

# Getting It Right: Errors Resulting from Imaging

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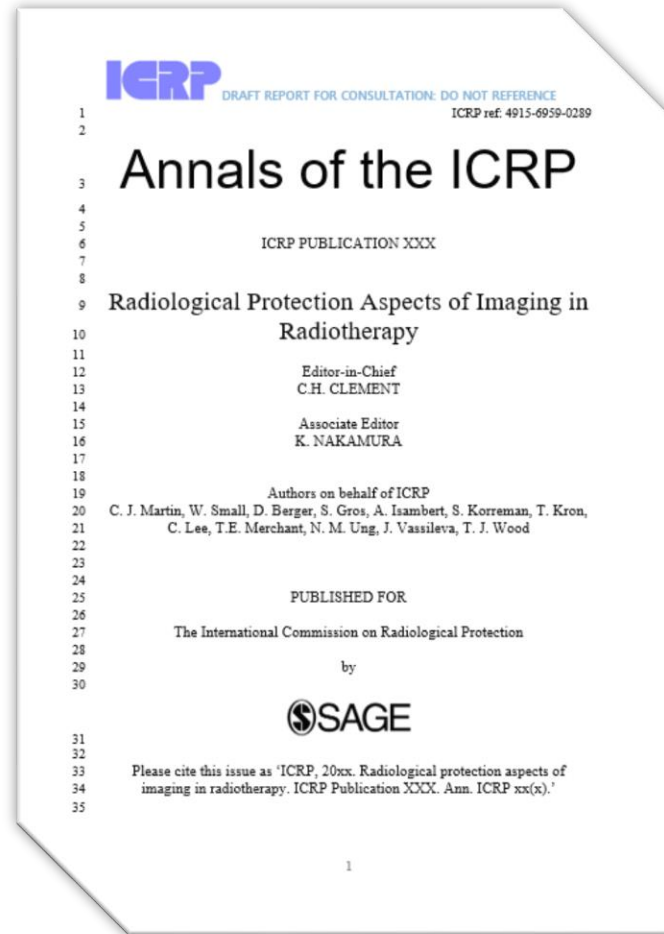


Registered with the Charity Commission for England and Wales (#1166304)



**Task Group 116 Workshop**  
**April 8, 2025**

# TG 116 : Radiological Protection Aspects of Imaging in Radiotherapy



**This talk**



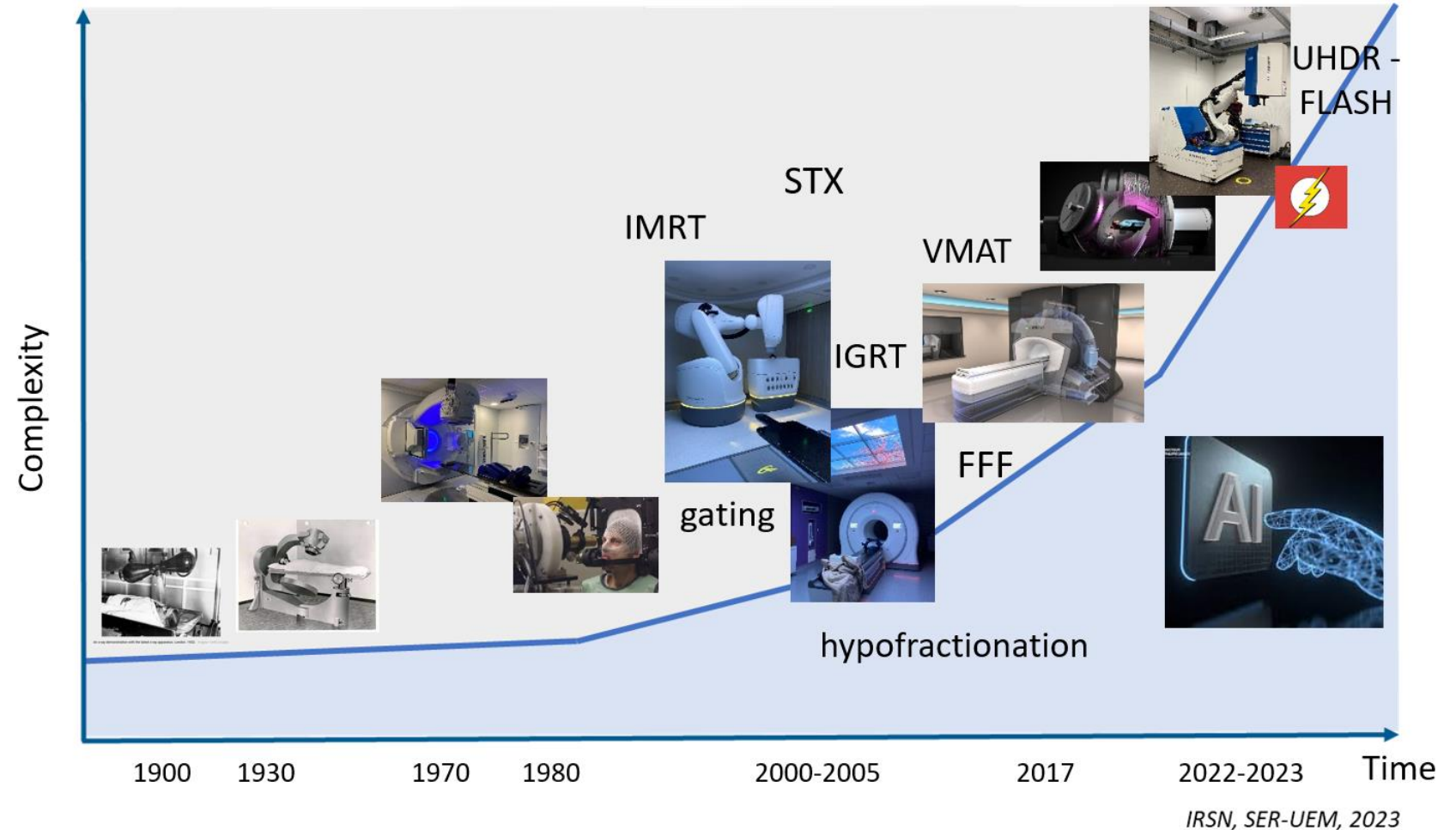
## **Current draft report section 11 and Annex C**

### **11. AVOIDANCE OF ERRORS ORIGINATING FROM IMAGING IN RADIOTHERAPY**

- 11.1. Terminology used for unintended and accidental medical exposures
- 11.2. Errors resulting from imaging during plan preparation
- 11.3. Errors resulting from imaging during the treatment
- 11.4. Promotion of good practice in imaging in radiotherapy

# Unprecedented technological developments in radiotherapy

- Increase use and more advanced imaging in RT
- **Some “errors” can happen while using imaging \***



\*Smith et al. / Quality management in radiation therapy: A 15 year review of incident reporting in two integrated cancer centres (2020)

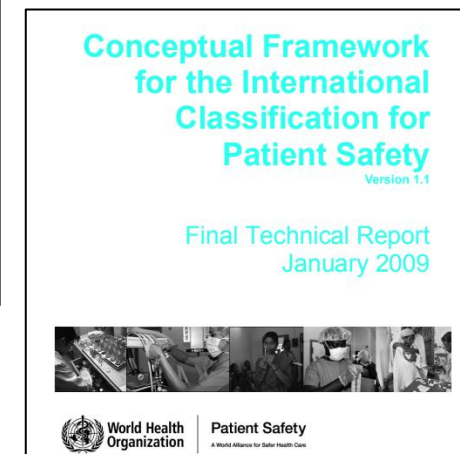
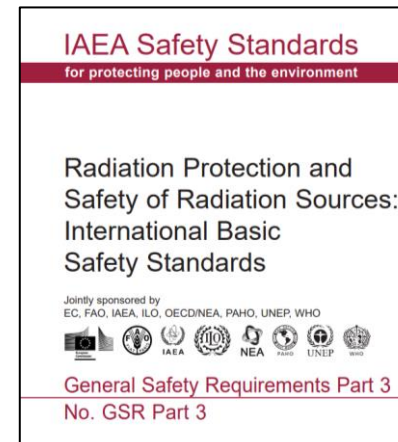
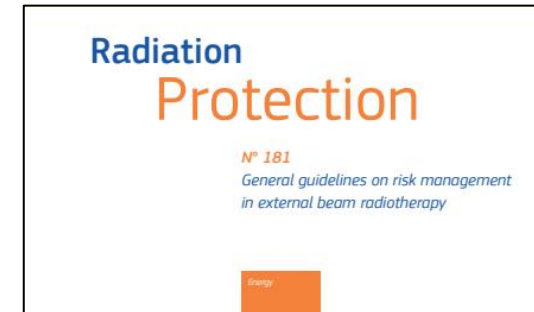
# Terminology used for unintended and accidental medical exposures

## What do we mean by « errors »?

Among the various recommendations for risk management and reporting systems, there is **little uniformity in the terminology** used (EC, 2015).

In this presentation,

«**errors**» = events that can lead to **unintended and accidental medical exposures** (IAEA and Euratom BSS 2013) + **near misses** (incidents which did not reach the patient) (WHO, 2009).



# Incident learning systems worldwide

Most examples are extracted from the Radiation Oncology Incident Learning System® (RO-ILS, ASTRO) reports, SAFRON and reports from radiation protection authorities.

**RO-ILS**

RADIATION ONCOLOGY®  
INCIDENT LEARNING SYSTEM

*Sponsored by ASTRO and AAPM*

SAFety in Radiation ONcology

**SAFRON**

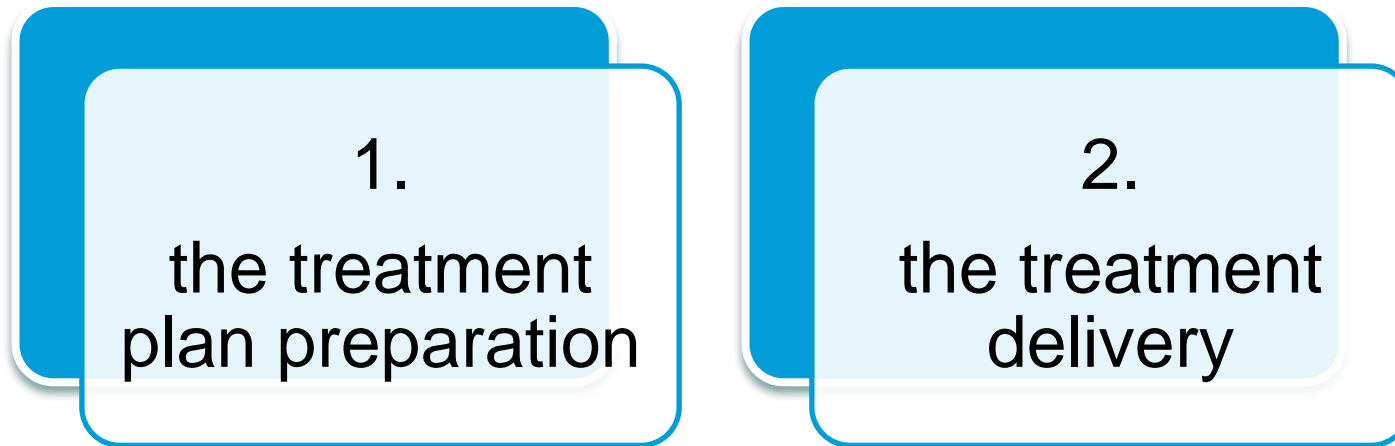


**ESTRO  
ROSEIS**



# Errors resulting from imaging

... were reported at 2 steps:



# 1. Plan preparation

1.  
the treatment  
plan preparation

Incorrect target  
volume  
delineation

Use of a wrong  
set of images

Errors from  
processing of  
image data

Differences in  
patient positioning  
between imaging  
and treatment

# 1. Plan preparation

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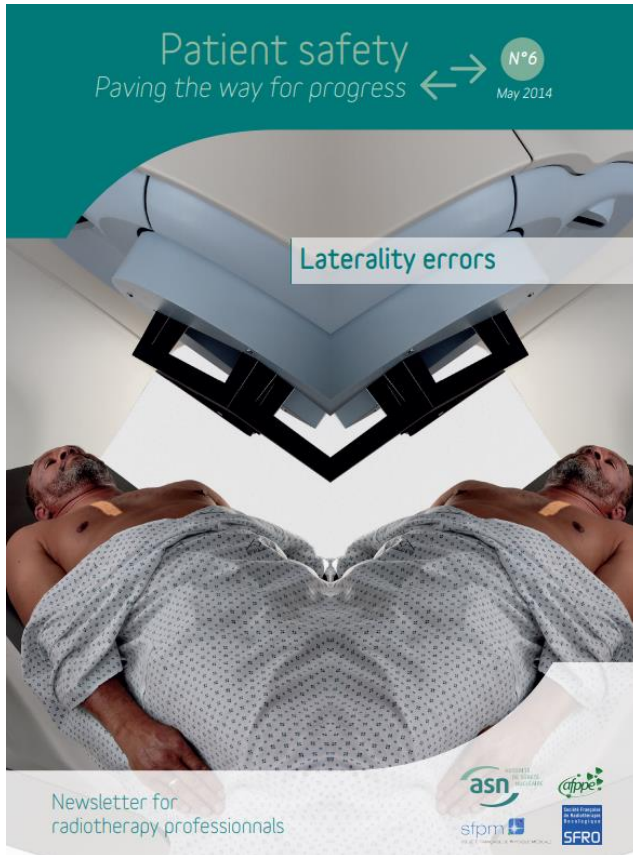
Errors from  
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and treatment



# 1. Plan preparation

Incorrect target  
volume  
delineation



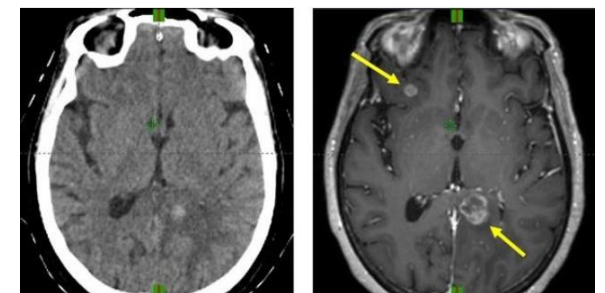
[Publications \(french-nuclear-safety.fr\)](http://publications.french-nuclear-safety.fr)



## Contributing factors

It can result when there is doubt about the location of a lesion to be treated:


- when there is uncertainty about the **side of the body** (laterality)
- or
- when **multiple lesions** are present, such as an additional benign target or a target that has been treated previously.



*Images used with  
permission from Loyola  
University Medical  
Center, Maywood, U.S.A.*

# 1. Plan preparation

Incorrect target  
volume  
delineation

	<b>RO-ILS</b> RADIATION ONCOLOGY® INCIDENT LEARNING SYSTEM <small>Sponsored by ASTRO and AAPM</small>
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[https://www.astro.org/ASTRO/media/ASTRO/Patient%20Care%20and%20Research/PDFs/ROILS\\_TR\\_Dosi.pdf](https://www.astro.org/ASTRO/media/ASTRO/Patient%20Care%20and%20Research/PDFs/ROILS_TR_Dosi.pdf)



## Preventive actions to consider (quotes):

- “Conducting a **prospective peer review** before initiating treatment plays a crucial role in preventing errors and impacting the patient’s care. This proactive peer review process becomes especially vital in the case of high-dose, hypofractionated treatments”
- “A time out procedure has been worked out: [...] the **RTT must ask the patient** some extra data (the injury for which he or she will be treated, **the laterality**, ...). There will also be a **check of the injury (scar control)**”



REX 1 - YEAR 2023

### Incident description

A patient is to be treated with external radiation therapy (DIBH) on the left thoracic wall (with expander) and glandular regions. The treatment scheme prescribed is 15 \* 2,670 Gy = 40,05 Gy.

Due to the contouring of the wrong breast by the attending radiation oncologist, an incorrect treatment plan was created and the patient was irradiated for 2 of the planned 15 fractions on the right breast instead of the left.

[https://afcn.fgov.be/fr/system/files/2023-rex-1\\_0.pdf](https://afcn.fgov.be/fr/system/files/2023-rex-1_0.pdf)



INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

# 1. Plan preparation

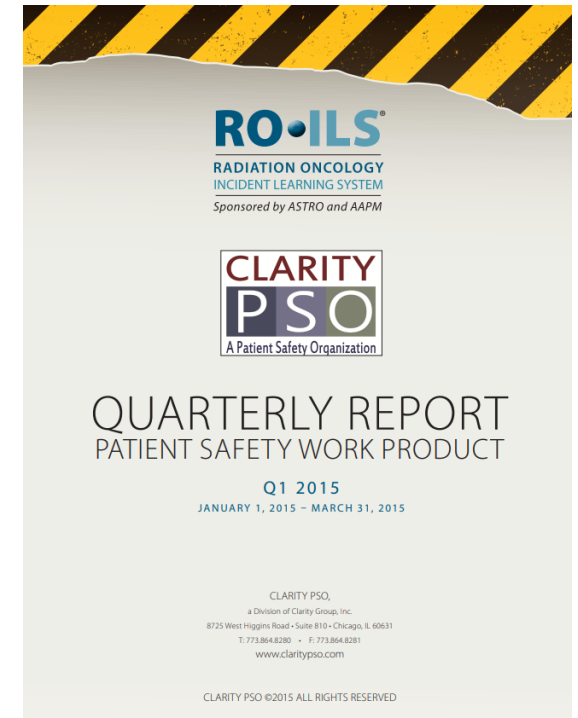
Use of a wrong set of images



Wrong set of images :

- Images from the **wrong patient (id error)**
- or
- Images from **previous treatment (successive treatments, outdated CT used for planning)**

**D.** Treatment plans that are done on the wrong scan set were reported three times this quarter, and at least twice previously. Two events are described in more detail as case reviews later in this report. A common occurrence is accidentally using an outdated CT for planning a treatment course.



[https://www.astro.org/ASTRO/media/ASTRO/Patient%20Care%20and%20Research/PDFs/ROILS-Q1\\_2015\\_Report.pdf](https://www.astro.org/ASTRO/media/ASTRO/Patient%20Care%20and%20Research/PDFs/ROILS-Q1_2015_Report.pdf)

# 1. Plan preparation

Use of a wrong set of images



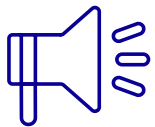
## Preventive actions to consider:



- Identify planning CTs with **scan names** that are unambiguous.
- Put the **scan date** in the scan name.



- Consider discussing, with your manufacturer, the potential of a planning software alert that would ask for confirmation if a new plan is created on a scan that is likely to be out of date, e.g. more than three months old



## 2. During treatment delivery

2.  
the treatment  
delivery

Incorrect  
vertebral body  
localisation

Differences in  
motion  
management  
techniques

## 2. During treatment delivery

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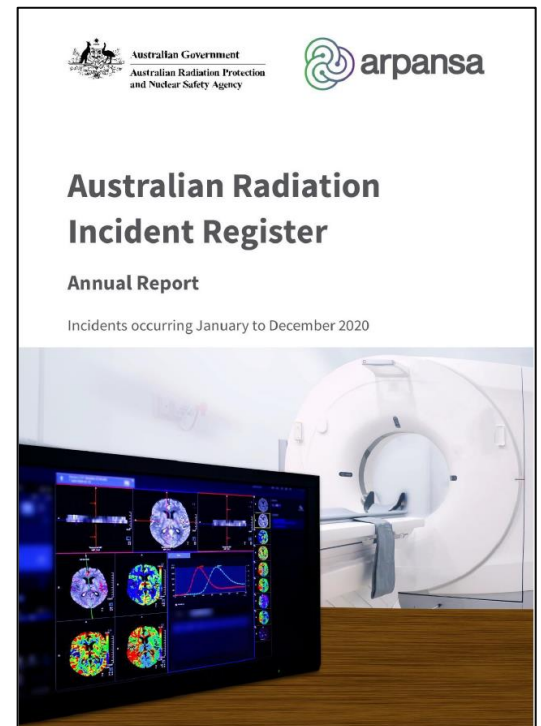


<https://www.french-nuclear-safety.fr/Media/Files/00-Publications/Patient-safety-12.-Patient-repositioning-imaging-vertebra-identification-error>



**“One of the main causes of significant events in radiotherapy”**  
France (ASN, 2018)

“Misalignment or targeting the wrong site can occur for a variety of reasons.  
**Mismatching using the spine was a factor in more than half of these types of incidents.**”  
Australia (ARPANSA, 2020)



[https://www.arpansa.gov.au/sites/default/files/arir\\_-\\_annual\\_summary\\_report\\_2020.pdf](https://www.arpansa.gov.au/sites/default/files/arir_-_annual_summary_report_2020.pdf)

also described in the **USA (ROILS)**, **Belgium (FANC)**, **Finland (STUK)** ...

## 2. During treatment

Incorrect  
vertebral body  
localisation

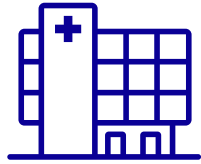


### Preventive actions to consider:

- In cases where identification of the correct vertebra could be an issue, **increase the length of the FOV to include either the superior or inferior portion** of the section of spine being treated.
- Ensure that the visual identification of vertebral bodies is not based solely upon bony anatomy and follow a consistent pattern of **matching multiple anatomic points**.
- Include **dose contours** overlying adjacent structures.
- Set **maximum tolerances** on the shifts allowed between set-up and treatment.
- Where available, **optical surface guidance** can offer an independent check on patient positioning.



# Safety gaps still present within the patient alignment process



Crouch et al\* (Australia) identified « **verification imaging** » as the **2<sup>nd</sup> source** (about 20%) of incident reports in their ILS (Learning In Radiation ONcology (LIRON))



In 2024, a team from California\*\* performed a **retrospective analysis** of 17610 registrations **between planning scans and pretreatment CBCT scans** (2414 patients)



They highlighted the **reliability and safety of IGRT** (error rate of 0.04% per delivered fraction).



They stressed that the incidents that occurred expose **safety gaps still present within the patient alignment process**

# Key message



Imaging in radiotherapy has led to major advances in the quality and safety of treatments



Incidents and errors are an important opportunity to learn and improve processes.

This also applies to imaging in radiotherapy.

**Thank you !**

**ICRP**