STUDY CASE N° 19: RADIONUCLIDE GAUGES IN ROUGH INDUSTRIAL ENVIRONMENTS

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❑ Introduction

Industrial gauges for permanent installation using radioactive sealed sources are widely used in Norway, as in the majority of other developed countries. The gauges are used to measure thickness and density of many materials and also used as level gauges. Such gauges are often well-suited and are the preferred choice when working in rough environments where other options fail due to a number of reasons; primarily heat, cold, pressure, corrosive agents, dust, dirt or vibration.

Frequently used isotopes in industrial gauges are caesium-137, cobalt-60 and americium-241. Depending upon the specific application, industrial gauges in some instances contain relatively small quantities of radioactive material, however in some cases activity levels can be as high as several hundred giga becquerels.

Even though the gauges are designed for many years of use in harsh environments, heat, cold, pressure, corrosive agents, dust, dirt and vibration can be a serious threat to the radiation safety and integrity of the device. From our experience in Norway during inspections, some examples of such cases are described which might give special radiation protection challenges.

❑ Example 1: worn out because of vibration – lost source

In 2005, two industrial gauges supposed to contain Co- 60 sources were found with serious defects. In one of them the radioactive source was missing, and has not yet been recovered.

The particular gauge model (see Figure 1), which is commonly used with no problem, was found to fail in dusty and vibratory environments after about 10 years of use.

Figure 1: The pin (~ 5mm) securing the locking mechanism to a slit in the source housing was grinded off.

When the pin securing the locking mechanism is grinded off, only the sealing will hold the shutter mechanism in place. The thin metal wire of the sealing is not meant for holding the gauge together, and is easily snatched off (e.g. by vibration).

Figure 2: For security reasons the gauge is not usually padlocked in open position, and with the pin grinded off the source holder is easily removed from the shielding.

Figure 3: The gauge with the missing source also missed the screw keeping the spring-loaded plate in place.

These serious incidents happened to a well-known gauge model. The gauge is of a so-called "Scandinavian" or "Swedish" design, and the use of this model outside Scandinavia is unknown to us. The manufacturer is now making a model specially made for vibratory environments.

❑ **Example 2: corrosive environment**

Some radionuclide gauges are installed in corrosive environments and rust might in turn lead to problems with the opening/ closing/ shutter mechanism.

In figure 4 an extended handle has been welded on the shutter mechanism in such a way that extra force might be used to open and shut the rusty gauge (for example with the use of a hammer). There are examples where this has led to shutter damage and the gauge has no longer been able to be put in shut position.

Figure 4: Rusty radionuclide gauge with extended handle

❑ **Example 3: covered and worn-out markings and signs**

In some industrial environments chemical agents might wipe out the labels and markings, or they are covered with production waste.

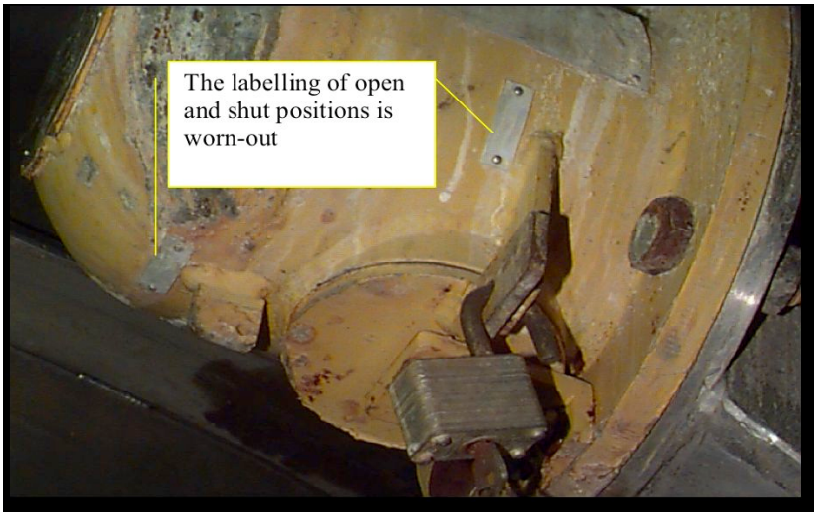

Figure 5: The labelling of open and shut position is worn-out.

Figure 6: Challenging environment, but in this case the gauge is protected by a mudguard and a trefoil warning sign was placed to the right of the picture.

Production waste covering the warning labels is also a safety threat, and procedures for cleaning labels regularly are important to have in place.

❑ Lessons learned

The lesson learned from inspections is first of all that the undertakings should prepare instructions and work procedures which ensure proper cleaning and maintenance of the radionuclide gauges.

Radionuclide gauges exposed to particularly rough environments should be inspected more frequently. With the registration regime we have today, we have little information on the environment where the gauges are installed. With the introduction of electronic webbased notification of radionuclide gauges, the Norwegian Radiation Protection Authority plan to introduce questions about the installation environment.

With an enhanced inspection frequency, last but not least, **information** to the undertaking will also be an important contribution to radiation safety.