

# Use of Prospective Risk Analysis for radiation protection in healthcare

## Background

An I-125 source is used as a tumour marker. The whole procedure involves several departments within the hospital, including the Radionuclide Centre, Radiology department and the Surgical Theatres. The I-125 source has a maximum activity of 14 MBq and a length of 4,5 mm (see Figure 1). The source is inserted into the tumour in the Radiology department using ultrasound or X-ray. After patient treatment, the tumour is removed during surgery using the I-125 source as a marker. Prior to examination of the extracted tumour, the I-125 source is extracted from the tissue in the Pathology department. All I-125 sources are collected by the Radionuclide Centre and are later disposed of as radioactive waste.



Figure 1: An I-125 source used as a tumour marker

## Introduction

The use of risk analysis in healthcare is mostly based on surveying the radiation dose during regulatory working conditions and in case of an incident. Depending on the outcome, further radiation protection measures are taken until the radiation dose is as low as reasonable achievable and no other dose limits are reached.

Before starting the procedure 'I-125 source as a tumour marker', standard risk analysis is performed. Safety precautions are taken to minimize the radiation dose and the possibility of losing an I-125 source. At the start of the procedure a checklist was introduced to monitor each critical step in the procedure. The use of this checklist is compulsory.

Despite all of the precautions, there were several (near) incidents of missing I-125 sources. The maximum calculated radiation dose was less than 0,2 mSv.

## Methods

Because of the (near) incidents, a prospective risk analysis was performed to identify important risk moments in the procedure with the intention to reduce the possibility of losing an I-125 source. To accomplish this prospective risk analysis we used the Healthcare Failure Mode and the Effects Analysis (HFMEA) method. The HFMEA method is a proactive program to identify and reduce safety risks to patients, visitors, workers, facilities and equipment.

A multidisciplinary team approach is necessary to perform a HFMEA. The next steps must be taken in the HFMEA procedure:

1. selection of the process and delimitation
2. form a team
3. picture the process
4. perform an analysis and fill in the form
5. label the actions to improve
6. reporting
7. improving

The objective is to identify where a process may fail (Failure Modes) prior to failure occurring. Each failure mode has a potential risk, with some risks more likely to occur than others. Therefore, each risk must be evaluated (see table 1).

Frequency	Seriousness			
	Catastrophic	Large	Moderate	Small
Weekly	Very high	Very high	High	Low
Monthly	Very high	High	Low	Very low
Yearly	High	Low	Very low	Very low
Less than once a year	Low	Very low	Very low	Very low

Table1: Risk matrix; risk score based on frequency and seriousness

After the potential risks have been evaluated, actions are implemented into the process, in such a way that they significantly reduce the likelihood of the failure reoccurring. All evaluations/implementations have been documented in a rapport.

## Results

After performing the HFMEA method, new important risk moments were identified. More attention must be drawn to the presence of the I-125 source in all of the departments involved ways of signals in the surgical program and the patients file. Besides increased attention, more control moments were established to ensure the presence of the I-125 source. One example is the control of source placement in the tumour with the help of a diagnostic examination (echo or mammography, see figure 2).

The checklist is brought in line to the new control moments. All personnel involved are informed of the new procedure.

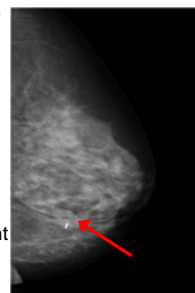


Figure 2: Control mammogram in which the I-125 source is visible

## Discussion

It is proven that the use of I-125 as a tumour marker is very useful. Although this must never be a reason of implementing a procedure without looking at all the risks from radiation protection's prospective.

## Conclusion

Using a Prospective Risk Analysis such as the Health Failure Mode and the Effect Analysis (HFMEA) method is useful for determining the failure modes in a complex procedure such as described above. However the HFMEA is very time-consuming and therefore not suitable for application in all procedures.

