Training and Education

Nondestructive Examination Technology in the Education and Training for Regulatory Body Inspectors
N. Yamagami, JNES, Tokyo

INTRODUCTION

Mission of JNES inspectors

Incorporated administrative agency Japan Nuclear Energy Safety Organization (JNES) was established on October 1, in 2003. It is an expert organization with the mission to ensure safety in the use of nuclear energy in cooperation with the regulatory authority, the Nuclear and Industrial Safety Agency (NISA).

Nondestructive Examination technologies are very effective to inspect the important systems, structures and components at the nuclear power plants, and I am sure that NDE contributes to safety preservation sufficiently.

JNES inspectors cover 59 nuclear power plants consisting of 55 operating units, 3 constructing units and 1 closed unit, in Japan now. 110 JNES inspectors are engaged in inspection at site. All inspections are conducted by inspectors who have satisfied the qualification requirements defined by laws. The qualification requirements are educational background, years of experience, training and so on.

Qualification for inspectors

JNES has 10 kinds of Regulatory Body Inspector Qualification which are defined according the type of inspections.

In particular, the following 3 qualifications are important, because they can almost cover the major inspections at the nuclear power plants; Inspector on Electric Structure, Periodic Safety Management Review Personnel, and Welding Safety Management Review Personnel.

JNES recommends acquisition of nondestructive testing qualification and certification to our inspectors, besides the Regulatory Body Inspector qualification.

About 30% of JNES inspectors are certified for some nondestructive testing qualifications. Other non-certified inspectors also have attended our NDE training course and have an equal competence to the certified personnel for level 2 of NDE qualifications.

JNES INSPECTOR TRAINING SCHEME

Training system of JNES inspectors

We consider that it is necessary to combine On-the-job training, Off-the-job training and self-education adequately for effective level up of our inspectors’ competence.

Figure 2 shows our Training System of JNES Inspectors.

When new graduates or mid-careers are adopted, they shall take the Basic Training first.
They pass through the Special Training of Radiation Protection, and they proceed to the Qualification Training afterwards. They shall study and master technical knowledge and skill required for each qualification, and they must pass the degree-of-comprehension examination. After qualification training, newcomers shall start OJT at site. According to years of each experience, qualification is acquired mostly within two years after adoption.

Certified inspectors select necessary advanced training course among the menu of Capability Improvement Training and spend shall 5% or more at work hour on the education and training in a year.

Capability Improvement Training consists of follow-up training about each qualification, instruction on new technical knowledge and human skill, practical training at Japan Nuclear Safety Training Center and so on, which include training on NDE technology, of course.

**Training results**

4 kinds of Qualification Training courses were carried out, at 11 times, and 44 inspectors took lectures in total in 2008.

Training contents and minimum hours required for qualification training are decided by laws. It is noted that the subjects of NDE technology are included in Qualification Training for Inspector on nuclear facility and quality assurance. As for NDE, JNES inspectors are obliged to learn Radiographic Testing, Ultrasonic Testing, Magnetic Particle Testing, and Liquid Penetrate Testing for more than five hours in the lecture and practice of qualification training.

52 kinds of Capability Improvement Training courses were carried out, at 114 times, and 854 inspectors took lectures in total in 2008.

Since it is necessary for JNES inspectors to evaluate with accuracy whether Licensees execute inspections and maintenance appropriately at the site or not, the knowledge on nondestructive inspection is so significant that the inspectors might judge the results of such examinations correctly. The Training of NDE was one of most popular courses in the Capability Improvement Training, and 12 courses were carried out, at 35 times, and 119 inspectors took lectures in total. As the kind of the
NDE training increased year by year, and contents came to take up various topics, we rearranged training contents and management method systematically in 2007.

NDE TRAINING SYSTEM FOR JNES INSPECTORS

UT training system

We have 18 kinds of NDE Training Courses of JNES inspector now. Ultrasonic Testing is most substantial training course among five NDE technologies, because UT is the most important to detect indication inside the components and material at site.

Figure 2 indicates ultrasonic testing training system. UT training has 5 stages and 8 kinds of courses. 1st stage of mandatory training for inspectors and 2nd stage of course to maintain and improve skills are essential, and 3rd stage of manual UT specialist development course, 4th stage of automatic UT specialist development course and 5th UT crack sizing specialist development course are prepared as specialist course.

The objective on essential stage is to master ability equal to UT level 2 qualification by completing four training courses.

The person who passed a degree-of-comprehension examination of each training completes the course and can advance to the next course. However, failing the degree-of-comprehension examination continuously by two degrees, he must try the same course again.

Then, I will explain each UT training course sequentially from the top.

UT record evaluation training is an original course specially prepared for training of JNES inspectors. It is an important course for JNES inspectors who examine the UT records of Licensee’s inspection at site as usual. Actually, JNES inspectors seldom perform UT inspection with UT equipments, unless some accidents occur.

RT, MT, PT and ET training system

Figure 3 shows training systems of RT, MT, PT, and Eddy Current Testing.
These are similar systems to mandatory training of UT for inspectors.

I will explain RT as a representative case. At first, each inspector shall attend the RT technical training of mandatory training for inspectors. After completion of it, he shall proceed to MT, PT and RT Records Evaluation course. Then, he shall attend the RT refreshment training regularly to maintain and improve his skill.

In the case of ET, training for steam generator heat transfer tube eddy current test shall be prepared after ET technical training.

There is not any specialist course on RT, MT, PT and ET now. We will consider new training courses and make a specific plan every year, and make an effort to improve the training system for level-up of inspectors’ competence.

![Diagram of Training Systems]

**Figure 3 - Training systems of RT, MT, PT, and ET**

**EXPECTATION FOR NDE TECHNOLOGY**

I will give you my view and expectation for NDE technology to be still more developed hereafter, last. NDE technologies have been mainly applied to in-service inspection for class 1 and 2 components, measurement of piping thickness, and defect sizing for integrity evaluation at the nuclear power station.

- In-service inspection for class 1 and 2 components is included in Periodic Licensee’s Inspection, and JNES confirms Licensee’s implementation through Periodic Inspection and Periodic Safety Management Review.
- Measurement of piping thickness is very significant on aging degradation management, and JNES checks Licensees to take appropriate measures.
- JNES contributed to introduction of Performance Demonstration (PD) certification system on defect sizing for integrity evaluation. Then, JNES has been reviewing the results of integrity evaluation of structure and components.

New regulation system is expected to encourage that maintenance method and inspection technology are more sophisticated and more relevant.

In new regulation system, we lay a special emphasis on the following key words.

- Inspection and evaluation in operation Periodical Licensee’s Inspection shall be executed not
only in outage, but also in operation.

- **Reliability-centered maintenance**: In addition to time-based maintenance, condition-based maintenance shall be required.
- **Aging degradation management**: New regulation system requires inspections to be linked with countermeasures for aging degradation, and Licensees shall take appropriate measures for aging degradation at an early phase of a plant life.

Therefore, NDE will be still more required to detect indication of degradation, defects and unusual phenomena. I expect NDE technologies to be improved and refined, in order to be more efficient and more effective for safety management activities.