



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

3rd Edition, February 2016

Issued under the authority of the Governing Board for Certification
All correspondence should be addressed to:

TWI Certification Ltd
Granta Park, Great Abington, Cambridge CB21 6AL, UK
Telephone: +44 (0) 1223 899000
Fax: +44 (0) 1223 894219
Email: twicertification@twi.co.uk
Website: www.cswip.com

CSWIP is administered by TWI Certification Ltd
The use of the UKAS Accreditation Mark indicates accreditation in respect of those activities covered by
Accreditation Certificate No 25

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: α , β , γ . 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 γ -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.