Development of Safety Regulation and Management System in Energy Industry of China: Comparative and Case Study Perspectives

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Abstract

Safety regulation and management in China is reviewed. The review provides insight into the regulation, standards and management practice adopted, and it identifies trends and needs for improvement in China. The research finds that China is actively improving its safety regulation system by revising laws and standards, and entitling regulatory organizations with new functions; at the same time, more companies in China are aware of the importance of safety management and accreditation. At the current stage, the legal systems in China are effective in terms of improving awareness of and investment in safety management. However, there is a long way to go before effective safety management system implementation and mature safety culture in place. From the experience of safety legislation and management in Australia, we find that safety culture and implementation are essential to the healthy development of energy industry. We conclude that safety regulation and management would benefit greatly from guidance on how to form safety management system and cultivate safety culture, as well as from the further development of feasible performance measures.

1. Introduction

Safety is essential to natural gas industry which is regarded as of high risk operation. With the growing natural market maturity in China, there is a strong need to improve the safety regulation and management to ensure a safe approach to gas industry development. According to China government planning, the consumption of natural gas (NG) will reach 200 billion cubic meters per annum by the end of 2020. Such a fast development cannot be sustained without the corresponding development of safety regulations and management.

In terms of the safety legislation, the regulatory authorities responsible for occupational health and safety usually have a different point of view from industry. For these authorities, maximizing environmental quality and safety is the primary objective and competitive production is the constraint. The authorities therefore impose two types of requirement on industry:

The first type of requirement is normative: such requirements consist of fixed standards, norms and criteria that industry must fulfill. They may include items such as maximum emission levels, workplace quality requirements (concentrations, noise levels, and safety precautions) and quantified acceptable safety levels. Normative requirements guarantee minimum levels of environmental protection, safety, and occupational health, but do not contribute to improving these conditions over time. This is the main style China safety legislation adopts.

The second type of requirement is performance-based and includes tools such as the obligation of sustainability or continuous improvement, best available techniques; and at the same time, balance is kept by the regulatees in terms of not

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entailing excessive costs, as low as reasonably achievable or practicable. This approach is more extensively adopted by Australian companies in gas industry, which usually have the background of large international companies.

There is a trend that safety legislations and management systems are becoming increasingly complex, and there is a strong need from the industry to make systems integrated, simple and to avoid unnecessary complexity. There is a clear difference between large and medium companies. In the one hand, large companies adhere easily to larger systems, as effort involved is smaller relative to the benefit of having identical work practices [1]. This can be observed from the case of large oil and gas companies in both China and Australia, which usually have set up complex safety management systems.

On the other hand, medium-sized companies in particular find it difficult to follow complex and integrated management systems. Focus is more on performance in practice rather than on the amount of documentation. The challenge is to implement management routines that adhere to safety legislations and yet less resource demanding, practical, and adequate for the tasks to be solved. In China, as many gas companies are small or medium sized companies, they have a strong wish to be able to focus on the safety management essentials so as to implement safety policies with limited resources. [2]

We compare Australian and Chinese legislations and company practices to learn lessons and best practice to provide foundation to improve the safety management in China. It is observed that Australia has worked on the integration of the occupational health and safety regulation with the establishment of the Model Work Health and Safety Regulations. In China, there is an early sign of similar movement as the Safe Production Supervisory Commission has been entitled limited regulatory function to supervise limited occupational health affairs in 2012.

2. Safety regulation in China

In China, there is currently no unified and specified regulatory organization in charge of the safety regulation for energy industry in particular at national level. Safety for all industries is regulated basically as three aspects: occupational health, safety and environment; and environmental protection. There are currently no unified law for occupational health and safety at national level, however, there are related laws and regulations can be found in several important laws issued, which are regarded as foundation of the safety legal system in China.

Occupational health and safety were previously regulated separately by two government departments. As there are some overlaps at the one hand, and omission at the other, regulatory functions on occupational health and safety started to see some emerging trend recently since 2012, when the Safety Production Supervisory Commission is entitled to regulate and manage both safe and occupational health issues nationwide.

Since the 1990s, the Chinese Government has explicitly mandated the establishment of a socialist market economy and stated that it should be under the rule of law. Since then, there is continuing development of safety related legislation. The foundation law of safety legislation is the Labor Law promulgated July 5, 1994, and was effective as of January 1, 1995. The Law is the basic body for adjudication of labor relations, and has established labor contract and group contract systems, a tripartite coordination mechanism, a labor standard system, a system for handling disputes, and a labor supervisory system, basically shaping a new approach to labor relations. Since the 1994 Labor Law, several other important laws and regulations have come into force.

Article 19 in the Safety Production Law of People's Republic of China says: "The production and business operation have more than 300 employees shall establish an administrative organ for production safety or have fulltime personnel for the administration of production safety; if they have fewer than 300 employees, they shall have full-time or part-time personnel for the administration of production safety or entrust the engineering technicians who are equipped with the relevant professional technical qualifications as provided by the state to provide services in the administration of production safety." (National Economy and Trade Commission, 2002). Most Chinese enterprises established the safety departments or staffed with full-time safety management personnel. Safety department generally refers to safety production management organization in Chinese enterprises (usually referred to as environment, safety, health department in the foreign enterprises, or the safety department). It is the main implementation in the system of enterprise's safety management and composed by departments and persons which bear responsibility for safety management.

3. Safety regulation in Australia

Compared with China, there is a trend of unified organization to oversee safety activities in Australia. Because there is considerable variation in legal requirements and in enforcement, there is an urgent need for uniform OHS legislation, inspection and enforcement across all jurisdictions.

In 1985 the federal government legislated for the formation of the National Occupational Health and Safety Commission (NOHSC). NOHSC was abolished in 2005 and replaced by the Australian Safety and Compensation Council (ASCC), which was subsequently replaced by Safe Work Australia in 2009. Safe Work Australia was established by an Act of

Parliament, with statutory functions established by the Safe Work Australia Act 2008. Safe Work Australia's statutory functions include developing national policy relating to OHS and workers' compensation, for approval by the Ministerial Council for Workplace Relations. Safe Work Australia also has responsibility for preparing, and as necessary revising, a model Act, model regulations and model codes of practice relating to OHS. The model Act and regulations, and an initial set of priority codes are due to be adopted by the Commonwealth, the six state and the two territory governments by January 2012. Safe Work Australia is also developing policy dealing with the compliance and enforcement of the model OHS legislation, to ensure that a nationally consistent approach is taken to compliance and enforcement.

The trend since the 1980s has been for the inspectorates to move away from a central control model, to a regionalized model, with regional managers as the key decision-makers, and broad policy frameworks being produced by the central offices. Many inspectorates have changed their organizational structures, and have divided their field inspectorates into industry-based teams.

Most jurisdictions now have a balance of proactive and reactive inspections (i.e. responses to injuries or complaints). Proactive inspections are increasingly centered less on random inspections, and more on targeted programs.

Australian work health and safety regulators use a wide range of strategies and mechanisms to nurture regulatees' willingness and capacity to comply with work health and safety law. They communicate and provide information to regulatees through a wide variety of 'arms length' methods. These include guidance material which is accessible electronically at regulators' websites or in publications at regulators' metropolitan and regional offices, direct mail outs as part of targeted campaigns, telephone or online information services, media advertising, seminars and workshops, and participation in field days or other public events, among other methods. Regulators work with and through industry and trade associations, unions, work health and safety consultants and professional bodies, and training providers to widen access to work health and safety information and support the development of health and safety capacity.

Through inspection and enforcement the work health and safety regulators' inspectors engage directly with regulatees. Inspectors have broad powers to enter and inspect workplaces, investigate work health and safety matters, and receive information and assistance from those inspected. They may provide advice and information and have statutory powers to issue improvement and prohibition notices (administrative enforcement), and initiate prosecutions for contraventions of work health and safety law (criminal enforcement). In some states and territories inspectors can issue infringement notices (on the spot fines) and accept enforceable undertakings. If the model WHS Act is enacted uniformly in all Australian states and territories all of these mechanisms will be available to work health and safety inspectorates in all Commonwealth, state and territory jurisdictions (model WHS Act) [3] [4] [5].

4. Case studies of safety management system

4.1. Woodside Experience

Woodside is a famous energy company in Australia. It is a distinctive feature of the Australian companies to first position the importance of HSE (health, safety and environment) in the overall value setting of the company. This top down approach is key that employees understand that it is of the key concern of the top management. The importance of HSE is demonstrated in its position in Woodsides' company value. As a result, the aspiration in health and safety is set as: "No one gets hurt, no incidents". They believe that all injuries and occupational diseases are preventable.

Another distinct feature is that the company would assess their HSE risks on an evolving basis, reflecting the requirement of the business. This environmental scanning approach is highly recommendable to Chinese companies. For example, the impact of global expansion on health and safety is carefully defined by HSE management. Woodside adopts a framework of HSE development path, and positions itself according to its current resources, ability and experience.

The external focus of HSE management in Woodside is to look for best in class and emerging ideas which can be utilized in Woodside, while its internal focus is on consultation and engagement with all levels of the line organization to ensure our efforts are relevant, practical and achievable. Safety Improvement Plan is carried out by three methods: leadership – coaching; standards – Golden Safety Rules; and tools such as First Priority tool. These are the key focus areas for the HS Function because the management is not expecting to do it all at once.

Woodside adopts a progressive method to improve its HSE management and sets a 5 year health and safety plan to promote its HSE performance. It is noticeable that the company does not choose to report only the good news. Comparatively speaking, the performance review is more objective. As they comment that "We benchmark just better than average performer against international peers, near the top in Australia. Fatality potential incidents increased."

Woodside's safety performance was recognized externally in May by winning the APPEA Safety Performance Award. This is the most prestigious safety award in the Australian Oil and Gas Industry and recognizes reductions in injury rates and safety initiatives. The Award is judged by a panel of industry representatives.

In early 2004 Woodside started to benchmark safety performance against international peers, the Oil & Gas Producers. They measure injury performance as Total Recordable Case Frequency. They are third quartile on average when measured against our peers.

They have set a 15% performance improvement for a number of years and started to achieve it. The performance so far has however shown an upwards trend and is being addressed through targeted programs. Their objective is to be top quartile, meaning a 40% reduction a year over the next three years, while one of their counterparts, Du Pont, states that the best sustainable performance they have seen is 33%.

In order to achieve this step change in performance, they have held workshops with the wider Woodside Leadership Team or the top 70 personnel. Related workshops include the case for change, safety improvement initiatives, and leadership visibility and accountability so as to challenge the wider leadership team to consider their role.

Golden Safety Rules apply to all Woodside employees, contractors and visitors involved in controlled activities. All Woodside and contractor management, supervisors and work teams have defined responsibilities. At the same time, each Golden Safety Rule has a champion associated with it.

Golden Safety Rules are being developed one at a time, with Electrical Isolation being the first Golden Rule to be finalized by the Electrical Isolation workgroup. The remaining eight Golden Safety Rules are a work in progress. The draft electronic version of the Golden Safety Rules is available to view on the HSE intranet site. Feedback is also solicited to improve the Rules.

Woodside is also benchmarking themselves with the best practices in the industry. Therefore, it is pointed out that these Golden Safety Rules may look familiar as other organizations (such as BP and Shell) have introduced them successfully.

Woodside expects visible leadership from the top and at all management levels within Woodside. HSE leadership and commitment are demonstrated through work in four aspects: regular site visits by senior managers; senior management review of all serious or high potential incidents; senior management 'Personal Safety Commitments' and organization scorecard includes safety performance.

Woodside has also set up a tool which assigns expectations under the management system to each senior manager. It has also set up a diary of visits to monitor what sites are being visited and what sites are missing out. The managers also have to feedback to the site team their observations and similarly to the two Senior Management Forums held by the HSE management.

Senior managers have also developed 'personal safety commitments' that focus on the things they are going to do to improve safety performance in their area of responsibility and set an example to others

HSE incentive mechanism in Woodside operates by recognizing safety initiatives and promotes leadership at all levels of Woodside. To recognize initiative and good performance, the company also has the COO Safety Awards and Annual Woodside Safety Award (part of HSE Awards). HSE Leaders Program involves all levels of management, and aligns people to 'No one gets hurt, No incidents' objective.

The 'HSE Leaders Program' for line management and technical staff aim to align everyone with our aspiration of 'No one gets hurt, No incidents'. Personnel attended ranges from Directors down to facility supervisors and leading-hand technicians and it now includes the development of 'Personal HSE Commitments' by those who attend.

Continuous Improvement Targets can be for an existing operating facility or activity, or for an opportunity (included in the Basis of Design). The core of HSE management is to improve hazard management competency. Competency for each level is defined in Woodside's Standard for HSE Competence and Shell's HSE Skills Portfolio.

4.2. TownGas Experience

TownGas is a successful Hong Kong based gas company with a history of more than 100 years, which is highly recognized as a model company in the region. In recent years, TownGas has been investing in China's gas market and quickly expanding its market share in China as an important company in the gas industry. It is particularly well recognized for its knowledge, experience and performance in HSE management, and thus could be taken as a model for China's gas companies.

It adopts a governance structure based on three-tier risk management framework. Its standardized organizational structure includes: Towngas (HK) Corporate HSE Department, Towngas(China) / HSE Department, and Individual Joint Venture HSE Department. All levels report to senior management directly and corporate HSE manager reporting to Managing Director.

Direct safety responsibility is on Top Management, and joint venture general managers are directly responsible for safety and risk management issues. The top management is expected to organize monthly safety meeting to discuss safety issues within the corporation and develop corporate safety policy. Members attending the meeting include managing director, head of business unit, corporate HSE manager and relevant senior vice president.

TownGas also sets up Regional General Manager Safety Committee, which would oversee network leakage survey, customer gas safety, confined space safety, pipeline risk classification, and permit to work system etc.

General Managers of the joint ventures are required to conduct monthly safety and risk management inspection since Sep. 2005, specifically to conduct at least one safety inspection on a particular topic monthly. The major tasks of general managers include ensuring all departments implement safety and risk management measures, reducing operational risks, improving process flow effectively, and enhancing worker's productivity and cost effectiveness.

Qualification of safety managerial staff is regulated in TownGas, and safety managerial staff must be qualified as PRC Certified Safety Engineer.

TownGas adopts standardized HSE management system and develop HSE management system documents for its joint ventures. The 67 documents include 1 management handbook, 23 procedural documents, and 43 operating documents. In addition, TownGas also carries out regional training and organize workshops across Mainland by region.

One distinct characteristic of TownGas' HSE system is its mutual Aid Plan for regional planning, use of resources, reporting and liaison mechanism, through which joint ventures can respond effectively to emergency, and reduce the incident impact on the corporation and public. At the same time, it can promote teamwork and show the synergy and effective use of resource. For example, in 2010, to strength capability on handling emergency, Towngas Shenzhen headquarters & Shunde JV performed a joint table top exercise.

Towngas has developed a systematic safety & risk management audit system, covering 10 aspects, with more than 700 items, using a standard audit checklist. The aim of safety and risk management audit in TownGas is to effectively identify and enhance joint ventures' safety performance. TownGas provides Hong Kong style safety training for staff in mainland China, covering topics such as control centre, distributional control system, isolation system, security control centre, meter maintenance, site inspection. It emphasizes fire safety and risk management training covering gas safety, disciplinary knowledge and skills in fire fighting. Its Safety and Risk Management Workshop have trained more than 140 senior managerial and HSE staff (including 8 general managers) from 60 joint ventures in China by 2010.

The effective HSE management of TownGas relies heavily on it HSE communication management system. The frequently communicated safety information includes HSE reporting, gas incident, OSH incident, transport safety, training, environmental data, carbon inventory, HSE website, and accident alert, etc. They also launch campaigns such as workshops for newly established areas, Group HSE Activity, "Gas Safety and OHS Day ", Safety and Occupational Safety Quiz, and Safety Olympic, etc. The HSE staff also created games to practice emergency site layout, use of fire hose, fire extinguishers, wearing breathing apparatus, personal protective equipment, and etc.

The experience of HSE management of Town Gas can be concluded as the following:
- Standardized organizational structure for HSE management organizations is adopted.
- Standardized safety management system is implemented across the company.
- Support and participation from top management is visible.
- Constantly enhancement of safety awareness at all levels through various activities.
- Involvement of staff is regarded as key to improve HSE performance.
- Standardized operating procedures are adopted.
- Emergency response procedures are practiced periodically.
- Exchange of Safety information and knowledge (training, workshops, safety promotion activities) is taken as important daily work.
- Comprehensive audit system is strictly carried out by external and internal auditors.

5. Conclusion and suggestion

From the above reviews and analysis of the safety legislation and management systems of China and Australia, we suggest that an effective way of implementing safety legislation is to use a basic set of minimum normative requirements, supplemented with the requirement that industry demonstrate continuous improvement of safety management systems, consistent with industry's development.

A large number of gas companies in China are small or medium sized companies, though some gas projects are supported by large energy companies. Comparatively, the small and medium sized companies in gas industry lack the resources to adopt compressive safety management systems. In order to encourage natural gas industry to improve safety conditions beyond the level of minimum national legal requirements, we suggest that an integrated safety regulatory organization can be established at national level in China to reduce gas companies' burden to check on the numerous legislations, regulations and policies issued by different levels of authorities; so that quality of legal compliance and safety management can be improved based on the industry's best practice [6][7][8].

Although in China, both prescriptive regulation and performance-based evaluation are in place; however, they are not in an integrated manner. Without regulation being substantially implemented and performance indicators continuously monitored, the safety regulation system would not be effective. As the costs of monitoring need to be in balance with the benefits yielded by the collected data, the Chinese government needs to invest more in safety regulation to avoid a post hoc approach of penalty style management. There are sufficient indicators to monitor the quality of the external and occupational environments. Assessment of performance in the area of accident prevention requires the additional development and validation of useful and straightforward "early indicators". These could include the use of safety culture or safety attitude assessments proactively.

Acknowledgements

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