An Innovative Model of HSE Risk Management Applied in First-line Organizations

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Abstract
In this paper a new model of "two documents & one checklist" was presented. The model was applied in first-line organizations to ensure that workers integrate HSE requirement into daily work to prevent accidents. The underlining principle and application of the model, as well as the document structure and steps of compilation were described in the paper, through which the model is explained thoroughly. Now the model has received wide recognition and application.

Key words: HSE, risk management, first-line organizations

1. Introduction

Petroleum & petrochemical industry is an industry with high risk, both in exploration and development of oilfields and in processing and production at refineries. Nowadays, most of the major international petroleum companies have implemented the HSEMS (Health, Safety and Environmental Management System) or its equivalent to control the high risks (Hu et al , 2006). The core of a HSEMS is HSE risk management. It is the ultimate goal of any HSEMS to prevent accidents by improving HSE risk management at first-line organization level. Based on the idea to control the risk at first-line organization level, the model of "two documents & one checklist"(CNPC , 2001) was developed and improved little by little with years of experience of implementing and operating HSEMS. The model was implemented in first-line organizations operating in both fixed and non-fixed locations, to raise employees risk awareness and to improve quality of HSE risk management. The end result would be sustainable improvement in HSE performance.

2. Structure and Principle of the Model

As the name suggests, the model contains two documents and one checklist. The first document is "work-post HSE guide", and the second document is "project HSE plan". Both documents are designed mainly to guide workers to work or operate in a standard and safe manner. The checklist is designed to verify whether the condition of the workplace such as machines, equipments, tools and so on, are safe or not. The application of "two documents & one checklist" in first-line organizations ensures that not only workers operate according to standard procedure but also that the workplace is kept in safe condition. By eliminating the two underlining causes of most accidents, namely unsafe action of workers and unsafe condition of the workplace, the model is quite effective in accidents prevention (Hu et al, 2010).

When categorizing hazards by their sources, two groups may be defined. One group of hazards is that inherent in specific processes, such as well-blowout in well-drilling, explosions or fire in refining, and vehicle incidents in transportation, etc.. The other group is that resulting from circumstantial changes, such as the change of person, equipment, technology, environment and so on within a specific project (CNPC, 2001). One of the characteristics of the hazards inherent in specific processes is that they are associated with certain specialty or industry type. For example, the hazard of well blowout occurs only in well-drilling operation of oil field development, not other industry such as refining, construction, or transportation, etc., so it is a specific hazard of process of well-drilling. The workers in the work posts should have the ability to prevent incidents resulting from this kind of hazards and the skill to mitigate their effects if they do happen (Donna, 2004).

In order to meet the demand, the "work-post HSE guide" is thus developed according to every specific work post (job position) or specialty to focus on this kind of hazards. The "work-post HSE guide" of well-drilling such as "driller HSE guide" is aimed to prevent or mitigate chronic and acute effects of accidents such as well blowout resulting from the risks of hazards associated with well-drilling work posts (job positions). The other characteristic is that this kind of hazards will remain unchanged as long as the work object, equipment, technology, and those being interrelated are not changed.

For example, the hazard of well blowout exists in well-drilling operation home and abroad, in the past and at present, and it will remain unchanged in the future as long as the high-pressure oil or gas reservoir is open up by the normal method. Since these hazards remain unchanged under the condition that the work object, equipment, technology, and those being interrelated are unchanged, the control measures for these risks, once developed, remain effective for a long time to ensure risk control performance. Only when permanent changes such as improvement of equipment and technology occur, shall the "work-post HSE guide" be modified (As for the management of hazards resulting from their temporary change, they will be addressed by the other document, "project HSE plan") . An example would be when mechanical rigs were replaced by electric rigs as result of well-drilling technology advancement. The hazards associated with electric rigs are different from those associated with mechanic rig, so are the risk control measures. In this case, the "work-post HSE guide" should be modified as a result of the permanent change and remain effective until the next permanent change. In a nutshell, the feature of the "work-post HSE guide" is that it is relatively constant and can be used for a long time once being finished for the characteristic of the hazards it manages.

The hazards resulting from circumstantial changes, just as the name implying, come from changes specific to the conditions of a particular project or activity, such as the temporary change of personnel, environment, technology, material and equipment and so on within a specific project. These hazards are not closely related to any specialty or industry type. The characteristic of this kind of hazards is variability. They are different from one project to another. The second document of the "two documents", the "project HSE plan", is designed to control this kind of hazards. The "project HSE plan" must be developed for every project or activity. The reason is that each project has its own uniqueness, which means every project has different circumstances and conditions, hence the circumstantial changes. The hazards resulting from these circumstantial changes are different from one project to anther, and so are the measures to control the risks of these hazards. Every project therefore should have its own HSE plan to deal with its unique issues. In addition, it shall be emphasized that before modification on the "work-post HSE guide" is completed if there is any permanent change, the "project HSE plan" shall address the hazards resulting from both permanent changes and temporary changes. In a nutshell, the "work-post HSE guide" is designed to control the risks of the hazards inherent in specific processes on the one hand, on the other hand, the "project HSE plan" deals with the risks of the hazards resulting from circumstantial changes which are not included in "work-post HSE guide", therefore, both "work-post HSE guide" and "project HSE plan" will cover the management of all hazards need to be controlled in a specific project.

The checklist is designed to facilitate inspection of the workplace condition in which each worker operates. It has the same characteristic as the "work-post HSE guide" that it remains relatively unchanged. Whenever there are equipment changes, it shall be modified accordingly. The two documents control both the risk of hazards resulting from circumstantial changes and the risk of hazards existing in specific process, both of which cover the control of nearly all kinds of hazards respectively, while the one checklist verifies the workplace condition. In this way, through the application of "two documents and one checklist", not only the risks from the unsafe behavior of person can be avoid, but also the risks from the unsafe condition of workplace can also be controlled, most accidents can thus be prevented effectively.

3. Compilation of the "two documents & one checklist"

The "work-post HSE guide" is developed in the following way. A work post (or job position) is selected for analysis. According to the theory of risk management, the analysis contains three main steps (OGP, No. 6.36/210). The first step is the identification of hazards associated with the selected job position. In this step, relevant workers, HSE experts and other resources shall all participate. Hazards to be identified are those arise from the job position activities, and materials handled, etc. There are many hazard identification techniques. A common method is to analyze the work procedure step by step, from preparation, start-up, to end of the work, including maintenance and other potential emergency operations.

The key issue in this phase is to identify the hazards systematically and thoroughly. The next step is to evaluate or assess the consequences and risks of the hazards identified. All the hazards shall be evaluated against screening criteria to control the amount of hazards in a controllable range. By screening and prioritization, risk reduction efforts can be effectively directed to the high risk hazards. The probabilities of occurrence and the severity of consequences to people, environment, and assets are evaluated to draw conclusion on risk level. Group effort by technical staff, mechanical staff, HSE professionals, and other relevant stakeholders, such as regulators and community members, is required to use risk evaluation techniques effectively.

The final step is to develop risk control measures. High risk hazards are selected out, and the measures to reduce the risks are developed accordingly. The best control measure is to eliminate the hazards, followed by risk reduction to a level as low as reasonably practicable. There will be risk control measures developed for hazards identified in one job position, are actions taken by other job positions. In this case, these measures should be grouped according to the action owner. In order to be used more conveniently, the document should be developed according to every work post (job position), it is so-called "work-post HSE guide". If the work would be done through cooperation closely by the other job positions, the work procedures and hazards control measures for these job positions should be combined together as one "work-post HSE guide" for the specialty and used by the relevant post workers within the specialty. The document shall be checked and approved by the relevant authority. Workers shall be trained on the document contents in class or by self learning. It is precisely because the "work-post HSE guide" is relatively permanent, that the document can be expanded to include more and wider contents. Other useful information on HSE besides HSE risk management may be included. If the content is outside the scope of the first-line organizations, the document should be compiled by the enterprise or its specialized companies.

The "project HSE plan" is compiled in nearly the same way as the "work-post HSE guide". One of the differences is that hazard identification and risk evaluation and control is conducted base on a single project instead of work post (job position). The hazards to be identified and evaluated include those caused by the unique issues of a project in various factors, such as the temporary change of personnel, environment, technology, material, machine, equipment, etc. For example, when a drilling team which normally drills wells on flat terrain undertakes a drilling project in a mountainous area, hazards such as mountain flood and rock fall as a result of change of environment should be identified. Another difference between "project HSE plan" and "work-post HSE guide" lies in the timing of compilation. The "work-post HSE guide" can be developed whenever it is required, and then made available to the workers as training material. However, the "project HSE plan" must be written just before the beginning of the project. The reason is that "project HSE plan" is the HSE management plan for the specific project at hand, with the aim of controlling risks resulting from the unique issues of the project. If "project HSE plan" is written too early, the risks associated with the latest details of the project will not be identified, and the document will become meaningless if it is written after the project is completed. Therefore "project HSE plan" must be completed just before commencement of the project. Comparing to "work-post HSE guide", "project HSE plan" is quite simple. For most of the hazards are those inherent in specific processes, they belong to the management of "work-post HSE guide", therefore, the rest of which belong to management of "project HSE plan" is quite less. It is easy to be complied, so it is most practical for the first-line organization to develop. The workers, especially those in the key posts of the first-line organizations, must join in the compilation of the document. By participating the project HSE risk management activity, these workers will become familiar with the risks associated with their own posts to ensure risk control effectiveness.

The checklist is designed for each job position respectively to cover all parts of the worksite. The checklist should be designed scientifically to ensure that workers in every post examine parts of the worksite (such as the working face and equipments, tools, etc) that they use or manage themselves, and no parts of the worksite are omitted or left un-inspected. Since there are many different disciplines and job positions, with very different characteristics, only the principle is given to guide the design of the checklist when we launched the campaign.

4. Application of the Model

At first, the model of "two documents & one checklist" was applied mainly in the mobile workforce such as drilling teams, and exploration teams, etc., which move from one place to another to undertake different projects. Before the commencement of a project, the project worksite shall be investigated and HSE information collected for development of the "Project HSE plan".

The draft document shall be reviewed and approved by authorized level, and then all the people taking part in the project should be called in to be trained on the "Project HSE plan" just before the start of the project. Through training, the people working in the project will not only aware the risks they will face and the risk reduction measures, but also be familiar with how to apply these measures for effective risk reduction. As for the control of the risk of hazards existing in specific process, it is the role of the "work-post HSE guide" to handle. Workers may self-study daily, or be trained in class to improve their operation competency. If the risk of some hazards existing in specific process are much too high in the project, the measures to reduce the risks in the "work-post HSE guide" should be emphasized by training the workers with the guide before the start of this project, similar to the use of "Project HSE plan".

The checklist is used by the workers to inspect every part of the worksite assigned to him at shift hand-over, and during his shift. If nothing abnormal is found, the worker shall mark on the checklist; otherwise, he may attempt to solve the problem himself or report to his superior, depending on the case. After successful application in mobile workforce, the model was applied to the fixed worksites, such as workshops. There are fewer hazards resulting from circumstantial changes in workshops compared with the projects mobile workforce engaged in. The "two documents & one checklist" was adapted to "one document (the "work-post HSE guide") & one checklist" to satisfy the new condition. However, whenever there are any possible risks resulting from circumstantial changes during the work need to be control, a document similar to "Project HSE plan" should be developed.

One of the great progresses made by implementing "two documents & one checklist" model in first-line organizations has been to help the workers build up the so-called "risk awareness". In the past, most of the workers' risk awareness was very low. So long as they did not run into any accidents or incidents themselves, they would think that all the accidents and incidents couldn't happen to them, and were far away from them, and that the HSE risk management was none of their business. Even when the accidents and incidents did happen to them, they would think it was their bad luck. Neither did the workers realize that breaking rules means risk, nor did they understood the causation relation between breaking rules and accidents. Since the application of "two documents & one checklist", the workers have not only learned the risks from the two documents, but have also from the risk management activities they have taken part in such as hazards identification, risk evaluation, etc. in order to compile the two documents. They have learned from both the documents and the activities that risks exist everywhere and accidents may happen if they do not follow the standard procedures, or if the worksite condition is unsafe. In this way, they have begun to accept the concept of HSE risk management, and the risk awareness has thus been built up in their mind little by little.

Another progress made by applying "two documents & one checklist" model in first-line organizations has been to find out the way to work out the applied preventive measures, and to put them into practice. In the past, there were few so-called preventive measures in the first-line organizations. In that case, what they did was to mend the fold only after the sheep had been stolen. For example, before an accident happened, they did not even identify the risk causing the accident, let alone take corresponding measures to prevent it, but if it really happened, they would pay much more attention to it. They would not only try their best to find the cause of the accident, but also took the lessons learned to modify the extant rules and regulations, operating procedures, and so on in order to prevent the same kind of accident from happening once more. But they would feel at a loss again if another new project or a new activity lay ahead, for they didn't know what new risks were that they would face, and what accident could happen in the project or activity.

In this case, what the management of first-line organizations could do was only to emphasize orally the importance of safety again and again, and asked the workers to pay more attention to safety, etc. which were all abstract sermons and could not be converted into preventive measures to reduce the risks beforehand. With the introduction of "two documents & one checklist" model, these kind of problems are solved little by little. Not only the specific risk-reducing measures can thus be worked out with the guide of risk management theory, but also the measures can be put in practice in a reasonable way. For example, the permanent measures to reduce the risk of hazards linked to a specialty which is more and durable are put into the "work-post HSE guide" which remains unchanged for a longer time.

While the temporary measures to reduce the risk of hazards resulting from the circumstantial changes of every project are put into the "project HSE plan" which is compiled for every project, the document is designed quite simply; in this way, it will be quite easy for both compilation and communication to the workers just before the commencement of the project. Therefore, the application of "two documents & one checklist" not only improves the risk awareness of the first-line organizations workers, but also strengthens the HSE management in a scientific way. With the improvement of the risk awareness, workers know the importance of safety and want to work safely. Furthermore, "two documents & one checklist" makes the risk reducing measures much more exercisable, which, in turn, informs workers how to operate safely. As a result, the HSE performance in the first-line organizations which apply "two documents & one checklist" is improved steadily and greatly. Through many years popularization, nearly all the mobile first-line organizations within our CNPC are implementing "two documents & one checklist", and thousands of fixed workshops within our corporation are trying to implement the model of "two documents & one checklist", and now the implementing of "two documents & one checklist" is spread to other petroleum companies outside of our CNPC (Hu et al, 2010). What is more, the model of "two documents & one checklist" has been written in the textbooks for university students of the petroleum engineering specialty (Li，2008), which marks that it is recognized publicly.

5. Conclusion

The model of "two documents & one checklist" is a model of HSE risk management applied in first-line organizations, which contains two documents and one checklist. One of the two documents, "work-post HSE guide", is about the control of hazards existing in specific process, its content is quite much more than that of the other document, but it is relatively constant and can be used for a long time after finished, the other one, "project HSE plan", deals with the risk of hazards resulting from circumstantial changes, it should be made frequently according to the characteristic of every project, but it is easy to be made and propagated for its simple content. Both of the documents are made to guide the actions of personnel, while the checklist is made to inspect the specific situation. In a word, the structure of the model is simple, and its method is scientific. The application of the model of "two documents & one checklist" in first-line organizations not only improves the workers' risk consciousness, but also provides them with an effective and exercisable risk-reducing tool, which ensures workers not only operate in the normal way but also keep the situation in its safe state, and accidents can thus be prevented. The successful application of the model proves that it is fit to be applied in the HSE risk management of first-line organizations, therefore, the application of the model of "two documents & one checklist" provides a new mode for the first-line organizations to implement HSE risk management effectively.

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