Certification of industrial radiography operators in Norway

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Abstract
Industrial use of sealed radioactive sources in Norway is described in terms of inventory of category 1 and 2 sources, together with more detailed statistics for the industrial radiography industry. Companies performing industrial radiography must be authorized by the Norwegian radiation protection authority (NRPA), and by June 2005 NRPA has issued 90 radiography licences. One of the requirements in the authorization is that site radiography must be performed with 2 operators certified in radiation protection. From January 1st 2005 the operator certification function is entirely delegated to external, independent, accredited certification bodies. The certification body has to be accredited for this particular personnel certification function. A Normative document, describing the necessary radiation protection training and qualifications of industrial radiography operators, has been prepared in cooperation between NRPA and the Norwegian society for non-destructive testing.

1. Introduction

Industrial radiography often involves the use of large sealed radioactive sources. The International atomic energy agency (IAEA) has provided a categorization system for radioactive sources [1]. In this system category 1 represent the most dangerous sources from a health effect point of view, with increasing category number signifying decreasing level of risk. The classification system consists of 5 different categories, and in table 1 the total Norwegian inventory of category 1 and 2 sources is shown.

	Number of undertakings	Number of radioactive sources	*IAEA Category*
Irradiation facilities	1	1	*1*
Blood irradiation facilities	9	9	*1*
Gamma knife	1	1	*1*
Teletherapy	2	2	*1*
Industrial radiography	88	198	*2*
Brachytherapy (afterloading)	4	4	*2*
Total	105	215	

Table 1. Norwegian inventory of Category 1 & 2 radioactive sources.

As seen from the table, the majority of high risk sources in Norway are used within industrial radiography. This is a large industry in Norway, due to the extensive offshore activities. The major radiation sources applied are X-ray machines (typical 200 – 300kV), and radioactive sources of Ir-192 (1500 GBq) and Se-75 (3000 GBq). To a small degree Co-60 sources are also applied, and in special situations even portable accelerators may be used. The latter is well suited for testing of very thick objects, and is generally hired for particular projects. A 6 MeV betatron may be used for concrete objects up to 1m thickness.

2. Industrial radiography statistics

In table 2 some statistics from the Norwegian industrial radiography industry is shown. Site radiography, i.e. radiography outside shielded enclosures, is usually done with radioactive sources. As opposed to X-ray machines, radiation sources do not apply electric power, and is thus the preferred option in the oil industry. Site radiography with radioactive sources has a number of high risk features: Large gamma sources are placed in unshielded positions for radiography in non-standardized environments like factories and mechanical work shops etc

	Number
Industrial radiography licenses	*88*
Radiation protection certified operators	*518*
Operators without radiation protection certification	*31*
Cameras for gamma radiography	*198*
X-ray machines	*187*
Companies having one or more shielded enclosure	*42*
Total number of shielded enclosures	*63*

Table 2. Statistics from Norwegian industrial radiography, as of April 7th 2005.

During radiography the sources are brought in and out of a shielded position, with a risk of the source getting jammed, unintentional brought into unshielded position, lost etc. The dose rate from an unshielded radiography source is typical 100 – 200 mSv/h at 1 m distance. In Norway there is annually 5 – 10 reported incidents/minor accidents involving radiography sources, and globally there is frequent reports of serious accidents, some even fatal, with radiography sources. Data over accidents with clinical consequences to occupationally exposed workers for the time period 1975 -2000 have been reported by Unscear [2], see table 3.

Field of application	*Number of accidents*
Nuclear fuel cycle	*9*
Industrial radiography	*36*
Other industrial use of radiation	*29*
Tertiary education and non industrial use	*13*
Medical uses of radiation	*12*
Total number	*99*

Table 3. Accidents with clinical consequences to occupationally exposed workers 1975-2000, from Unscear [2].

3.Industrial radiography – Regulatory regime

Due to the high risk nature of NDT work, there are strict regulatory requirements for this industry. Companies performing industrial radiography must be authorized by the Norwegian radiation protection authority (NRPA). One of the requirements in the authorization is that site radiography must be performed with 2 certified operators, while for radiography in shielded enclosures one certified operator is sufficient. Previously the radiation protection certification of operators was done by the NRPA. From January 1st 2005 this function is entirely delegated to external, independent, accredited certification bodies. The certification body has to be accredited for this particular personnel certification function. A Normative document, describing the necessary radiation protection training and qualifications of industrial radiography operators, is one of the basic elements in the accreditation and certification process. Such a Normative document has been prepared in a cooperation between NRPA and the Norwegian society for non-destructive testing, and is issued as a formal NRPA document as StrålevernHefte 28. The document is heavily influenced by annex III “Classroom based training in radiation protection for industrial radiographers “ of the IAEA safety report series 20 [3] The Normative document may be downloaded from the NRPA web site (www.nrpa.no). The other basic document in the accreditation process is European and international standard EN ISO/IEC 17024 [4].

4. Training requirements

In the Normative document, competence within the following topics is required for radiation protection certification in industrial radiography:

- Regulatory requirements for using radiation sources for industrial radiography.
- Basic properties of X-and gamma radiation.
- Radiation output of the various kinds of radiation sources, and be able to use this information for dose calculations.
- Hazards and health effects from ionizing radiation.
- Radiation protection terminology
- Regulations for transport of radioactive sources, to a level corresponding to the specialized course for class 7.
- Basic principles for radiation protection, and be able to perform calculations with time, distance and shielding.
- Use of radiation protection instrumentation.
- Practical means for operational dose reduction.
- Correct work procedures with regard to measurements of radiation levels, erecting barriers, daily control and use of sources and equipment.
- Service, maintenance and calibration of equipment.
- Be able to detect abnormal situations, and to make the proper corrective actions.
- Reconstruction and dose estimations in connections with accidents.
- Writing reports and keeping logbooks

The Normative document also describes the content of a standard 35 hours training course regarded necessary for obtaining the qualifications listed above, together with a description of the examination process and the minimum requirements for passing the examination.

5. Radiation protection certification

For the time being there are two certification bodies performing this radiation protection certification in Norway. One of the certification bodies is based in Sweden, and is being accredited by Swedac. The other is Norwegian, and is being accredited by Norsk Akkreditering. In principle, any operator may apply any of the two certification bodies for a certificate, on the basis of documentation of qualifications and practice. Most applicants attend one of the two established 35 hour training courses in Norway. As of June 1st 2005 approximately 100 operators have attended the training courses and applied for a certificate within the new certification regime. About 85 % have passed the examination and received a certificate.

The certificate is valid for 10 years, and according to ISO/IEC17024 [4], the certification body shall maintain sole ownership of the certificate. In order for the certificate to be valid throughout the entire 10 year period, the certificate must be endorsed every 2.nd year by the radiation protection officer of the undertaking. The new certification regime thus established implies that the radiation protection qualifications of operators are kept under surveillance by the national accreditation bodies and the certification body which have issued the certificate, and not by the radiation protection authorities.

Occasionally, foreign radiography companies apply for a Norwegian radiography authorization. As a transitional arrangement for 2005, short term radiography authorizations have been issued to foreign companies without specific requirements that all operators must hold a Norwegian radiation protection certificate. It is then pointed out that for a future long-term authorization, the operators must be certified according to the new certification regime.

6. Conclusive remarks

The majority of international reported serious accidents within industrial radiography are caused by operator errors or failures to follow procedures, while a minor part is caused by equipment failure alone. The equipment used in Norway for gamma radiography is the same as used elsewhere in the world and the same as equipment used in a number of reported serious accidents abroad. Training of operators and establishing of safety culture has been of vital importance for improving the radiation safety in industrial radiography, and we believe that the established system of operator certification is a useful tool in this respect. We also think that transferring the certification process to accredited external bodies will ensure a better follow up and maintenance of competence and training of the certificate holders, according to the accepted international principles described in EN ISO/IEC 17024.

Outsourcing the certification system also represent less administrative burden on the NRPA, and it is also in line with the current political trends:
Stortingsmelding (white paper) nr.17- 2000-2003 concerning governmental regulatory supervision: ”The objective is to terminate traditional systems for governmental regulatory supervision in areas where these with advantage could be replaced, or at least reduced, by alternatives like f.in. accreditation or certification”.

References

[1] International Atomic Energy Agency-Tecdoc 1344 (2003). Categorization of radioactive sources.
[2] United Nations Scientific Committee on the Effects of atomic Radiation. Unscear 2000 report to the General Assembly. Volume 1:Sources.
[3] International Atomic Energy Agency safety report 20.”Training in radiation protection and the safe use of radiation sources. Annex III: Classroom based training in radiation protection for industrial radiographers (2001).
[4] EN ISO/IEC 17024 (2003):”Conformity assessment – General requirements for bodies operating certification of persons. Brussels.

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