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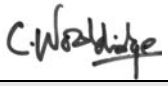
Chapter Pilot: P.CHAUMIN *Name/Initials*  *Date 17-06-08*	
Approved for EDF by: A.PETIT *Name/Initials*  *Date 26-06-09*	Approved for AREVA by: C.WOOLDRIDGE *Name/Initials*  *Date 25-06-2009*

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For information address:

AREVA NP SAS

An AREVA and Siemens Company
Tour AREVA
92084 Paris La Défense Cedex
France

EDF

Division Ingénierie Nucléaire
Centre National d'Equipement Nucléaire

165-173, avenue Pierre Brossolette
BP900

92542 Montrouge
France

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SUB-CHAPTER 6.5 - IN-SERVICE INSPECTION PRINCIPLES (EXCLUDING MAIN PRIMARY AND SECONDARY SYSTEMS)

In-service inspection is a preventive maintenance operation involving non-destructive examinations and checks on equipment. These checks and examinations constitute a monitoring and maintenance programme (or inspection plan) which is systematically scheduled and implemented during planned outages. This sub-chapter addresses in-service inspections carried out on the nuclear island pressurised equipment, excluding the MPS/MSS (Main Primary System / Main Secondary System). This includes pressurised auxiliaries, safety auxiliaries and those parts welded to the pressurised components. MPS/MSS in-service inspections are addressed in Chapters 5 and 10.

1. SAFETY REQUIREMENTS

In principle, In-Service Inspections (ISI) are performed in areas that are sensitive to the development of different kinds of damage (e.g. crack initiation and propagation under fatigue conditions, corrosion, vibratory fatigue, radiation damage, fast fracture damage, etc.).

These sensitive areas depend on the design of the equipment and its operating conditions. They are identified at the design stage.

Equipment is designed and installed to facilitate the inspection of sensitive areas (i.e. it is accessible and can be inspected).

For areas not considered to be design-sensitive, in-service inspection is performed by sampling, based on the defence-in-depth principle. This type of inspection is also performed in design sensitive areas to meet regulations relating to pressure retaining boundaries.

For areas where radioactivity is important, design, construction and installation provisions ensure that the collective dose impact of in-service inspections is minimised as far as reasonably practicable.

2. AREAS CONSIDERED

The areas considered for in-service inspection are those, for example:

- containing welded joints,
- potentially presenting a risk of in-service damage, linked in particular :
    - to the thermal, thermal-hydraulic and mechanical loads applied to the equipment,
    - to the action of the fluids in contact with the equipment.
- which are subjected to periodic inspection in accordance with pressurised equipment regulations.

3. PRINCIPLES

3.1. SCOPE, TYPE AND FREQUENCY OF IN-SERVICE INSPECTION

The scope, type and frequency of in-service inspection depends on :

- the level of potential damage during service and the dynamics of the potential development of the damage,
- the importance to safety of the consequences of equipment failure,
- operational feedback,
- Regulatory requirements,
- the equipment state.

3.2. PRINCIPLES APPLIED AT THE DESIGN STAGE

The designer is required:

- to anticipate the damage mechanisms that are likely to affect the equipment, in order to eliminate or minimise them as much as possible,
- to identify items of equipment that need to be inspected and to specify the means of inspection. This will take into account the residual risks not eliminated at the design stage as well as applicable regulations,
- to make provision in the design for easy access to items of equipment to be inspected. Access should allow detection and characterisation of any cracks taking into account the materials used, surface conditions, the geometry of the items to be inspected and location and geometry of the welds themselves,
- to recommend examination methods to be used in specific inspections. In principle, visual and dye penetrant examinations are preferred. Televisual examinations may be used, particularly on surfaces which may be contaminated with radioactive particles. Radiographic or ultrasonic examination of the main welds in pressurised items may be required as may automatic or remote controlled examinations. It is expected that the design will minimise the necessity for such techniques.

3.3. PRINCIPLES USED FOR THE OPERATIONAL PHASE

The plant operator establishes maintenance and monitoring programmes including appropriate frequency of implementation, based on:

- Initial maintenance plans, by type and group of equipment, taking into account operational feedback (reported cracks and degradation, material properties, operating incidents), statutory requirements and the importance to safety of the consequences of equipment failure,

- Manufacturers' Instructions which take statutory hazard analysis results into account together with the associated recommended in-service inspections,
- The requirement for the equipment to remain effective.

4. MEASURES FOR FACILITATING INSPECTIONS

Measures provided to facilitate the inspections, in addition to the design, construction and installation provisions already made, are:

- for equipment, provision of :
  - sufficiently large manholes and handholes,
  - eyeholes on pressure housings to allow visual examinations from a distance (e.g. shell side of the heat exchangers),
  - access areas for remote examination of the insides of heat exchangers,
  - plugs for radiographic inspection access holes,
  - locally removable insulation,
  - means for full venting and drainage.
- for the area around equipment, provision of :
  - temporary or permanent means for accessing the areas to be controlled (cellular metal floor, etc.),
  - biological shielding in the vicinity of radiological hot spots,
  - automatic or remote control inspection means in order for personnel to remain distant from radiologically active areas,
  - sufficient clearance to allow examination of items to be inspected.