

現場檢査를 위한 要員教育과 資格 Personnel Training and Qualifications for Inservice Inspection

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INTRODUCTION

In a nuclear power plant, inservice inspection (ISI) deals not only with the ability to perform non-destructive examinations but also with the basic knowledge necessary for working safely in the operating and shutdown reactor environment. This is especially important to the supervisory personnel of ISI teams. Therefore, it is necessary for training of ISI staff to have information about expected work location and environments in a shutdown reactor facility. Although health physicist is provided by the utility station to work with ISI screw, the ISI personnel should be provided, as a part of training, sufficient information on reactors with respect to components and systems that might present restrictive working conditions. Basic training and qualification of ISI personnel are in accordance with ANSI N45.2.6, SNT-TC-1A and as well as guidance from US NRC Regulatory Guides 1.8, 1.58, 8.8 and 8.10.

BASIC REACTOR INFORMATION

ISI personnel should have a basic background knowledge of reactor systems. Although overall knowledge is not absolutely necessary to perform actual nondestructive examinations, the background information is important in planning work and in minimizing exposure of NDE personnel while performing the inservice inspection. Reviewing the actual plant configuration and checking the conditions of each system could minimize radiation levels. Flushing the system also lowers the exposure to radiation. All this information should be co-ordinated with the operating plant personnel. A shorter downtime for the operating reactor can be achieved by providing NDE personnel with reactor plant knowledge and providing integrated working team relationship. The radiation dose accumulations of NDE personnel will also be reduced. Sufficient personnel training is required to review the plant layout and be able to identify potential radioactive areas. Then planning and specific plan procedures can be developed for each work location. This kind of training should be considered as a basic training for reactor plant layout.

QUALIFICATION AND TRAINING:

Requirements for ISI personnel qualification and training for performing NDE are given in the American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A. The qualifica-

tion requirements for all NDE methods are shown in Table 1. The experience, education and training requirement in SNT-TC-1A varies for each NDE method due to its technical complexity. From Table 1, one can compare the certification requirements for magnetic particle against ultrasonic examinations and see that qualification requirements vary according to the method of examination. The qualification requirements for ultrasonic and radiographic examinations are more stringent than for magnetic particle and liquid penetrant examinations.

It should be noted that personnel qualification requirements specified in SNT-TC-1A are minimum. A great deal of emphasis should be given to educating ISI personnel in various welding processes, fabrication methods, the potential defects associated with each processes, the effect of joint detail and weld preparation, and the effect of different material properties on different NDE methods. An understanding and ability to read piping isometrics is absolutely essential. A basic understanding of radiation safety and protection is extremely important.

INSPECTION PROGRAM:

An effective ISI Program is one which meets the code requirements while maintaining efficient utilization of examination personnel and equipment without additional cost increase, and excessive down-time for the plant. Before preparing for ISI program, it is important that the owner select an inservice inspection vendor at the beginning of the design stage to determine the access requirements relative to their examination equipment. Each project can then, with the aid of the ISI vendor evaluate their program during design reviews and possibly take exception to those provisions that may be conservative. The ISI program must first determine from ASME Section XI the "Examination Method" (i.e., visual, surface or volumetric), "Areas Subject to Examination", and the "Tests" which are required for each component in question. Knowing the required examination method, subject areas, and required tests, the user can then determine the provisions necessary to facilitate the requirements. The ISI personnel training program should include:

- I. Definition of system boundaries
- II. Design provisions for access to the components for examination
- III. Design of weld joints and surface preparations
- IV. Preservice inspection requirements.

To develop such a program for ISI training can be obtained either by on-the-job training or by the use of experienced consultants. The ISI training program should also include actual working plan for ISI performance and consideration must be given to the following subjects:

- I. Available qualified manpower
- II. Radiation level in the examination area
- III. Number of examinations to be performed
- IV. Examinations to be performed manually or with automatic equipment
- V. Location of welds
- VI. Required time to complete examinations

Prior training in this area is of utmost importance and can be obtained by taking NDE courses that provide hands-on training.

QUALITY ASSURANCE

In ISI program, quality assurance fundamentals must be utilized to assure that all code requirements have been met, and sufficient documentation is available for the work performed. In performing ISI, prior preparation with detail procedure is extremely important. The procedure must be followed. Equipment and materials must be checked before performing actual work.

Adequate training is required to prepare proper records of examination. The code contains the requirements for the inspection report, however preparation of examination report is an important part of training. These records are legal documents and must be traceable.

