

Special Article

Advanced Korean Industrial Safety and Health Policy with Risk Assessment

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This article describes a systematic roadmap master plan for advanced industrial safety and health policy in Korea, with an emphasis on. Since Korean industries had first emergence of industrial safety and health policy in 1953, enormous efforts have been made on upgrading the relevant laws in order to reflect real situation of industrial work environment in accordance with rapid changes of Korean and global business over three decades. Nevertheless, current policy has major defects; too much techniques-based articles, diverged contents in less organization, combined enforcement and punishments and finally enforcing regulations full of commands and control. These deficiencies have made it difficult to accommodate changes of social, industrial and employment environment in customized fashion. The approach to the solution must be generic at the level of paradigm-shift rather than local modifications and enhancement. The basic idea is to establish a new system integrated with a risk assessment scheme, which encourages employers to apply to their work environment under comprehensive responsibility. The risk assessment scheme is designed to enable to inspect employers' compliances afterwards. A project comprises four yearly phases based on applying zones; initially designating and operating a specified risk zone, gradually expanding the special zones during a period of 3 years (2010-2012) and the final zone expanded to entire nation. In each phase, the intermediate version of the system is updated through a process of precise and unbiased validation in terms of its operability, feasibility and sustainability with building relevant infrastructures as needed.

Key Words: Risk assessment, Model project

Introduction

In Korea, industrial safety and health policy started with the enactment of labor standards law in 1953. Rapid development of heavy and chemical Industry in 1970's and 1980's led to

the foundation of the Industrial Safety and Health Agency 1987 and then in 1990 the relevant acts were entirely revised in order to establish standards and management system that are appropriate to apply to a variety of industries most of which are toxic and of anti-environment. Since then significant efforts have been made to upgrade and advance the relevant policies in pace with changes of industrial safety and health that came up with global competition of world business and economy crisis, and thereby, rapid change of market demands.

Nevertheless, current industrial safety and health act needs to be improved. Table 1 shows hierarchical structure of the industrial safety and health act.

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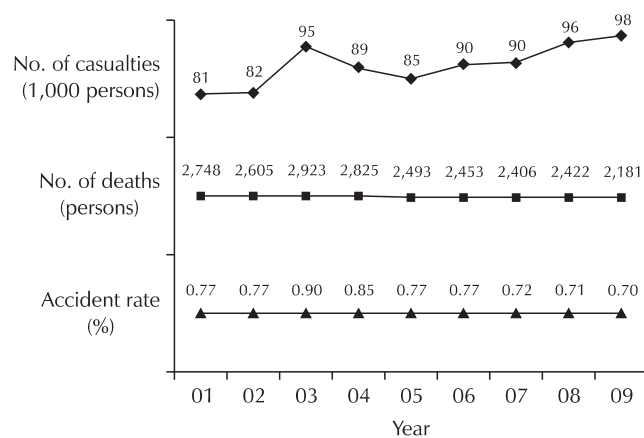
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Table 1. Hierarchical structure of the industrial safety and health act

Base law (Constitution)				Laws (criminal punishment cum economic sanction)
Industrial safety and health act (Law)				
Enforcement decree (Presidential Decree) of the industrial safety and health act				
MOEL ordinances (4 ordinances)				
Enforcement Regulations	Safety rules	Health rules	Rules on restricting employment in harmful and dangerous work	Administrative regulations
Technical guidelines and work environment standards (notices), rules and instructions				

**Fig. 1.** The trend of accident rate.

The structural problem is that entire industries are regulated by a magnificent number of regulations (e.g. approximately 1,000) and 74 notices under one comprehensive legal system, and 70% out of regulations are about technical issues, which represents that the internal structure of the legal system is not well organized.

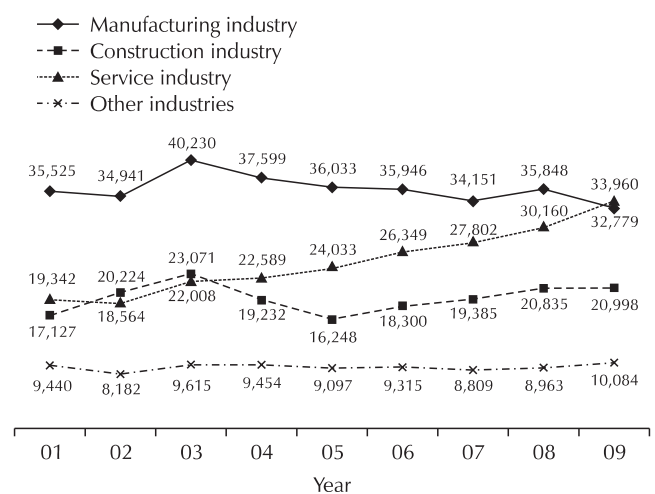
Regulations and enforcement tend to be specific to individual item in the state of disorganization.

Most parts of regulations are articulated in a way of an application of combined prior-enforcement and ex-post-facto-punishment rather than compulsory statements to employer beforehand.

Regulations make enforcements of commands and control rather than the implementation of a system of guiding to systematic voluntary management of hazardous agents and self-control over risks (Table 1).

These deficiencies have made it difficult to accommodate changes of social, industrial and employment environment in customized and responsive fashion.

Current law has a limitation to control the number of non-standard workers and the frequency of accidents to workers

**Fig. 2.** The change of circumstances of industry (Unit: person).

employed in service field because it is likely to be in favor of standard workers and manufacturing industry.

Item-specific regulation system is deficient to deal with the number of a variety of types of accidents.

The complexity of the Industrial Safety and Health Act often confuses both employees and employers, resulting in negative and passive commitment of its compliances. This is shown in Fig. 1, where accident rate remains stagnant with 0.7% over the past 10 years which reflects intensifying reliance on government (Fig. 1).

Fig. 2 shows how each category of industries have changed over years, saying that it has been becoming more difficult to accommodate circumstances securing effective application of regulations. The percentage of the service industry ever increases (workplaces: 59%; workers: 42%). Share of casualties in service industry increases from 23% ('01) to 35% ('09). The number of casualties among vulnerable workers (females, elderly persons, migrant workers, etc.) increases every year. It should be noted that accident ratio increase from 37.4% ('04)

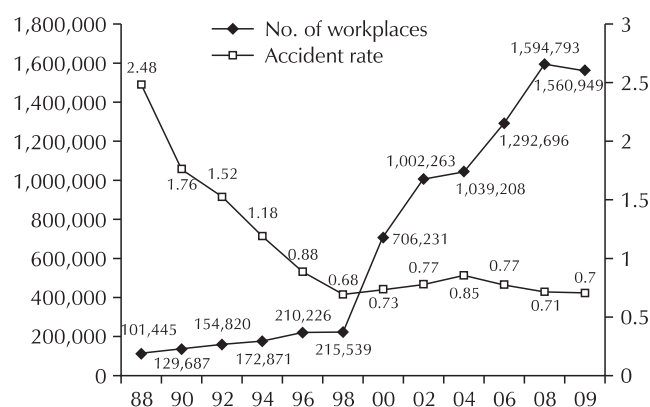
Table 2. Penalty against violation ('04-08) (Unit: person)

Classifi- cation	Total	Successfully prosecuted				Non-prosecuted					Disconti- nuance of prosecu- tion	Disconti- nuance of testifier
		Sub- total	Trial		Summary indict- ment	Sub- total	Stay of prosecu- tion	Clear from suspicion	Not guilty	No right of arraignment		
			Imprison- ment	Without detention								
2004	7,687	6,606	15	89	6,502	1,056	447	558	-	51	15	10
2005	6,537	5,050	5	50	4,995	1,476	672	764	-	40	8	3
2006	4,496	3,368	3	116	3,249	1,119	507	567	-	45	9	
2007	4,490	3,487	3	93	3,391	1,000	396	570	-	34	3	
2008	4,251	3,248	2	172	3,074	995	359	578	-	58	8	

Prosecution service, Crime Analysis, 2004-2008.

Table 3. Effectiveness of regulation

Total	Action taken					
	Stop work	Stop use	Penalty fee		Correction order	Recommendation
			No. of cases	Amount (10,000 KRW)		
1,398 cases	92	159	204	54,000	802	141

**Fig. 3.** The trend of number of workplaces.

to 45.1% ('09) and chemical consumption increases from 234 million tons ('98) to 364 million tons ('06) (Fig. 2).

Table 2 is about penalties against violation, questioning an effectiveness of the regulation, as the number of successful prosecution has been very limited (Table 2).

Investigation and supervisory actions at large scale would be taken for the workplaces where multiple significant accidents occurred. In 2009, a group of inspectors supervised a Korean shipbuilding corporation for 10 days, and found approximately

1,400 violations as specified in Table 3. With this number, we can question on whether the owner did not or could not observe the regulations. Another question is that the accidents will not occur if the correcting actions are all taken (Table 3).

Fig. 3 shows the trend of number of workplaces with limited number of prevention resources. The number of workplaces doubled from 706,231 places ('00) to 1,560,949 places ('09), however, the number of prevention personnel remained almost unchanged at 1,000 during last 10 years (Fig. 3).

Therefore, the paradigm of current system needs to be shifted. In political aspects, the industrial safety and health policies should shift to the responsibility of the owner from the government regulation system, adopting a risk assessment scheme. In execution aspects, we need to change the way of inspecting for workplaces. Upon the employer's responsibility for managing risks for employees, on one hand, prior-regulation for determining whether or not the compliances of the Industrial Safety and Health Act is committed will make the case-specific regulation more effective, on the other hand, the inspection on systematic ex-post-facto-regulation is to be strengthened. In performance aspects, the adoption of risk assessment scheme will encourage employees to apply the system to their work environment in more proactive, positive

fashion. On the same page MOEL made a decision to adopt and apply a risk assessment scheme to entire industries.

Experiences on Legalization of Risk Assessment Scheme

Korea has established a standard for evaluating harmfulness and hazards in industry and then enforced to apply it to a set of industrial fields as follows.

- Chemical industry: process safety management (PSM) system
- Manufacturing and construction industry: a harmfulness and hazard prevention plan
- The assessment of the harmfulness and hazards on musculoskeletal disorders, work environment, occupational stress agents and chemical substances

Table 4 lists examples that are more detailed (Table 4).

Executing Project for Constructing Risk Assessment Scheme

The Korean government has made significant efforts on

applying the risk assessment scheme as follows:

- Adopt the risk assessment scheme to the second 5-year plan for industrial disaster prevention of MOEL.
- Develop/supply risk assessment standard models to 1 construction and 65 manufacturing sites, respectively and afterwards recommend making proactive use since 2006.
- Add responsibility on risk assessment to owner's comprehensive duties as prescribed in the Industrial Safety and Health Act in 2009.

There are several successful experiences in risk assessment.

From the 1960s, Korean industries have been encouraged by the government to nurture heavy and chemical industry and to modernize the economics and industrial structures. Therefore, the hazards from potential accidents such as fire and explosion or release of toxic chemicals have also increased. As the chemical companies recognized the importance of preventing major hazards, Process Safety Management (PSM) system for preventing major industrial accidents was introduced in January 1995 by amending Industrial Safety and Health Act, and it has been enforced from January 1, 1996. The PSM system comprises major four elements, based on risk assessment

Table 4. Examples of partial application of the industrial safety and health act

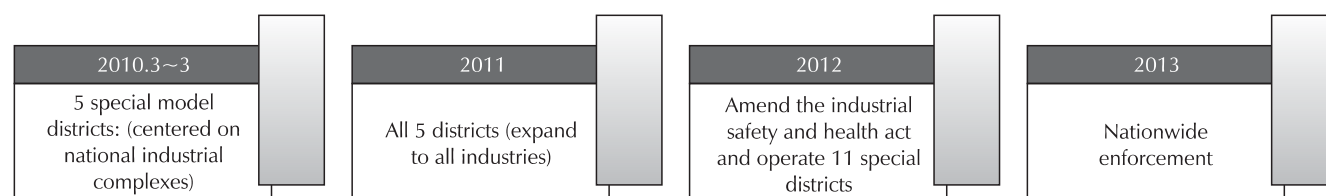
Item	Basis	Summary of the system
Safety and health diagnosis	Article 49	When inspecting workplaces experiencing many and frequent accidents, check the risk factors associated with machines, devices, equipment, process, materials, or falls
Process safety management (PSM) system	Article 49-2	Use the risk assessment technique of the checklists and HAZOP at the chemical plants to conduct risk assessment qualitatively and quantitatively covering the overall process
Harmfulness and hazard prevention plan	Article 48	Identify in advance the risk agents (falls, struck by falling/flying objects, fires or explosions) associated with installation, relocation or change in the manufacturing and construction industries
Risk assessment on musculoskeletal disorders	Health rules Chapter 9	Qualitatively and quantitatively assess the harmful agents of work related to musculoskeletal burdens through questionnaires or interviews, checklists, or NIOSH guidelines
Testing work environment	Article 42	Check the exposure level using appropriate test methods by taking samples or by directly checking
Survey of occupational stress and hazard agents	Health rules Article 14	Using a questionnaire, check the causes of occupational stressor in relation to the work environment, type of work, and working hours
Assessment of the harmfulness and hazards of chemicals	Article 39	Test and check the physiochemical properties of the materials containing chemicals through such means as test of harmfulness to determine danger to the human body

Table 5. Number of major industrial accidents in PSM sites (Unit: EA)

Year	Total	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09
Number	134	20	20	11	8	10	6	8	18	11	5	3	4	6	4

Table 6. Accident cases of D heavy industries and construction co.

Item	2004	2005	2006	2007	2008	2009
Accident rate (%)	1.82	1.49	0.84	0.34	0.38	0.4
No. of injuries	101	72	30	12	14	16

**Fig. 4.** Project execution plan.

as the most important key element. Its implementation and operation over 14 years have made magnificent achievements; while regular and fatal accident rates have decreased, both productivity and product quality have increased as shown in Table 5.

As another successful example, a risk assessment scheme was applied to the project, “Occupational Safety Health Management System (KOSHA18001) Certification” in 1999. In general, the system evaluates a company's management structure to check whether it meets the requirements of KOSHA 18001 system on the purpose of voluntary participation to occupational safety and health management system. Risk assessment process is the key element at the stage of planning. Through the process of assessing potential risks, the level of safety and health can be identified, which becomes vital sources for establishing occupational safety and health activity promotion plan. Table 6 shows how KOSHA 18001 was beneficial. For example, since D Heavy Industries and Construction Co. obtained KOSHA18001 Certification in 2004, D had remarkable decrease of industrial accidents (1,500 potential risk factors on monthly average identified and removed in advance) (Table 6).

The project initiates with the infrastructure build-up through a set of intermediate test phases, and finalizes with full application of the system by its legalization. Basic execution steps are described as follows:

- 1) Make advertisements for an enhancement of the relationship between labor and management.
- 2) Upgrades infrastructure customized.
- 3) Process Legalization and then facilitate the final version of system nation-wide.

A set of intermediate phases are based on zoning for applying beta version of risk assessment scheme, designating and operating it in a specified zone, and gradually expanding zones

during a period of 3 years (2010 - 2012) as shown in Fig. 4;

- Phase 1 (2010): Designate and operate in 5 industrial complexes as special zones.
- Phase 2 (2011): Expand to all administrative districts to which the zones belong.
- Phase 3 (2012): Amend the Industrial Safety and Health Act
- Phase 4 (2013): Expand to all workplaces in the nation (Fig. 4)

Under the condition of voluntary participation in the program, many benefits will be provided; free training/consulting services, exemption from supervision and preferential financial support. We secure a driving force in collaboration with the MOEL, Korea Occupational Safety and Health Agency (KOSHA) and civilian sector. We plan to make a survey to evaluate how much the system is settled and manage the system on annual basis with performance appraisal.

Task Force for the Project

MOEL is to take charge of the project as a leading module. Task Force (TF) team comprises the MOEL, KOSHA and consulting agencies, TF will be a basic framework for executing the project, involving major policy-making, operation, performance evaluation and management, as shown in Fig. 5.

Fig. 6 shows the procedure for the implementation of the system.

Approximately 11,600 manufacturing industries that locate in five national industrial complexes such as Namdong, Daeduck, Hanam, Sungseo and Noksan will be subject to participate in the model project. The number of workers is approximately 205,000.

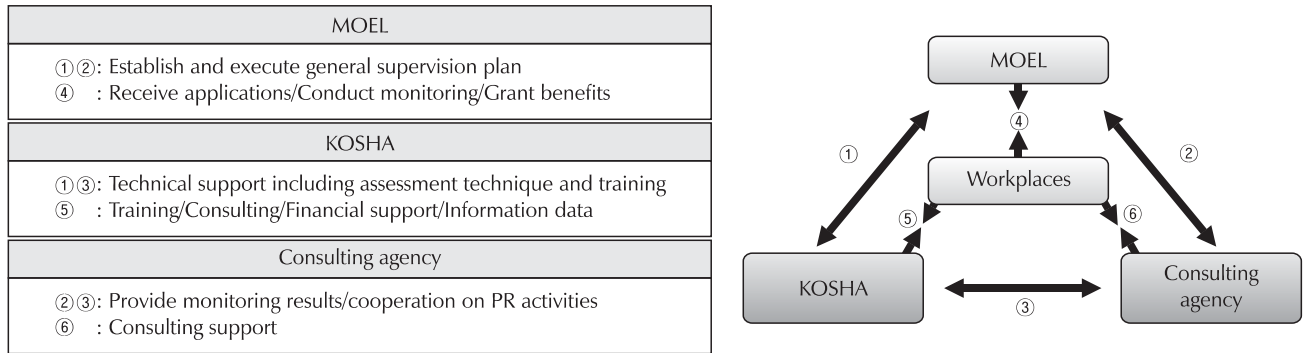


Fig. 5. Role of project members.

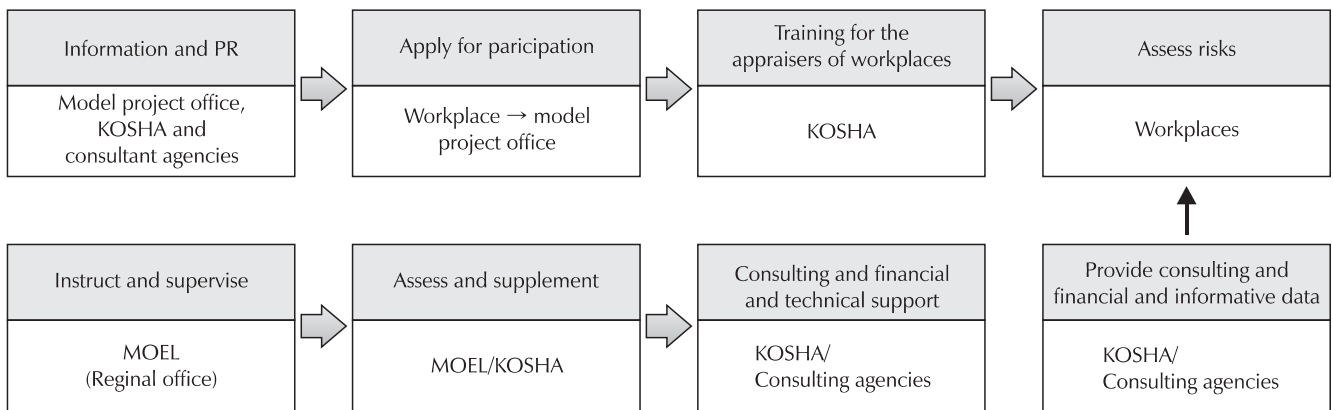


Fig. 6. Implementation procedure.

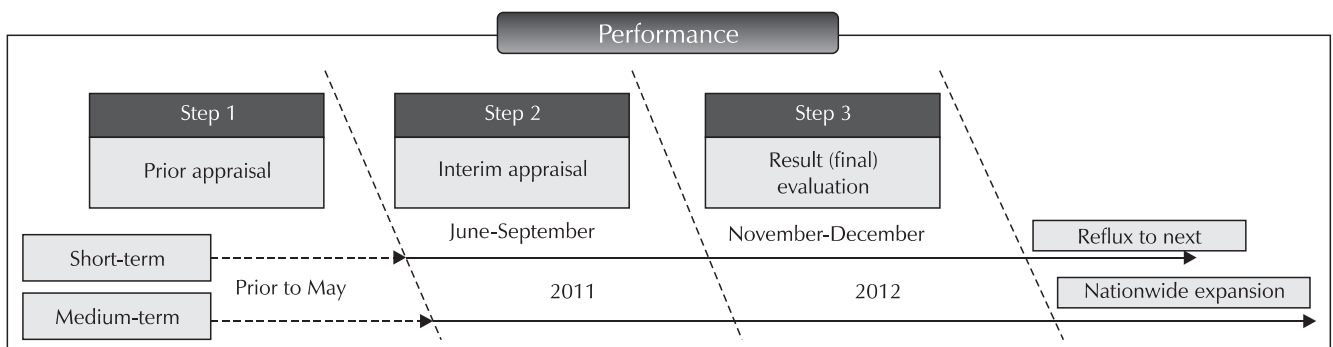


Fig. 7. Performance evaluation plan.

Initially MEOL and KOSHA are intended to develop evaluation techniques and prepare/ distribute manuals e.g. 4M (65 small industries), Checklists/What-if (200 equipment types and 10 major multiple-type checklists by 66 manufacturing industries) and HAZOP, and provide reference materials on the evaluation technique, examples of evaluation and cases in foreign countries through an online system.

KOSHA and consulting agencies have already completed

training courses for instructors from MEOL. Training program by KOSHA for about 3,000 appraisers of workplaces is ready to run and on-the-spot training will be available for small workplaces as well.

TF will make the program public to the companies in the special zone, in distribution of business information leaflets (15,000 copies) and press media advertisement (1 type). The surveys on the program in terms of understanding and attitude

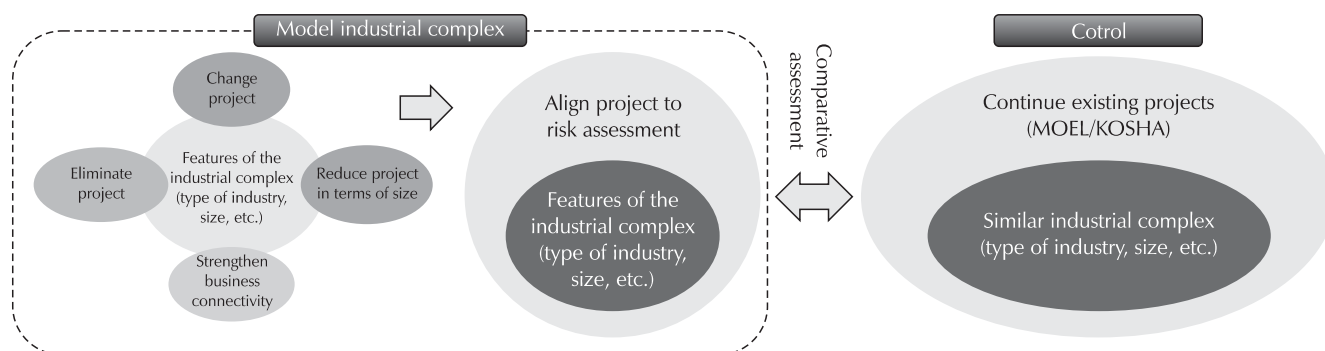


Fig. 8. Performance evaluation groups.

and performance evaluation programs will be conducted before and after executing the model project at each phase.

Performance Evaluation Plan

Fig. 7 shows performance evaluation plan comprising surveys and performance appraisals.

The survey is intended to check how much owner/workers/safety-related personnel understand and think of the program. It is scheduled three times; before commencing the project, at the end of year and when the final project is completed. On-the-spot surveys are also available using a sampling method based on structured questionnaires. Prior-surveys will be conducted for approximately 1,400 places (15%) as of 2010.

Two key factors for the performance appraisals are expansion rates and reduced accident rates. Performance appraisals require a variety of inputs, outputs, and outcome indexes. We need to make performance appraisal process secure in terms of its objectivity and reliability. To do so we compare it to similar industrial complex group as shown in Fig. 8.

Expected Effects

In the aspect of protection of workers, the responsibility of the Owner by imposing comprehensive obligations for preventing accidents and resolving the problem of blind spots in taking safety and health measures will be strengthened. Thus, workers for themselves can contribute to the prevention of accidents by understanding the harmful and dangerous factors accurately that can cause damage to workers. In the aspect of management of workplaces, voluntary preventive actions can be achieved in collaboration between labor and management sides in neither any government's interference nor government's guidance and supervision.

As owners take comprehensive responsibility on risk as-

essment, along with voluntary management of safety and health, it might turn out as a highly efficient investment by taking preventive actions as needed rather than enforced by relevant laws. It is expected that consulting services for supporting activities of risk assessment would be activated in many workplaces. In the aspect of government intervention, government becomes less intervene as owners take major responsibility based on the system, which ends up with the system inspection approach. This should enable to achieve the standardization of government's instruction/supervision, to diminish administrative workloads and thereby to manage supervisory personnel in versatility. The amendment of relevant regulations becomes less frequent, which would help government innovate administrative regulation system.

Conclusions

A systematic roadmap master plan for advanced industrial safety and health policy in Korea with an emphasis on risk assessment scheme has been detailed in order to overcome limitations and defects embedded in current industrial safety and health act. The deficiencies include too much techniques-based articles (70%), contents of divergence by too many different item-specific regulations, the application of combined enforcement/punishments and finally lack of self-controllability over risks. The generic approach to the solution is addressed as a 4-year roadmap plan that is to establish a new industrial safety and health system with an emphasis on risk assessment scheme. Basic idea is to encourage voluntary participation of owners and workers under comprehensive responsibility through the new risk assessment scheme. The project will be launched and go through 4 yearly phases with evaluation processes (2010-2013), targeting the implementation of a nationwide version of system at the end of final year.

If the model project is successfully completed and then

the risk assessment scheme is operated nationwide in Korea, there will be tremendously good outcome with respect to the protection of workers, management of workplaces and government intervention. Finally, the introduction of risk assessment into Korean occupational safety and health regulations will contribute to keep the low accident rate stagnant for last 10 years.

Future Plans

In 2012, the legal system will come up with an upgraded version. The set of articles related to detailed risk assessments in the Industrial Safety and Health Act will be inserted. The government will legalize the detailed articles for the Owner's obligation compliances as Presidential Decrees (Ministry of Labor ordinances) and its technical prescriptions in Notices (standards). Risk assessment related items such as principles, methods, and procedures will be inserted by the process of legislation in order for the Owner to take into account. Notices (standard) will include subjects, time of assessment, information on risk assessment, verification method, the calculation of risk levels, and actions for reducing risk levels. At the same time, the existing articles similar to risk assessment, e.g. safety diagnosis and harmfulness tests will be updated.

The way of supervision and instruction by government is going to be converted into a system inspection approach that only requires checking for appropriateness and operability of risk assessment scheme. Autonomy at workplaces is supported as much as possible; however, non-compliances will be heavily penalized.

We need to install a system environment that integrates risk assessment to service system e.g. technical support, maintenance, as opposed to conventional service that is non-standard, local and case-specific trainings. Good references include safety health management system (KOSHA 18001), Process

Safety Management (PSM) and Hazard Prevention Plan.

Intensive efforts should be made on having the system settled in nationwide; nurturing risk assessment experts, organizing steering committees and focusing on small and medium-sized workplaces for their capability for self-assessment and self-management.

Finally, we also need to make efforts on detailing execution procedures (including basic principles, evaluation techniques for risk assessment scheme) in the format of KOSHA code, as far as the autonomy of workplaces does not have negative effects, and developing a variety of new additional models that can be applied at workplaces as many as possible.

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