



**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 BS EN 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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These syllabi are applicable to candidates seeking certification in accordance with the current version of Document CSWIP-ISO-NDT-11/93- Requirements for the Certification of Personnel engaged in Non-Destructive Testing in accordance with the requirements of BS EN ISO 9712'.

## **RADIATION SAFETY**

### **1 Level 1 Examination (Basic radiation safety)**

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

### **2 Level 2 Examination (Radiation protection supervisor)**

- 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. NDT 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. ICP Publication 9.
- Work with ionising radiations COP L121. London, Health and Safety Executive; 2000; ISBN 9780717617463.
- SI 1999 No 3232: The Ionizing Radiations Regulations 1999. HMSO.
- Radiation Safety for Site Radiography: Kluwer Publishing Ltd 1986.