Report from a French incident

Deterministic effects to worker's hand during unauthorised density gauge disassembly

Description of Incident

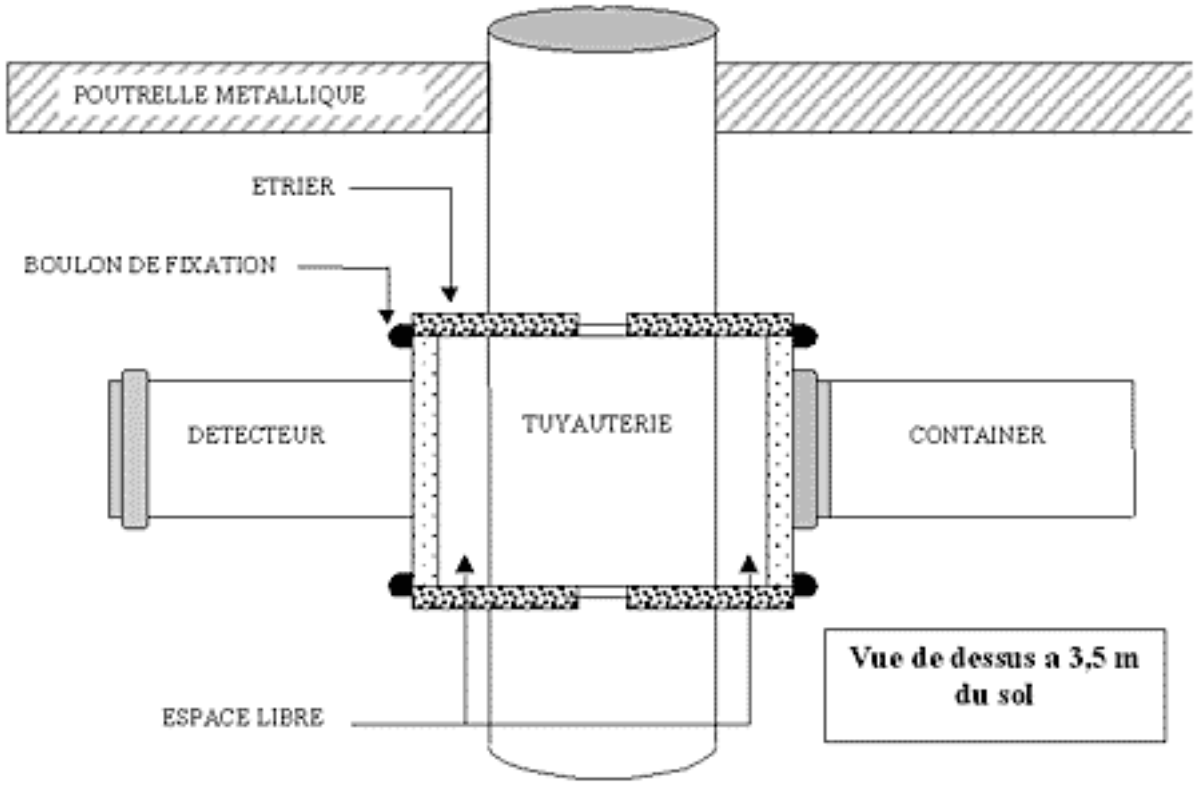
In the effluent control plant in a textile factory, a worker notices that the gauge, intended to measure the density of washing liquids released into the environment, is dirty. He undertakes to clean it.

The gauge is located in a noisy and cramped location, on a very hot pipe. It is installed at a height of 3.5 m and is only accessible by means of a ladder. The device is equipped with a radiation warning sign, which is clearly visible at 2 m above the ground. The source details (caesium-137, 7.4 GBq) are written on an engraved plate fastened on the source container.

To clean the unit, Mr. A completely disassembles the container and removes the source. He uses a piece of paper for this, wedging it in the collimator tube with the intention of separating it and freeing it with compressed air. To do this, he grasps the tube with his right hand and takes it to another workshop. Then, suspecting the presence of the source at the end of this tube, he went to get a QFE, which confirmed his suspicions. Consequently, he decided to continue working on the source holder using pliers.

At the end of the operation, he felt a warm sensation in his right hand and he was accompanied to the nearest hospital. A few days later, he was sent to the Curie Institute, at the request of the occupational health physician. The amount of time his hand was exposed was 30 to 45 minutes. Throughout this operation, he did not wear his dosimeter.

Diagram of the plant



Legend

Poutrelle métallique	*Reinforcing metal link*
Etrier	*Middle jamb*
Boulon de fixation	*Mounting bolt*
Détecteur	*Detector*
Espace libre	*Free space*
Tuyauterie	*Piping system*
Container	*Container*
Vue du dessus à 3,5 m du sol	*Top view, 3,5 m from the ground*

Radiological consequences

The worker was the only person exposed. Erythema appeared immediately at the end of his working period of 30 to 45 minutes, accompanied by a sensation of heat (first degree burns). It was followed by a purplish edema and the emergence, within two to three weeks, of a broad lesion, 5 centimeter in diameter, of epithelial separation; the whole progressing towards local necrosis.

Given the clinical determination, the dose delivered to the right hand probably exceeded 25-30 Sv. Biological dosimetry, by chromosome aberration analysis, was also performed, indicating a whole body dose of 200 mSv, assuming uniform irradiation (the dose was estimated to be between 0 and 400 mSv, for a 95% confidence interval).

Lessons to be learned from the incident

The installation of the radioactive source in a noisy, congested area, located in an inaccessible place on a very hot pipe, did not facilitate easy maintenance and monitoring, and led to the unfortunate initiative taken by the worker.

The worker's behaviour reflects his poor understanding of the device and the risks related to the source. The one-week training that he had received was too perfunctory and it did not make him properly aware of the risks involved.

Before undertaking any maintenance operation, it is necessary to ensure that the radioactive source is well shielded by using a suitable radiation monitoring instrument. In this example, the worker did not check the dose rate before attempting to clean the device. An electronic alarming dosimeter would have indicated the presence of the source and prevented high doses being received (although this should be used as an additional precaution, and not as a substitute for a dose rate monitor).

All of this demonstrates a lack of radiation protection culture - on the part of the employer and employee, even though the worker was trained and qualified.