

Industrial Radiography in Belgium



S. Coenen
V. Schrayen

Regulations

Belgian Regulation (Royal Decree) is very general and is not written specifically for industrial radiography.

Sometimes a confusing situation on the field:

- ✓ Lack of clear rules
- ✓ Misunderstanding of the regulation by licensee of industrial radiography applications

→ Objective : Increase radioprotection



Methodology

Not an « easy » sector: try to get a buy-in

3 phases :

- ✓ Inspection campaign in the field
- ✓ Discussion with licensee (e.g. round tables discussions)
- ✓ Additional license conditions to be implemented.

→ Iterative process (several phases) !



1st phase 2007-2010

- ✓ Inspection campaign 2007-2008
- ✓ 3 round table discussions with interested parties in 2009 & 2010
- ✓ December 2010: renewal of licenses for all 16 licensees.
 - ➔ Safety Guide N° 408 of IAEA - Radiation safety in industrial radiography (Draft)
 - ➔ Only applicable for site radiography (not for fixed installations)

1st phase: New License Conditions (1)

- ✓ Justification
- ✓ At least 2 operators (except for fixed installation in a shielded irradiation vault).
- ✓ Management system for safety in place
- ✓ Missions & responsibilities of all persons (including customers)
- ✓ Operational electronic dosimetry
- ✓ Accident prevention and safety culture (risk analysis, site audits, ...)
- ✓ Notification to FANC of events significant for safety and/or radiation protection

1st phase: New License Conditions(2)

- ✓ Radiation protection training of personnel
 - ➔ Approval by FANC
- ✓ Radiography equipment (ISO 3999)
- ✓ Site activities
 - ✓ annual dose limit (300 $\mu\text{Sv}/\text{an}$),
 - ✓ dose rate limit (10 $\mu\text{Sv}/\text{h}$ -> 40 $\mu\text{Sv}/\text{h}$)
- ✓ Intervention team
- ✓ Temporary storage of the source on site

2nd phase 2011-2013 (1)

2nd inspection campaign on site (2011 - 2013)

Verification that new license conditions are met.

Main Conclusions

- ✓ No active use of survey meter
- ✓ Inappropriate reaction in case of alarm.



2nd Phase: License Condition on the use of survey meter



In collaboration with the sector

- 
- ✓ April 2013: New license conditions:
 - Survey meter
 - Active measurements
- 
- 
- 

2nd phase 2011-2013 (2)

3th Inspection campaign : administrative
(main office)

Verification of « management » aspects and
other « administrative » controls.

- ✓ From 15 to 25 non conformities !!!
- ✓ Action Plan to be developed by licensee



June 2014: All actions satisfactory solved

3th phase 2014 - ...

- Inspection campaign 2014 focused on fixed installation (safety features of irradiation vault, verification by authorised inspection organisation, ...) : link with license conditions.

Main conclusions

- ✓ Various design of irradiation vaults, missing safety features.
- ✓ Various other remarks

3th phase: Working groups

- ✓ October 2014: round table with sector (NDT companies, Inspection Organisations, manufacturers, ...)
- ✓ Representative of ASN (Mme Delrue)
- ✓ Presentation of strategic plan and new requirements
- ✓ Creation of 5 working groups:
 - Irradiation vaults
 - Clients
 - Training
 - Minimal requirements
 - Incidents & emergency preparedness

To be finalised by january 2016



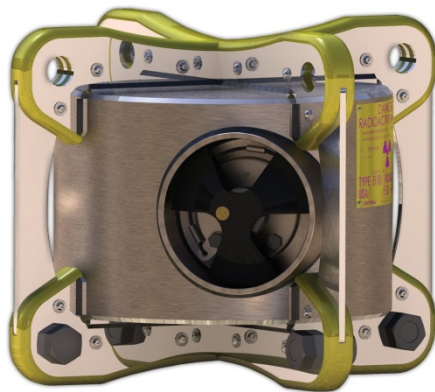
Incidents 2014 - 2015

- October 2014: Exposure of members of public (airport handlers) during radiography (bad coordination of work programme)
- October 2014: Failure of source retraction ^{192}Ir (TSI3)
- November 2014: Exposure of 4 members of public (bad coordination of work programme)
- January 2015: Operators declare difficulties in source retraction of DUAL 60 source container
- March 2015: Wrong manipulation during source transfer of ^{192}Ir source from DUAL 60 to UKI4 container, leading to exposure of a worker and a FANC inspector (INES 1)
- March 2015: Legal dose limit exceeded during radiography (65 mSv registered on dosimeter, INES 2)

Incident Magotteaux – April 2015

Magotteaux : metal casting company

→ Use of a ^{60}Co (3,7 TBq) source for quality control of pieces



New type of container SENTRY 330 (QSA Global) which replaces the previous GammaMat TK 100 container

Incident Magotteaux

- ➔ Fixed installation (in irradiation vault, approved by inspection organisation)
- ➔ Automated manipulation of the source



Incident Magotteaux

10 april 2015: significant event

- ✓ 10h30: source blocked outside the container
- ✓ 15h22: Notification AFCN
- ✓ No exposure of operators.
- ✓ Several attempts to retrieve the source under supervision of inspection organisation and with the help of manufacturer
 - ✓ Decoupling of automated system and manual system (remote handling)

➡ Not successful

Incident Magotteaux

13 april 2015:

Visualisation by means of endoscopic camera to find the exact location of the source.

- ➡ Additional attempts to remotely retrieve the source were not successful
- ➡ Further interventions not allowed by inspection organisation and FANC

Incident Magotteaux

- Need to establish a unique protocol to retrieve the source
- Intervention team : licensee and inspection organisation, QSA Global, Military, Civil Protection, FANC
- Use of military grade robot, used for mine clearing purposes
- Cold test on real size mock-up of irradiation vault



Mock-up of inner part of irradiation vault

Robot moving
the container
that will house
the source

-

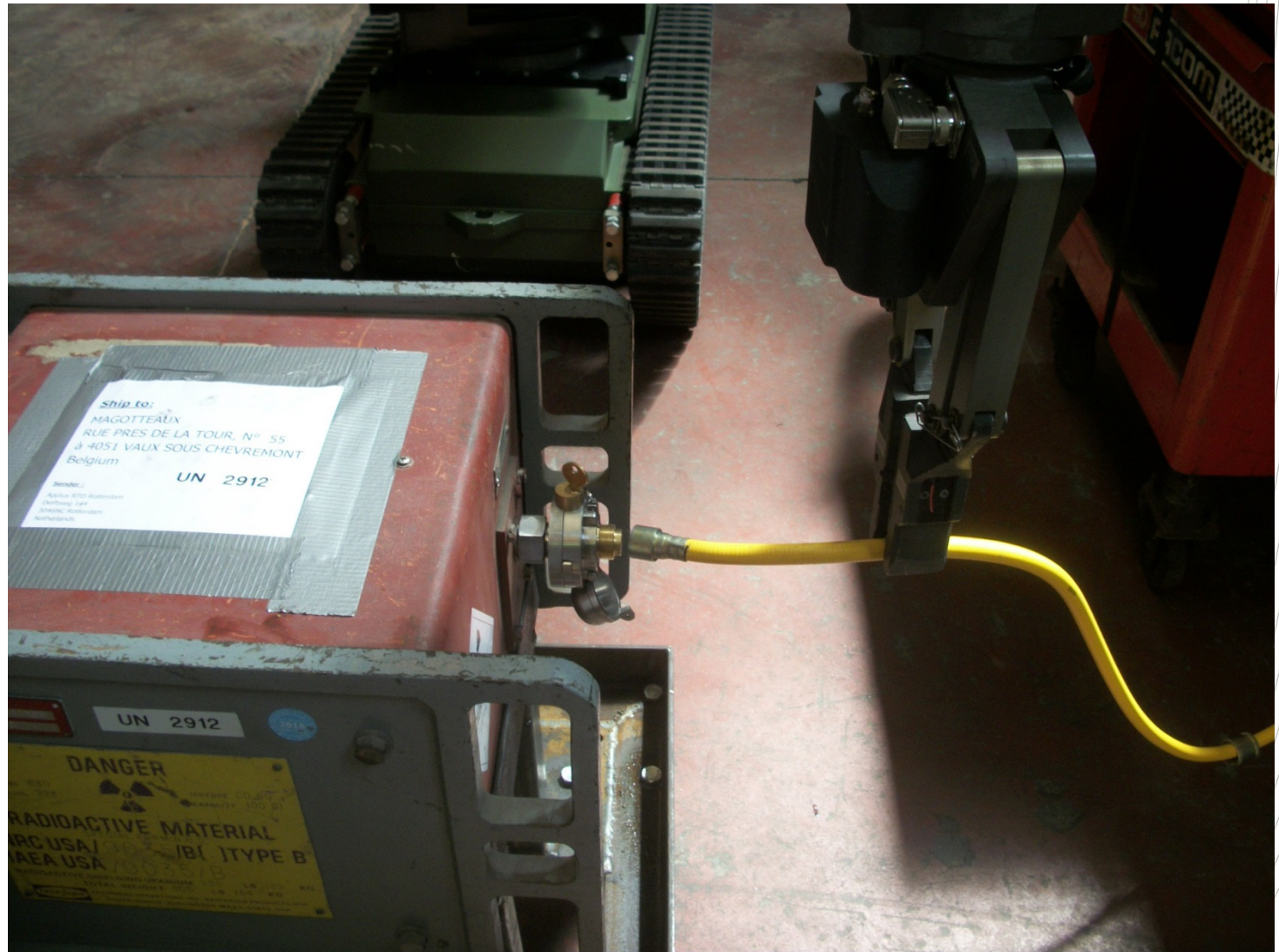
Container
needed to be
modified





Cold testing of robot manipulations

Positioning
of the
cable by
the robot



Source entered in
container – safely
interlocked – success of
the operation





Cold testing – Image of on-board camera



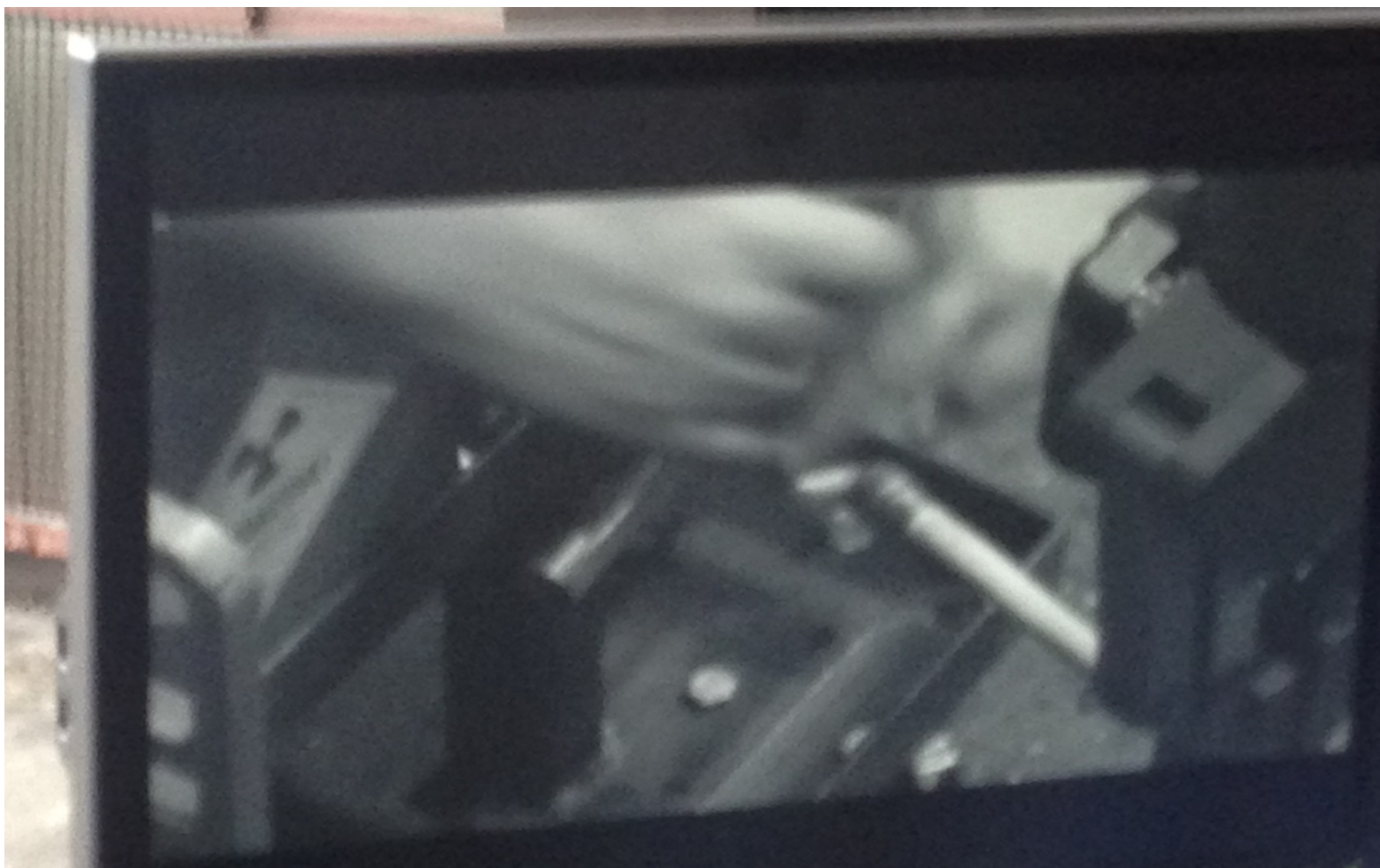
Dose Cartographie with shielded doors open

5 $\mu\text{Sv/h}$

FANC ● AFCN



Preparation of retrieval – Robot entering the
irradiation vault



Intervention – Removal of command cable of source holder: source intact and safely retrieved and stored in Techops 600



Human error: ejection hoses not properly
connected
(Images from irradiation vault)



Reparation of cable and micro balls

Put back into service
on 18 may 2015
after extensive
testing (including
cold tests).



Questions

In theory, flying is very simple:
Just throw yourself to the ground

...

and

...

MISS