

# Development of Virtual Training Software for Bulk Handling Facilities Based on the IAEA Training Course

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## 1. Introduction

ROK has been supporting and contributing total 17 tasks to IAEA in-cash and in-kind. These tasks consist of training, safeguards approaches, Analysis Support and NWAL Coordination, information analysis, Safeguards Information Systems and System Usability. Among them, ROK is focusing on development of virtual training for bulk handling facilities. It would be expected that ROK will continuously support virtual training to IAEA through the ROK-SP[1].

IAEA has difficulties in the inspection training due to the problem of finding the training place, and therefore, has a high interest in the training software module development. Especially, the nuclear fuel processing plant training process is complex and the inspection has to be carried out using different verification equipment for each process, so almost no software development was not carried out[2].

Accordingly, ROK agreed with IAEA on then nuclear fuel processing plant software development and started the development. Especially, IAEA provided a book introducing the internally developed process and inspection process for the nuclear fuel processing plant, and based on this, the training software was developed.

Also, the developer directly participated in the training course and completed the training for the part on the inspection process and training for the effort to develop the software closer to the viewpoint of IAEA.

Based on this, the nuclear fuel processing plant's training zones were divided for each process, and the software was developed based on the core measurement zone for each process.

## 2. Development of IAEA Inspector Training Software

### 2.1 The 1<sup>st</sup> Stage Virtual Training Software in 2012

The first SW simulated the BHF with a 3D perspective model similar to the real one. Inside the facility, ROK were able to move freely to first-person viewpoints, and ROK helped the user to understand by attaching a process diagram.

In addition, the main equipment and the IAEA inspection equipments are expressed in a similar

manner, and the main functions and usage methods are explained.



Fig. 1. The 1<sup>st</sup> Stage Virtual Training SW.

### 2.2 The 2<sup>nd</sup> Stage Virtual Training Software

With the 1st stage completion in Feb. 2012 of the training course software development for the nuclear fuel processing plant, which was newly signed in 2011, ROK proposed a discussion with IAEA to have the discussion meeting with IAEA, and IAEA mentioned as follows for the additional matters and future implementation plan.

IAEA asked if IAEA can add new verification equipment to the verification equipment developed in the current software, and ROK explained that it was possible if ROK had detail pictures and operation manual. Also, IAEA asked to insert 'guided tour' part in the software so that the beginner can look around the overall process at the first running of the software, and ROK answered that it can be added after the development of the simplified model.

IAEA requested to re-configure the software after the development with the system that the trainees can utilize the software after completing the training, and for this, IAEA requested the following additional functions.

- Test module with un-matching facility inventory list and quantity (insert number, figure insertion, etc.) having the trainees find them
- Module with a mission at the beginning and have the trainees complete the mission (Module directing to directly go to a certain process and perform certain activity to understand the process in the procedure of completing the given mission. Also add the description of receiving help from the person in charge of the facility in detail)
- If IAEA provides diversion and misuse scenario, it will be added to the software training evaluation module (hidden facility, etc.)

In the second SW, ROK reflected some of the IAEA requests, and made the following improvements.

- The user can grasp the facility at a glance, thereby improving understanding of the structure. It was made in perspective view so that both outside and inside can be confirmed at the same time.
- Process equipments and inspection equipments are also arranged in a three-dimensional form, so as to confirm equipments in actual facilities.
- In addition, in order to improve the understanding of each process, the process flow diagram and the process equipment are connected to implement the function of activating the equipment in different colors when selecting the equipment in the process flow chart.
- The documents used in the IAEA inspections are also presented through examples to enhance the understanding of the users.



Fig. 2. The 2<sup>nd</sup> Stage Virtual Training SW.

### 2.3 The 3<sup>rd</sup> Stage Virtual Training Software

ROK finished 3rd stage reflecting the result of discussion with IAEA as follows.

- A fly-through tour describing the facility, with animation of the key equipment (process oriented and focused on the nuclear material fuel flow without safeguards)
- A tour of the facility or an interactive walk through where the user can freely explore the facility and learn about safeguards activities or equipment (more than an on-line manual)
- Interactive challenge or simulation that allows the IAEA to “test” the student and incorporate learning objectives in the virtual environment; such that after “playing”, the user is familiar with the key elements because he or she has had to challenge him/herself.

In addition, Some functions are added such as IAEA HW compatibility, Logo modification, Contents, 3D reality improvement, Training & Evaluation mode function improvement, etc at 3rd stage.



Fig. 3. The 3<sup>rd</sup> Stage Virtual Training SW.

## 3. Conclusions

ROK sent our training module to IAEA and held the discussion meeting to review additional modifications and future application plan. IAEA highly evaluated this software module and decided to apply to the IAEA inspector training course in the future. Especially, to consider the user convenience, IAEA inspectors tested the demo version and received opinions. ROK promised IAEA to continuously enhance the convenience and add the parts that the lecturer can utilize. In addition, the following improvements will be made in future upgrading work.

- Optimization to increase versatility
- Produced in realistic shape
- User interface improvements with minimal manipulation

## REFERENCES

- [1] ROK SP Handbook, ROK, 2013.
- [2] Fuel Fabrication (IAEA Training Manual on the Nuclear Fuel Cycle), IAEA, 2011.