www.irmbrjournal.com December 2014
International Review of Management and Business Research Vol. 3 Issue.4

The Exploration and Practice on the Management of Different Kinds of HSE Risk

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Abstract

The paper analyses the merits and drawbacks of the HSE Case, and a new model to manage different kinds of HSE risk has been developed. The new model divides the HSE Case into two parts, which makes the documents not only easy to be compiled but also feasible to be communicated especially for the projects of which the time limit is always tight. A checklist is added to the model which is made even more scientific and reasonable in the light of the theory of accident prevention. The application of the model ensures the workers not only to operate in the normal way but also to keep the workplace in the safe state, and the accidents can thus be prevented.

Key Words: *HSE, Risk Management, First-Line Organizations, HSE Case.*

Introduction

Both petroleum industry and petrochemical industry are all the industries with high HSE (Health Safety and Environment) risk, both in exploration & development of oilfields and in processing & production at refineries. How to improve the HSE risk management at first-line organization level is the sticking point to prevent accidents effectively. Therefore, all the petroleum and petrochemical companies have been trying to improve their HSE risk management at the first-line organization level. For example, the HSE Case is an outstanding case developed by Shell Corp. to improve the HSE risk management of a project at the first-line organization level. We learned the method of HSE Case during the project cooperation with Shell Corp. as early as the 1990s, and we tried to apply it in the HSE risk management of first-line organizations of our corporation, but we failed to carry it through due to many kinds of reasons. Through many years exploration, we developed the model of "Two Documents & One Checklist"(CNPC, 2001a) based on the model of HSE Case and according to the practice of HSE risk management of our corporation. The application of the model of "Two Documents & One Checklist" in first-line organizations is quite successful; its documents are not only much easier to be compiled but also feasible to be implemented

compared with the HSE Case. The successful application of the model proves that it is suitable to be applied in the HSE risk management of first-line organizations, especially in those of our corporation.

The Model of HSE Case

The concept of the HSE Case was first put forward by Shell Corp. after the famous Piper Alpha accident, and it is mainly used for the HSE risk management of a project. Owing to the reason that the projects involved in oil and gas exploration and production are always with high HSE risks on the one hand, and this kind of projects are in a diverse landscape of differing operating and business environments on the other hand, in order to improve the HSE management and satisfy the stakeholders expectations related to HSE management, a document is developed to meet these requirements. Therefore, the HSE Case of a project is not only a key deliverable of HSE plan of the project but also a documentary evidence of HSE management presented to those concerned (Shell, 2004). With its successful implementation, many companies and associations accept it as a good industry practice little by little, for example, IADC (International Association of Drilling Contractors) adopts it for both offshore drilling projects and land drilling projects (IADC, 2007).

The feature of HSE Case is that all the things about HSE management of a project are compiled into one document, i.e., the HSE Case. According to the method of the development of HSE Case, before the commencement of a project, the worksite of the project shall be investigated in order to collect the HSE information of the project and the characteristic of the project should be analyzed based on the collected HSE information of the project, and a HSE Case of the project can thus be developed by applying the theory of HSE risk-management. After the draft document being reviewed and approved by authorized level, all the people taking part in the project should be trained with it just before the start of the project. Through being trained, the people working in the project will be aware the risks they will face and master the risk control measures. In this way, the accidents may happen in the project can thus be prevented if they do implement the preventive measures during their work. In the meantime, the document should also be presented to the external stakeholders to satisfy their expectation on HSE management of the project.

The HSE Case helps us to find out a way to work out the applied preventive measures and to put them into practice. In the past, there were few so-called preventive measures could be worked out beforehand especially at first-line organizations level. When a new project or a new activity lay ahead, they did not know the way how to identify the risks causing the accidents, let alone take corresponding preventive measures to prevent accident from happening. What the manager of a project could do in that case was only to emphasize orally the importance of safety again and again, and demand 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. After introduction of the HSE Case, we can find out the way to work out the applied preventive measures and to put them into practice just before the commencement of a project. In this way, most accidents, if not all, can thus be prevented at least in theory. Although the HSE Case provide us with a way to work out the applied preventive measures beforehand and to put them into practice to prevent accidents, but if the case that "just sits on the shelf" (Mauricio Serrano et al, 2008) is by no means a useful tool to manage HSE risks. Besides, it is especially hard for our company to carry out in daily work. The reasons are too many, an actual typical example in the following can be used to explain. A drilling team which normally drilled wells on flat terrain now undertook a well-drilling project in a mountainous area. The time limit for the project was quite tight and the time for preparation was even more insufficient (by the way, it is a normal phenomenon in our corporation). But according to the method of the management of HSE Case, before the commencement of the well-drilling project, the HSE Case of the project should be developed.

During the HSE hazards identification, besides the kind of hazards resulting from circumstantial changes such as mountain flood and rock fall which rise from change of environment should be identified, the other kind of hazards such as well blowout which is inherent in well-drilling process should also be identified.

What is more, besides the hazards of safety, the hazards of health and environment should also be addressed. Therefore the hazards need to be handled were too much, and the paper work of HSE risk-management for a drilling team was too heavy to bear, neither the time limit of the project nor the ability of persons in the well-drilling teams was allowed to do so. Furthermore, due to its too much content, even though the HSE Case could be compiled with the help of the professional from superior department, it is hard to make the document to be communicated to the workers just before the start of a project, let alone be understood and kept in mind by the workers in order to implement them during their work within such a short period of time. Therefore the procedure from compiling the HES Case to putting it in use was hard to carry on in the first-line organizations of our corporation, and the results would be by no means of high quality if it did be carried through limpingly, which means the whole work of HSE risk-management carried out in this way was nearly meaningless, and it is no wonder that the accidents might happen as ever.

The Improvement on HSE Case

The HSE Case is a case into which all things on HSE management of a project are put, and it is compiled for every project. Owing to its too much content, it is hard for a HSE Case to be compiled and communicated within a quite short time just before the start of a project. The reason why the HSE Case is hard to carry on is mainly due to its too much content; may it be broken up and rearranged? In fact, it can be broken up and rearranged reasonably. If the hazards are categorized by their sources, two kinds of hazards may be defined (CNPC, 2001b). One kind 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 characteristic of this kind of hazards is that they are associated with certain specialty or industry. Just as the above example, the hazard of well-blowout occurs only in oil field development such as well-drilling, not other industry such as refining, construction, or transportation, etc.

The other characteristic is that this kind of hazards remains 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. It is just because this kind of hazards remains unchanged that a relative fixed document can be developed to manage it. Once being finished, this document can be long-term used instead of being changed with the project.

Besides the above relatively fixed hazards, the other kind of hazards is that resulting from circumstantial changes, such as the temporary change of person, equipment, material, technology, environment 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. Just as the name implying, this kind of hazards comes from changes specific to the conditions of a particular project or activity, such as the change of environment of a specific project. They are different from one project to another; therefore, the document being developed to manage such kind of hazards should be changed with the project just like the HSE Case.

But owing to the reason that the HSE hazards inherent in specific processes have been put into the fixed document for their characteristic and this kind of hazards cover the majority in number, therefore, the content left to the variable document which is changed with the project is quite less, so the variable document will become quite simple in this way. Owing to its simple content, the variable document will become quite easy for both document compilation and communication to the workers just before the commencement of the project on the one hand, on the other hand, the fixed document may be a bit more difficult to compiled due to its more content, but there is no time limit for its compilation and it can be used for a long time once being finished.

In a word, owing to the reason that the hazards can be divided into two kinds and two corresponding documents, the fixed one and the variable one, are developed to manage them respectively, i.e., the HSE Case can be divided into two parts. The fixed document has much more content than that of the variable one, so it need much more time and effort to be developed and the document is worth it for it can be long-term used once being finished, while the variable document will become quite simple in this way, and it is not only easy to be compiled but also feasible to be communicated just before the commencement of the project. In this way, the problems met by HSE Case have been vanished.

Construction of the New Model

Just as the above statement, one of the characteristic of the hazards inherent in specific processes is that they are associated with certain specialty or industry. For example, the hazards lead to well-blowout occurs only in well-drilling operation, the workers involving in the well-drilling operation such as the drillers should have the ability to prevent the incident resulting from this kind of hazards and the skill to mitigate its effects if it does happen (Donna, 2004). In addition, this kind of hazards is relatively fixed and much more than that of variable ones in number. In order to meet the demand, the fixed document called "work-post HSE guide" is thus developed according to every specific operating post (work-post) to focus on this kind of hazards. The "work-post HSE guide" of well-drilling such as "the driller HSE guide" developed for drillers is aimed to prevent accidents from happening or mitigate their chronic and acute effects such as well blowout accident resulting from the hazards associated with the driller operating post. 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. Therefore, once being finished, the document can be long-term used for training and self-studying; only when the permanent change happen can the document be modified, because the hazards resulting from temporary change are addressed by the variable document. 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 owing to the characteristic of the hazards it manages. Compared with the HSE Case which changed with every project, the fixed document may save more time and effort on the document compilation; what is more, it makes both the compilation and the application of the document feasible in practice.

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, equipment and so on within a specific project. The second document of the "two documents", the "project HSE plan", i.e., the variable document, is designed to control this kind of hazards. Because of the reason that every project has its own uniqueness, which means every project has different circumstantial changes, and the hazards resulting from the change will be different, so are the measures to manage them, the "project HSE plan" must be developed for every project or activity. 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 which are not included in "work-post HSE guide", i.e., those resulting from circumstantial changes, 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 model of "Two Documents & One Checklist", just as the name suggests, contains two documents and one checklist. The first document is "work-post HSE guide", i.e., the fixed document, and the second document is "project HSE plan", i.e., the variable document. Both documents are designed mainly to guide workers to work or operate in a standard and safe manner. Owing to the reason that all the accidents may be led by the misoperation of people and the unsafe state of workplace, a checklist to verify the condition of the workplace is thus added in the model. The checklist is designed to facilitate inspection of the workplace in which each worker operates. The application of "Two Documents & One Checklist" in first-line organizations ensures the workers not only to operate according to standard procedure but also to keep the workplace 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, 2010a).

The Files Compilation and the Model Application

After a first-line organization is set up, the operating posts within it will be defined, and the "work-post HSE guide" can be developed. When the document for a specific operating post (or work-post) being compiled, the specific operating post (or work-post) is selected for analysis. According to the theory of risk management, the process contains three main steps (OGP, 1994). The first step is the identification of hazards associated with the selected operating post (work-post). In this step, relevant workers, HSE experts and other concerned shall all participate. Hazards to be identified are those arise from the job position activities, and materials handled, etc. Hazards exist in such phase as preparation, start-up, end of the work, including maintenance and other potential emergency operations should be all included. The key issue in this phase is to identify the hazards systematically and thoroughly in order to find out hazards as much as possible, only in this way, can the very hazards may lead to accidents be found out. The next step is to evaluate 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. In fact, the formal risk evaluation techniques should be used with the help of experienced personnel from the post of technology, equipment, HSE and other key posts concerned are invited in order to assess them correctly. The final step is to develop risk control measures.

The hazards of which risk is high enough to be selected out, and the measures to reduce the risks are developed accordingly. The measures worked out to control the HSE hazards should reduce the risks to a level as low as possible based on cost/benefit analysis. The measures which should be implemented by the operating post worker will be written into the document. The documents shall be given to the workers after being checked and approved by the relevant authority. Workers are encouraged to learn the document by self-learning or trained with it in training class to enhance their HSE management knowledge and to improve their operation skill, and the accidents caused by the hazards inherent in specific processes can thus be avoided. 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 specific project instead of an operating post. The hazards to be identified and evaluated are those not including in the "work-post HSE guide" but appear in the project due to the circumstantial changes, such as the temporary change of personnel, environment, technology, material, machine, equipment, etc. Just as the above example states, when a drilling team which normally drills wells on flat terrain undertakes a drilling project in a mountainous area, the persons concerned should go to the well-site and have an investigation, hazards such as mountain flood and rock fall as a result of change of environment should be identified, and measures would be worked out for those of hazards which should be controlled through risk evaluation. The timing of compilation is another great difference between "project HSE plan" and "work-post HSE guide". The "work-post HSE guide" can be developed whenever it is required, and then made available to the workers as training material for long-term use. 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, the "project HSE plan" must be completed just before commencement of the project and commutated to the workers the risks and the corresponding measures of the project, and its life will come to an end after the project is finished. 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 ensures that any parts of the worksite are neither omitted nor repeated inspected.

Through many years' continuous improvement and popularization, most of the first-line organizations within our CNPC have already implemented the mode of "Two Documents & One Checklist". According to an incomplete statistics, there are more than twenty thousand mobile first-line organizations which covering more than ninety percent of the whole mobile first-line organizations of our CNPC have already implemented the mode, and near half of fixed workshops of our corporation are trying to implement the mode. A few companies outside of CNPC such as SINOPEC have followed us and implemented the mode and now the implementing of "Two Documents & One Checklist" is spreading to other companies outside of our CNPC (Hu et al, 2010b). 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 has been recognized publicly.

Since the application of the mode in the first-line organizations of our CNPC, the fatality accident rate has dropped about one tenth as much as ten years ago， while with the expansion of production scale and new business, the number of employees is nearly double in the meantime. The fatality accident rate has dropped reposefully every year, even though we are far away from eradicating the occurrence of fatality accident.

Conclusion

The HSE Case is used mainly as a documentary evidence to satisfy the differing internal and external stakeholder expectations on HSE management, while through the improvement on the original HSE Case, the model "Two Documents & One Checklist" can not only satisfy the differing internal and external stakeholder expectations related to HSE management but also make it feasible to be implemented in the first-line organizations as an effective HSE management mode.

The new model divides the HSE Case into two parts, the fixed document and the variable one. The fixed document is about the management of hazards existing in specific process, its content is quite much more than that of the variable one, but it can be compiled without time limit and can be long-term used after being finished for its relatively constant content. While the variable document deals with the hazards resulting from circumstantial changes, it should be made frequently according to the characteristic of every project or activity just as the HSE Case, but it is easy to be made and propagated owing to its simple content. In this way, the two documents can be not only compiled conveniently but also feasible to be implemented in the first-line organizations. Because both of the documents are made to guide the actions of personnel, the checklist is thus added in the model to inspect the specific situation of workplace for the reason that all accidents may cause either by the unsafe operation of workers or the unsafe state of workplaces. Therefore, the application of the model ensures the workers not only to operate in the normal way but also to keep the workplace in the safe state, and all kind of accidents can thus be prevented.

The successful application of the model proves that it is suitable to be applied in the HSE risk management of first-line organizations, and therefore, 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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