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Introduction of the Integrated Safeguards approach at LWRs in KOREA

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1. Introduction

Since safeguards inspection in Korea started, the IAEA and Korea have been looking for possible cooperation for more efficient and effective safeguards implementation. As a part of the efforts, the IAEA and Korea agreed the enhanced cooperation on the LWR inspection at the 8th Joint Review Meeting in 1999. The enhanced cooperation on LWR inspection is a kind of traditional safeguards approach based on remote monitoring.

From the current situations, it is expected that integrated safeguards would be applied in near future. In this aspect, this study analyzes the form of integrated safeguards appropriate to Korean LWRs.

2. IS approach at LWRs

2.1 IS approach at LWRs without MOX

IAEA concludes the absence of undeclared nuclear material and activities in a State by means of the safeguards agreement and Additional Protocol between the IAEA and a State. This conclusion can be only drawn to a State with a comprehensive safeguards agreement and the Additional Protocol in force, and the integrated safeguards approach is only applicable to such a State. Under integrated safeguards, the timeliness verification goal for irradiated fuel can be changed from 3 months to 1 year. However the traditional safeguards requirement for an annual PIV is still valid under integrated safeguards. Random (and short notice) interim inspection at a LWR selected on a random basis with 20% selection probability per year (at least one reactor per year) will be performed with 24 hours advance notification. The detection probabilities and defect tests for verification of fresh fuel and irradiated fuel without MOX can be applied with one level less than those in the current safeguards criteria.

2.2 The feature of IS at LWRs in Korea

Among the three available options (ISP-1, ISP-2 and ISP-3), it was agreed between IAEA and Korea that ISP-2 (short notice random interim inspection under remote monitoring) is the best option for a smooth transition from current safeguards to integrated safeguards at LWRs in Korea. Under the ISP-2, the surveillance systems operate continuously during open core period. And it would not be a big burden to the the facility because there would be no need to have an additional design change for the installation of remote monitoring devices.

Table1. Calculation of PDIs under TS and IS at LWRs in Korea

	Traditional Safeguards	Integrated Safeguards
PIV	1PIV : 1 inspection, 1day => 0.75 PDI 1 Post-PIV : 1 inspection, 1day => 0.75 PDI PIV-equivalent : 0.25 PDI	1Pre-PIV : 1 inspection, 1day => 0.75 PDI 1 Post-PIV : 1 inspection, 1day => 0.75 PDI PIV-equivalent : 0.25x0.5 PDI
Interim Inspection	1 RMSI : 1 inspection, 1day => 1PDI	RII : 0.3 PDI
Additional Activities	1 SA/FFV/SFV : 1 PDI	SA : 0.3 PDI
PDI Total	3.75PDIs [0.75x2+0.25x1+2]	2.2PDIs[0.75x2+0.25*0.5+0.3x2]

2.3 IS inspection activities

(1) Inspection activities during PIVs

A PIV (or PIV-equivalent with 50% selection probability) is conducted once a year. For each reactor refueled during a particular calendar year, a PIV will be performed at the time of refueling as follows; pre-PIV, and post-PIV. DIV can be conducted during post-PIV or PIV-equivalent at the selected LWRs.

(2) Inspection activities during RII

The RII is contributing to the detection and deterrence of undeclared activities that may take place at a LWR, including diversion of declared nuclear material. A RII at a LWR is selected on a random basis with 20% selection probability per year and 24 hour advance notification. The RII is supported by triggered remote monitoring surveillance data.

(3) Design Information Verification

The Design Information is re-examined, at least once a year. Periodic Design Information Verification (DIV) is performed to confirm its continued validity normally at the time of the operator's PIT at a random basis. DIV can be conducted during each PIV-equivalent at the selected LWR.

(4) Complementary Access

Complementary Access at any place on the site is possible in conjunction with a pre-PIV/post-PIV/PIV-equivalent inspection/DIV, with advance notice pursuant to the Additional Protocol.

2.4 The expectation of IS Approach in Korea

In case of integrated safeguards, it is expected that there will be 2 to 3 times of inspections a year for each LWR due to the decrease in interim inspections. And also when using NDA method, the sample size can be reduced because the detection probability will be applied one step lower. The LWR inspection under integrated safeguards would be expected to be very efficient without reducing effectiveness

Table2. Comparison of TS and IS Approach at LWRs

	Traditional Safeguards	Integrated Safeguards
Timeliness Detection Goals	1 year for fresh LEU 3 months for spent fuel	1 year for fresh LEU and spent fuel
Permanent C/S measures applied to spent fuel pond and reactor	Surveillance on spent fuel pond and reactor. Seal on reactor core	No permanent surveillance. Seal on reactor core.
Evaluation of C/S measures by the Agency	During inspection, quarterly	During PIV and random interim inspection

3. Conclusion

The option, which was agreed between IAEA and Korea is 'ISP-2', that is, a short notice random interim inspection under remote monitoring. The option 'ISP-2' is evaluated as an economically efficient option compared with the others because we can still use current remote monitoring systems installed at all LWRs. Also the 24-hour short notice can make the SSAC authority inspector perform all of the short notice inspections simultaneously with IAEA inspector. This paper can help to understand how IS will be applied to LWRs in Korea.

REFERENCES

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