission density only to 105 hazardous substances.

C. 1987~1990

The work environment evaluation system in Korea had been largely changed since 1986, and workers started to request for the improvement of working condition such as their salary using evaluation results from evaluation institutes and the evaluation results were used for occupational disease recognition data as well.

By raising questions to the credibility of some results of work environment evaluation or utilizing at the judgment of

dangerous and hazardous works regulated on the Article 43, Labor Standard Act, the intention of evaluation had wrongly been interpreted. Sometimes, therefore, results of work environment evaluation were served as momentum for a conflict between the labor and management.

Ministry of Labor, amending the Enforcement Regulation of Occupational Safety and Health Act in December of 1986, had amended partially for the targets of work environment evaluation and the qualification of evaluators.

The workplaces that are remarkably hot or cold and the workplaces to manufacture cokes were added at the existing six objects in Article 39 (workplace subject to work environment evaluation), Enforcement Regulation.

Ministry of Labor extended the permissible concentration of hazardous substances from 105 to 324 substances and extended it again to 697 substances by establishing Exposure Standard of Chemicals and Physical

Factors in 1988. As the permission density of the hazardous substances was made public at the Notification of Ministry of Labor, and it was recognized that the work environment evaluation must be executed for the all substances set in the regulations.

TLV of the ACGIH, the permissible limit, is for an evaluation of a worker's personal exposure, the evaluation after 1987 was mixed with sample collection method and the local evaluation method that was originally carried out for the work environment management had been vanished. The spot sample collection method, however, as a way for an improvement for work environment has been utilized till now.

Upon the occurrence of occupational disease in Wonjin Rayon in the late of 1980's, occupational disease was embossed as a social problem and the government revived the special inspections for work environment of the workplaces with high possibility of accidents and it showed that the evaluation results by the evaluation institutes had incredibility.

D. 1991~1994

There was a major revision of Occupational Safety and Health Act in 1990 to widen workers' rights to participate and rights to know were much intensified in the revised Occupational Safety and Health Act. The evaluation results were supposed to be reported to Minister of Labor. That was a significant change in a sense that the evaluation results could be used to judge whether employers perform the responsibility of health protection for workers through an improvement of work environment.

For the workplaces subject to work environment evaluation on the Article 93 in Enforcement Regulation, Occupational Safety and Health Act, two types of workplaces deal with or manufacture four alkyl fume and hazardous chemicals set by the Minister of Labor were added to the existing eight workplaces, the qualification of evaluators for work environment was set, and health managers were designated as the persons with over the second grade of the Industrial Hygiene Management Engineer and evaluation institutes assigned by heads of the local labor offices.

The period of work environment evaluation was stipulated one time or more every 6 months, and government announced the standard for environment quality control and work environment evaluation by establishing regulation of work environment evaluation and quality control」(No. 92-17, Notification of Ministry of Labor) in April of 1992 and partially amended it on May of 1993 and November of 1994.

Ministry of Labor had exerted to settle the work environment evaluation system in Korea such as enlargement of designated work environment evaluation institutes, newly designation of professional evaluation institutes and the qualification of evaluation institutes, and the work environment evaluation system was an issue owing to a matter of credibility.

With lack of professional technical human resources, equipment owing to disinterest of the employers and workers, and cursory evaluations by outside designation evaluation institutes, the utilization of the results of work environment evaluation was still low.

The number of evaluation institutes gradually increased by years to 71 institutes as of June of 1993(18 colleges and laboratories, 22 general hospitals, 12 associations, 6 industrial accident hospitals, 4 self-evaluation workplaces, 9 professional evaluation institutes, etc). The most of them were evaluation agencies. Self-evaluation, however, could not be activated. Taking a look at work environment evaluations carried out by these institutes and agencies in 1990 and 1991, the total number of measuring workplaces was 11,709 and 13,013.

Because of the lack of expertise of the evaluation institutes and staff, short-term inspection schedule and non-setting of the concrete method to the evaluation, analysis and evaluation, there was a tendency to depend on the subjective judgment of the evaluation institutes and staffs. They, therefore, often put weight to easy factors; evaluation

of chemical factors was low.

Looking into the number of evaluations by hazardous factor and excess rate of permission limit based on evaluations conducted in 1991, the noise and lighting evaluations were about 200,000 cases(73.6%) out of 280,000. In case of chemical factor evaluations, however, were only 13.8%. Added to that, there were only 3,256 cases(8.4%) of exceeding permission limit out of total 38,884 cases. Exposure Standard of Chemicals and Physical Factors is partially revised(No. 86-45, Notification of Ministry of Labor) in March of 1991.

E. 1995~2001

Amending the Occupational Safety and Health Act in Jan. 5, 1995, if there was any request from labor representative, the duty of explanation for the results of work environment evaluation was stipulated and by introducing the MSDS and it gave a big influence to recognize the objects for work environment evaluation. Added to that, the system of industrial safety consultant and industrial hygiene consultant were introduced and let them evaluate work environment and direct employers for improvement.

On Feb. 8, 1999, the procedure to report the results of work environment evaluation to Ministry of Labor was stipulated and partially revised Exposure Standard of Chemicals and Physical Factors(No. 86-45, Notification of Ministry of Labor) in January, 1998, February and May, 2002 that was stipulated ion on Dec. 8, 1986.

Beside, Work Environment Evaluation and Qualification Control Regulation(No. 92-17, Notification of Ministry of Labor) was partially amended several times.

At that time, there were remarkable growth and accumulation of technologies in the evaluation history for work environment in Korea and personal sample gathering using personal air sampler was widely used instead of spot sampler.

It was also a period that the evaluation institutes expanded quantitatively, while the local system of exclusive evaluation was abolished and the autonomous competitive system was introduced. The employer could change evaluation institutes at his discretion and the evaluation result could be distorted.

As the workers' interest in the work environment was increased, in some large corporations who have labor unions, labor unions actively took part in the work environment evaluation.

In this period, the number of the workplaces to be evaluated for work environment was 23,117 as of the last half of 1999 and it was more than two times compared to the early of 1990's. Looking into permissible limit excess rate, there were 6,502(28.1%) out of total 23,000 based on workplaces evaluated in 1999. In case of noise, permissible limit excess rate was about 93%. However, excess rate of the dust, organic solvent and specified substances was just 7.4%.

F. 2001~Current

Amending the Occupational Safety and Health Act on Dec. 30, 2002, the Articles about the qualification of the evaluators and the method and frequency were upward regulated in Notification of Ministry of Labor for Enforcement Ordinance and established a ground to assess evaluation institutes and announced the results of the assessment.

Amending the Enforcement Regulation on Jul. 7, 2003, it changed the workplaces for evaluation from 10 types designated in the past to workplaces with workers exposed to 191 kinds of hazardous substances and abolished the clauses about duty of work environment evaluation for workplaces in where short time of work and small quantity of organic substances.

By the full amendment of regulations about the Occupational Health Standard, the concept of the specific chemicals and organic solvent introduced from Japan was deleted. However, it was a period to still use the name of

organic solvent and special substances to the substances for medical screening. Total 191 kinds of substances were designated as the objects for work environment evaluation including 189 kinds of the chemical factors(113 organic compounds, 23 metals, 17 acids and alkalis, 15 of gaseous substances, 14 permission substances, 6 kinds of dusts and 1 metal working fluid) and 2 kinds of physical factors(noise and high temperature).

To elastically adjust the period of work environment evaluation from one time in every 6 months according to the excess of exposure standard, the followings are stipulated:

- For one time evaluation in three months
  - When carcinogen among chemical factors exceeds the exposure standard.
  - When non-carcinogen among chemical factors exceeds as more two times as the exposure standard.
- For one time evaluation in a year
  - When the evaluation result is below the exposure standard continuously for recent two times at a workplace there has been no change to influence the results of work environment evaluation like changes in work process for the last one year(except for the carcinogen)

The distortion of evaluation results between an employer and the evaluation institutes remains still an issue and there has been no remarkable technical development of the evaluation compared to those of 1990's.

However, the number of total workplaces in where evaluations made was about 30,775 as of the second half of 2004. The increase was about 2.5 times compared to that of early 1990's. In case of the excess rate of the permission limit, there were about 6,491 workplaces(21.1%) out of 30,000 as of 2004 showing continuous decrease compared to that of late 1990's. There were 97.5% that exceeded noise permission limit. However, there were only 2.4% that exceeded chemical factors.

It shows that there were 122 evaluation institutes(11 colleges and laboratories, 61 general hospitals, 14 associations, 6 industrial accident hospitals, 13 self-evaluation workplaces, 17 professional evaluation institutes and others) in the first half of 2005.

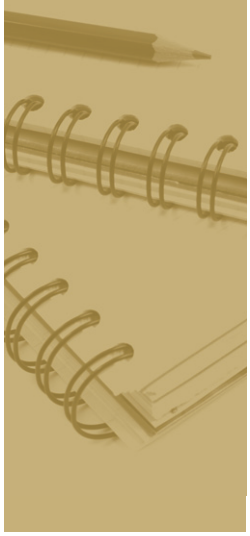
Utilization of the results of the work environment evaluation

To prevent occupational disease by the hazardous chemicals with strong poisoning(190 kinds of substances), more than two times of work environment evaluation and one more of special medical screening should be carried out. Management of work conditions and active and positive technical support for engineering improvement must be conducted for those workplaces at where the results exceed permissible limit. For this, KOSHA should understand the actual conditions of the entire chemicals used at workplaces. Consequently, it is necessary to conduct a survey on actual conditions of work environment every 5 years and to computerize the data and to periodically renew 50,000 kinds of MSDS in order to provide workers with the right information on chemicals. The workers should recognize the danger and hazardous of chemicals. Besides, KOSHA should keep with the international tendency.

As you can see from an occurrence of toxic skin diseases by Trichloroethylene to a worker in a cellular phone parts manufacturing company recently in Korea, there are some parts that cannot be managed with the existing system. To supplement it, KOSHA must make a survey on actual condition of the distribution and use of major chemicals(30 kinds). The data acquired from the survey shall be used in developing the Korean-type Chemical Control Tool Kit and shall be opened in a website for easy and convenient use by small sized companies. To utilize the evaluation results as precautions against occupational disease from chemicals exposure, a system such as "Workplace Health Partner" should be promoted for easy and convenient use by employers and workers.

Lymphohematopoietic Cancer Incidence and Mortality of Semiconductor Workers

Recently, the cases of lymphohematopoietic cancers including leukemia of semiconductor workers had become a social issue. To deal with that Occupational Safety and Health Research Institute carried out a survey to evaluate the work-relatedness of the leukemia of female worker in OO semiconductor in June of 2007 for about 4 months. The survey, however, could not find out a carcinogen which is associated with luekemia in her work. Accordingly, the institute made an epidemiological survey to review the mortality and incidence of lymphohematopoietic cancer of whole workers in the local semiconductor industry in 2008. In this article, we present the findings on the survey.



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Background and purpose

The family of a female worker who died of leukemia in OO semiconductor applied for compensation for the occupational disease to Korea Worker's Compensation and Welfare Service in 2007. Korea Worker's Compensation and Welfare Service requested for evaluation on the relationship between the death and the job concerning this case to Occupational Safety and Health Research Institute. Occupational Safety and Health Research Institute examined the work environment and job details of the worker starting from July in 2007 to November in 2007. The survey team, however, could not find out any well-known main cause of leukemia such as benzene and ionizing radiation, etc. During the examination, however, we found that another female worker who was in the same team with the deceased worker died of leukemia as well.

On the 28th of December in 2007, therefore, evaluation committee on epidemiological survey decided to draw conclusions on the work-relatedness of the above-mentioned worker and to conduct an epidemiological survey of the risk of lymphohematopoietic cancer of the entire domestic semiconductor workers. Accordingly, Occupational Safety and Health Research Institute performed an

epidemiological survey on domestic semiconductor manufacturers to study the risk of lymphohematopoietic cancer including leukemia starting from March to December in 2008.

Progress of survey

June 28th, 2007 : Having request for an survey of OOO(died of leukemia) from Korea Worker's Compensation and Welfare Service

June ~ Nov, 2007 : Survey of the individual case of OOO.

- The committee could not find the direct main cause of leukemia and any relationship with the work.

Dec. 28th,2007 : 11th evaluation committee on epidemiological survey

- The committee deliberated on the survey of OOO, and reserved the judgment.
- The committee planned to establish an epidemiological survey plan to study the risk related to leukemia for the entire semiconductor workers.

Jan. 23rd, 2008 : 12th evaluation committee on epidemiological survey

- The committee presented an epidemiological survey and research plan for the health of the workers who work in the semiconductor manufacturing processes and got an approval for that survey.

April ~ Nov., 2008 : examining workplaces and collecting data

- The survey team conducted field study and reviewed work environment.
- Data from unemployment insurance: received the statistical data from unemployment insurance of the Ministry of Labor
- Employee record : received the employee records from the company

April ~ Nov., 2008 : Gathering and review of death & disease data and gathered statistical data

- Utilization of medical institute for cancer treatment: data from National Health Insurance Corporation
- Cancer registry: data from National Cancer Center
- Vital status and cause of death: data from Korea National Statistical Office

May ~ Nov., 2008: Statistical analysis

Dec., 12: Review the result and writing a report

Dec. 23rd, 2008 : the 17th evaluation committee on epidemiological survey

Dec. 29th,2008 : Present of the result

Method

The subject of the survey was workers of semiconductor factories ranging from the past to the present and secured data from unemployment insurance and employee records of the companies. Based on these data, we set up 2 cohort, one is from unemployment insurance data and the other was from employee records.

We followed up the death and the incidence of lymphohematopoietic cancer in the subject through the statistical data of the cause of death from Korea National Statistical Office and the cancer registry data from Central Cancer Registry. In case of morbidity, we used treatment data from National Health Insurance Corp to evaluate the utilization of medical institutions. We calculated 3 indexes of standardized cancer mortality ratios (SMR), standardized cancer registry (incidence) ratios (SIR), and standardized utilization of medical institutions rate ratios (SRR) and then 95% confidence interval. In case of SMR and SIR, the reference group was general population and in case of SRR, the reference group was office workers in the cohort.

Total survey targets are nine workplaces of 6 companies and 37 their partners' workplaces in where they have wafer fabrication process among the member companies of Korea Semiconductor Industry Association. However we made an

<Table 1> Number of persons and observation period for analysis cohorts

		Data of cause of death (1992-2006)	Data of cancer registry (1988-2005)	Health Insurance treatment data (1997-2008.5)
Cohort from unemployment insurance	Index of analysis	SMR	SIR	SRR
	Observation period	1995~2006	1995~2005	1997~2007
	Number of persons	167,196	166,824	156,478
	person-year*	1,269,049	1,102,761	1,326,416
Cohort from employee records	Index of analysis	SMR	SIR	SRR
	Observation period	1998~2009	1998~2005	1998~2007
	Number of persons	102,348	95,688	110,228
	person-year	631,419	541,478	845,906

analysis of only six companies' workplaces and 29 partners' workplaces in where we could collect data from unemployment insurance or data from employee record.

We collected data of total 229,683 workers who ever worked in these target workplaces by adding data from unemployment insurance of 217,131 persons and employee records of 139,763 persons to establish cohorts. We restricted the cohort to workers who worked more than 1 month within the observation period . In case of analysis of SIR, the already diagnosed cases before the the start of observation was excluded from the cohort. In case of employee record cohort, partner companies' employee records were excluded because their records were available only for the recent a few years.

To classify the survey targets from the data of unemployment insurance, we re-classified nine jobs classified on the original data into production employees & clerical employees, and site employees & non-site employees.

In case of employee records, we excluded workers who have no relationship with semiconductor manufacturing process from the cohorts. we divided the semiconductor workers to manufacturing workers and office workers and then classified manufacturing workers in to operators and engineers in wafer process(fabrication) and assembly process. This classification system is similar with those of epidemiological surveys in England, USA, and Thailand.

Results

All cause of death and cancer

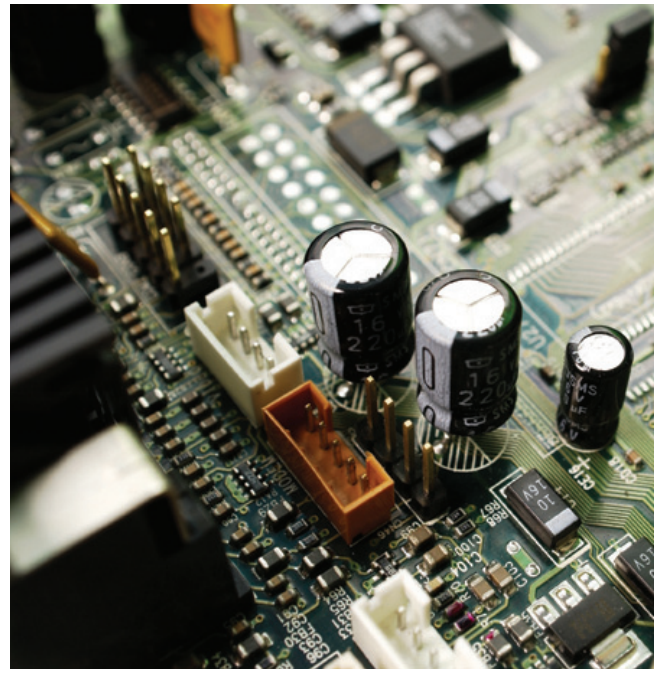
Overall mortality was significantly low for male (SMR=0.53, 95% C.I 0.49~0.57) and female (SMR=0.66, 95% C.I 0.59~0.75) in unemployment insurance cohort,. SMR of all cancer was also significantly low in male (SMR=0.74, 95% C.I 0.63~0.86) and in femele (SMR=0.74, 95% C.I 0.57~0.93) in unemployment insurance cohorts.

<Table 2> Summary of SMRs and SIRs of unemployment insurance cohort

Division	Sex	Lymphohematopoietic cancer			Leukemia						Non-Hodgkin's lymphoma					
		Mortality			Mortality			Incidence			Mortality			Incidence		
		Case	SMR	(95% CI)	Case	SMR	(95% CI)	Case	SMR	(95% CI)	Case	SMR	(95% CI)	Case	SMR	(95% CI)
Total	Male	10	0.48	0.23~0.88	6	0.51	0.19~1.12	15	0.86	0.48~1.42	4	0.57	0.16~1.47	13	0.84	0.45~1.44
	Female	12	0.92	0.47~1.60	9	0.89	0.41~1.70	15	1.04	0.58~1.71	3	1.05	0.22~3.07	15	1.61	0.90~2.66
	Total	22	0.65	0.41~0.98	15	0.69	0.39~1.14	30	0.94	0.64~1.35	7	0.71	0.29~1.47	28	1.13	0.75~1.63
Site employees	Male	4	0.60	0.16~1.54	4	0.98	0.27~2.52	7	1.15	0.46~2.37	0	0.00	-	5	1.06	0.34~2.47
	Female	8	0.96	0.41~1.89	7	0.99	0.40~2.05	11	1.06	0.53~1.90	1	0.64	0.02~3.57	9	1.58	0.72~3.00
	Total	12	0.80	0.41~1.40	11	0.99	0.49~1.77	18	1.10	0.65~1.73	1	0.28	0.01~1.54	14	1.34	0.73~2.25
Non-site employees	Male	6	0.42	0.16~0.92	2	0.26	0.03~0.95	8	0.71	0.31~1.40	4	0.81	0.22~2.08	8	0.74	0.32~1.47
	Female	4	0.84	0.23~2.16	2	0.66	0.08~2.39	4	0.97	0.26~2.48	2	1.54	0.19~5.57	6	1.67	0.61~3.64
	Total	10	0.53	0.25~0.97	4	0.38	0.10~0.96	12	0.78	0.40~1.36	6	0.97	0.35~2.10	14	0.98	0.53~1.64
manufacturing employees	Male	6	0.60	0.22~1.31	4	0.71	0.19~1.81	7	0.90	0.36~1.86	2	0.63	0.08~2.28	5	0.72	0.23~1.68
	Female	10	0.90	0.13~1.66	8	1.02	0.44~2.00	12	1.04	0.54~1.83	2	0.83	0.10~3.01	11	1.52	0.76~2.72
	Total	16	0.76	0.43~1.23	12	0.89	0.46~1.55	19	0.99	0.59~1.54	4	0.72	0.20~1.84	16	1.13	0.64~1.83
Clerical employees	Male	4	0.36	0.10~0.92	2	0.30	0.04~1.09	8	0.84	0.36~1.65	2	0.58	0.07~2.08	8	0.95	0.41~1.86
	Female	2	0.68	0.08~2.46	1	0.49	0.01~2.74	3	1.01	0.21~2.96	1	1.43	0.04~7.97	4	1.97	0.54~5.04
	Total	6	0.43	0.16~0.93	3	0.35	0.07~1.01	11	0.88	0.44~1.57	3	0.72	0.15~2.10	12	1.14	0.59~2.00
Mother enterprise	Male	7	0.44	0.18~0.90	6	0.63	0.23~1.37	15	1.03	0.58~1.69	1	0.19	0.00~1.08	11	0.90	0.45~1.62
	Female	10	1.03	0.49~1.88	8	0.98	0.42~1.93	14	1.16	0.64~1.96	2	1.06	0.13~3.83	12	1.77	0.92~3.09
	Total	17	0.66	0.38~1.06	14	0.79	0.43~1.33	29	1.09	0.73~1.56	3	0.43	0.09~1.25	23	1.21	0.77~1.82
Partner Company	Male	3	0.62	0.13~1.81	0	0.00	-	0	0.00	-	3	1.66	0.34~4.85	2	0.61	0.07~2.19
	Female	2	0.60	0.07~2.18	1	0.53	0.01~2.94	1	0.41	0.01~2.28	1	1.03	0.03~5.73	3	1.19	0.25~3.49
	Total	5	0.62	0.20~1.43	1	0.25	0.01~1.37	1	0.19	0.00~1.07	4	1.44	0.39~3.68	5	0.86	0.28~2.00

※ Case: the number of the dead persons or patient, SMR: Standardized Mortality Ratios, SIR: Standardized Incidence Ratios, 95% CI: 95% confidence interval,

Incidence of all cancer was also statistically significantly low with 0.86 (95% C.I 0.77~0.96) for male in unemployment insurance cohort. Incase of female, however, it was 0.97 (95% confidence interval, 0.87~1.09) and that was not statistically significant.



Lymphohematopoietic cancer

There was significantly deficits of death from lymphohematopoietic cancer in male (SMR=0.48, 95% C.I 0.23~0.88) in unemployment insurance cohort and insignificantly deficits (SMR=0.41, 95% C.I 0.11~1.06) in employee records cohort.

Mortality of lymphohematopoietic cancer was close to expectation in female (SMR=0.92, 95% C.I 0.47~1.60) in unemployment insurance cohort and insignificantly elevated (SMR=1.56, 95% C.I 0.68~3.08) in employee record cohort.

Leukemia

Death rate of leukemia was below expectation (SMR=0.51, 95% C.I 0.19~1.12) and the incidence of leukemia was close to expectation (SMR=0.86, 95% C.I 0.48~1.42) in unemployment insurance cohort.

Both of mortality and incidence of leukemia in female are close to expectation in unemployment insurance cohort. Mortality and incidence of leukemia was elevated in female (SMR=1.48, 95% C.I, 0.54 ~ 3.22 and SIR=1.31, 95% C.I 0.57 ~ 2.59) but that was not statistically significant.

<Table 3> Summary of SMRs and SIRs of employee records cohort

Division	Sex	Lymphohematopoietic cancer			Leukemia						Non-Hodgkin's lymphoma					
		Mortality			Mortality			Incidence			Mortality			Incidence		
		Case	SMR	(95% CI)	Case	SMR	(95% CI)	Case	SMR	(95% CI)	Case	SMR	(95% CI)	Case	SMR	(95% CI)
Total	Male	4	0.41	0.11~1.06	2	0.36	0.04~1.29	8	0.87	0.38~1.72	2	0.62	0.08~2.24	6	0.77	0.28~1.69
	Female	8	1.56	0.68~3.08	6	1.48	0.54~3.22	8	1.31	0.57~2.59	2	2.05	0.25~7.42	9	2.67*	1.22~5.07
	Total	12	0.81	0.42~1.42	8	0.83	0.36~1.63	16	1.05	0.60~1.70	4	0.95	0.26~2.44	15	1.35	0.76~2.22
manufactu ring workers	Male	2	0.36	0.04~1.29	2	0.60	0.07~2.16	5	0.93	0.30~2.17	0	0.00	-	2	0.47	0.06~1.69
	Female	6	1.29	0.47~2.82	4	1.08	0.29~2.77	6	1.09	0.40~2.36	2	2.30	0.28~8.32	8	2.66*	1.15~5.25
	Total	8	0.78	0.34~1.54	6	0.85	0.31~1.85	11	1.01	0.50~1.80	2	0.75	0.09~2.71	10	1.38	0.66~2.53
office workers	Male	2	0.49	0.06~1.77	0	0.00	-	3	0.80	0.16~2.33	2	1.40	0.17~5.06	4	1.15	0.31~2.94
	Female	2	4.16	0.50~15.03	2	5.61	0.68~20.26	2	3.54	0.43~12.79	0	0.00	-	1	2.71	0.07~15.05
	Total	4	0.88	0.24~2.24	2	7.61	0.09~2.75	5	1.15	0.37~2.69	2	1.31	0.16~4.72	5	1.30	0.42~3.03
manufacturing workers in FAB line	Male	2	0.47	0.06~1.69	2	0.78	0.09~2.83	5	1.22	0.40~2.84	0	0.00	-	1	0.31	0.01~1.71
	Female	4	1.26	0.34~3.22	3	1.18	0.24~3.46	5	1.33	0.43~3.11	1	1.67	0.04~9.33	3	1.47	0.30~4.31
	Total	6	0.81	0.30~1.75	5	0.98	0.32~2.29	10	1.27	0.61~2.34	1	0.50	0.01~2.80	4	0.76	0.21~1.94
manufacturing workers in Assembly line	Male	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	1	0.99	0.03~5.51
	Female	2	1.37	0.17~4.95	1	0.85	0.02~4.76	1	0.56	0.01~3.14	0	0.00	-	5	5.16*	1.68~12.05
	Total	2	0.72	0.09~2.61	1	0.51	0.01~2.84	1	0.33	0.01~1.82	0	0.00	-	6	3.03*	1.11~6.60

※ Case: the number of the dead persons or patient, SMR: Standardized Mortality Ratios, SIR: Standardized Incidence Ratios, 95%CI: 95% confidence interval,

non-Hodgkin's lymphoma

Mortality and incidence of non-Hodgkin's lymphoma in male in both of unemployment insurance and employee record cohort was below expectations.

The followings are the analysis result of the risk of non-Hodgkin's lymphoma in female.

- Mortality rate of non-Hodgkin's lymphoma in unemployment insurance cohort was similar level with that of general population group and incidence ratio of non-Hodgkin's lymphoma shows higher level but that was not statistically significant.
- Two persons died of non-Hodgkin's lymphoma (SMR=2.06, 95% C.I 0.25 ~ 7.42) in employee records cohort,
- Nine females suffered from non-Hodgkin's lymphoma and it was a finding of statistically significant(SIR=2.67, 95% C.I 1.22 ~ 5.07).

In subgroup analysis, significantly elevated SIR was found in female manufacturing workers(SIR=2.66, 95% C.I 1.15~5.25) and female manufacturing workers in assembly line (SIR=5.16, 95% C.I 1.68~12.05).

Risk of utilization of medical institute for lymphohematopoietic cancer

When office workers was used as a refernece group, male manufacturing worker's rate for lymphohematopoietic cancer in unemployment insurance cohort was close to expectation and female's rate was a little bit higher than that of office workers.

In case of employee records cohort, the rate of manufacturing workers's lymphohematopoietic cancer in male was close to expectation but the rate was lower than office workers in female.

Other findings on the survey

We reviewed Material Safety Data Sheet(MSDS) of chemicals used in each workplace and searched the classification code of International Agency of Research on Cancer(IARC). According to IARC, benzene, ionizing radiation, and ethylene oxide are main occupational causes and highly related to lymphohematopoietic cancer. In the review, there was no benzene and there was 0.001% of ethylene oxide in one surfactant for etching process according to MSDS submitted by one company.

<Table 4> Summary of analysis result of risk level

Disease (ICD-10 code)	Sex	Analysis cohort	Standardized mortality ratios (95% confidence interval)		Standardized incidence ratios (95% confidence interval)		SRR (95% confidence interval)	
Lymphohematopoietic cancer(C81~C96)	Male	Unemployment insurance	0.48*	0.23-0.88	-	-	0.96	0.56-1.65
		Employee record	0.41	0.11-1.06	-	-	0.96	0.43-2.11
	Female	Unemployment insurance	0.92	0.47-1.60	-	-	1.30	0.65-2.71
		Employee record	1.56	0.68-3.09	-	-	0.46	0.15-1.44
Leukemia (C91~C95)	Male	Unemployment insurance	0.51	0.19-1.12	0.86	0.48-1.42	0.56	0.19-1.62
		Employee record	0.36	0.04-1.29	0.87	0.28-1.72	0.74	0.19-2.90
	Female	Unemployment insurance	0.89	0.41-1.70	1.04	0.58-1.71	1.36	0.46-4.06
		Employee record	1.48	0.54-3.22	1.31	0.57-2.59	0.66	0.14-3.23
Non-Hodgkin's (C82~C85)**	Male	Unemployment insurance	0.57	0.16-1.47	0.84	0.45-1.44	1.20	0.61-2.36
		Employee record	0.62	0.08-2.24	0.77	0.28-1.69	1.83	0.72-4.68
	Female	Unemployment insurance	1.05	0.22-3.07	1.61	0.90-2.66	1.15	0.44-2.99
		Employee record	2.05	0.25-2.44	2.67*	1.22-5.07	0.35	0.08-1.49

※ Comparative group

Standardized mortality ratios, Standardized Incidence Ratios: general population group

- Medical expenses analysis: clerical employees in the cohorts

* Statistically significant

** In case of Standardized Incidence Ratios, C96 is included.

† In case of cancer registry statistics, Standardized Incidence Ratios cannot be analyzed because statistics of the whole lymphohematopoietic cancer (C81~C96) was not available.

In review of the survey the data of work environment evaluation of subject company for the past 5 years, TLV(Threshold Limit Value) was above 50% in only one case of acid-base materials in FAB process out of total 16,846 cases. Occupational Safety and Health Research Institute measured work environment and the level of ionizing radiation in some processes which related in cases of leukemia. Benzene was not detected. The level of ionizing radiation of ion implanters generate X-rays in FAB process and X-ray testers in the assembly process was about the same level with natural level of radiation..

We gathered data of special health examination in 2000~2007 to analyze and compare hemoglobin status with those of outside comparative groups(other worker groups that was only exposed to noise) considering sex and age. The data, however, were not consistent in each examination year so that we could not judge the rate of abnormal hemoglobin range was elevated in subject group.

Conclusion and implications

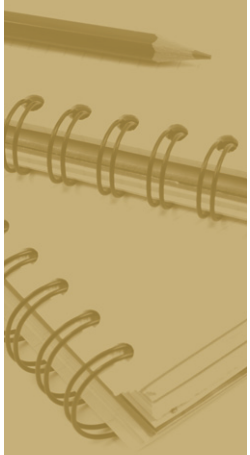
Our findings, though inconclusive, particularly those relating to non-Hodgikin's lymphoma, need to be treated very seriously. They raise the possibility of the possibility of a work-related risk of cancer.

But this epidemiological survey had a limit of short tracking period to evaluate the risk of lymphohematopoietic cancer that has low incidence and mortality rates. And there was possibility of classification errors because of lack of precise information on the job and process details.

More long-term studies and more detailed studies like nested case-control study will be needed to clarify work-relatedness of lymphohematopoietic cancer of semiconductor workers and it is needed to gather more detailed information of past occupational history, personal & environmental factors of workers.

Epidemiologic Research on Sudden Cardiac Deaths and Cancers at a Tire Manufacturer

Tire manufacturing industry is known for leading to high potential cancer risk regarding such as bladder cancer and leukemia. In September 2006 to September 2007, including diseases resulting in sudden cardiac deaths, lung cancer and liver cancer occurred in at a Korean tire manufacturing factory in a relatively short time. Ministry of Labor requested Occupational Safety and Health Research Institute(OSHRI) of Korea Occupational Safety and Health Agency (KOSHA) to conduct epidemiologic research to investigate its causes and to establish its measures. The research was conducted for about four months. The results are as follows :



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Background

From May 2006 to September 2007, 13 employees died from diseases in a tire manufacturing factory. Seven workers died from cardiac diseases, two from lung cancer, one from meningioma, one from hepatocellular carcinoma, one from esophageal cancer and one from suicide. OSHRI conducted the epidemiologic research to this accident to investigate the common causes of 12 cardiac diseases except for one suicide and identify if they are related to any exposures to the past works at the factory. The invsestigation team composed of three teams; analysis of the job characteristics team, work environments evaluation team and health effects team, and each team did its special investigation. The subjects for this research were 7,140 people who had worked at the factory related to the deaths and other 16 subcontractors. They took four rounds of measurement of the working environment to find chemical and physical elements, and conducted two investigations to the job characteristics. The data we analyzed to evaluate health effects of the subjects were the mortality records from Korea National Statistical Office(KNSO), the medical insurance records(TEDS) from Korea National Health Insurance Corporation(KNHIC) acquired with the consent of the workers, and both general and temporary health examination data. Usually, the epidemiologic

research by OSHRI should go through the review from the evaluation committee of epidemiologic investigation which consists of 15 experts across the country. The result of this investigation on the tire factory was also put under review from the committee. Besides, it went through the process to collect the opinions from the advisory committee consisting of experts recommended by NGOs, the academic circles, Korea Employers Federation(KEF), Federation of Korean Trade Unions(FKTU) and Ministry of Labor and the representatives of the workers' families.

Results of epidemiologic research

The epidemiologic research was conducted by subdividing into three parts: "general characteristics of the company" which reflect the characteristics of works and operations, "evaluation of working environments" which measures and evaluates their chemical and physical elements, and "evaluation of health effects" which evaluates the dangers of getting cardiovascular diseases and cancers.

General characteristics of the company

The establishment of the tire manufacturer for investigation was founded in 1941. It introduced a variety of information system for production management annually, and in the years of 2003 and 2005, it started to operate production management system called 1st and 2nd TOP (Total Operation Performance). The average production against monthly average workforce in each year has increased 2.3%~5.5% annually since 2001. The production against workforce in 2002, 2003 and 2006 compared to the previous year increased.

Working schedule of the 74.3% of workers were shift work. Among those working on site, 88.5% of workers of the company do the shift work and 78.8% of workers of the suppliers do the shifts. They do three shifts under four groups and have two days off after five days on duty.

In this type of three shifts, the morning group works for 7 hours 10 minutes, the afternoon group for 7 hours 20 minutes,

and the night group for 7 hours 20 minutes. However, the data from the company shows that the shift workers work four more hours as overtime working before or after shifts.

There is so called 'double duty'. When you have two days off after the night shift, you are sent to the morning shift again without having the days off, or you are sent to the night shift before starting the morning shift.

Results of evaluation of working environments

At present, this factory produces tires using about 66 kinds of chemical substances. The evaluation of working environments revealed that those substances could be acute induction elements of sudden cardiac death, chronic danger elements to facilitate cardiovascular diseases, and chemical and physical elements known for carcinogenic substances.

HCFC(Hydrochlorofluorocarbon), methylene chloride and nitrate considered as elements of inducing sudden cardiac death were found not to be used at the time of epidemiologic research. At that time, carbon monoxide was found to be less than TWATLV and styrene, butadiene, polynuclear aromatic hydrocarbons and carbon disulfide less than TWA-TLV as well.

Regarding rubber fumes, their exact compositions and effects on health were not reported yet, but they exceeded 0.6㎎/㎥ from exposure limit of UK in the vulcanization process and production management. In the elaboration process and vulcanization process, 7~8 species of polynuclear aromatic hydrocarbons which can lead to cancers in the human body were detected.

The vulcanization process makes a very hot thermal environment with steam and fumes, etc. arising from hot rubbers. This creates over than 40 hot environment from June to August and over 30 to November.

"A research on improvement of harmful gases and thermal environment from vulcanization process," conducted on this factory by a university on September 2007, showed that high temperature from the vulcanization process would not go out of the factory but it flows out to the bottom of partitions and goes into the place where workers work. Considering this research results, it was assumed that some workshops were likely to be exposed to high temperature not only in the vulcanization process but also in the processes adjacent to this process. Regarding noise measurement, 46% of workers were exposed to noises which exceeded 85dBA.

Results of evaluation of health effects on cardiac diseases and cardiovascular diseases

This research shows that in 1996 to 2007, the standardized mortality ratio(SMR 141.1; CI 60.8~278.1) of workers with ischemic heart diseases(gender, age-adjusted) was 1.7 times as high as the standardized mortality ratio(SMR 84.0; CI 67.8~102.9) of general population, and the SMR of the current workers with seven person dead was high(SMR 151.4; CI 60.7~312.0), compared to the SMR of the retired workers with one person died(SMR 80.9; 0.1~450.0). The SMR of the current workers from ischemic heart diseases was 5.6 times in 2006 as high as the nationwide mortality statistics.

The standardized medical utilization ratio from angina pectoris, one of ischemic heart diseases, was high in the current workers with results of 261.7(CI 176.5~373.6) in 2006 and 244.9(CI 217.0~472.0) in 2007 respectively, compared to prevalence rate of annual angina pectoris diagnosed by doctors under 2005 Korea National Health and Nutrition Examination Survey. This result was significant in terms of statistics.

We examined if the increase in mortality rate of the current

workers with ischemic heart disease and the increase in medical utilization rate from angina pectoris were common in this factory or just limited to a specific operation, and if the medical utilization from hypertension and diabetes increased along with this condition. The mortality rate from ischemic heart disease was shown larger in the current workers than in the retired workers. Most of them were found in the worksite group, the technology group and the research group except for the office group. And if you look further into the mortality rate from cardiovascular diseases, you can see the death in every working group.

When comparing the medical utilization rate of the current workers with ischemic heart diseases by the working groups, those from the research group who accepted medical treatment in 2003 and 2004 were 10.4 and 9.3/1,000 workers respectively. This was higher than the other working groups. In 2005, most of the groups showed almost similar medical utilization rate except for the technology group which had no examinees in 2005, but the office group had 16.6 and 10.0 examinees out of 1,000 workers in 2006 and 2007 respectively. This was the highest of the other working groups. In the years of 2003 to 2007, the medical utilization ratio of the current workers with hypertension, one of the underlying diseases out of ischemic heart diseases, was 157.4(CI 140~177.0) in 2007. This was higher than that of the entire nation with the same disease and it was also significant in terms of statistics. Meanwhile, the medical utilization ratio of the retired workers with hypertension was 141.3(CI 104.9~186.3) to 210.9(CI 168.0~261.4) from 2004 to 2007. This was higher than that of the entire nation with the same disease and it was also significant in terms of statistics.

When comparing the medical utilization rate of the current workers with hypertension in the period of 2003 to 2007 by the working groups, those from the office group showed the highest medical utilization rate of the worksite group, the research group and the technology group. The same goes for the retired workers. And the medical utilization rate of the current workers with diabetes, one of the basis diseases out of ischemic heart diseases, in the period of 2003 to 2007, was lower than that of the entire nation with the same disease and it was statistically significant in terms of statistics in 2003 to 2005. Meanwhile, the medical utilization ratio of the retired workers with hypertension was 109.8(CI 67.9~167.8) to 147(CI 103.5~202.6) from 2004 to 2007. This was higher than that of the entire nation with the same disease and it was also significant in terms of statistics in 2006 to 2007. The medical utilization rate of the current workers with diabetes in the period of 2003 to 2007 showed no significant difference when compared by each group.

In the period of 2003 to 2006, the workers of stage 2 hypertension(over 160 mmHg of systolic blood pressure or over 100 mmHg of diastolic blood pressure) out of the health screen examinees increased but gradually reduced in the office group, the research group and the worksite group in 2004. However, there were 3.31% in the office group, 2.9% in the worksite group, 2.1% in the technology group and 1.5% in the research group.

Stage 1 hypertension(over 140~159 mmHg of systolic blood pressure or over 90~99 mmHg of diastolic blood pressure) showed 0.8~27.9% but after 2004, it gradually reduced and showed 0.8~6.6% in 2006. It was the highest in the office group.

When we examined the smoking and alcohol drinking habits of some workers through the health interview survey their smoking rate was 67.3%, which was higher than 53% from that of national sample group, and their drinking rate was 41.1% in 1 to 3 times a week, 7.8% in 3 to 4 times a week. This rate means higher than the results of National Health and Nutrition Survey(NHNS). Particularly, some factories showed higher frequency of drinking rate. However, their obesity rate was low, compared to the results of NHNS. In the SMR for twelve years from 1996 to 2007, stomach cancer(7 cases) and esophageal cancer(1 case) were higher than national mortality rate, but its statistical significance was not shown. The standardized medical utilization ratio of the treatment episode data set from KNHIC was high in stomach cancer, esophageal cancer, colon cancer, blood-forming organ cancer, kidney

cancer, laryngeal cancer, bladder cancer, lung cancer and pancreatic cancer, but there was no statistical significance in the other cancers except for stomach cancer.

Conclusion

Although the SMR of entire causes of mortality of both current and retired workers in the period of 1996 to 2007 was low, compared to the whole population(total mortality SMR 84), that is to say, though this group is the workers' group and it should be the group whose death toll from any cause whatsoever is fewer than average death toll of the entire nation, the standardized mortality ratio from ischemic heart diseases (ischemic heart diseases SMR 141) was relatively very high. Specifically, most of the deaths from ischemic heart diseases were found in the current workers(seven out of total eight workers). In this way, the mortality of the current workers from ischemic heart diseases was particularly higher than total mortality rate(total mortality of the current workers SMR 67, ischemic heart diseases SMR 151).

To explain this result, based on the data we have collected and analyzed, the first possibility is task-relevant. Considering that the mortality toll from ischemic heart diseases was shown significantly higher in the current workers than in the retired workers(ischemic heart diseases from the current workers SMR 151 and from the retired worker SMR 78) and this kind of death occurred only in the worksite group, the research group and the technology group except for the office group, it is assumed that the mortality from ischemic heart diseases is very likely to be related to worksite, research and technology-relevant tasks.

In this research, it is likely that high temperature was the occupational causes of sudden cardiac deaths and over working due to shift work was one of the occupational risk factors of coronary heart disease. Generally, it is known that sudden cardiac deaths occur resulting from various individual factors.

The primary focus of this epidemiologic research, however, is the identification of collective characteristics of occupational risk factors rather than non-occupational factors. So task-relevance of sudden cardiac deaths should be determined individually by considering the occupational characteristics and working environments including individual risk factors.

As stomach cancer is the most common cancer in Korea, it is necessary to analyze and examine in many ways why the workers in this establishment showed significantly high medical utilization rate for stomach cancer.

However, as the workers in the rubber tire factory are

exposed to various chemical substances whose harmfulness is not revealed and they are apt to be exposed to many carcinogenic substances and the factory is not ventilated properly, they need to improve their working environment as technically as possible to minimize their workers' exposures to these substances.

Action plan

Necessity of further research

It is necessary to perform the research on effects of the organizational culture and the working methods on the health of workers.

Also, we need to find out through case-control study if there are any differences between the workers(case) of this factory using medical utilization for ischemic heart disease and the workers(control) not using medical utilization, and which group is exposed to specific risk factors including non-occupational risk factors. Then we can work out the customized countermeasures suitable for collective health characteristics of workers. Besides, regarding cancer diseases whose standardized mortality ratio was higher than that of the whole population and stomach cancer whose medical utilization rate was higher than that of the whole population, it is necessary to make a follow-up study on cancer diseases in the tire manufacturers along with examinations of data whose diagnosis accuracy is confirmed. And for rubber fumes and fine dust whose harmfulness is not found, it is necessary to research their effects on the health of workers including those who work at other tire factories.

Recommendations on the manufacturer

The workers of rubber tire factory are likely to be exposed to various chemical substance and carcinogenic substances whose harmfulness is not found. When we examined the ventilation facilities including local ventilation system in this epidemiologic research, their abilities to ventilate were not met. So the manufacturer should improve their working environment by rearranging those ventilation systems properly.

To prevent sudden cardiac deaths, they need to improve thermal environment like vulcanization process and minimize the exposure of workers to this environment. If the exposure is inevitable because of the nature of the process, they should take actions not to have this task placed on to the workers who are in Stage 2 hypertension (over 160 mmHg of systolic blood pressure or over 100 mmHg of diastolic blood pressure) or who have been treated with ischemic heart diseases.

If you prevent sudden cardiac deaths more aggressively, they have to make and carry out the plans for specific working environment control and task control for workers not to be exposed to the occupational causes of sudden cardiac deaths and the occupational risk factors of coronary heart diseases. In addition, all of sudden cardiac deaths have the underlying diseases such as coronary heart diseases. As this kind of death occurs in the group whose health is not in good condition, the manufacturer should take care of their health by paying good attention to non-occupational risk factors(habitual elements of smoking and drinking, and basic health elements of hypertension, diabetes and hyperlipidemia) that their workers have. Particularly, for those who have high blood pressure and various disease risk elements at the same time, the manufacturer should take more positive actions such as considerations of their tasks(see “Risk Assessment and Follow-up Guide to Prevent Stroke and Cardiovascular Disease at Work(KOSHA code H-11-2004)” Korea Occupational Safety and Health Agency(KOSHA)).

Fourthly, taking into account the one case of sudden deaths, which led to this epidemiologic research, and the working styles of the workers from a department at the first half year of 2006, it is found that the workers have continued to work without day-off even on holiday. It can build up their fatigue. So it is recommended to manage the working hours on their shift system more systematically. Fifthly, it is difficult to identify in a short time the effects of exposure of the workers to various harmful factors of low concentration and the effects of chronic illness or long-term shift system on workers' health. So it is necessary to establish health monitoring system on which the data of the entire workers' exposure to harmful substances and the effects of those substances on their body are stored.

Occupational Injury and Illness Statistics in Korea

The present occupational accident statistics is announced on a quarterly basis after collecting the data of occupational accident survey and the approval from the applications of medical treatments requiring more than 4 days from workplaces with more than 1 regular employee which have applied for the occupational accident compensation insurance.

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System of occupational accident statistics and development of occupational accident compensation insurance

Changes in the system of occupational accident statistics

Occupational accident statistics in Korea is applied to the employees who work at a company covered by the occupational accident compensation insurance, and it is closely associated with the system of occupational accident compensation insurance. Starting with the enforcement of the system of occupational accident compensation insurance in 1964, occupational accident statistics have adopted the current form of the after the establishment of occupational accident survey regulations and the enactment of occupational safety and health law in 1981, and the establishment of Korea Workers' Compensation & Welfare Service(KWCWS) in 1995, the establishment of a computer network among KWCWS, KOSHA and Ministry of Labor [Figure 1].

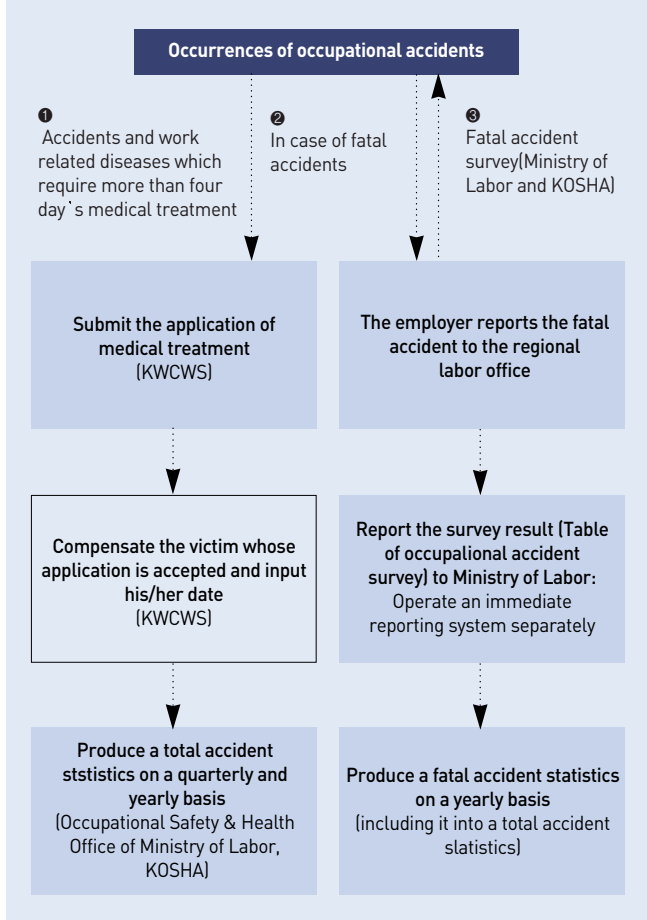
Changes of the occupational accident compensation insurance

When examining the changes of the occupational accident compensation insurance by focusing on the applications of the occupational accident

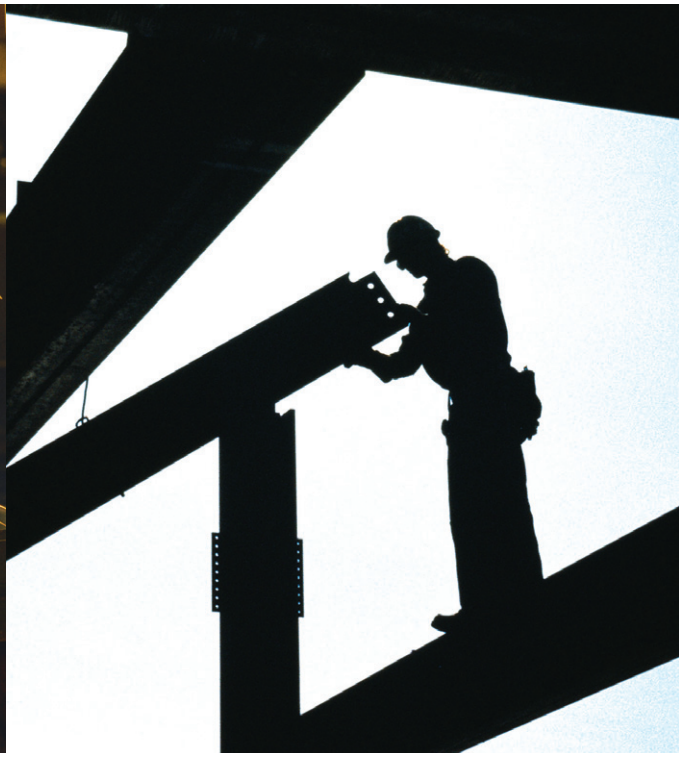
<Table 1> Changes of system of occupational accident statistics

Dates	Description of Changes
1964. 01.	Enforcement of the system of occupational accident compensation insurance(more than 500 regular employees) and production of occupational accident statistics.
1972. 01.	Analysis of collection of occupational accident survey data
1975. 03.	Approval of reports of occupational accident survey data
1977. 02.	Approval of general statistics of occupational accident survey (Approval No. 11806: Korea National Statistical Office)
1981. 01.	Establishment of occupational accident survey regulations
1981. 12.	Enactment of occupationalsafety and health law
1992. 07.	Expansion of application of occupational accident statistics (more than 5 regular employees)
1993. 01.	Exemption of duties of occupational accident report (replaced with submission of application of medical treatment)
1996. 10.	Establishment of a computer network (KWCWS-KOSHA-MOL) to produce the occupational accident statistics
1998. 05.	Transfer the work of occupational accident statistics to Ministry of Labor(KOSHA)
2000. 07.	Expansion of applications of occupational accident statistics (more than 1 regular employee)
2000. 12.	Approval of designated statistics of the survey of occupational accident causes(Approval No. 38001: Korea National Statistical Office)
2002. 12.	Establishment of duties of recording and maintaining the occupational accidents(Article 10.2 of occupational safety and health law)
2005. 03.	Constitution of T/F for improving the system of occupational accident statistics(Ministry of Labor)
2005. 09.	Preparation of the action plans for improving the system of occupational accident statistics(Ministry of Labor)
2006. 01.~ Present	Operation of the working group for improving the system of occupational accident statistics(Ministry of Labor)

compensation insurance law, it followed the same way with development progress of our country. A regulation of occupational accident compensation that stipulated that an employer is irresponsible for occupational accidents of workers(Part 8 of Labor Standard Law) was first established in 1953. And when we enacted the law of occupational accident compensation insurance in 1963, we could finally have the compensation system for occupational accidents. In the early days of 1964, when the occupational accident compensation insurance law was enforced, this law was applied to 64 workplaces(about 81,000 employees) of mining and manufacturing whose employees were over 500. Since then, its sizes and types of industry for application of the law were expanded. In 1976, in case of some specific workplaces for manufacturing such as mining, chemistry, coals, petroleum, rubber or plastic product manufacturers, the law could be applied to the workplaces with more than five employees(expanded to 1,833,000 employees from 21,369 companies). In 1982, construction projects adapted the system of the lump sum payment for occupational accident compensation insurance, and this system was applied to 3,941,000 employees from 60,213 companies. In 1989, the application scope of occupational accident compensation insurance was expanded from the establishments which apply Labor Standard Law to all the businesses. So it was applied to 7,058,000 employees from 154,820 companies. In 1993, its application scope was



[Figure 1] Flow chart of production process of occupational accident statistics



expanded to the industries of education service, public health & care, social welfare, research and development, and in 1997, a bill for exemption to apprentices, trainee, and transferee abroad was prepared. In 1999, it was expanded to the construction project whose contract amount is over 20 Million Won and which has more than 1 regular employee, and it allowed the employers of the small and medium-sized companies with less than 50 employees to join this insurance temporarily. So it was applied to 9,485,000 employees from 706,231 companies. In 2004, the number of the workplaces which were applied this insurance was expanded to 1 million companies including 10 million employees. Accordingly, a law was enacted for collection of premium of unemployment insurance and occupational accident compensation insurance, and both premiums were to be collected together. With continuous improvement of the system, 11,680,000 employees from 1,292,696 companies benefited from the occupational accident compensation insurance in 2006.

Details of occupational accidents

Trend of occupational accident occurrences by year

The trend of occupational accident occurrences in Korea is closely associated with increases of economically active population and development of industries. In the early days of 1960s when Korean economy started to grow, the occupational accidents were fewer in number. The number of victims in 1964 was no more than 1,489(rate of accidents 1.82).

However, in 1970 when Korean economy headed toward stable growth, the occupational accidents started to be considered as critical social problem, and the number of victims in 1978 increased to 139,242(rate of accidents 4.48). In 1980, the Korean industrial structure rapidly changed, resulting from innovation of industrial technology, but the working conditions and environments were not up to the standard, which led to a variety of accidents and

occupational diseases. As a result, 1984 had to witness 157,800 victims (rate of accidents 3.60), which hit records highs. This fact served as a momentum for Korean government to prepare for the policies of occupational accident prevention in many ways and to recognize the need of an agency to take care ofoccupational accident prevention. Accordingly, Korea Occupational Safety and Health Agency(KOSHA) was established in 1987. Since then, with help of a variety of the policies of occupational accidents prevention and the executions of the projects, the rate of accidents continued decreasing from the second half of 1980, and finally it recorded 0.99% in 1995. From that time on, the rate of accidents maintained at around 0.7%, but the estimated amount of annual economic loss kept growing from 1,200 billion Won in 1987 and 7,700 billion Won in 1997 to 15,800 billion Won in 2006 <Table 3>.

Comparison of occupational accident index

When you look into the trend of changes of the number of the establishments, the employees, victims from 1987, the year of KOSHA established, to 2006, you will notice that the numbers are 121, 107, 100 in 1988, 207, 136, 60 in 1994, 845, 177, 48 in 2000, 1,547, 218, 63 in 2006 respectively (occupational accident index: 100). The number of the workplaces and the employees has been on the increase, compared to that of 1987, and the number of the victims decreased before 1998, but it was a little bit increasing [Figure 2].

Comparison of occupational accident index by industry

When you look into accident rate and frequency rate by year, you will notice their rates are 26.62 and 9.77 in 1987, 24.78 and 9.26 in 1988, 11.82 and 4.69 in 1994, 7.27 and 2.89 in 2000, 7.69 and 3.31 in 2006 respectively. So they

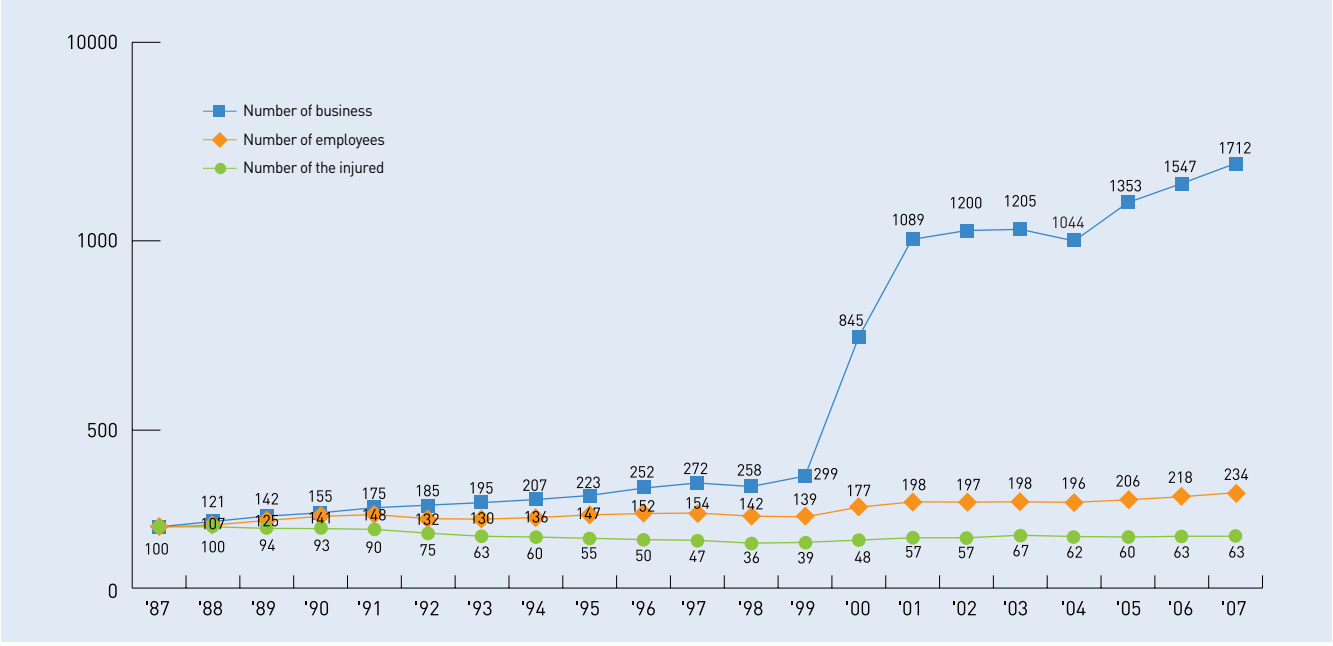
<Table 2> Occupational accident occurrences by year

(Unit: Person)

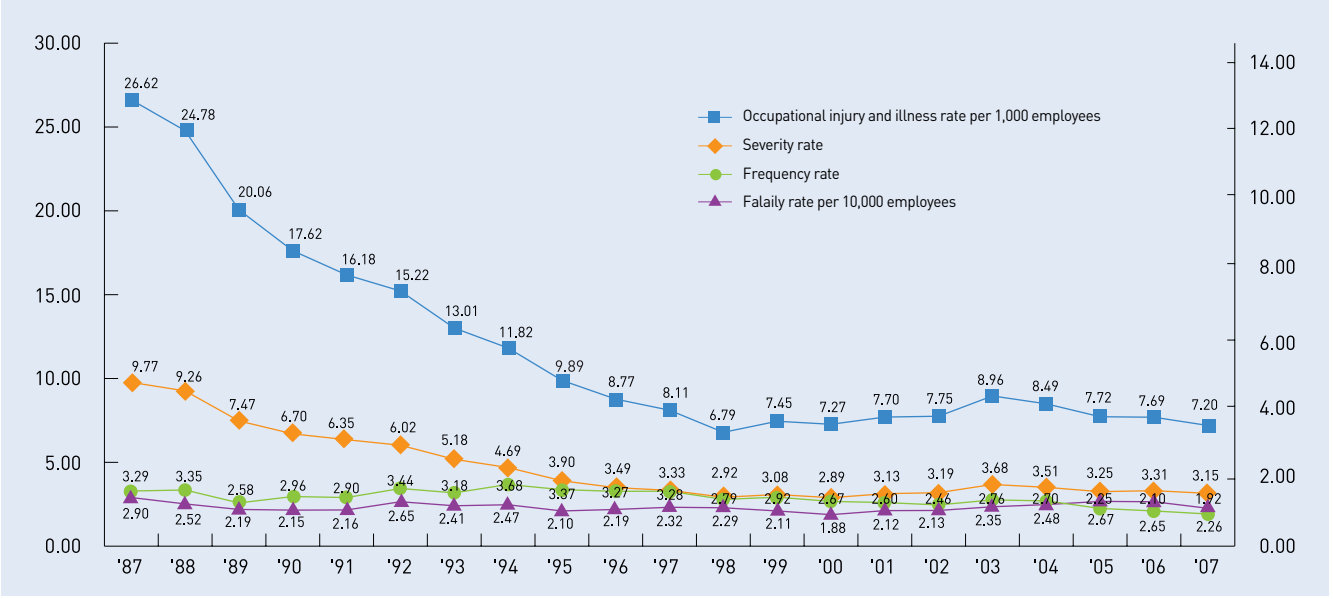
Year	Number of establishments (Place)	Number of employees	Number of the injured (accident rate : %)	Number of the casualties(fatality rate per10,000 employees)	Number of the occupational diseases	Economic loss (Estimated amount: 1 million Won)	Severity rate	Frequency rate
'87	83,536	5,356,546	142,596 (2.66)	1,761 (3.29)	1,623	1,206,030	2.90	9.77
'88	101,445	5,743,970	142,329 (2.48)	1,925 (3.35)	2,150	1,484,973	2.52	9.26
'89	118,894	6,687,821	134,127 (2.01)	1,724 (2.58)	1,561	1,846,527	2.19	7.47
'90	129,687	7,542,752	132,893 (1.76)	2,236 (2.96)	1,638	2,696,757	2.15	6.70
'91	146,284	7,922,704	128,169 (1.62)	2,299 (2.90)	1,537	3,507,570	2.16	6.35
'92	154,820	7,058,704	107,435 (1.52)	2,429 (3.44)	1,328	4,657,820	2.65	6.02
'93	163,152	6,942,527	90,288 (1.30)	2,210 (3.18)	1,413	4,362,655	2.41	5.18
'94	172,871	7,273,132	85,948 (1.18)	2,678 (3.68)	918	4,992,814	2.47	4.69
'95	186,021	7,893,727	78,034 (0.99)	2,662 (3.37)	1,120	5,667,887	2.10	3.90
'96	210,226	8,156,894	71,548 (0.88)	2,670 (3.27)	1,529	6,776,685	2.19	3.49
'97	227,564	8,236,641	66,770 (0.81)	2,742 (3.33)	1,424	7,780,210	2.32	3.28
'98	215,539	7,582,479	51,514 (0.68)	2,212 (2.92)	1,288	7,255,330	2.29	2.79
'99	249,405	7,441,160	55,405 (0.74)	2,291 (3.08)	1,897	6,371,130	2.11	2.92
'00	706,231	9,485,557	68,976 (0.73)	2,528 (2.67)	2,937	7,281,330	1.88	2.89
'01	909,461	10,581,186	81,434 (0.77)	2,748 (2.60)	4,456	8,722,695	2.12	3.13
'02	1,002,263	10,571,279	81,911 (0.77)	2,605 (2.46)	4,190	10,101,675	2.13	3.19
'03	1,006,549	10,599,345	94,924 (0.90)	2,923 (2.76)	7,740	12,409,070	2.35	3.68
'04	1,039,208	10,473,090	88,874 (0.85)	2,825 (2.70)	9,183	14,299,570	2.48	3.51
'05	1,130,094	11,059,193	85,411 (0.77)	2,493 (2.25)	7,495	15,128,855	2.67	3.25
'06	1,292,696	11,688,797	89,910 (0.77)	2,453 (2.10)	10,235	15,818,800	2.65	3.31
'07	1,429,885	12,528,879	90,417 (0.72)	2,406 (1.92)	11,472	16,211,300	2.26	3.15

show the similar trend to the trends of changes of the number of the victims. Severity rate was shown to be 2.90 in 1987 and 1.88 in 2000. Usually, it tends to decrease and increase in this range repetitively every 4 and 5 years. Fatality rate per 10,000 employees tends to have decreased and increased in the range of 3.68 in 1994 and 2.10 in 2006 repetitively every 4 and 5 year [Figure 3].

Changes of forms of major occupational accident occurrences

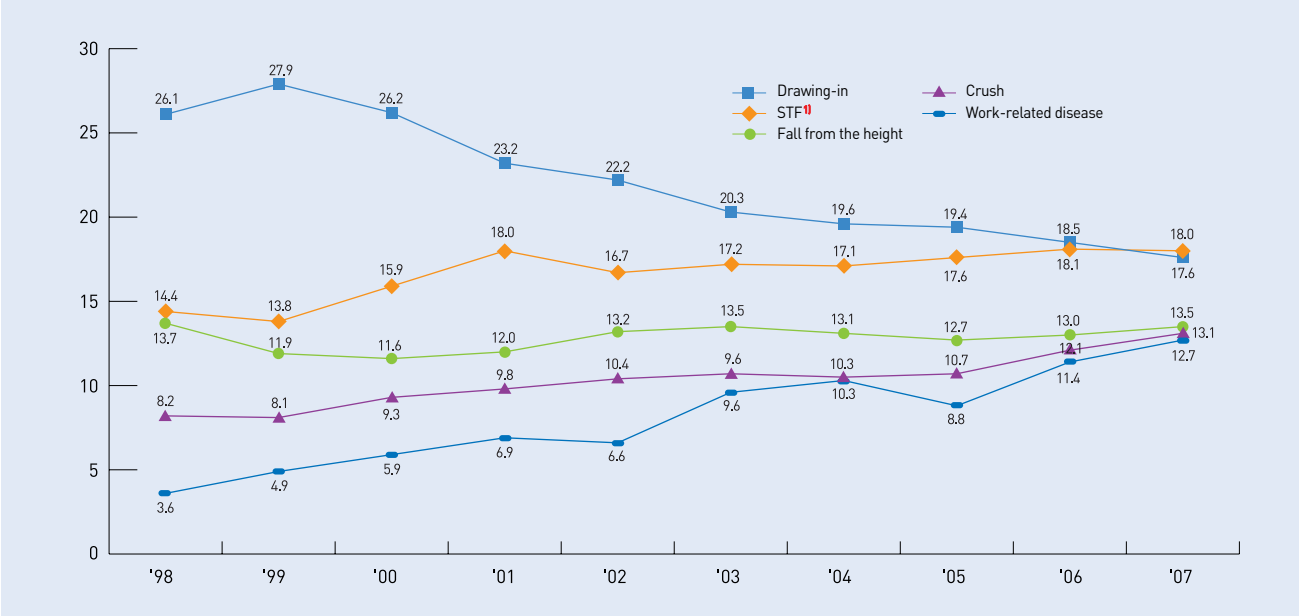


[Figure 2] Trend of occupational accident occurrences by year(comparison of index)



[Figure 3] Trend of occupational accident index by year(entire industry)

When you look into the trend of the changes of forms of occupational accident occurrences from 1998, when the statistics of occupational accident was transferred to KOSHA in 2006, the rate of the accidents was 27.9% in 1999 and 18.5% in 2006, which has been on the significant decrease. The rate of the accidents from collisions and turning over has been on the gradual increase. The rate of occupational diseases was 3.6% in 1998 and 11.4% in 2006, which has been on the significant increase. Particularly, in the year of 2003 when the occupational skin diseases and liver diseases were added to the criteria for work-related diseases, this rate is shown to have significantly increased, compared to that of the previous year. In the year of 2006 when they started to classify the accidental lumbago into the work-related diseases, the rate increased by 29.5%. The rate of the work-related diseases out of the whole occupational accidents was 11.4%, which was the highest rate <Table 3>, [Figure 4].



[Figure 4] Trend of changes of occupational accident occurrences by year

1) Slips, Trips, Falls to the same level

<Table 3> Major occupational accident occurrences by year

(Unit: Person)

Year	Total number of the injured	Drawing-in	STF	Fall from the height	Crush	Falling & flying object	Excessive movements	Occupational diseases	Others
'98	51,514	13,429	7,418	7,057	4,248	4,505	2,869	1,838	10,150
'99	55,405	15,461	7,659	6,609	4,489	4,280	3,405	2,732	10,770
'00	68,976	18,058	10,935	7,981	6,440	5,529	5,297	4,051	10,685
'01	81,434	18,856	14,672	9,771	8,001	7,025	5,954	5,653	11,502
'02	81,911	18,146	13,705	10,835	8,525	7,580	6,182	5,417	11,521
'03	94,924	19,238	16,373	12,799	10,193	8,183	7,000	9,130	12,008
'04	88,874	17,395	15,159	11,676	9,371	7,343	7,149	9,183	11,598
'05	85,411	16,557	15,071	10,814	9,125	6,454	6,535	7,495	13,360
'06	89,910	16,649	16,305	11,686	10,908	6,632	3,131	10,235	14,364
'07	90,147	15,881	16,231	11,834	12,202	6,565	1,426	11,472	14,563

Analysis on the Type of Occupational Accident & Disease of the Aged Workers for Recent 10 Years

In Korea, the aged population who are 65 years and older about 9% comparing to entire population in 2005, already surpassed 7% which is the judge criterion of aging society of the UN and it is expected that we will enter the Aged Society in 2017 and enter the Super Aged Society in 2025. The aging of the labor population means a need for a specialized prevention measure of injury to the aged workers. Therefore, by analyzing the characteristics to occur the industrial disaster of the aged workers for the pst 10 years, I would present the basic data necessary to establish a specialized prevention measure of injury later.

Preface

According to the data of the National Statistical Office(NSO), in Korea, the aged population who are over 65 years old is about 9% compared to entire population in 2005, already surpassing 7% which is the judge criterion of aging society of the UN and it is expected that we will enter the Aged Society in 2017 and enter the Super Aged Society in 2025[1]. estimation of future population, NSO, November, 2006

This leads to anestimation that the aged workers in the industry field have increased rather than that only the aged population has increased. Seeing the increase and decrease of the number of employed persons for the recent 10 years, while the number of employed persons of thirties ~ fifties of age has increased 1% to 47%, the number of employed persons over 65 years old shows about 82% from 832,000 persons in 1998 to 1,514,000 persons in 2007[2]. survery of economically active population, NSO, each year

Generally, it is known that as the age gets higher, the function of body deteriorated. ILO reports that the muscular strength weakens by 15~20% and the

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aged people find it difficult to control their postures under the situation to need a precise adjustment, and it occurs that not only the works by the changes of temperature and environment are difficult but also the function of sight control and the function of hearing are lowered[3].

Besides, one document form Japan shows that, comparing with the body function of 25~29 years old, the age persons who are 50~59 years old have aslittle as 20% in a grasping power and the hearing, ability of the sense of equilibrium and recovering ability after night shift are decreased to about 60~70%[4].

Considering the deterioration of body function by graying and the increase of the aged workers, there is a need for a specialized prevention measure of injury appropriate for the aged. Then, by analyzing and looking for the risk elements incurring the industrial injuries, I would present the basic data necessary to establish a prevention measure of injury specialized to the aged.

Object of the analysis

The industrial injuries occurred from 1998 to 2007 is the object of the analysiies. The statistics of the industrial

1) estimation of future population, NSO, November, 2006
2) survery of economically active population, NSO, each year
3) ILO Encyclopedia of occupational health and safety 4th-edition, 2000
4) Sailors Accidents Prevention Association, Overconfidence and Irresolution of the Experienced Sailors, 1997

<Table 1> Industrial injuries and diseases by years · ages

(Unit: Persons)

Age	Item	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Below 25 years	Total	4,554	5,268	4,788	5,398	5,046	5,140	4,090	3,755	3,791	3,597
	Ratio	8.8%	9.5%	6.9%	6.6%	6.2%	5.4%	4.6%	4.4%	4.2%	4.0%
	Accident	4,526	5,219	4,699	5,314	4,974	4,977	3,990	3,689	3,611	3,422
	Ratio	9.1%	9.9%	7.2%	7.0%	6.5%	5.8%	5.0%	4.7%	4.5%	4.3%
	Disease	28	49	89	84	72	163	100	66	180	175
	Ratio	1.5%	1.8%	2.2%	1.5%	1.3%	1.8%	1.1%	0.9%	1.8%	1.5%
25~39 years	Total	21,395	22,906	27,262	30,204	27,431	33,184	30,792	29,501	30,022	28,641
	Ratio	41.6%	41.3%	36.5%	37.1%	34.7%	35.0%	34.6%	34.5%	33.4%	31.8%
	Accident	21,096	22,383	26,312	28,835	27,192	30,496	28,057	27,809	26,682	24,719
	Ratio	42.5%	42.5%	40.5%	38.1%	35.5%	35.5%	35.8%	35.7%	33.5%	31.4%
	Disease	299	523	950	1,369	1,239	2,688	2,285	1,692	3,340	3,922
	Ratio	16.3%	19.1%	23.5%	24.2%	22.9%	29.4%	24.9%	22.6%	32.6%	34.2%
40~54 years	Total	18,053	19,608	26,492	31,977	33,115	38,570	36,641	35,613	38,020	39,776
	Ratio	35.1%	35.4%	38.4%	39.3%	40.4%	40.6%	41.2%	41.7%	42.3%	43.0%
	Accident	17,220	18,384	24,625	29,499	30,713	34,702	32,788	32,509	33,910	34,248
	Ratio	34.7%	34.9%	37.9%	38.9%	40.2%	40.4%	41.1%	41.7%	42.6%	43.5%
	Disease	833	1,224	1,867	2,478	2,402	3,968	3,853	3,104	4,110	4,528
	Ratio	45.3%	44.8%	46.1%	43.8%	44.3%	42.4%	42.0%	41.4%	40.2%	39.5%
Over 55 years	Total	7,478	7,621	10,434	13,855	15,319	18,030	17,351	16,542	18,077	19,133
	Ratio	14.5%	13.8%	15.1%	17.0%	18.7%	19.0%	19.5%	19.4%	20.1%	21.2%
	Accident	6,800	6,685	9,289	12,133	13,615	15,619	14,406	13,909	15,472	16,286
	Ratio	13.7%	12.7%	14.3%	16.0%	17.8%	18.2%	18.1%	17.9%	19.4%	20.7%
	Disease	678	936	1,145	1,722	1,704	2,411	2,945	2,633	2,605	2,847
	Ratio	36.9%	34.3%	28.3%	30.5%	31.5%	26.4%	32.1%	35.1%	25.5%	24.8%

Note) The victim treated as impossible for division(34 persons in 1998, 2 persons in 1999) is excluded from the obbject to analysis, and the ratio is the one of the number of victim of each age comparing to entire victims by each year.

injuries collecting by utilizing the inner system of the Ministry of Labor include the case which a medical treatment was approved by submitting the application, the case of the survey of the industrial injury and the case to take a administrative · judicial measure from violating a duty of the report to occur the industrial injury and the standard of the aged workers is the persons over 55 years old, the one of them defined by the 'Enforcement Ordinance, Promotion of Employing the Aged Act'.

Result

Status of industrial injuries of the aged workers by year

The occurence of the industrial injuries of the aged workers over 55 years was 19,133 persons like <Table 1>, increases 11,655 persons comparing to 1998, the ratio to hold in the entire victims for 10 years is 21% in 2007 and has increased every year since 1998, it increased by 6%P comparing to 1998 unlike that the ratios of the industrial injury of the workers below 25 years old and 25~39 years old decreases 2%P and 4%P respectively. In addition, it is analyzed that while the ratio to hold in the entire injury as the age gets higher has increased in the accidental injury on-the-job, the one in the injury of disease on-the-job has decreased <Table 2>.

Status of industrial injuries by the type of incidence of the aged workers

▷ Status of occupational injuries

During 1998~2007, the type of injury which has the

<Table 2> Status of occurrence of accident by years · ages

(Unit: Persons)

Age	Item	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Below 25 years	Total	84	79	56	65	44	56	63	40	36	38
	Ratio	3.8%	3.4%	2.2%	2.4%	1.7%	1.9%	2.2%	1.6%	1.5%	1.6%
	Accident	80	76	53	59	36	52	56	36	33	37
	Ratio	4.8%	5.2%	3.7%	3.8%	2.6%	3.4%	3.6%	2.6%	2.5%	2.7%
	Disease	4	3	3	6	8	4	7	4	3	1
	Ratio	0.7%	0.4%	0.3%	0.5%	0.7%	0.3%	0.5%	0.4%	0.3%	0.1%
25~39 years	Total	669	654	666	717	520	613	619	529	442	449
	Ratio	36.3%	37.1%	37.6%	34.4%	27.4%	28.8%	30.2%	28.8%	25.4%	24.7%
	Accident	604	540	531	533	377	441	464	402	338	341
	Ratio	36.3%	37.1%	37.6%	34.4%	27.4%	28.8%	30.2%	28.8%	25.4%	24.7%
	Disease	65	114	135	184	143	172	155	127	104	108
	Ratio	11.8%	13.7%	12.1%	15.4%	11.7%	12.4%	12.0%	11.6%	9.3%	10.6%
40~54 years	Total	922	974	1,085	1,202	1,183	1,312	1,212	1,099	1,153	1,045
	Ratio	41.7%	42.5%	42.9%	43.7%	45.4%	44.9%	42.9%	44.1%	47.0%	43.4%
	Accident	646	557	551	633	594	654	606	606	610	583
	Ratio	38.9%	38.3%	39.0%	40.8%	43.1%	42.7%	39.4%	43.3%	45.8%	42.2%
	Disease	276	417	534	569	589	658	606	493	543	462
	Ratio	50.2%	49.9%	47.9%	47.5%	48.0%	47.3%	47.0%	45.0%	48.4%	45.2%
Over 55 years	Total	537	584	721	764	858	942	931	825	822	874
	Ratio	24.3%	25.5%	28.5%	27.8%	32.9%	32.2%	33.0%	33.1%	33.5%	36.3%
	Accident	332	283	279	326	371	386	411	354	351	422
	Ratio	20.0%	19.4%	19.7%	21.0%	26.9%	25.2%	26.7%	25.3%	26.4%	30.5%
	Disease	205	301	442	438	487	556	520	471	471	452
	Ratio	37.3%	36.0%	39.7%	36.6%	39.7%	40.0%	40.4%	43.0%	42.0%	44.2%

note) The ratio is the one of the number of victims of each age compared with the number of the entire victims by years.

most frequent incidence for the injuries on-the-job of the aged workers is the one by falling down and it holds 28.5% among the entire number for 10 years of them. The following is 17.4% of the falling, 16% of the drawing-in · crush, 11.9% of the collision, 10% of the falling · flying objects <Table 3>.

This frequency by the types of incidence shows difference from other ages, it is analyzed that as the age gets higher, the ratio of the falling down and fall accident to hold in the entire injuries by ages increases and the ratio of the winding · crushing decreases and the difference of the three major injuries of the accident on-the-job by ages has significance(*p<0.05) by statistics<Table 4>.

▷ Status of occupational diseases

During 1998~2007, the type of injury which has the most frequent incidence for the diseases on-the-job of the aged workers is the brain disease · cardiovascular disease and it holds 31.9% among the entire number for 10 years of them. The following is the 42.6% of the pneumoconiosis, 8% of lumbago, 6.6% of the noise induced hearing loss and the 6.2% of the work of burden to body<Table 5>.

Except for the pneumoconiosis, comparing/an-alyzing the three major diseases with high frequency by ages, it is analyzed that as the age gets higher, the ratio of the brain disease · cardiovascular disease and the noise induced hearing loss increases and the ratio of lumbago decreases and the difference of the three major injuries of the disease by ages has significance(*p<0.05) by statistics <Table 6>.

Consideration and conclusion

According to the analysis for the industrial injury of the workers over 55 years old occurred during 1998 to 2007, the ratio of the aged victims of workers accounted for is 21.2% of the total in 2007 and increases about 6%P comparing to 1998 and the number of victims increases 11,655 persons. It can be said for a simple increase as the number of employed people increases, but it cannot be judged as a simple increase in that while the increase rate of number of employed people over 55 years old in 2007 comparing to 1998, the increase rate of number of victims comes to about 156%.

<Table 3> Ratio by ages of three big types of injuries with high frequency of occurrence of the aged workers

(Unit: Persons)

Age	Total	STF[1)]	Fall from the height	Drowing in	Crush	Falling/ Flying object
Over 55 years	124,214	35,351	21,555	19,876	14,726	12,443
Ratio	100.0%	28.5%	17.4%	16.0%	11.9%	10.0%

1) STF(Slips, Trips, Falls to the some level)

<Table 4> Ratio by ages of three big types of injuries with high frequency of occurrence of the aged workers

(Unit: Persons)

Age	Entire	STF	Fall from the height	Drawing in
Below 25 years	100.0% 44,421	13.8% 6,122	5.3% 2,355	35.9% 15,925
25~39 years	100.0% 264,031	15.5% 40,841	11.5% 30,476	25.7% 67,926
40~54 years	100.0% 288,598	18.0% 51,866	16.2% 46,811	23.0% 66,252
Over 55 years	100.0% 124,214	28.5% 35,351	17.4% 21,555	16.0% 19,876

<Table 5> Five major types of disease out of duty with high frequency of occurrence among the aged workers

(Unit: Persons)

Age	Entire	Brain disease · cardiovascular disease	Pneumoconiosis	Lumbago	Noise-induced hearing loss	Work of burden to body
Over 55 years	19,626	6,251	8,355	1,575	1,291	1,217
Ratio	100.0%	31.9%	42.6%	8.0%	6.6%	6.2%

<Table 6> Ratio by ages of three big types of disease with high frequency of occurrence among the aged workers

(Unit: Persons)

Age	Entire	Brain disease · cardiovascular disease	Lumbago	Noise induced hearing loss
Below 25 years	100.0% 1,006	10.0% 101	47.2% 475	0.5% 5
25~39 years	100.0% 18,307	14.5% 2,660	46.1% 8,441	1.2% 211
40~54 years	100.0% 28,267	30.7% 8,688	23.0% 6,502	3.9% 1,089
Over 55 years	100.0% 19,626	31.9% 6,251	8.0% 1,575	6.6% 1,291

In case of the fatal accident, in 2007 the number of fatality of the aged workers is 874 persons, showing an increase by and increases 337 person comparing to 1998, and that it occurs more than the fatality of the workers of 25~39 years old that the number of employed people comes to about 2 times since 2000 can show the severity to the fatal accident of the aged workers. Seeing the foreign example that the fatality rate of the workers over 65 years old comes to 2.6 times more that the fatality rate of the workers of 16~64 years old, the prevention of the fatal accident of the aged workers can be very important[5].

It is analyzed that in the type of incidence of occupational accidents of the aged workers, the injury from falling down is 28.5% for entire injuries for 10 years and it occurs the most. It is judged that because the control of posture is difficult as the age gets higher, it occurs much. It is thought that it needs a specialized education to the aged workers, seeing that as the age gets higher, the ratio of STF and fall from the height to hold in the entire injuries by ages increases and the drawing-in · crush decreases. In case of occupational diseases in the aged workers, the brain disease · cardiovascular disease is 31.9%, it occurs the most and the next is 8.0% of lumbago and 6.6% of noise-induced hearing loss. It is analyzed that an particular thing is that in the lumbago, as the age gets lower, the ratio to hold in the entire injuries by ages has increased.

Considering all the change of employment structure and the progress of occurring the industrial injury above, it is judged that the number of victims of the aged workers has continuously increased, and it is analyzed that although a simple comparison is difficult as an analysis about the Injury Status of the aged workers by the type of occupation and the kind of work is not made, there is a difference in the type of incidence of injury from the workers of the other ages. In this point, it needs the specialized support of the safety and health technique and education unlike the common ones for the workplaces to employ many aged workers and the government needs various statistics and the spread of the technique data so that many workplaces can utilize them.

5) Kisner, S. & Pratt, S., Occupational fatalities among older workers, Journal of Occupational and Environmental Medicine, 8, 715-721, 1997

A Proposal for the 31st ICOH Congress

On behalf of the ICOH 2015 bid committee, the Korea Occupational Safety & Health Agency (KOSHA) and the Korean Society of Occupational & Environmental Medicine(KSOEM) are pleased to introduce our proposal to host the triennial International Congress in Seoul, Korea.

1. Summary
   - Date : May of 2015
   - Venue : COEX, Seoul
   - Registration fee : $600~700
2. Motto
   - Global Harmony for Occupational Health : Bridge the World
3. Supporting Groups
   - Ministry of Labour / Seoul Metropolitan Government / Korea Tourism Organization
   - 3,500 professionals from five academic societies(occupational medicine, hygiene, safety, nursing and ergonomics)

A Leading Occupational Health & Safety Organization, KOSHA!

Since the establishment in 1987, KOSHA has persistently made every effort to meet our goal of building a safe and healthy environment for all workers throughout Korea and beyond. To this end, we have held the annual Korea Occupational Safety and Health Congress for more than two decades. Based on this long-time experience, we successfully hosted XVIII World Congress on Safety and Health at Work in 2008, recording the biggest number of participants and the highest level of satisfaction in its history.

Safety and Health Summit

A True Convention City, Seoul!

Seoul is a unique city where state-of-the-art technology and traditional culture coexist in dynamic harmony. A number of invaluable cultural assets in Seoul mirror its 600-year history. With its high-quality IT and socioeconomic infrastructure, Seoul has successfully hosted a number of prestigious international events like the 2002 FIFA World Cup, the 3rd ASEM Summit in 2000 and the 12th World Conference on Lung Cancer in 2007.

UNESCO World Heritags in Korea

I still vividly remember the exciting moments of the 2008 Seoul World Congress. KOSHA would like to once again invite all distinguished ICOH members to an even more inspiring, insightful and successful gathering - 2015 ICOH Congress in Seoul Korea.

Sincerely yours,

M. K. Noh

Noh, Min Ki
President of KOSHA

한국산업안전보건공단
KOREA OCCUPATIONAL SAFETY & HEALTH AGENCY