EXPLORATION ON THE APPLICATION OF UNATTENDED AND REMOTE MONITORING SYSTEMS AT THE LEVEL OF GOVERNMENT AND FACILITIES

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Abstract

The concept of Unattended and Remote Monitoring Systems is commonly used in the field of IAEA nuclear safeguards. Usually, those technologies such as alarm detectors, gamma or neutron detectors, video cameras and data remote transmission network are used to transmit real-time or regular measured data back to supervisory departments (e.g. IAEA). It is mainly used to supervise those nuclear materials in semi-enclosed areas or areas where staff rarely enter, which is helpful to supervisors determine whether the nuclear materials are under control. However, with the development of those technology such as "Internet +" and 5G network etc., the concept of Unattended and Remote Monitoring Systems can be further extended to expand the application of the technology in the field of nuclear security. Similar applications have been widely applied at the level of nuclear facilities. For example, for one unattended nuclear materials or radioactive source warehouses, and some automatic processing workshops of nuclear materials, etc. , there is no longer a guard post at the main gate. Instead, some technologies such as door magnetic alarm and video review are adopted and managed by the remote monitoring center. However, there are many problems such as so much kinds of detection means and data transmission equipment that can be used, and many work focuses of the guard in the monitoring center, etc., which need to be systematized and integrated. This paper analyses the current situation of the development and application of Unattended and Remote Monitoring Systems, explores what problems exist in the application of those technologies in the field of   nuclear security, discusses the feasibility of selective use of advanced monitoring technology at the level of government supervision for real-time or timely monitoring of key units or key parts, and puts forward countermeasures and suggestions combined with the application of new technologies.

Keywords：remote monitoring, unattended, nuclear security, supervision of government.

1. INTRODUCTION

With the development of computer technology and network technology, remote monitoring technology has made great progress with the rapid development of high-tech chip, sensor technology, communication network and automation technology since the 1990s. The essence of unattended is that no one is on duty to protect it. There have been descriptions of unattended phenomena in different historical periods. For example, 'A peaceful and prosperous time, doors are unbolted at night' is also a realm of unattended. With the increasing cost of human resources around the world and the progress of remote monitoring technology, these two concepts are often used in combination, such as unattended store, unattended parking lot, unattended pump room, etc., which are the combination of remote monitoring and unattended, also can be called Unattended and Remote Monitoring Systems. The unattended remote monitoring system mentioned in this paper is usually composed of anti-theft alarm

probe, emergency button, fire detector, door magnetic switch, perimeter prevention, smoke sensing measurement, radioactivity measurement, high-definition identification and other combinations, to complete the collection of remote processing alarm information and the system deployment / withdrawal, etc.

In addition, the security situation of the international community is becoming more and more complex. The risk of terrorists and transnational criminal organizations attempting to illegally acquire, traffic in nuclear materials or other radioactive materials, or even create nuclear terrorist events cannot be ignored. In order to further improve the level of nuclear security, it is necessary to strengthen the application of remote monitoring and unattended in the field of nuclear security.

2. APPLICATION STATUS OF UNATTENDED AND REMOTE MONITORING

Remote monitoring and unattended technology can be divided into three parts: 'remote', 'monitoring' and 'control', characterized by no need for personnel on site. 'Remote' is the relative distance and distribution. In the early monitoring system, due to the limitation of communication technology and cost, monitoring terminals are mostly distributed around the monitoring site. For the distributed monitoring sites, only relatively decentralized and centralized monitoring methods can be used. Nowadays, with the development of computer and communication technology, information transmission breaks through the limitation of distance and region, which makes it possible to combine remote monitoring and centralized monitoring. Compared with the traditional monitoring technology, their close combination enables remote monitoring to achieve a longer distance and a more centralized way of monitoring; 'monitoring' means that the monitoring system collects monitoring data such as physical quantity, environmental parameter and characteristic parameter from the monitored physical system or place through communication technology and various sensor technologies; while 'control' means that the monitoring personnel collect monitoring data through the monitoring system. Set the monitoring data as the basis to remotely control the working state and production process of the monitored physical system or place. Now this technology is widely used and rapidly developed in safe city, medical technology, mining and other fields. As a special technology application in the field of nuclear security, it provides technical guarantee for the comprehensive and reliable implementation of nuclear security, and is widely used in the field of security.

2.1 In terms of urban management.

Huang Zhangxing et al. [1] discussed the application of remote monitoring technology in urban management. Unattended and Remote monitoring is often used in smart city and safe city management, involving municipal management, urban traffic, social security, urban water supply and drainage, power supply, population management, epidemic disease control, prevention of key areas, emergency response and other aspects. Urban monitoring system involves various fields, such as civil block area, intelligent building, bank supervision, road checkpoint monitoring, public places, etc., and the monitored targets include personnel, policeman, motor vehicles, mobile objects, ships, etc. Now with the development of high-definition video technology, face recognition system, big data analysis and other technologies, remote monitoring and unattended is widely used in personnel recognition, vehicle recognition, parking charge management, automatic tracking and other aspects.

2.2 In terms of medical technology.

Zhu Yue et al.[2]designed an unattended infusion monitoring system based on single-chip microcomputer. The system can reduce the times of patrol inspection of TCM nurses in the infusion process, not only save human resources, and also reduce the contradictions between doctors and patients. The system uses photoelectric detection technology to realize the intelligent monitoring device in the infusion process through single-chip microcomputer. The system can monitor the whole infusion process in real time, and gives different alarms according to the detected conditions, so as to attract the attention of medical staff and deal with it in time. With the development of artificial intelligence technology, remote monitoring technology is more and more widely used in the medical field, such as the application and management of remote monitoring in peritoneal dialysis patients at home are also developing.

2.3 In terms of nuclear safeguards.

Nuclear safeguards inspection refers to a series of verification activities carried out by the International Atomic Energy Agency (IAEA) in order to verify whether the guaranteed nuclear materials conform to the nuclear safeguards agreement. For some specific areas, such as reactor building, spent fuel pool and facilities to be decommissioned, remote monitoring and unattended technology are often used for supervision. Specifically, it includes two technical measures: sealing and monitoring. Sealing refers to the use of some physical barriers, such as walls, shipping boxes, containers or tanks, to reduce the possibility of illegal transfer of nuclear materials. Monitoring refers to the application of remote monitoring technology, which is observed or observed by personnel or instruments to avoid illegal transfer of nuclear materials, damage of sealing, information fraud or change of nuclear facility design indicators.

In the IAEA support technology and equipment(2011 edition), the equipment and technology for remote monitoring and unattended application in the field of nuclear support are specified. Such as: dual Minolta camera monitoring system (phsr), advanced camera monitoring device (APSU), pyrotronic television monitoring device (PTVs), advanced television monitoring system (star), underwater camera (uwtv), underwater periscope (uwvd), advanced underwater periscope (AUV d), CANDU spent fuel cluster counter (CSFC), CANDU Reactor new fuel cluster counter (CFFC), multiplex television monitoring system (MXTV), Multi camera optical monitoring system (MOS), special CCTV tape inspection station (GRS), door magnetic alarm, neutron measurement, gamma measurement, etc. Through the special Internet network, the special encryption method is used to transmit back to IAEA for timing or untimely analysis, and has the function of abnormal alarm.

2.4 In the field of nuclear security.

Similar to safety city management, remote monitoring and unattended system is widely used in the field of security. Wang Nan [3] and i.v. breido [4] both discussed the application of anti-theft alarm system in the field of power transmission and transformation security. Through monitoring the changes of voltage, power, load and other parameters of the power grid system, early warning and emergency treatment can be carried out through the preset alarm system. Meng Yang [5] et al. designed the home intelligent security system, using single chip microcomputer, sensor, short message communication module and voice control module to transform the ordinary home, realized the intelligent security function, and expanded the function of adding home intelligent control to make it more intelligent and humanized. In the field of nuclear security, the modern physical protection system platform integrates video monitoring, detection and alarm, power monitoring, security lighting, access management, security communication, security patrol, authorization management and other functions. For example, a nuclear power plant with four units may need more than 300 alarm devices, more than 100 access control devices and more than 100 cameras. Nuclear material warehouse, ground perimeter and water perimeter are unattended for most of the time. Although irregular patrols will appear, most of the security personnel are concentrated at the entrance, security control center or standby point, which belongs to the unattended state of close distance remote monitoring.

3. CHALLENGES AND OPPORTUNITIES FOR DEVELOPMENT

On the one hand, as Han Yeliang et al. [6] discussed in the article 'nuclear security: crown in the field of security', nuclear security should lead the development of security, study how to use new scientific and technological means such as biometrics and video analysis, and also study how to deal with new threats such as 'low, slow and small' and under water area. On the other hand, technology is like a double-edged sword, bringing convenience to people, but also some hidden dangers. With the transformation of nuclear security from civil defense, physical defense and dog defense to civil defense, physical defense and technical defense, the security work is gradually replaced by equipment. Some nuclear facilities are prone to use hundreds of detectors, cameras, access control equipment, etc., which need the operation and management of security personnel. Most of these management are concentrated in the monitoring duty center. How to effectively ensure the working status of the security guards in the monitoring center is a major problem faced by nuclear security. For example, in February 9, 2016, a serious train collision occurred in Germany, at least eight people are dead and around 100 people are injured. It was due to the failure of dispatching duty officers. In September 5, 2012, Tangshan maritime administration imposed administrative penalties on duty personnel sleeping in foreign ships.

With the development of communication technology such as 'Internet +' and 5G network, remote monitoring and data transmission technology has made great progress. For example, home surveillance cameras can be connected to mobile phones through 4G network, and can receive monitoring alarm information at any time, and monitor household security status in real time. In addition, in the era of 'post nuclear

security summit', IAEA and member states have continued to pay attention to nuclear security issues, and gradually formed a consensus on the development of nuclear security for major public events, major urban area and other issues. Nuclear security 'four defense line construction' was gradually improved.

4. RECOMMENDATIONS

In the era of information explosion, the issue of nuclear security is no longer a partial problem of a facility itself or a country (region). It is in a state of Pull one hair and move the whole body. It needs comprehensive and coordinated development. In the new era of rapid development of remote monitoring and unattended technology, high-definition camera technology, 5G network technology, biometric technology, advanced detection technology, etc., while improving the nuclear security culture and strengthening the responsibility, It is also necessary to soberly recognize that nuclear security responsibilities are not only on the shoulders of the guards of the monitoring center, but also the responsibility of facilities operators and government regulators. . Therefore, it is recommended that:

4.1 In order to implement the overall responsibility of the nuclear facility operator, it is necessary to establish a remote monitoring center in the facility operator or the Department in charge of security, to conduct real-time remote monitoring of the nuclear facility monitoring center, access, important parts, etc., and to supervise and remind the security guards at all times. Through face recognition, video monitoring, network transmission and other technical means, real-time master (or video storage) the status of the monitoring center's monitoring hall and important entrance and exit duty personnel, including whether there is off duty, working status, the number of duty personnel, as well as the activities of workers or visitors in the protected area.

4.2 In order to strengthen the supervision and management of nuclear security, it is necessary to research and collect the nuclear security remote monitoring center in the government regulatory agency. The center can be independent of the physical protection system of nuclear facilities, focusing on monitoring the performance of security personnel, such as monitoring duty room, main entrance and exit, etc.

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