Upgrades of Physical Protection in KAERI

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1. Introduction

The primary objectives of the physical protection are to protect nuclear material from theft and unauthorized removal and to prevent the sabotage of nuclear material and facilities. To accomplish the objectives, a system for the physical protection (PPS) of nuclear material and facilities should be established and implemented under the "Law for physical protection and measures against radiological emergency" and the recommendations INFCIRC/225 /Rev.4, which are considered as a baseline for the PPS.

The current PPS of KAERI including the physical protection elements such as detection, delay and access control was reviewed and analyzed. The options for upgrading the PPS were suggested to meet the domestic and international obligations. An upgrade plan chosen by KAERI is being established.

2. Legal Basis of Physical Protection

The Ministry of Science and Technology (MOST) Notice for the "Law for physical protection and measures against radiological emergency" entered into force on June 2004. According to the Law, the nuclear facilities should establish the PPS to effectively prevent the theft or unauthorized diversion of nuclear material and the sabotage of nuclear facilities.

In addition to the domestic Law, the Convention on the Physical Protection of Nuclear Material (INFCIRC/274/Rev.1) entered into force in Feb. 1987, and the international recommendations on "The Physical Protection of Nuclear Material and Nuclear Facilities" (INFCIRC/225/Rev.4) were revised in March 1997. The recommendations of INFCIRC/225/Rev.4 are considered as a baseline of the PPS, and most of the bilateral agreements between the ROK and nuclear supplier countries require the implementation of the PPS with the recommendations of INFCIRC/225/Rev.4.

3. Upgrade Plans of Physical Protection System

The PPS of KAERI has been established and implemented to meet the recommendations of INFCIRC/225/Rev.3 since 1993. However, there is a need to strengthen and enhance the PPS of KAERI under the domestic Law entered into force in 2003 and the recommendations of INFCIRC/225/Rev.4 revised in 1997.

The current PPS to the protected area around the nuclear facilities were reviewed and evaluated in order to meet the domestic and international obligations on the physical protection. It was performed with two U.S. experts from SNL in Sept. 2004.

A protected area is recommended by INFCIRC/225 /Rev.4 only for the nuclear material of category I or II. However, the protected area of KAERI is drawn around all six nuclear facilities including category III facilities. Two of the 6 nuclear facilities are category II, and the other four are category III or lower as shown in table 1.

Table.1. Nuclear facilities in the protected area

Facility Name	Cate-gory	Description of Nuclear Material
1. HANARO (Research Reactor)	II	◆ LEU (Enrichment : 19.75 %)
2. HANARO Fuel Fabrication Plant	II	◆ LEU (Enrichment : 19.75 %) for the fabrication
3. PIEF	III	◆ Irradiated PWR fuel only for the examination ◆ Category of PPS was changed from II to III after the movement of fresh TRIGA fuels to HANARO
4. IMEF	III	◆ Small amount of irradiated HANARO fuel (Less than 1 kg-U235)
5. DUPIC Fuel Development Facility	III	◆ Irradiated PWR fuel is used for the fabrication of CANDU fuel
6. Nuclear Material Storage	III	◆ Storage for NU, DU and LEU. ◆ The amount of LEU is less than 3 kg-U235

KAERI and U.S. experts suggested four options for upgrading the PPS to the protected area around the nuclear facilities as follows:

Option ① Improvement of the existing protected area boundary. This option proposes to make improvements to the protected area as it is currently defined. The following positive and negative aspects for this option were identified:

Pro: . All facilities receive balanced protection
. Access is consolidated into a single facility

Con: . Very expensive
. Perimeter so big that the PPS effectiveness is minimized
. Difficult to implement plan

Option ② Reduction of the perimeter length by surrounding only category II buildings: This option proposes a protected area boundary that encompasses only the two category II buildings. The proposed perimeter would follow the current perimeter for only a small length, and then divert to surround these two facilities. The following positive and negative aspects were identified:

Pro: □ The perimeter will provide efficient & effective early assessed detection of adversary intrusion
. It permits efficient access control at the protected area boundary for both category II facilities, including contraband searches

. It permits use of existing personnel parking area

. It clearly meets INFCIRC/225/Rev.4

Con: ☐ It is expensive

☐ It requires redefinition of current access roads

Option ③ Reduction of the perimeter by immediately surrounding each category II facility with a perimeter fence: This option is very similar to option 2, except that it involves developing two protected area (one for each category two facility). Because the two category II facilities are relatively nearby, the tasks, pros and cons are identical to option 2, and that two access points (one for each perimeter) will be required in this option.

Option ④ Use of the inner area boundary walls to define the protected area for each category II facility: This option involves drawing a protected area boundary along the substantial walls of the actual material handling area within the two facilities. To do so, it requires that the entire layer be upgraded to improve detection, delay and access control through the boundary. The advantage and disadvantages of this option are as followings:

Pro: ☐ Relatively inexpensive

☐ Utilizes existing substantial wall barrier: minimum possible entry points for adversary

☐ Minimum impact in non-category II facility personnel

☐ Permits use of existing parking and access roads, and building entry routes

☐ Minimum visible demonstration of security

Con: ☐ Difficulty implementing contraband controls/ searches at boundary

☐ Central Alarm Station (CAS) cannot be installed within protected area. Must be hardened to compensate

4. Upgrade of Physical Protection System

After a review of four plans to upgrade the PPS to the protected area around the nuclear facilities, KAERI finally chose the option ④ because it can get a high degree of efficiency with low cost.

The physical protection elements such as detection, delay and access control through the boundary were reviewed and evaluated to effectively establish and implement the PPS using the substantial walls of the actual material handling area.

All doors along the protected area should be replaced with security doors including the installation of additional barriers to delay the adversary.

To do the access control and detection of the adversary intrusions, the detection system such as balanced magnetic switch sensor, metal detector, magnetic lock, CCTV and volumetric sensor should be installed at the entry doors into the protected area, and all entry doors will be under the control of CAS. A few of detection system will be additionally installed at the category III facilities. The searches for employees and visitors will be implemented at the entry point of category II facility (packages, purses, briefcase, etc.).

A CAS with hardened wall and door will be established at the entry place of HANARO building. All alarms, videos and access control installed HANARO, HFFP, PIEF, IMEF and HANARO fence will be connected to the CAS.

The role and number of the guard posted to the buildings around the category II facilities were carefully reviewed and evaluated. The overall PPS boundary is drawn in the figure 1.

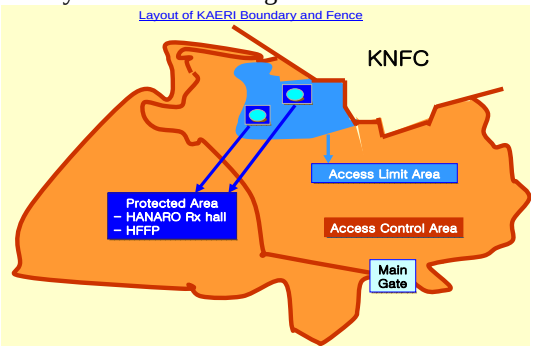

Figure1. Physical Protection Boundary in KAERI

In addition to the upgrade plan, the temporary compensating measures were completed and implemented to meet the domestic and international requirements of physical protection until the upgrades are completed. The compensating measures include the installation of some detection equipment around the category II facilities and the strengthening of the roving patrols around the protected area, etc. The new PPS is being established in KAERI according to the upgrade plan.

5. Conclusion

The current PPS of KAERI was reviewed, and four upgrade options for the physical protection of the nuclear material and facilities in KAERI were suggested.

KAERI finally made a decision to use the inner area boundary walls to define the protected area for each category II facility. The physical protection elements such as detection, delay and access control through the boundary were reviewed and evaluated to use the substantial walls of the actual material handling area. The detail procedures for the implementation of the PPS will be developed to cope with the different situations in the near future.

REFERENCES

[1] INFCIRC/274/Rev.1 “Convention on the Physical Protection of Nuclear Material”, IAEA, Austria, 1980

[2] INFCIRC/225/Rev.3 “The Physical Protection of Nuclear Material”, IAEA, Austria, September 1993

[3] INFCIRC/225/Rev.4 “The Physical Protection of Nuclear Material and Nuclear Facilities”, IAEA, Austria, March 1997

[4] IAEA/TECDOC-967, “Guidance and Consideration for Implementation of INFCIRC/225/Rev.4”, IAEA, Austria, September 1997