

# *ASNT Level III Study Guide: Radiographic Testing Method second edition*

## Text Corrections

---

The following text corrections apply to the first printing of *ASNT Level III Study Guide: Radiographic Testing Method second edition*. Subsequent printings of the document will incorporate the corrections into the published text.

**Page 3:**

The first sentence in the second paragraph under *Activity* should read:

This 1Bq = 1 sts<sup>-1</sup>.

**Page 6:**

Question 1.2 answer b. should read:  $\frac{I_1}{D_2^2} = \frac{I_2}{D_1^2}$

Question 1.9 should read:

The reduction in the energy of photons when they are scattered by ~~free~~ electrons which thereby gain energy is called:

**Page 12:**

Question 2.5 answer b. should be changed to: 10.2 cm.

Question 2.6 answers should be changed as indicated:

- a. 34 6000 mA • min per week
- b. 7 850 mA • min per week
- c. 17 850 mA • min per week
- d. 2550 mA • min per day
- e. 71 400 mA • min per month

**Page 13:**

The first sentence in the second paragraph should read:

To acquire the energies necessary for industrial radiography, the electrons must experience an accelerating voltage from about 30 kV to 30 MeV.

**Page 17:**

In the left-hand column, under the heading *Chemical Form*, the following edits should be made:

The radioactive material is in the form of metal pellets or wafers ~~whenever possible~~. This is particularly true for cobalt and iridium. ...

Each pellet produces about 185 GBq (5 Ci) after neutron bombardment. Iridium is irradiated in 1 mm (0.04 in.) thick ~~pellets~~ wafers 2 or 3 mm (or 0.08 of 0.12 in.) in diameter, ...

**Page 18:**

Question 3.5 answer d. should read: Ra-226.

**Page 24:**

Under the subhead *Permissible or Allowable Personnel Dose*, delete the second and third paragraph and replace with the following:

CFRPart 20–Basic Radiation Safety

Part 20, Standards for Protection Against Radiation, sets down the basic terms and rules for radiation safety, including radiation dose limits. Following are only those requirements in Part 20 that are not covered in more detail in Part 34.

1. Radiation Dose Limits [Section 20.1201 and Section 20.102]

The Nuclear Regulatory Commission has annual (calendar year) radiation dose limits. Note: This book is concerned only with radioactive sources located outside the body. There are separate NRC limits for such intakes of radioactive materials. Those limits are not considered here because radiography sources are sealed inside steel capsules that rarely allow particles of radioactive material to be released into the air. The following are the Nuclear Regulatory Commission limits for adults in areas where access is restricted for the purpose of radiation protection:

Dose Limits

1. An annual limit which is the more limiting of:

- a. The total effective dose equivalent being equal to 0.05 Sv (5 rem), or
- b. The sum of the deep dose equivalent and the committed dose equivalent to any individual organ tissue other than the lens of the eye being equal to 0.5 Sv (50 rem).

2. The annual limits to the lens of the eye, to the skin and to the extremities which are:

- a. A lens dose equivalent of 0.15 Sv (15 rem), and
- b. A shallow dose equivalent of 0.50 Sv (50 rem) to the skin or to any extremity.

The whole body dose is a measure of the amount of radiation that has been received by a large portion of the body, particularly the parts important from a radiation protection point of view. These parts are the bone marrow where leukemia would originate or the gonads where genetic damage to offspring would originate. Usually the dose reading on the film badge or thermoluminescent dosimeter is considered to be the whole body dose. Whole body for external exposure is head, trunk (including male gonads), arms above the elbow or legs above the knee.

The annual occupational dose limits for minors are 10% of the annual dose limits specified for adults [Section 20.1201]. Note, however, that Department of Labor regulations prohibit individuals under the age of 18 from working in occupations involving exposure to radiation [29 CFR Section 570.120 and Section 570.57]. Minors are not allowed to work as radiographers.

There is a special limit on radiation dose to the skin from radiation that does not penetrate beyond the skin. This limit for the skin is rarely of interest to radiographers. Skin dose generally comes from beta particles, which usually do not have enough energy to reach deeply into the body and do not contribute to the whole body dose. The radioactive materials in radiography sources emit beta particles, but the beta particles do not penetrate the steel capsule containing the radioactive material.

**Page 25:**

Replace Table 4.4 with the following.

---

**Table 4.4:** Maximum permissible dose (MPD) values per 10CFR20.1201.

<b>Controlled areas</b>	<b>Maximum Yearly Dose Sieverts (rem)<sup>a</sup></b>
Whole body, gonads, lens of eye	0.05 (5)
Skin (other than hands and forearms)	0.50 (50)
Hands	0.50 (50)
Forearms	0.50 (50)
Other organs	0.50 (50)
Noncontrolled areas	0.001 (1)

<sup>a</sup>The numerical value of the dose equivalent in rem may be assumed to be equal to the numerical value of the exposure in roentgen for the purpose of this report.

**Page 29:**

In the right-hand column, the second sentence in the first paragraph under *Calibration and Maintenance* should read:

The required calibration interval for survey instrumentation is 6 months and, for pocket dosimeters, annually.

**Page 32:**

In Table 4.5, the third column, head should read:

Maximum dose rate at 1 m (3.3 ft) from package surface

**Page 33:**

Question 4.1 should be deleted.

In Question 4.9, answer a. should read:

a. white cell count ~~increase~~ decrease.

**Page 36:**

The last paragraph in the right-hand column should read:

Geometric unsharpness, therefore, varies directly with the focal spot dimensions and with the object-to-film distance and inversely with the distance from the focal spot (or source) to the object.

**Page 38:**

In Table 5.2 near the bottom, it should read:

Where:  $U_g = (s)(t)$  *sod*

**Page 44:**

Question 5.15 should read:

If an acceptable 2.5 density is obtained using a 30 mA•min technique at an SFD of 61 cm (24 in.), what would the exposure time be at 91.4 cm (36 in.) SFD using 5 mA•~~min~~ to obtain the same film density?

**Page 56:**

Question 7.2 answers d. and e. should be reversed to read:

d. All of the above.

e. None of the above.

**Page 77:**

In the right-hand column, in the third and fourth paragraphs, the figure number should be reversed to read:

Linear motion – The part under testing is moved past the collimated X-ray beam or the collimated X-ray beam is scanned over the surface of the part, as in Figure 10.10.

Rotary motion – the X-ray source and slit are stationary and the cylindrical part rotates 360 degrees or more through the collimated X-ray beam, as in Figure 10.9.

**Page 78:**

The figure heads should be changed to read:

Figure 10.9: Rotary in motion radiography.

Figure 10:10: Linear in motion radiography.

**Page 83:**

Question 10.2 should be changed to read:

When radiographing a steel specimen 1.9 cm (0.75 in.) thick with 275 kV peak X-ray, the use of a copper filter that is of the specimen thickness is recommended (if more latitude is necessary).

**Page 109:**

The following answers should be changed:

1.3 d

1.22 c

7.2 d