

A Study on the Method of HSE Risk Management of Engineering Projects

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Abstract

The paper present a new method of HSE risk management applied in engineering projects based on the fact that all hazards can be divided into two kinds according to their characteristics, therefore two different kinds of files are developed to address different kinds of risks related with the personal action. In the mean time, a checklist is developed to ensure the safety of the condition of workplace. With the reasonable division of HSE risks management, not only both the personal action can be regulated and the safe condition of workplace can be assured and the accidents can therefore be prevented but also the method can be carried out smoothly even in the engineering projects of first-line organization.

Keywords: Engineering projects, HSE, Risk-management

1. Introduction

Oil and gas well-drilling industry is an industry with high HSE (Health, Safety and Environment) risks, especially the safety issues (CNPC, 2001). In the meantime, the health and environment problems are also the trouble ones if they are not properly dealt with, for both employees and the correlative public are more and more concerned about their health and the environment around them. But how to manage them well still remains a great challenge. Because there is too much work need to be done just before the start of a well-drilling project, the preparation time is so limit that the normal HSE risk management method such as the "HSE case" can not be followed. What is more, for most of our first-line organizations, besides the lack of the ability of risk management, their HSE awareness is thin for the time being, all of which made it hard for the first-line organizations such as drilling teams to implement the method of "HSE case" in the well-drilling projects. Through analysis the problems appeared in risk management activities with such method, a new model called "two documents & one checklist" (Hu, 2006) has been developed according to characterization of hazards, in which two documents are addressed respectively for the two different kinds of hazards. By virtue of such method, the document which must be prepared just before the start of a project is simplified to a large extent, accordingly, the problems can be mitigated and the risk management activities can be gradually carried out.

2. Background

As we all know, the core of a HSEMS (Health, Safety and Environment Management System) is HSE risk management, and it is just in the grass-root organizations that most of accidents occur. Therefore, after the HSEMS was introduced into our company, we have paid great attention to the issues of HSE risk management in the grass-root organizations and tried to find methods to apply the theory of HSE risk management in the project management, especially in those engineering projects with high risks such as well-drilling projects. At first, the method of "HSE case" from Shell Co. was introduced for the drilling teams to carry out HSE risk management in well-drilling projects. According to this method, before the commencement of a well-drilling project, the well site should be investigated and HSE information be collected for development of the "HSE case" by applying HSE risk management theory. After the draft document was reviewed and approved, all the personnel involved in the project should be trained with it just before well-drilling start. Through training, the personnel working in the project would get aware of the risks they would face and would be familiar with how to apply these measures for effective risk reduction. However in fact, the procedure above is very hard to implement due to the following reasons. Here is a typical example we meet in daily work. 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. But according to the method of HSE case, before the commencement of a well-drilling project, the “HSE case” of the project should be developed. During identification of the HSE hazards, besides the kind of hazards such as well blowout which is inherent in well-drilling process, the other kind of hazards such as mountain flood and rock fall as a result of change of environment 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 workload of HSE risk-management for a drilling team was too heavy to bear. First of all, according to the method of HES Case, there was too much risk-management work to be done in order to develop a HSE case just before the start of a project, neither the time limit of the project nor the ability of persons in the well-drilling teams was allowed to do so. Secondly, for it is an overall HSE risk management of the whole project, there were too much thing in the HSE case need to be communicated to the workers just before the start of a project. What was worse, the things in the HSE case need to be understood and kept in mind by the workers in order to implement them in practice of the project to prevent accidents was too much to handle within a very short period of time. Therefore the procedure was hard to carry on, and the results would be by no means of high quality if it did be carried through limpingly, which means the whole work of risk-management was near meaningless.

3. Model Development

Just as the example mentioned above, the hazards can be categorized into two groups by their sources. One group of hazards is that inherent in the specific processes, such as well-blowout in well-drilling, explosions or fire in refining, and vehicle incidents in transportation, etc.. The other group results from circumstantial changes, such as the change of environment, equipment, person, technology, materials and so on within a specific project. Just as the example above, the hazards of mountain flood and rock fall which are the result of change of environment for a drilling team that used to work on the flat terrain just belong to this kind of hazards. One of the characteristics of the hazards inherent in the specific processes is that they are associated with certain specialty or industry type. For example, the hazard of well blowout exists only in well-drilling operation of oil field development, not other industries such as refining, construction, or transportation, etc., so it is a specific hazard in the well-drilling process. The workers in the work posts should have the ability to prevent accidents 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, a document called “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” for 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 relevant to the 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 other relevant matters are not changed. For example, the hazard of well blowout exists in well-drilling operation at 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 other relevant matters are unchanged, the control measures for these risks, once developed, remain effective for a long time to ensure risk control performance. Only when some permanent changes occur such as updating of equipment and technology, shall the “work-post HSE guide” be modified (the management of hazards resulting from their temporary change are 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 relevant to the electric rigs are different from those of mechanic rigs, 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 word, the feature of the “work-post HSE guide” is that it is relatively permanent and can be used for a long time once being developed for 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, i.e., the hazards vary with different projects. The second document of the “two documents”, the “project HSE plan”, is designed to control this kind of hazards. The “project HSE plan” has to be developed for every project or activity, because 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 another, 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.

Compared with the HSE Case, in the model of “two documents and one checklist”, the file such as “HSE case” is divided into two documents. On the one hand, the “work-post HSE guide” is designed to control the risks of the hazards inherent in the specific processes, which has nothing to do with the circumstantial changes of different projects, and 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 jointly cover the management of all hazards need to be controlled in a specific project. In this way, only the “project HSE plan” is needed to be prepared and communicated to the workers just before the start of a project, while the document is much simpler than the HSE case for most of hazards are left to the “work-post HSE guide”, and thus the problems mentioned at the beginning of the paper will be mitigated or even disappear. Another feature of the model of “two documents and one checklist” is that a checklist is added to inspect the condition of workplace while the two documents are used to guide the workers to operate in a normal way by the two documents. 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 is any equipment change, 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 the 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 effectively prevented.

4. The Compilation of Files

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, Report No. 6.36/210). The first step is the identification of hazards relevant to 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 to be 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 authorities. Workers shall be trained with the document before they take their jobs, and will continue to be trained in class or by self-learning to improve their operation competency, and the hazards inherent in the specific process can thus be managed. 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 beyond the scope of the first-line organizations, the document should be compiled by the enterprise or its specialized companies.

The “project HSE plan” is developed 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 based 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. Just as the example above, when the drilling team which normally drills wells on flat terrain undertakes a drilling project in a mountainous area and the environment has changed, hazards such as mountain flood and rock fall should be identified when its HSE Plan is prepared. Another main difference between the “project HSE plan” and the “work-post HSE guide” lies in the timing of compilation. The “work-post HSE guide” can be developed after the first-line organization is set up, and then made it available to the post worker as training material. However, the “project HSE plan” must be written just before the beginning of the project because 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 hazards results from the latest changes 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. In general, before the commencement of a well-drilling project, the well site shall be investigated and HSE information be collected for development of the “Project HSE plan”. The draft document shall be reviewed and approved by authorities, and then all the personnel involved in the project should be called in to be trained with the “Project HSE plan” just before the start of the project. Through training, the people working in the project will not only aware of the high risk hazards they will face and the risk reduction measures, but also be familiar with how to apply these measures for effective risk reduction. Comparing with “work-post HSE guide”, “project HSE plan” is quite simple for most of the hazards are those inherent in the specific processes which belong to the management of “work-post HSE guide”, therefore, the rest of which belongs 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 in the project HSE risk management activities, these workers will become familiar with the risks relevant to their own posts to ensure effective risk control.

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.

Through many years promotion, nearly all the mobile front-line organizations within CNPC are implementing “Two Documents & One Checklist”, and now “Two Documents & One Checklist” is spreading to other petroleum companies beyond CNPC (Hu, 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

According to the feature of hazards, two different documents are developed, i.e., the “work-post HSE guide” and the “project HSE plan”, between which the “project HSE plan” is designed to manage the hazards resulting from circumstantial changes which need to be developed just before the start of a engineering project. It is not only much easier to compile the document but also time-saving to propagate it, because this kind of hazards managed by the document, “project HSE plan”, is quite fewer. On the other hand, the “work-post HSE guide” is designed to control the risks of the hazards inherent in the specific processes, which are more in number but are relatively constant, therefore the document may be a bit difficult to be developed, but it can be used for a much longer time once being finished. In a word, “work-post HSE guide” and “project HSE plan” address different kinds of hazards respectively and scientifically according to their features through the partition of hazards, and both of them will jointly cover the management of all hazards need to be controlled in a specific project. In addition, a checklist is added to the model to insure the safe condition of workplace.

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.

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