



**CERTIFICATION SCHEME FOR PERSONNEL**

**Document No. CSWIP-ISO-NDT-11/93-R  
Requirements for the Certification of Personnel Engaged in Non-Destructive Testing in accordance with the requirements of EN 473 and ISO 9712**

**APPENDIX 1**

**Examination Format and Syllabus for the Certification of Personnel engaged in Non-Destructive Testing of Welded Joints and General Engineering Components**

**PART 9: Radiation Safety Levels 1 and 2**

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## **EXAMINATION FORMAT AND SYLLABI ON WHICH CANDIDATES FOR CERTIFICATION IN THE NON-DESTRUCTIVE TESTING OF WELDS AND CAST COMPONENTS WILL BE EXAMINED**

These syllabi are applicable to candidates seeking certification in accordance with Document CSWIP-ISO-NDT-11/93- Requirements for the Certification of Personnel engaged in Non-Destructive Testing.

### **RADIATION SAFETY**

#### **1 LEVEL 1 Examination**

- 30 multiple choice questions
- Time allowed 45 minutes
- Pass mark 70%.

#### **2 Level 2 Examination**

- 40 multiple choice questions
- Time allowed 60 minutes
- Pass mark 70%.

#### **3 LEVEL 1 RADIATION SAFETY LEVEL 1 BASIC SYLLABUS**

##### **a. Basic Concepts**

Matter, molecules, elements, atoms, fundamental particles, atomic number, mass number, isotopes, radionuclides. Types of radiation:  $\alpha$ ,  $\beta$ ,  $\gamma$ . Radiation energies (eV). Production of X-rays. Activity, decay, half-life. Sealed and unsealed sources. Contamination. Ionisation.

##### **b. Equipment**

Gamma radiography: Remote exposure containers; Collimators. X-ray generators. Linear accelerators. X and  $\gamma$ -ray compounds. Site radiography.

##### **c. Radiation Units and Dose Limitation (1 hour)**

Quantities and units

Activity (Bq). Absorbed dose (Gy). Dose equivalent (Sv). Dose rate ( $\mu\text{Sv/hr}$ ). Conversion from old to SI units. Commonly used prefixes.

##### **d. A brief summary of legislation**

Radioactive Substances Act 1993

Ionising Radiation Regulations 1999

Approved Code of Practice Parts L121 Work with Ionising Radiation.

Guidance Notes : "Radiation Safety for Site Radiography" ECIA, London

Radioactive Material (Road Transport) Act 1991

Radioactive Material (Road Transport) Regulations

Radiation safety for site radiography, Engineering Construction Industry Association (ECIA), London.

The high-activity sealed radioactive sources and orphan sources regulations 2005.

##### **e. Dose limitation**

Justification, optimisation, dose limits. Regulatory Dose Limits. Reference levels:  $7.5 \mu\text{Sv/hr}$

##### **f. Biological Effects**

Cell, nucleus, DNA, chromosomes. Cellular damage, varying radiosensitivity. Acute macroscopic effects: stochastic and deterministic effects. The effects of chronic exposure.

### **g. Principles of Protection from External Radiation**

Basic parameters: time, distance, shielding, source outputs. Half value and tenth value thickness.

Practical aspects: The use of enclosures versus site radiography, Wind-out containers, X-ray sets, collimators, Safety and warning systems, Radiography compounds, Required interlock systems for compounds, Communication between radiographs

### **h. Shielding Calculations**

Exercise on manipulation of radiation units.

Exercises on the following: Calculating source and X-ray intensity; Calculating dose from dose-rate, use of inverse square law, use of half value and tenth value thickness for calculating shielding.

### **i. Personal Dosimetry (½ hour)**

Classification – medical surveillance, dose assessment, ADS dose record keeping.

Types of dosimeter – film badges, TLDs, personal alarm monitors.

ALARP – investigation.

Exposure – investigation.

Over-exposure – investigation, notification.

The requirements of the Outside Workers Regulations.

Use of Radiation Passbook for outside workers.

### **j. Radiation Monitoring**

Types of monitor (direct, indirect reading) correct use. Correction factors. Testing and calibration. Frequency of monitoring. Record keeping.

### **k. Specific Requirements of Regulations (¾ hour)**

Source accountancy. Controlled and Supervised Areas. RPA and RPS. Local Rules. Transportation of sources.

### **l. Accidents and Hazards in Perspective**

Accident case histories. Effects of low radiation doses, sources of information on radiation risks. Risk estimates and comparison with other risks.

### **m. Emergency Procedures**

Case studies of incidents related to industrial radiography. Transport incidents. Emergency equipment. Actions to take in event of emergency. Contingency plans.

## **4 Level 2 Radiation Safety Supervisor Syllabus**

The syllabus for Level 2 Radiation Safety covers the same syllabus as Level 1 but with more emphasis on the supervisory and recording aspects of the subject.

## **5 References**

Factory Form 324: Precautions in the use of Ionising radiation in Industry.

Recommendations of the International Commission on Radiological Protection. ICRP Publication 9

Work with ionising radiations COP L121. London, Health and Safety Executive 1999.

SI 1999 No 3232: The Ionizing Radiation Regulations 1999. HMSO.

Radiation Safety for Site Radiography: Kluwer Publishing Ltd 1986