HAMMER-IMS

# Hammer-IMS bvba

*Why nuclear and radioactive sensing should be replaced by clean alternatives*

## 1 Introduction

Many of our daily consumption objects are produced based on nuclear technology: the papers on your desk, the textiles of your clothes, the transparent foil wrapped around your lunch, even the dashboard of your 'green' car. Up to now, a nuclear sensor has been the only reliable way to sense the quality of these sheet materials.

The use of nuclear and radioactive sensing technologies has been a logic choice for industrial quality control. Many drawbacks are related to its exploitation. They are discussed in this document. Hammer-IMS offers non-nuclear and non-radioactive sensing products that do not have these drawbacks. The products are based on millimeter waves.

## 2 Case: non-woven industry requires licenses for nuclear and radioactive sensors

This section explains the historical need of the non-woven industry in particular for both nuclear and radioactive sensor devices.
Measuring and controlling the basis weight of nonwovens during the production process is essential for the quality of the nonwoven and the economics of the production line. The cost structure of the production of nonwovens is mainly determined by the raw materials for production of the fibers. This strong economic drive forces producers to install basis weight measurement systems. An important set of basis weight measurement techniques rely on radioactivity. Two common methods are generally applied-beta-emission based sensing devices and X-ray based sensing devices. State-of-the-art measurement tools include x-ray or beta-emission based sensors which require special licenses depending on the sensor. Although X-ray is a cleaner technology than beta-emission, it requires special licenses when applied for high-mass nonwovens basis weight sensing as well. Voltages above 5 keV typically require specific licenses (Belgium, 2001; Germany, n.d.; UK, n.d.).

## 3 Further restrictions by law on the use of nuclear or radioactive sensing concepts

Previous section discussed a case in the non-woven industry. The case explained that appropriate licenses need to be obtained in order to be able to use X-ray or applied-beta-emission based sensing devices. Further restrictions (on local level, but also for federal governments or state unions) may apply regarding the use of these devices. Two examples are shown below.

### European regulations (state union)

The European Council's Basic Safety Standards (Europe, 2013) describe restrictive standards for the protection against the dangers arising from exposure to ionizing radiation. A citation of (Europe, 2013) follows:

*..."Member States shall establish legal requirements and an appropriate regime of regulatory control which, for all exposure situations, reflect a system of radiation protection based on the principles of justification, optimization and dose limitation...".*

The cited text means that European member states should implement laws that restrict the usage of nuclear and radioactive technology to these cases where nuclear technology is really a necessary technology (justification), moreover not allowing higher radioactive power levels than necessary for that case (optimization) and not letting people too closely and too frequently interact with these kind of technologies (dose limitation).

### Local regulations

In Belgium (member state of the European Union), for example, the parliament needs to vote suitable laws, complying these European guidelines. The Federal Agency for Nuclear Control (FANC) has the role to maintain these laws in Belgium. The principle of "justification", as defined by the European Basic Safety Standards therefore is applied in the Belgian Federal laws as well. This means, if a company, hospital, research institute, university, ... wants to apply for a license for a new nuclear installation, FANC evaluates this specific application in the light of existing non-nuclear alternative technologies. If non-nuclear technologies perform similar or better, FANC may choose not to accommodate the request for this new license. The conclusion by the FANC resulting in a go or no-go for nuclear technology also takes into account economical arguments. If it turns out that new technology is too expensive, nuclear licenses might still be granted. Today, non-nuclear alternatives are becoming more and more affordable and reliable. Therefore, a specific federal law can be voted in the parliament, forcing companies to phase-out existing installations in the field of application. This is currently being implemented in the field of sensing systems for the degree of filling of bottles in breweries (FANC, 2015). Be ahead and start thinking of non-nuclear or non-radioactive alternatives...

## 4 Cost of ownership

Nuclear and radioactive sensing systems come with a high total-cost-of-ownership. Some of them are listed here:

- Expensive nuclear source replacements
- Nuclear waste processing
- Nuclear safety inspection
- Contributions to regulatory offices
- For new installations
- Periodically
- Operator safety training
- Problems with labor unions
- Costs related to tracking the laws
- ...

These costs may pile-up to more than 300kEuros over the total lifetime of a single sensor. Even then, medical radiation overdose hazards may still occur...

## 5 What's next?

Non-nuclear and non-radioactive technology will keep on emerging. Hammer-IMS millimeter-wave technology, incorporated in the Marveloc 602 product family, is expected to be supported by the European Council's vision and local governments of its member states. Web producers and processors are aware of the pushing presence of the European philosophy and the local laws and the high total-cost-of-ownership of these technologies. Therefore, there is an increased tendency to explore new thickness and basis-weight sensing technology as offered by Hammer-IMS.

### References


Belgium. (2001). *Belgian royal decree of 20 july 2001 laying down the general regulation for the protection of the public, workers and the environment; against the hazards of ionizing radiation, as amended*. Website. (`http://www.fanc.fgov.be/GED/00000000/3400/3492.pdf`)

Europe. (2013). *Eur-lex, access to european union law: Official journal of the european union: Council directive 2013/59/euratom of 5 december 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing directives 89/618/euratom, 90/641/euratom, 96/29/euratom, 97/43/euratom and 2003/122/euratom*. Website. (`http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2014:013:TOC`)

FANC. (2015). *Verbod op het gebruik van am-241-bronnen voor vulhoogtemeting*. Website. (`http://www.fanc.fgov.be/nl/page/verbod-op-het-gebruik-van-am-241-bronnen-voor-vulhoogtemeting/1584.aspx`)

Germany. (n.d.). *"verordnung über den schutz vor schäden durch röntgenstrahlung (röntgenverordnung - röv), german law;"*.

UK. (n.d.). *Joint service publication 392: Management of radiation protection in defence - part 2: Leaflet 23 - high voltage electrical equipment; uk law*.