



Implementation of the Safeguards-By-Design (SBD) for Small Modular Reactors



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INTRODUCTION

SMART

- System-integrated Modular Advanced Reactor
- developed by Korea Atomic Energy Research Institute(KAERI)
- the earliest licensed SMR in the world
- received its Standard Design Approval(SDA) in 2012
- finalized its Safety Enhancement Research in 2016
- completed SMART-PPE (Pre-Project Engineering) in 2015-2018

IAEA

- pursuing the development of a safeguards approach to SMRs
- in preparation for the possibility of nuclear materials being transferred to the country where SMRs are firstly introduced if they are exported.

KINAC

- Korea Institute of Nuclear Nonproliferation and Control
- Technical Support Organization

DETAILS OF THE TASK

A. Background of the task

The IAEA MSSP (Member State Support Program) is a project to support the IAEA outside the IAEA's regular budget through voluntary contributions from member states to implement effective safeguards.

Recently IAEA proposed a new SP-1, 18/CCA-002 (Safeguards-By-Design for Small Modular Reactor), which was accepted by the NSSC. Earlier this year, ROK held an advisory meeting attended by SMART design experts from the KAERI to apply the concept of SBD at the design stage for SMRs.

In order to prepare a Safeguards Technical Report (STR) in the future, they all agreed that the existing advisory council is not enough and it is needed to organize and implement the task as a commissioned research.

B. The necessities of the task

The SBD principles for SMRs are still in the development stage, and the level of understanding upon the application of the SBD approach to SMRs and the participation from member states are relatively low. SMRs currently being actively developed by many countries, including the United States, Russia, China, Argentina, and the ROK, have different design characteristics. Therefore it is very important to consider a SBD approach from the initial design stage for each type of reactors. The SBD principles need to be prepared from the initial design stage, reflecting the unique design features of SMART.

C. The objectives of the task

To apply the IAEA's SBD principles to SMRs; the design characteristics of the SMART facility developed by the KAERI are to be verified and a foundation shall be established to ensure that SBD is faithfully implemented from the initial design stage of SMRs.

To identify the technical challenges necessary for implementing SBD principles to SMRs, and to check the SBD application procedures for the design of SMART facilities.

To promote the awareness of the need for SBD among member states and nuclear power plant industries, and to contribute to cooperation between IAEA and member states.

To build a foundation for SBD application in the design of SMART by providing a DIQ and by supporting the documentation of STR.

D. Contents of the task

(1) Preparation of Design Information Questionnaire

DIQ is a collection of questions to identify characteristics of the reactor facilities that must be considered in applying safeguards. Major contents of the DIQ are: general design information, fuel injection and nuclear material handling procedures, fuel design, nuclear material flow and material balance, and facility drawings, etc.

(2) Support for Preparation of Safeguards Technical Report

The safeguards technical report is the final result of the parent task of the present commissioned research.

Major contents of the STR are: necessity of safeguards in the design stage, legal background and status of IAEA safeguards, introduction of SMART development status and key features, description of SMART's large equipment transport means and entrances, SMART's nuclear material movement paths, etc.

CONCLUSIONS

A recently assigned task regarding implementation of SBD for SMART facilities was briefly introduced. By achieving a high degree of completeness of DIQ, it would be a model example for other member states who want to apply the SBD to SMRs. To generate the safeguards technical report, input will also be made for the portion allocated to the KAERI. It includes: description of the SBD implementation information so that the concept of safeguards can be secured in the design stage of SMART, information required by the IAEA for the application of safeguards to SMART, comprehensive design information related to safeguards, and so on.