

FEDERAAL AGENTSCHAP VOOI NUCLEAIRE CONTROLE AGENCE FÉDÉRALE DE CONTRÔLE NUCLÉAIRE 21st EAN Workshop: Optimization of the transport of radioactive material April 23 -25th Petten (NL)

Radiation protection and dose evaluation of workers in the transport sector in Belgium

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Feedback on the implementation of the new Belgian regulation on radiation protection





22/10/2017

Royal Decree on the Transport of Class 7 Dangerous goods (radioactive material)

Before RD 22/10/2017 : every transport of class 7 dangerous goods was subject to a license (general licenses and special licenses).

As of RD 22/10/2017 (with a transitional period): the transport of class 7 dangerous goods can only be done by recognised carriers + for certain high risk transports an additional license is required.



Different types of recognition:

- Transport companies: 4 different UN-groups
 - \rightarrow UN-group 1: only excepted packages
 - \rightarrow UN-group 2: other UN-numbers then those belonging to UN-groups 1, 3 and 4
 - \rightarrow UN-group 3: fissile material
 - \rightarrow UN-group 4: UF6
- Recognition for handlers at ports and airports
- Recognition for interruption sites (transport interruption longer then 72 hours, maximum 15 days)

Possibility to be recognised with subcontractors



Conditions to be recognised as a carrier:

Submit a complete application including:

- > A radiation protection program, validated by the RPE;
- Emergency procedures including a procedure for handling events (nonconformities, incidents and accidents);
- A description of the health physics department with the designation of the RPE and RPO's;
- A description of the management system;
- Confirmation of third-party liability insurance.



Treatment of the file:

After receiving a complete file, a compliance audit is organised at the premises of the applicant (except for UN-group 1 carriers).

These compliance audits are repeated every 3, 5 or 7 years depending on the type of recognition:

e.g. For carriers transporting fissile material and/or UF6: every three years.



«A Radiation Protection Programme shall be established for the transport of radioactive material »

→ introduced in the IAEA Safety Standards Series ST-1, 1996 Edition and a few years later in the modal regulations

During the initial compliance audits (first application for recognition), we nevertheless encountered a number of shortcomings:



Regulations for the Safe Transport of Radioactive Material

1996 Edition (Revised)

REQUIREMENTS

No. TS-R-1 (ST-1, Revised) miteresticae, store depety states





Audit conclusions regarding radiation protection programs (1/2):

- → Absence of radiation protection programs: mainly at port handlers, airport handlers and air carriers;
- → Radiation protection program exists but is not part of the management system: question whether it's sufficiently known and effectively applied, and when it will be revised;
- \rightarrow Dose estimation not adjusted to reality;
- → NDT-companies: existence of a radiation protection program but no attention to transport operations;



Audit conclusions regarding radiation protection programs (2/2):

- → No definition of what is considered as a deviating value for dosimetry results;
- \rightarrow No description of actions taken in case of a deviating dose result;
- → Insufficient awareness training to staff regarding radiation protection measures;
- \rightarrow Absence of contamination control measurements of the vehicles.



Development of radiation protection programs at port handlers:

- → 4 recognised port handlers (4 container terminals and 2 breakbulk terminals);
- → The same RPE worked for the 4 handlers and developed the RPP in collaboration with these handlers;
- → Historical data on number of containers handled, UN numbers and transport indexes were available;
- → Dose estimation based on this historical data and on estimated exposure times for affected workers.





Example: $U_3O_8 - UN2912$

Maximum dose rate at 1 meter of container: 30 µSv/h



Exposure affected workers:

- Tally clerks/chief tally clerks: 30 seconds per container (0,0083 h);
- Crane operator : negligable exposure due to distance between crane operator and containers;
- Dock workers (placing/loosening twistlocks and lashing bars): 2 minutes per container (0,033 h)



The exercise gave following results for the concerned handlers:

Port handler	Maximum yearly dose for dock workers
Port handler 1	335 μSv
Port handler 2	1524 μSv
Port handler 3	145 μSv
Port handler 4	322 μSv

Conclusion:

Dock workers are considered as occupational exposed workers where the effective annual dose is assessed to be below 1 mSv:

- → Dose estimation is based on maximum dose rates near the containers, not on average dose rates;
- → The result assumes that all the containers handled at a certain terminal are handled by the same dock workers, which is not at all realistic.

No need for individual monitoring, nevertheless, follow up of handled containers is necessary.

Follow up 2018-2023

Evolution 2018-2023 (µSv/y)





Lower results and a major decrease are the result of different factors:

- → Overestimation of handled containers for some handlers ?
- \rightarrow Decrease after start war in Ukraine
- → Decrease after end of recognition of a train operator (no possibility anymore for connection ship → rail)



Dose estimations were considered realistic and were confirmed during punctual inspections in the period 2018-2023: dose rates as well as exposure times were in line with the estimations.





Increased knowledge and awareness of ionising radiation hazards among port workers:

- → Health physics department provided by the central employer of the pool of dock workers;
- \rightarrow External radiation protection expert;
- → Radiation protection officers working for the central employer of the pool of dock workers and others working for the different port handlers (at least one per port terminal);
- → Before every loading/unloading of class 7 radioactive material a "take 5" is given to the dock workers regarding radiation protection measures and emergency response procedures (prepared by the RPO, in collaboration with the RPE).

Conclusions



What conclusions can be drawn after 7 years of these regulations and monitoring of radiation protection programs?

- \rightarrow Overall: better follow up on doses for exposed workers;
- → Overall: better knowledge and awareness about radiation protection and emergency response as a result of greater focus on training programs;
- → Port and airport handlers which were, before 2018, no subject to our regulations (only the carriers had to ask for license): strongly increased knowledge and awareness about radiation protection and emergency response;
- → NDT-sector: also attention for radiation protection and emergency response during their transport operations.



Results of dose-evaluation 2000-2023

Dose-evaluations



- From 2000 until 2023
- 4 evaluations: each <u>+</u> each 5 years (With thanks to our colleague E. Herman)
- From Belgian operators:
 - 2 (4) Carriers of mainly medical isotopes
 - 2 Carriers of mainly nuclear material
 - 2 Handlers at the airport
- Based on results of passive dosimeters
- In Belgium: wearing a dosimeter is mandatory from a dose rate in the driver's cabin of 2.5 μ Sv/h, the dose rate in the cabin is limited to 20 μ sv/h.
- Cumulative dose for all workers in the company and Average dose per worker

General constatations



- Large fluctuations in received doses
- Cumulative dose for drivers of carriers for mainly medical radioisotopes is higher than for mainly nuclear materials
- Decisions and events, independent from carrier, have big influence (certainly in medical field):
 - Changes in consignors
 - Commercial decisions : of prices, distribution times, ...
 - Changes in routing
 - Production stops
 - Production relocation
 - Bankruptcy





2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023





Average dose vs number of drivers



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Handlers at airports





2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023



Road cumulative dose and average



2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023



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Conclusions



- Doses for drivers are difficult to evaluate.
- Even when we are convinced that with the regulation introduced in 2017 the radiation protection of workers in the transport sector is improved it does not show clearly in the figures due to external factors.





- Possibilities to refine the analyse due to digitalisation of transport data
 - Adding the number of packages transported into the analyses
 - Adding the total TI transported into the analyses



Questions?

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Thank you!