

Industrial radiography in Norway – legislation and qualification requirements with regard to reporting and handling of accidents.

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Norwegian legislation concerning authorization and reporting of accidents.

In Norway, a new act on radiation protection and use of radiation passed the Parliament the 12.th. May 2000. The main change in this legislation compared to the old act from 1938 is adoption of the ICRP recommendations as given in ICRP publication no.60 and adoption of the main obligations and legislative instruments as given in the EU Council directives 96/29 Euratom and 97/43 Euratom.

There are approximately 130 authorized companies in Norway performing industrial radiography. The main area of work for these companies is related to the oil and gas production offshore and onshore. The number of workers involved is approximately 1000.

According to the present Norwegian regulations, industrial radiography companies are authorised for a time period of 3 years. In order to renew the licence for a new 3-year period, the companies must submit a standard report covering the previous 3-year period. In this report, the companies must state the number of radiographs exposed and the number of accidents. Additionally, they are also obliged to report accidents and incidents immediately, according to the present regulation: *“The licensee shall immediately report any accident or incident of radiation protection significance to the Norwegian radiation protection authority”* From the authority side we find the use of time limited authorizations are an efficient way of having contact with this industry and to be updated regularly on the development in industrial radiography activities. In addition we believe that the need for renewal of licences will motivate companies to focus on radiation protection issues.

For the licensing period 1997-1999, an annual average of approx. 260.000 radiographs and 5 accidents were reported. In table 1 a short summary of the accidents for the time period 1995-2001 is given.

Table.1. Industrial radiography accidents for the time period 1995-2001, as reported by the NDT-companies.

Type of accident	Number	%	Doses involved
Concluded falsely that the exposure was completed or exposure initiated with operators working around source. - Alarm dosimeter out of use/failed-	8	26%	Large doses, up to 50 mSv
Source stuck in projection sheath	6	20%	Small doses. Less than 1 mSv
Source could not be returned to container due to mechanical failures.	6	20%	0,1-1,3 mSv
Barriers not respected	5	16 %	0 – 4 mSv
Source loose in projection sheath	4	13 %	2-6 mSv
Miscellaneous	2	6 %	
Total	31	100	

Present system of training.

Industrial radiography operators are licensed as radiation protection officers by the NRPA, on the basis of a 5 days training course at an approved training centre. There are two such centres in Norway. Handling of accidents, included practical exercises, are major issues in the standard courses- and the operators shall be trained to deal with minor accidents themselves. One of the basic messages in accident handling is to calm down, and take ample time for planning if a rescue operation is necessary. The use of dose budgeting is also advocated, i.e. calculating the dose rates in the various stages of the operation, and thus estimating the accumulated doses from the whole operation. The NRPA have issued a practical guide on accident handling in industrial radiography, in which 3 typical accidents are described. Also a dose budget or dose constraint of 5 mSv for a rescue operation has been introduced. The standard accidents described are:

- Source loose in projection sheath
- Source stuck in projection sheath
- Source fallen out of projection sheath

No reports have yet been received on the last kind of accident, and an evaluation of the reports and dose estimates of the two first accident scenarios indicate that these types of accidents are generally handled safely.

ICRP's Reference risk.

In ICRP Publication 64 (Protection from potential exposure: A conceptual framework) it was recommended that for potential exposure, limits of risk should be of the same order of magnitude as the health risk implied by the dose limits for normal exposures. In ICRP publication 76 (Protection from potential exposures: Application to Selected Radiation Sources) this view was further elaborated, and an individual occupational Reference Risk of $2 \cdot 10^{-4}$ in a year as a criterion of acceptability was introduced. The term "risk" is here defined as the probability of an accident multiplied by the consequence in terms of probability of death due to the radiation dose incurred by the accident. According to table 1, 5 mSv may be taken as a typical radiation dose from an industrial radiography accident. Applying the ICRP cancer death risk coefficient of $4 \cdot 10^{-2} \text{ Sv}^{-1}$, the Reference risk level of $2 \cdot 10^{-4}$ is reached at an individual accident frequency of one per year. According to the Norwegian accident reports statistics, there are typically 5 accident reports per year, i.e. one per 50.000 radiographs. No individual worker will ever reach this number of exposures in a year, and thus the Reference risk seem at a first glance not to be exceeded.

Future improvements

Informal meetings with representatives and workers from the NDT- industry suggest that the true accident rate is higher than the rates actually reported by the companies. Accident statistics are important inputs for improving radiation protection standards, legislation and training programs. Improving the reporting discipline and frequency is thus of considerable interest. In connection with the ongoing revision of the radiation protection regulations in Norway, several possible legislative regimes are being considered. These are:

- Continuing the present system, i.e.: "*The licensee shall immediately report any accident or incident of radiation protection significance to the Norwegian radiation protection authority*"
- Provide a standard classification system for accidents, and require the companies to report the number of incidents and accidents in each category in connection with the licence renewal every 3. year. (If no accidents/incidents are reported, there will be no renewal of licence ?)
- Make use of a non-governmental body like the NDT association, and require the companies to report accidents and incidents to this body for further distribution to the NRPA. The further reporting to the NRPA may or may not be made anonymously. The NDT association has already volunteered to make a standard accident report formula.

Other general changes in the radiation protection regulations for industrial radiography are also being considered:

- Time-limited radiography certificates, with mandatory refresher courses.
- More extensive competence requirements, and possibly a two-level certification system for radiographers.
- Introducing dose constraints or dose budgeting also for normal radiography operations.