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A research on a supporting program for Emergency Preparedness Plan in Korea

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Emergency preparedness plan (EPP) is a systematic management of activities involving a material degree of risk of loss or other damage to the surroundings (people, property and environment), and the boundary of accident recovery plan (ARP). The main purpose of the program is giving a safety management system to each facility in order to give an ability to prevent accident and to control accident immediately. The EPP includes not only typical safety-related documentations such as material safety data sheet (MSDS), standard operation procedure (SOP), emergency response plan (ERP), but also geometric information system (GIS) and accident recovery plan of each facility. EPP is established based on the preliminary safety analysis involving risk identification, assessment and prevention plans. Also the program is helpful for government or related agencies to control a number of accidents in small-scale companies in the whole country.
Since the EPP have been revised in 2006, we have known that the 70% of related agencies are the small-scale companies and they have a problem that they can't make the report by oneself. And more than 30% of related agencies submit the disabled reports. Therefore we should study the method to improve effectiveness.
The final purpose of this research is to make a supporting program of EPP. And we find a problem in the former program for the effectiveness operation and settlement by this research. Then we should minimize the waste time and provide the convenience to user.

1. Introduction

In 1984, explosion of a chemical plant in the Bhopal city is one of the worst disasters in industry. Since this incident has happened, toxic chemical materials become the issue in all countries of the world. And the people who work in the safety area worry about the possibility of incidents in chemical industry. Developed countries which are the US, EU, Japan classify the materials considering the characteristic of the physical and chemical property. From this they make out scenarios and prepare the guidelines to strengthen control systems which make the DB that can be used on the spot when the emergency occurred.

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Currently, the amounts of the chemical production are rapidly increased. But there are serious incidents concerning harmful chemicals so far until a recent date. Because the chemical plants of small and medium size are not built deliberately and developed nearby a residential area. When serious industry incidents occur like the leak, fire, and explosion, it is true that riskiness of incidents is relatively high like loss of economic and life.

Since EPP is revised newly, the searches of work condition in chemical plants are carried out. So we could know that the 70% of plants are small and medium size plants and they have difficulty in reporting EPP and also 30% of plants hand up the EPP that is impossible to use. So we need to find the plan to raise the effectiveness in reporting the EPP.

2. The search of the demand on the spot

2.1 The selection to survey plants

In Korea, there are 423 plants reporting the EPP to the Ministry of Environment. Most of the plants which have to report EPP are the small and medium enterprises. So they have problems reporting the EPP. To find the problems on the spot, we carry out the survey of safety supervisors. Because the distribution of the plant is different as regional, material used, amount used, amount of stock and so on, we consider that distribution.

Through this survey, we could know that Han River Bassin Environmental Office has the most plants with 113. After this manner, the plants are decided to survey. It is the result that 12 plants are decided in Han River Environmental Office, 10 in Nakdong River Environmental Office, 3 in Yeonsan River Environmental Office. We consider this results to select the workplaces to survey.

2.2 The contents of the survey

In this study, we visit the whole country to make up questions about the problem reporting the EPP. There are many small plants and they do not have a safety supervisors. So they have difficulty reporting the EPP.

We survey the workplace as scholarship, major, scale of plants, the number of employee, the method to write the report, the method of risk assessment. In consequence, we could know that there are no safety supervisors and the EPP is written by the safety supervisors who don’t have expert knowledge about the chemical. And many workplaces which are small size and have small enough employee are distributed.

To provide the convenience of user, we use existing document and provide the various DB and background knowledge. To develop the RA program, we simplify the RA Program and develop the optimized program and guarantee the preservation and stability. To develop the program checking submission, we maximize the convenience of user and check whether it is target of submission or not.

Fig. 1 shows the present condition about the RA of workplaces reporting the EPP. More than 80% of 423 workplaces arbitrarily write the RA and don’t write the RA. Because present RA system is not suitability to small and medium workplace, they do write the RA in proper order. So we need to make a simplified RA system.

3. A new simplified RA system

3.1 The analysis of RA system

There are four models in the RA(Risk Assessment) system in leak, dispersion, fire and explosion. In the leak model, there are 3 cases of leak like as the condition of materials in liquid, gas, ideal leak. Each cases have two case of leak in pipe and vessel.

Generally the dispersion model is divided by light and heavy gas. In case of light gas, there are two models like Gaussian plume and puff model. Gaussian Plume model can be used to estimate ground-level concentrations (glc) of pollution coming from a source of pollution. The puffs are assumed to have Gaussian or bell-shaped concentration profiles in their vertical and horizontal planes.

In case of heavy gas, there are four models like BM, HMP, DIGADIS and SLAB model. BM model is used to calculate the level of the materials when the momentum is ignored. HMP model is used when the stability of air from E to F. DIGADIS model can be used to model the horizontal jet emission or emission from the ground.

In case of fire model, there are four cases of fire like pool, jet, fireball and flash fire. A pool fire involves a horizontal, upward-facing, combustible fuel. The term implies the fuel in the liquid phase (pool), but it can also apply to flat slabs of solids fuels which decompose in a manner similar to liquids. A jet fire is made by the compressed or liquefied gas leak in the hole. The main hazard from the site is an escape of gas and ignition leading to a large fireball. It frequently bring the BLEVE. A flash fire is made by the leak of inflammable volatility materials. It makes the radiant heat in the process of combustion.

3.2 The comparison of K-CARM and ALOHA

To make the risk assessment, we compare with the existing risk assessment programs, like K-CARM and ALOHA. K-CARM of IRMS in Korea and ALOHA of RMP in US are the representative assessment program. Through these comparisons, we could find that there are some problems to use the existing risk assessment programs. When we use the RA programs simplifying the parameters, there are some differences in the result of the programs as the conditions. To solve these problems, we need to minimize the variables, consider the regional characteristic in Korea, make the slight program for user and command DB system.

4. A new web-based EPP system

4.1 DB system

Because the amount of the EPP DB and complexity of DB management is small, we would like to use the MySQL DBMS for the efficiency and accomplishment in the data of the small capacity. After we search the duplicated items in the EPP, protect the duplication of the DB. In the items of the EPP after we search the items that are subordinate to each other, use it for integrity in DB. In the items that are organizing the DB of EPP, we classify the items weather frequently demanded or not. It is important work for index operation when the search function is needed. After this manner, we design the components of DB through the ER (Entity-Relation) process. We make the

DB system designed by the ER process into the Meta-data and store it in the inside of the DBMS (DB Management System).

4.2 EPP system module

The system modules of this program are followed

- The module of member's control and logins
- Database module
- The module supporting the input
- The module for administrator

In the module of member's control and logins, the information which is the number of workplaces and the name of business and representatives, the contact address of the official is considered. Also, for the security, we make the module receiving the passwords. By storing the database which is already written, the module can input the data of EPP in order of precedence.

In the Database module, dangerous materials of MSDS use the data from the CCSM(Center for Chemical Safety Management) in Korea. Because we store the information on contact address of the fire stations and concerning business and make the prevention equipment into the DB and store the DB with system, the users of this system could easily read and search the data.

In the module supporting the input, it contains the module that can confirm the reports at any moment and can easily use interaction to input the date reporting the EPP.

In the module for administrator, it is divided into three modules, like prevention controls, statistics, management and admission. It automatically controls the validity period by making the prevention equipment into database. When the updates are required, the program informs the administrator of it.

4.3 User friendly program

In this study, we analysis the considerations using the web-based reporting program. There are items of document style to report the EPP. From the data of survey on spot, we could have the information of the problems reporting the EPP. So we import the data which is the result of the survey to the RA(Risk Assessment) system.

To make a user friendly program, we make the general template. Fig. 2 shows the formation of the organization in safety management. In this formation, the data can be inserted by the user or text in the inside the table. And this formation template is made similar to MS Office.

Fig. 3 shows the formation of the emergency net of department and employee. Fundamentally it use the blueprint like formation of organization. When insert the data of emergency communication system, the information of emergency organization is stored and the main regional contact address of workplace can be selected automatically.

Fig. 4 shows the formation to insert the range of people living near the plants and plan of shunt. In case of the step-by-step management plan, the explanation of drawing is required. Because existing EPP is not enough for template, we have a problem to define the adequate template. So we make a program inserting the drawing of image form.

From this information, the interface that the information is inserted as text form is offered. Finally we could add the data to the electronic document accordingly.

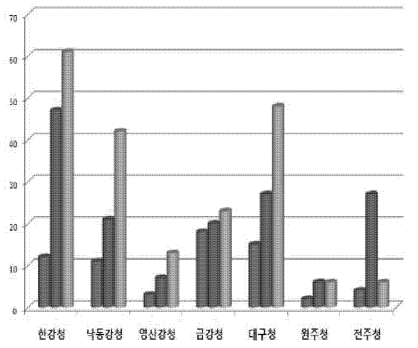

Fig 1. RA condition of workplaces

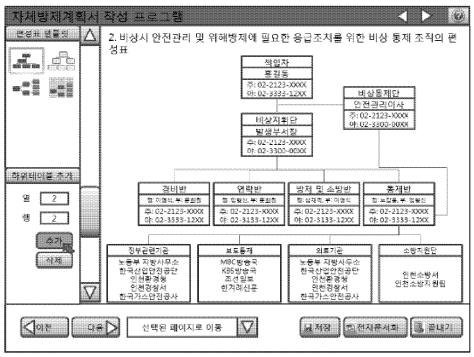

Fig 2. Organization chart of program

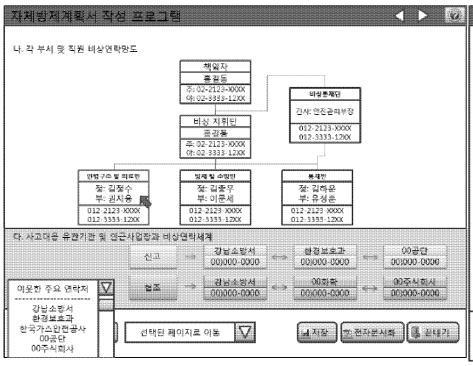

*Fig 3.E*emergency net of department

Fig 4. Result of RA program

5. Result

In this study, when In this study, when the domestic workplaces write the EPP, we would like to provide writer of EPP with convenience and minimize the waste of time and maximize the efficient management of organizations receiving the EPP. For this study, we lead out the direction of the study through the survey contents of the workplaces which are the 46 (10%) of the 423 workplaces and government agencies which are the 11 places.

To make the EPP program efficiently, we should search the reporting system currently performed at home and abroad and talk over the difficulties with the safety supervisors in workplaces and government. After this manner, the foundation study should be made. Above all things, to settle down the EPP system, it is important that the publicity, education and sense of security are continuously achieved.

6. Conclusion

1. We analysis the safety management report which is operated in Korea, like PSM and SMS. Through the problems in another reporting system, we find the solution of problems and reflect it to the EPP system. And we search the web-based safety management system in Korea, like IRMS and SIMS, and set up a benchmark. Finally, we suggest user-friendly design condition and work condition to store the itemized data and standard report system which is suitable for small and medium workplaces.
2. To reflect the actual condition of safety management and write the report EPP easily, we directly search the demand by interview with safety supervisors in workplaces and government agencies. These analyses by interview reflect to this study. For the efficiency in registration management of statistics and data, we search the requirement of the safety supervisors who receive the EPP in the government agencies.
3. By the analysis and reflection about the items which are need the definition of data and practical use of statistics; we define the items that are available on computation statistics. Through the interview, we design the visual GUI reflecting the characteristic of user and present the client GUI writing the EPP.

Applying these three items as above, we perform a study of the analysis comparing the diversity safety management report and web-based report system. In case of the program development, we exclude the duplications writing out the report. Basic material information and prevention facilities are loaded. And we make the education information of incident response process into DB by size. Additionally, we studied the risk assessment program that can be occurred in the workplaces as materials. Also, we planned the education and publicity for the system settlement that is the purpose of this study.

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