CNIC-01493
GNPS-0005

事故＝能量／有毒物＋信息失误

ACCIDENT＝ENERGY／TOXIC SUBSTANCE＋MISINFORMATION

中 国 核 情 报 中 心
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事故=能量 / 有毒物+信息失误

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摘　要

现代安全管理学者认为，随着生产技术和生产管理复杂性的增加，以及各种新型信息传输手段和沟通技巧的应用，发生职业安全事故的机理也显示出新的特点。这一特点集中表现为如何通过改进、完善信息传输和沟通交流的技术手段及管理措施使生产过程中所使用的能量和有毒物得到有效的控制，达到预防事故、限制事故后果的目的。该文以中国广东核电集团所属核电站为背景，通过案例分析，简明阐述这一机理的重要性及其应用。

Accident＝Energy／Toxic Substance＋Misinformation

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ABSTRACT

Nowadays, the ever-increasing complication of technology and management of industry, supplemented with a variety of information technology and communication skills, has made the modern safety professionals discover a new mechanism of accident occurrences. This mechanism is outstanding in that the integrity of energy and toxic substance utilized in the production processes can be effectively maintained and limited through improving and updating both the techniques and management of information and communications, and consequently, accidents are prevented from occurring, or once accidentally released, the consequences can be effectively mitigated. In light of the experience of China Guangdong Nuclear Power Corporation (CGNPC), the importance of the new mechanism and its prospects for further application in nuclear industry are depicted through case studies.

INTRODUCTION

Like any other industry nuclear power contains invariable risks which, once realized, will result in different categories of events or accidents such as personal injury or health problems, unplanned unit trips or property damage, or an uncontrolled release of radioactive material into environment. The key to the prevention of all these mishaps is to understand, first of all, the mechanism of the processes during which the inherent risks have been initiated into hard reality. One perspective to understand this mechanism could be expressed in the simple formula as indicated by the title of this paper, which means that accident or event occurs when energy or toxic substance is released under undesirable conditions due to misinformation[1]. The following two typical cases can help us to understand this allegation.

1 CASE STUDY

1. 1 Case 1[2]

Oct.1992, the jack pump of the Unit 1 turbine was found a serious leakage resulting in the oil flooding of the pump pit of about two meters in depth. After the pump was fixed, the Work Preparation Engineer requested to clean up the pit as well as all the oil-contaminated equipment. Two working groups were organized to do the job, the first to clean up the oil contaminated equipment, the other the pit on the heel of the completion of the equipment cleaning. The equipment cleaning agent as designated by the manufacturer of the equipment, was Genklene (Trichloro-ethane). Upon the completion of the job the workers of the first group dumped the residual Genklene into the drain located at the bottom of the pit. About fifteen to twenty minutes after the start of the pit cleaning, the three members of the second group were found symptoms of being poisoned. Fortunately, the first aid was carried out in time that this event did not come out with serious consequences.

Among others, the investigation of the event reveals two important facts:

(1) Posted on the barrel of Genklene is a warning sign with the instructions of safe usage in English. Unfortunately, none of the workers of the job understood English.

(2) The Work Order (the standard format of job instructions) prepared by the

Work Preparation Engineer contained only instructions on the cleaning processes and requirements, but no any instruction or cautions against the hazards of the cleaning agent.

1. 2 Case 2 [2]

April 1996, the penetration butterfly valve of the Reactor Building, EBA015VA, was found leak during the tightness test by a Performance Testing Work Supervisor (PTWS). Subsequently, PTWS requested the maintenance to fix the problem meanwhile he came to suspend his test permit with the operations Blocking Manager on the shift (The person in charge of issuing work permits and line-up of the equipment of systems). Meantime, upon the request of the PTWS, the coordinator and the section head of the maintenance department arranged two staffs to fix the problem valve, assuming that they could start work immediately under the test permit of the PTWS (Note, according to the rule, any job on the plant systems must be conducted under a permit which has to be co-signed by the Blocking Manager and the Work Supervisor).

The two workers arrived on the job site with a Work Order which had been prepared for a previous intervention for the same type of the equipment, for the Work Preparation Engineer assumed that the job in question would be the same as before. This Work Order requires as the first step of the intervention process to manually open the valve and then go inside and make a check. Following the instructions, the workers telephoned the operator in MCR (Main Control Room) requesting for an electrical order to the valve control mechanism so that the manual opening of the valve could be performed. Assuming that the tightness test was still underway, the operator in MCR did what was requested and the valve was opened manually and one of the workers went inside. While the job was in progress the shift changes took place in MCR. Then the new shift Blocking Manager informed the shift operator in MCR to restore EBA015VA as he found that the test permit of the equipment had already been signed off by the PTWS and the Blocking Manager of the precedent shift. Consequently, the valve was remotely shut off with the maintenance worker inside. Fortunately, he was not struck and the worker outside the valve alarmed MCR in time.

Obviously, the incident could have been prevented if any of the following assumptions had been avoided.

(1) The assumption of the maintenance coordinator and the section head that their workers could work immediately under the test permit of the PTWS (this

assumption might have resulted from either the vague or wrong exchanges of information with the PTWS, or from the over self-confidence of their own).

(2) The assumption of the Work Preparation Engineer that the former Work Order could be used (being accidentally right from technical point of view, however, the Work Order itself did not bear the precautions as required by the manufacturer of the valve to the effect that special stop devices shall be used during the maintenance to prevent unexpected valve closure).

(3) The assumption of the former MCR operator that the test was still under progress and what he did was but assisting the test as his duty called (this assumption could have been avoided if the Blocking Manager had informed him of the status change of the equipment immediately after the signing off of the test permit by PTWS).

2 THEORY AND APPLICATION

Theoretically, as the first factor in the accident formula, the energy and toxic substance make up so-called inherent hazards, which exist inseparably with the industry itself. As far as safety is concerned in this regard, what people can do best is to design, operate and maintain them properly and carefully, or in other words, to keep them run or remain within the designed limits and conditions. The dynamic factor of the formula is, as shown in the two cases above, the misinformation, which could be called initiating hazards. Metaphorically speaking, it is a kind of ignition source or fuse trigging off the inherent hazards into outbursts. The typical scenarios may be generalized as follows.

(1) Information missing or missed
(2) Information wrong or vague
(3) Information lost or delivered not in time
(4) Misunderstanding the information
(5) Involuntarily refusing or rejecting information

A further inquiry into the misinformation will certainly lead to the important discovery that all these scenarios are one way or another due to communication and organizational weaknesses or failures. With regard to communications, not only shall the function of the fixed physical means such as sensors, transmitters and monitoring indicators or alarms be kept operable all the time, but also the managerial communication channels, means and requirements be defined,

provided and maintained throughout the processes of the safe operation. The latter may call for such organizational development activities as defining databases, reducing interfaces, streamlining the hierarchy, optimizing the information flows, and educating both the managers and the working staff on the importance of inter-department communications and simplification of the management processes.

A good example of the application of this theory in CGNPC was the simplification of information flows of the plant emergency organization in 1997. Previously, the emergency exercises had turned out that the information flows among the different groups were not effectively organized even though there had been more than a dozen different data forms to be expected in use. A typical situation concerned the Emergency Operation Group (GOP) in the Main Control Room. During the exercises, though already under great pressure it was pestered by almost all sorts of inquiries and instructions from both internal and external organizations, which significantly distracted and disturbed the group. On the other hand, the group itself was too slow to send required data to other groups such as Emergency Headquarters (GEH), Technical Support (GTS) and Emergency Maintenance (GMS) etc. Consequently, all this made negative impact on the efficiency of the emergency responses as a whole.

To rectify this weakness a special work group was organized, and an analysis was performed with the focus on the information flows as well as the interfaces among the different groups of the Emergency Organization. The corrective actions in question could be simply generalized and illustrated as follows.

As far as GOP is concerned, first of all, only three out-going critical data sheets got their existence justified and then re-designed accordingly.

(1) Table A0: initial operation data sheet centered on the beginning of events with relevant critical parameters

(2) Table A2: follow up data sheet centered on the evolution of the unit status with relevant safety related parameters

(3) Table A1: general communication data sheet for inquiries or requests of instructions or supports from other groups

Besides, except for the link with the power grid dispatch the communication means and channels of the Main Control Room to the outside are to be switched off once the Plant Emergency Status is alerted.

Emergency Operation Group (GOP) Information Flow Chart [3] is shown in Fig. 1.

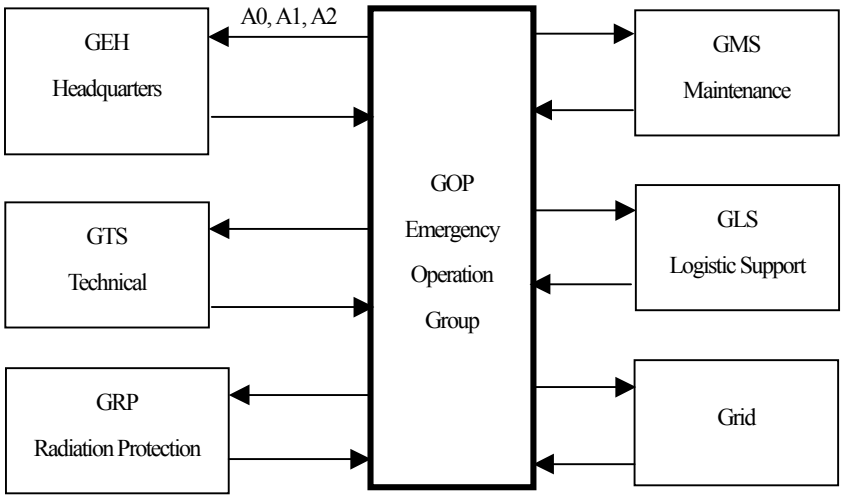

Fig. 1 Emergency Operation Group (GOP) Information Flow Chart

From organizational point of view, an operation engineer, who is not on the shift until the emergency organization is activated, is designated for processing both in-coming and out-going information of GOP, leaving the Shift Supervisor concentrating upon the direction and coordination of emergency operational maneuvers. Thus, though under the great pressure as before, the Main Control Room remained in good order and discipline throughout the exercises. In addition, special training courses were given for data collecting skills with regard to different panels and indicators and the skills filling out the different data sheets. As expected, with all these corrective actions in place, later exercises have witnessed much better performance.

3 CONCLUSION

In short, the perspective in this paper indicates that minimizing or eliminating the initiating hazards of misinformation is a key not only to successful accident prevention but also to the success of handling emergency situations so as to mitigate the consequences of events or accidents. Moreover, holding this key fast may call for a thorough self-examination and improvement program on the existing communications, processes and organizations, in which certainly buried are the root causes of weakness, events and accidents.

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