Transactions of the Korean Nuclear Society Autumn Meeting
Gyeongju, Korea, November 2-3, 2006

Application of a Physical Protection to HANARO

Jeong-Soo Ryu, Cheol Park, Yeong-Garp Cho, Jung-Hee Lee, Hoan-Sung Jung
HANARO Management Division, KAERI, jsryu@kaeri.re.kr

1. Introduction

After the fearful terror attack on September 11, 2001, in USA, international nuclear society has strengthened its physical protection system against nuclear reactors to prevent the theft of nuclear materials and its ill-intended application, and the destruction of nuclear installations and the obstruction of an operation in such facilities. In the nuclear agreements between Korea and USA or other countries, the observance of the IAEA recommendations on a physical protection for a nuclear installation and nuclear materials is clearly requested. Since IAEA recommendation on physical protection [1] was revised more strictly, KAERI made a plan to follow the strengthened IAEA recommendation and to improve the physical protection for the HANARO and fuel fabrication building. [2]

In response to the plan for the improvement of the physical protection system, the reactor hall, control room, and fuel fabrication building was established as the boundary of a physical protection concept. Accordingly, the existing doors were recommended to be replaced with new security doors against a terror attack. Therefore, security doors reflecting the design characteristics of the HANARO have been developed to replace the existing doors, and the design, fabrication, driving and leak tight tests were carried out before an installation. For securing a safety and easy operation of the security doors, HANARO access control system (HANACS) has been developed to perform a real time communication and identification of persons for an access control.

2. Design and Installation of Security doors at HANARO

HANARO security doors have been designed by considering the requirements for a security door in the physical protection concept and the drawbacks of existing doors. The safety and quality class of the security door is Non-Nuclear Safety(NNS) and "S" class, respectively. But the detailed design drawings, fabrication, installation, and test and documentation followed the procedures of the "T" quality class. In response to the strengthening of a physical protection system, a total of 10 security doors replaced the existing doors at the reactor hall, control room and fuel storage room. And the window of the control room is so weak to the terror that it was shielded by a concrete wall, too. Among 10 security doors, 6 for access to the reactor hall are automatic and the others are manual. Automatic doors adopted an electric motor driven system which is advantageous in narrow spaces.

Major design requirements for the security doors are as follows; 1) The thickness of door's steel plate is increased from 3.2 m of an existing door to 6 mm, 2) Transparent windows in the doors are fire-resistant and strengthened glass, 3) Door frame is anchored, 4) Door lock adopts multiple locking system (more than 2 ways) using magnetic locking system and clamp bar locking system etc. In the magnetic locking system, UPS was installed for an emergency condition of a loss of electric power.

Based on the design requirements on the security doors, technical specification was prepared and the detailed design was carried out. Then fabrication, functional test at the factory and field, performance test, and air tightness test were conducted one by one. Particularly, the following were confirmed through the field performance test; smooth automatic and manual opening and closing, air-tightness, structural integrity, access control and monitoring function, interlock logic, operation of safety equipment, status of pneumatic and electric lines, control panel and its operability, and so forth.

By submitting the summary on the results of those tests structural analysis and modified SAR related to the installation of security doors, an approval for the implementation was obtained from the regulatory authority. Pre-operational inspection by the regulatory body was mainly focused on the structure and control of the door and the reactor building leakage test. All pre-operational test results were satisfactory.

Figure 1. Security doors installed in HANARO building

BMS sensor and Magnetic lock at the all entry doors into the reactor hall were installed. And CCTV and

volumetric sensor between 2 interlocked doors were installed. An emergency door to the control room can not be opened from the outside.

3. HANARO Access Control System (HANACS)

HANACS manages the going in and out through the security doors of the reactor hall, control room, and fuel fabrication building, and controls the security doors themselves. It consists of a main server in the CAS room and two client computers in the control room and the HP room in the radiation protection department. Fig 2 shows an example of the computer screen of HANACS, which displays the status of the security doors, the persons entering the reactor hall area, and the network conditions, and so forth.

Access control to the reactor hall by HANACS is performed by two steps; firstly, the existing ADR system acknowledges a person at the outer security door which is the first barrier in a physical protection concept, and then an independent identifying process is done by a fingerprinting at the inner security door. The status of persons acknowledged by the system (ADR and fingerprint identifications) can be monitored and controlled without a time delay by the main server in the CAS and the client computer in control room as well. When the main server in CAS fails, the client computer can substitute the function of a main server.

The administrator at a remote area can also control each security door at the reactor hall, 1st and 3rd floors, control room, and fuel fabrication building. So identified persons can enter the building by a remote control of an administrator. In addition, interphones for a local communication are installed between security doors and other doors, and they can be used if necessary.

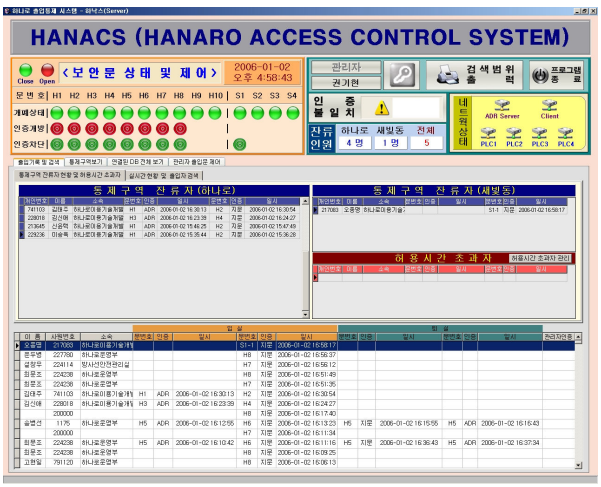

Figure 2. An example of computer screen of HANACS for controlling the security doors and the identified persons

4. Procedure of access for HANARO

The access procedures by HANACS can be classified into a normal procedure for a typical situation and an emergency procedure for an emergency condition and the loss of electric power. In order to enter the reactor hall, ADR identification at the outer security door and a fingerprint acknowledgement at the inner security door are necessary in turn. When getting out of the reactor hall, the inner door can be opened without an identification, and the fingerprint acknowledgement and ADR identification are needed sequently. When entering the control room, the outer and inner doors are open and closed manually by the fingerprint identifications, while the fingerprint identifications are not necessary when exiting the control room.

At the loss of main electricity to the reactor hall, UPS is working and the interlock is maintained. In this case, persons can go in and out by manipulating door handles manually because the interlock is working. When an unexpected emergency escape is necessary, persons can come out by pressing the emergency button in the box inside the dual doors. If the door is not working automatically, persons should open the door manually.

5. Conclusions

In accordance with the plan to improve the KAERI physical protection system, HANARO's security doors and the access control system (HANACS) were developed, and installed. After passing a pre-operation inspection by the regulatory body, they are now in good use.

Design characteristics of the reactor hall and control room and the drawbacks identified from the existing doors were considered in the course of the development, design, fabrication, analysis, and tests of the security doors and HANACS. Through these activities, it was confirmed that the design requirements were satisfied. Therefore, the HANARO safety has been further strengthened and the convenience in the activities has been improved as well.

REFERENCES

[1] IAEA, The Physical Protection of Nuclear Material and Nuclear Facilities" (INFCIRC 225, Rev.4)
[2] Notice of the Minister of Science and Technology, the Act of the protection and the nuclear emergency preparedness for the nuclear facilities, 2005.12.30.