DEVELOPMENT OF A HEALTHY SAFETY CULTURE UNDER DIFFERENT SOCIAL AND CULTURAL CONDITIONS: LESSONS FROM THE EXPERIENCES OF JAPANESE UTILITIES

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ABSTRACT

In anticipation of the steady expansion of nuclear power in Asia, all organizations involved in operating nuclear facilities are emphasizing the importance of regional cooperation in the development and enhancement of a safety culture. This paper, based on employees' attitudinal surveys, provides some lessons learned from the experiences of Japanese electric utilities in developing and enhancing a sound safety culture within the organizations which are operating nuclear power plants and related facilities, and discusses approaches for cooperation in Asia, taking into account the different socio-cultural environments.

INTRODUCTION AND BACKGROUND

At the end of 1996, 73 nuclear power units with a net capacity of 58.5 GWe were in operation in the Far East (Japan, South Korea, China, Taipei, China), which provided 18% of the region's electricity production. According to the recent projection (USDOE/EIA, 1997), the nuclear capacity in the Far East (Japan, South Korea, China, Taipei, China, North Korea) is projected to increase to 110.6 GWe by 2015 (reference case), exceeding North America (75 GWe) and about equal to Western Europe (113.6 GWe). In addition, the nuclear capacity in India is projected to increase to about 7.9 GWe, and, in all likelihood, a couple of ASEAN countries will have concrete commercial nuclear power programs at that time.

With an outlook toward the steady expansion of nuclear power in Asia, diverse pathways and a wide range of cooperative activities to ensure nuclear safety are being pursued internationally, and vigorous discussions are underway in the Asian region. With respect to nuclear safety culture, for example, during the Safety Culture Workshop proposed by the Australian government at the sixth International Conference for Nuclear Cooperation in Asia (ICNCA), Japan and South Korea, as the leading countries of nuclear power development and utilization in the Asian region, provided other countries with information about their experiences with safety culture development gained from their respective commercial nuclear power programs. Following the 1996 Tokyo Conference on Nuclear Safety in Asia, ways to facilitate the dissemination of theoretical knowledge and practical skills for enhancing nuclear safety culture were discussed at the Seoul Conference held in October, 1997.

This paper, based on employees' attitudinal surveys in three Japanese electric utilities, provides some lessons learned from the operational and managerial experiences to develop and facilitate a sound safety culture in organizations operating nuclear power plants and facilities, and discusses approaches for cooperation in the Asian region, taking into account the different socio-cultural environments.

NUCLEAR SAFETY CULTURE

Safety depends not only upon the technologies being employed, but also on the performance of the organizations managing the technologies. Nuclear safety culture is a key element of the overall cultures of organization's operating nuclear facilities. Not having a safety culture would be like plowing a field and forgetting the seed. The importance of clarifying the mechanisms with which the organizational culture works to maintain a high level of safety is increasing because the culture is changing, inherently

affected by social change that is symbolized by different behaviors between generations. Organizational and safety culture eventually manifest themselves in operating performances.

As mentioned before, regional cooperation is of growing importance to ensure nuclear safety. When it comes to practical considerations regarding nuclear safety culture issues in this context, however, careful attention should be paid to issues such as "cultural difference", "difference in people's perception", "difference in history and philosophy", "difference in logistics", "difference in humanity", and so on. Cultural influence is obvious in operations and visible through variations in staff educational requirements, shift transfer procedures, adherence to written procedures, the use of automation and in housekeeping conditions (M. Rosen, 1995).

There is no prescriptive formula for developing a safety culture. Nevertheless, there is an emerging belief that there are some common and universal characteristics and practices that organizations can adopt to make progress, as described in INSAG-4.

MANAGEMENT STYLE AND UNDERLYING NATIONAL CULTURE

In this section, we discuss the management style in the department of nuclear power generation of the Japanese electric utilities, and its distinctive features, as well as touch on the underlying national cultures behind the management systems.

Japanese Electric Utilities' Management Style

The excellent safe operation records of Japanese nuclear power plants may be said to be a result of the synergistic effect of the excessive response and adaptation to stringent societal pressures against nuclear power and the management system and the morale of the people concerned. This has made possible the thorough measures of trouble prevention and quality control by utility companies and manufacturers, and the economic conditions that have so far allowed the electric utilities to provide generous investment funds (Taniguchi et al., 1995).

The management system of the Japanese utilities can be called a spontaneous and cooperative type, centering the up-and-down behaviors of middle or senior managers. The guiding principles behind the management system can be summarized in the following three points; 1) to maximize the outcomes through teamwork and a mutually complementary system supported by the positive commitment of the constituent members of an organization in the activities directed toward the "big goal", 2) to maintain and intensify the vitality of an organization by encouraging each member to define their own job in a broad perspective, and 3) the belief that safety comes first, which leads eventually to long-term economic advantages. The core elements of the system emphasized from the viewpoint of a safety culture are *team-work, provision of motivations, information sharing,* and *organizational learning*.

Concerning organizational learning in particular, mutual interaction or spiralization of pragmatic and essential learning has been put into practice at the individual level through questions asked by middle or senior managers within group activities. As a consequence, it fostered the positive commitment of the members and led to an offer of incentives for being appreciated, building welcome circulation of feeling and safety culture.

In Japan, the management system that has supported nuclear power up to now has been structured in an extremely ingenious way, given environmental conditions. It is a system under which every member gives the other members a helping hand, removes defects, and improves things by uncovering defects through very flexible and voluntarily-motivated teamwork. This system has some strengths to ensure nuclear safety, but also has some weaknesses. It means that the system must have a certain tolerance to be able to function smoothly because the system has an inherent tendency to unevenly load work and of overdoing things. It also has the undesirable aspect of unduly relying on tacit knowledge because the enforcing power of the norms of the group is strong.

At present, the electric utility business is being exposed to the competitive market of electricity supply as a result of the Electricity Utilities Industry Law Amendment in 1995, and nuclear power in particular

is being required to be more economical to cope with the more stringent societal pressure against nuclear safety and development. On the other hand, looking within an organization, the younger generations with different values and thinking are emerging, and it becomes more difficult to secure competent human resources. Although the management system has effectively functioned throughout the first generation of nuclear power development, it will have to be adjusted or reformed in view of these situations.

Typical Example of Japanese Culture

In this section, we describe some typical aspects of the national culture underlying the management system.

In general, it is emphasized that responsibilities not being clearly defined is a typical symptom of a poor safety culture. One of the distinct characteristics of the Japanese people is that they tend to feel uneasy about clarifying their responsibilities. Europeans and Americans would feel awkward, even shocked, if they scrutinized an organization chart of a Japanese company, as it is likely that no clear descriptions of their responsibilities exist. Please note, however, that we are not saying that the Japanese are irresponsible people, just that they don't like to argue about who is to be held responsible. This mental attitude could have something to do with the origin of Japanese society, which was based on an agricultural community (S. Hayashi, 1991). Responsibility is regarded as an implicit norm which, in turn, means that a person would not be sure if he or she has fulfilled the responsibility. This mechanism is, in a sense, clever, since everyone would try to achieve maximum responsibility. The reality, however, seems slightly different. It is most likely that those who actually carry out a job are also expected to bear the total responsibility.

The primary reason why Japanese want to avoid formal meetings as a decision-making method is their dread of personal responsibility. Policy is carefully made by the entire group. All participants are equal in a unanimous decision by group consensus. This equality probably originated in paddy-field agriculture. Regarding this approach of harmonizing opinions, in Japanese-style decision-making we look for the least common multiple, whereas a Westerner looks for the greatest common divisor.

Compared with Westerners, other distinctive features of the underlying culture are as follows: 1) cultural time perception; even when thinking ahead, there is a strong tendency to position the future as an extension of the present, so-called "present-oriented", 2) aesthetic sense toward completion of work, so-called "not being negligent of the work", 3) attach importance to tacit or experienced knowledge, and 4) tendency to perceive affirmatively in chaos or fluctuation as the origin of living.

ATTITUDES AND CONSCIOUSNESS OF WORK

According to the questionnaire surveys conducted on managers working at the head offices, power stations and construction offices of three electric utilities (Tomioka, 1995, Taniguchi, 1995), the following consciousness and/or behaviors can be observed. First was the dominant opinion that a leader had better not give instructions in minute detail. Even top management give only allusive or equivocal suggestions without offering any specific targets, giving instructions or, in most cases, intervening in actions. Respecting the autonomy of employees is valued. Second, ambiguity exists in the scope and distribution of authority and responsibility within an organization. That is, however low the rank of the person who is in direct charge of some work, they have broad scope within which they can use their own discretion and apply solutions to problems to their own satisfaction. Third, there is clearly a tendency for people to put teamwork before leadership. They have a sense that responsibility lies with teams rather than with individuals. Fourth, there is a strong tendency toward governing the decision-making process by a philosophy that highly values harmony, so that to the extent possible, when there are divided opinions, a conclusion preferred by all the members is chosen. Fifth, conveyance of information through the atmosphere of meeting places and by perception has an important role beside explicit communication. Sixth, as the sharing of information was encouraged, even rank and file workers had good knowledge of the workings of the whole organization. Finally, senior and middle managers have

been provided with opportunities for double-loop learning; learning by practicing in their early years, followed by learning about the essentials of safety matters within the "big picture" goal. Through this process, tacit knowledge and knowledge gained through experiences accumulated at the group level within an organization have been continuously converted into explicit knowledge, such as that expressed in manuals.

Members of the sample group of the above-mentioned surveys experienced both bottom-level positions within the organization in the '70s and '80s, when the Japanese plant performance improved significantly, and managerial positions thereafter. Therefore, we believe that their consciousness and behaviors have probably influenced safety performance records.

On the other hand, regarding the consciousness and behaviors of rank and file employees who should play an active part in the second generation of nuclear power, large differences, in other words, the generation gap, can be observed significantly in some respects, compared with the managerial class people. Based on the results of questionnaire surveys and interviews with non-managerial employees working at nuclear power stations which have been conducted in 1996 (Taniguchi, 1997), it can be observed that there is a drastic change in perception of the relationship between the organization and the individual. Solid consciousness of a corporate community that exists in the minds of elder employees has disappeared considerably. Figure 1 shows the relative positions of each group in the thinking space, which is a result of statistical analysis (Hayashi's quantification analysis Type III) using the responses of present perceptions toward work. It shows clearly that younger generation employees are more individualistic.

Relatively speaking, there is a tendency that they do not attach importance to tacit knowledge or experiences, but rather adhere to written procedures or manuals, and there is little consciousness of ambiguity. They dislike talking in ambiguous or loosely-defined terms or with abstract expressions, and feel that responsibilities and job descriptions should be defined in detail. In addition, defensive attitudes have been observed in the surveys toward work and management expectations that have not been clearly communicated. These phenomena are adverse symptoms in terms of a safety culture.

According to Maslow's need hierarchy, in economically mature Japan, younger generation workers' needs are the highest level need, that is self-actualization. But in our study it is observed that most young workers at a plant site are dissatisfied with their jobs and that they feel they are not worth doing. The reason why this situation has occurred is probably that they feel little esteem or appraisal from society. Less understanding of nuclear power generation in society discourages their motivation.

Meanwhile, there are some commonalities between elder and younger employees in their consciousness towards work. First is a recognition that team-work is very important for ensuring safety. Second is that decision-making should be done by harmonizing the opinions.

LESSONS LEARNED FROM EXPERIENCES

In order to develop and strengthen the nuclear safety culture in an organization, a lot of suggestions and recommendations concerning the management have been done by the IAEA and other experts. Here, we provide some lessons learned from experiences of safety management in Japanese electric utility companies.

The first lesson is to foster an atmosphere in which mistakes, errors and near-misses can be discussed openly and without fear of blame or recrimination. This is very important as a prerequisite for information sharing and organizational learning, which are core elements of safety culture development. In order to realize this, the organization should value the respect of the autonomy of the employee.

Establishment of an organizational learning process is the second lesson. Organizational learning does not necessarily take an upward spiral starting from the individual level. It is important to establish some structure or system that promotes the linkages between the four modes of learning activity; creating knowledge through 1) shared experience such as on the job training (OJT), 2) meetings, or computer system usage, 3) reading textbooks, etc., and 4) conceptualization. During the learning

process, every employee must learn deeply the essential affairs, i.e. what is nuclear safety and what should be done for ensuring safety, as well as skills or know-how. Managerial people have to learn to not only talk themselves but also encourage rank and file employees to have the opportunity for essential learning.

The third lesson is the fact that management can cause a positive culture shift. Needless to say, the managers above middle class play a key role in safety culture development. In the process of safety culture development, managers should not only know how to motivate their team but also how to avoid de-motivating them. According to the surveys, the employees' norms, values and behavioral patterns are different not only between power stations within an electric utility, but also between generations and the type of occupation within a power station (Figure 2). Top-level and senior management should recognize these occupational differences and take them into account when designing and implementing an incentive system, learning practices and information sharing, which strongly affect safety culture. From now on, in Japanese utilities, the implementation of a senior management program focused on learning basic knowledge of behavioral sciences and risk communication is strongly needed.

Facing the general public and/or other countries, we have often wondered if there is a gap in perception of, or way of thinking about safety, thus causing large differences in assessments of the actual situation, and creating irritation on both sides. Why? Of course there could be many reasons, such as different historical backgrounds, but we think one of the reasons is that sound criticism, which is one of the essential factors of a safety culture, might not have existed in the climate of their countries, societies, and relevant organizations. Sound criticism is a prerequisite for the sound development of technology, and we must pay keen attention to it. In addition we should listen carefully to, and open-mindedly incorporate these criticisms as appropriate into our activities, while also communicating our safety related activities to society. This is a prerequisite for our safety culture to be further enhanced. It is the fourth lesson from our experiences, especially from the Japanese utilities.

The fifth lesson is the implementation of a periodic health diagnosis of the organization. Rapid economic growth in the Asian region will result in an increase in the quality of life in each country. Consequently, people's needs will probably change to that of a higher level in the near future. Therefore, it is very desirable for management to periodically diagnose organizational culture and employees' awareness. This basic information is significant for designing and implementing a managerial framework or system that measures motivation. In doing so, it is necessary to develop safety culture indicators and institutional arrangements that enable measuring attitudes and consciousness or beliefs about safety and work to be meaningful. Regarding the institutional arrangement, there are some ideas such as a third party audit system or an independent in-house committee authorized by the management board. We believe that the former is preferable because it maintains a sound relationship between management and labor unions.

Finally, we point out a critical issue which should be addressed in Japan. In the OSART reviews for Japan (M. Rosen, 1995), it has been pointed out that there may exist complacency toward anticipating and preparing for unexpected situations, and that there are some weaknesses, in particular in emergency preparedness, when compared to those of Western European and North American plants. Given the lessons learned from a ream of disgraceful affairs in the Power Reactor and Nuclear Fuel Cycle Corporation, not only is a decision-making process and information sharing appropriate for a crisis situation but also employees' mental training should be developed, taking account of the organizational culture and societal requirements.

DISCUSSIONS ON REGIONAL COOPERATION IN ASIA

Before discussion of regional cooperation approaches, we should recognize the general principle of cooperation. In international cooperation activities, we have to keep in mind that the donor country never views the recipient country as a student, but as an equal partner. We cannot mandate others to adopt a "best safety culture" or a "universal safety culture" even if they existed since this would deny the individual sense of responsibility or deform the organization. It might not enrich, but rather distort

the system. For this reason, it is first important to mutually understand differences in culture, socio-economic, institutional and political conditions surrounding the operating organizations, and then examine together how to foster a safety culture in an appropriate manner within the organization operating a nuclear facility.

When developing a safety culture, attention needs to be paid to the national culture. In some countries there may even be significant differences among regional cultures. The characteristics of a national culture can amplify or attenuate the factors associated with a good safety culture. A fundamental principle that underpins a good safety culture, namely respect for human health, safety and well-being, is entirely compatible with the value framework of all national cultures. National culture should not be viewed as an impediment to safety culture; being sensitive to its characteristics enables us to take advantage of cultural strengths and work with, rather than against, the flow of the world's rich and diverse cultural streams. Acknowledgment of multiculturalism is a prerequisite of the Asian regional program for safety culture development.

Awareness of significant differences in national culture is important in the case of multinational projects. In international turn-key contracts which are expected to be adopted in the Asian region, the vendor may import his nation's culture into the design and procedural framework. T his framework may not be totally compatible with the local culture and any mismatch has potential adverse consequences for future safety performance. In other words, it means that the importing country has to have its own safety culture.

Regarding the regional cooperation program, we propose the following three points. First, core elements of a safety culture is indeed good and effective communication and discussion, then it is clear that the exchange of information on the regional and international level through meetings and exchange visits is the key. That means exchanging good, as well as bad, experiences and for others not to criticize the bad experiences, but to learn from them.

The second proposal is for the implementation of a multinational research project for the purpose of promoting mutual understanding of cultures, behaviors and management systems of the organizations, and the thinking of individuals, and for identifying the strengths and weaknesses of national characteristics of each country in the region. In the research project the participation of experts from not only nuclear safety and management sciences, but also from the human behavioral sciences from each country is needed.

The third one is the establishment of an IAEA-ASCOT (Assessment of Safety Culture in Organization Team)-type review activity in the Asian region. It is intended to assess the effectiveness of a safety culture in each country, and provide recommendations to promote safety culture programs. This activity is not an inspection or an audit against standards, but rather an opportunity to exchange experiences and views. The team would be composed of experts in the fields of safety, behavioral and organizational sciences, and socio-culture from Asian countries.

Finally, regarding the institutional arrangement for the Asian regional cooperation, further discussions should be done, taking into account the utilization of existing frameworks such the utilities-based WANO, the governments-based ICNCA and/or CNSA, or a possibility of the new framework or organization such ASIATOM and ANSC (Suzuki et al, 1998).

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KEY WORDS

Nuclear safety culture, Asian regional cooperation, national culture

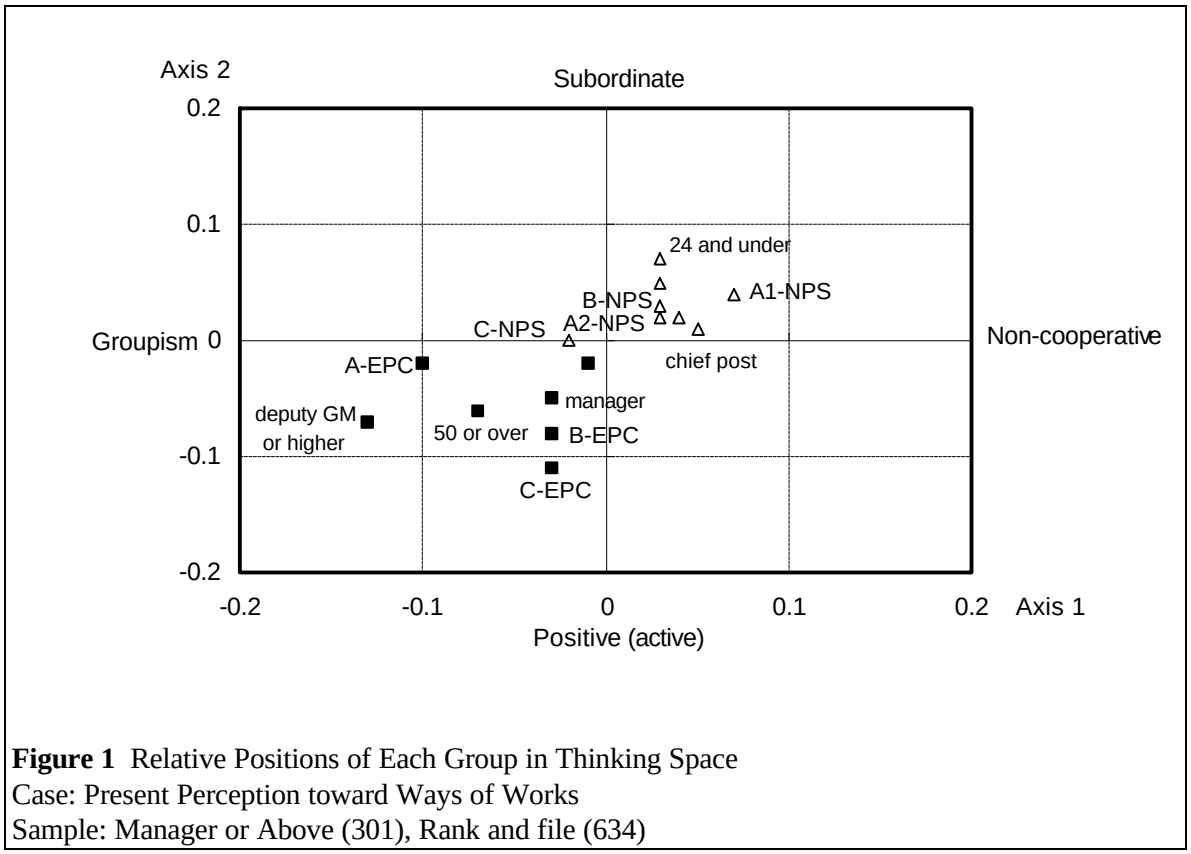

Figure 1 Relative Positions of Each Group in Thinking Space
Case: Present Perception toward Ways of Works
Sample: Manager or Above (301), Rank and file (634)

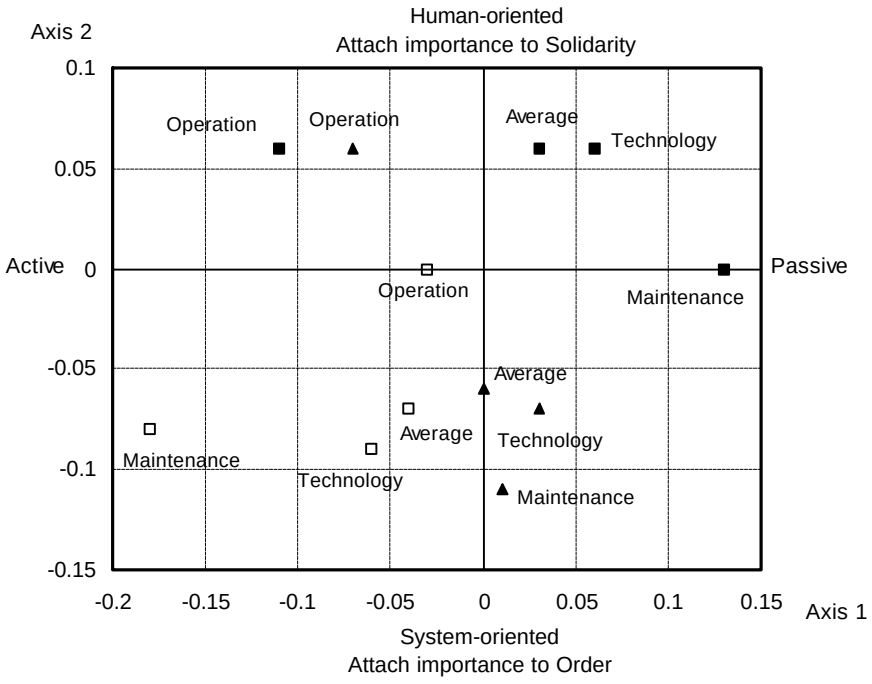

Figure 2 Relative Positions of Each Group in Thinking Space
Case: Present Perception toward Ways of Works
Sample: Manager or Above (301)