Conclusions & Recommendations

"Optimisation of the transport of radioactive material"

NRG PALLAS, Petten

23 – 25 April 2025

Dr Laura Woodward, UK Health Security Agency, EAN Secretary

EAN objective

- To provide a wider and more uniform implementation of the ALARA principle for the management of worker, public and patient exposures in all situations

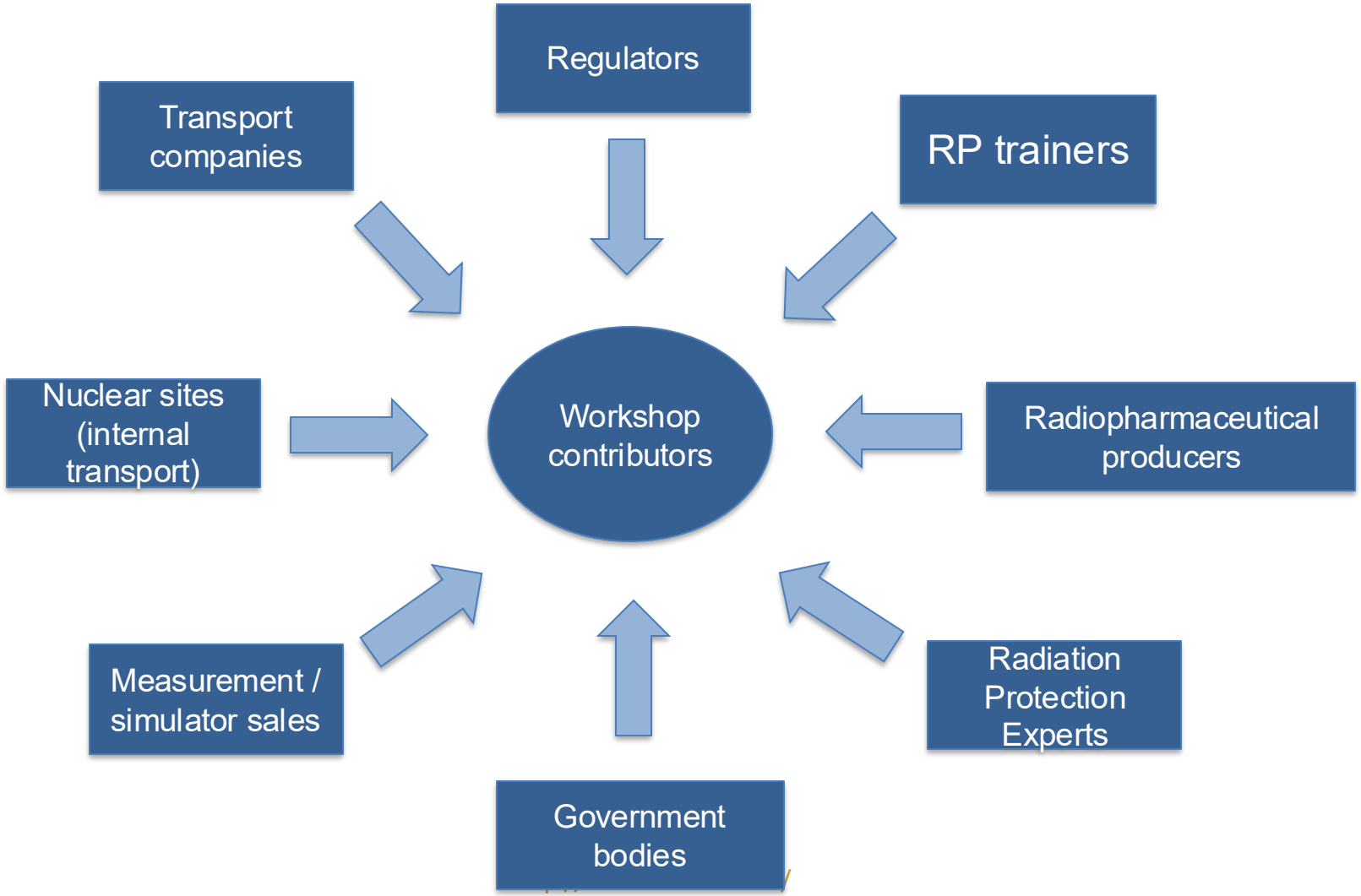
Workshop objectives

- Examine the current situation in Europe and the rest of the world
- Share experiences of improving the radiation protection culture
- Set of recommendations on optimising radiation protection in the field of transport

Themes

- International standards, regulatory and methodological guidance
- Case studies
- Incident, accidents and emergency response
- Transport of medical radiopharmaceutical sources

Stakeholders contributions



Stakeholders

- 51 participants, 10 countries (plus presentations from Japan and Australia!)
- Representation sufficient?
  - Countries?
  - Regulators?
  - Operators?
  - Carriers?

Summary of session presentations

Theme 1 : International standards, regulatory and methodological guidance

- First need to define what transport is
- The fraction of class 7 transports are relatively small (compared to the other 8 dangerous goods classes)
  - (<2% road, rail, <1% sea/canal, <10% air)
- SSR-6 (2018) is the IAEA safety standard to be followed
  - Soon to be an updated version
  - Supported by numerous guidance documents

Theme 1 : International standards, regulatory and methodological guidance

- IAEA working on new guidance “ageing management and maintenance of packages”
- Graded approach to design required
- Lots of stakeholders that don’t just include carriers, eg emergency responders

Theme 1 : International standards, regulatory and methodological guidance

- Reminder that SSR-6/ADR not the only requirements
  - Driving licence required!
  - Vehicles should be maintained
  - Etc.
- Max average dose to French carriers for medical applications is 1.47 mSv (compare doctor 0.8 mSv and dentist 0.2 mSv)
- Important to update your regulator of events/incidents
  - Detect non-conformities but also used to improve best practice

Theme 1 : International standards, regulatory and methodological guidance

- Ensure good practices are used:
  - Use remote measuring devices
  - Reduce loading/unloading times
  - Use roads with less traffic
  - Prep documentation far away from the package
  - Handling without hands
  - If possible, shielding between driver and packages

Theme 1 : International standards, regulatory and methodological guidance

- Belgium implements max dose rate for driver's cabin (20 µSv/h) – no other European countries have a similar limit
- Safety culture very important
- Communication is key (including with regulators)
- Training very important
- Must have a robust radiation protection programme - that is actually implemented and includes transport!

Theme 2: Case studies

- Practical optimisation implemented to reduce doses:
  - Time spent near packages
  - Providing personal electronic dosemeters
  - Automating steps
  - Training
  - Radiation protection programme put in place
- How closely to internal transfers need to meet ADR?
  - Include ADR into the radiation protection programme

Theme 2: Case studies

- Ensure suitable competency of drivers and others involved in the work
  - training is key
- Agreement between all those involved in internal transfers (if more than one company on site)
- Understand transport accident scenarios – especially as packages are Tera and Peta Bq
- If a worker is unsure the star principle used (stop, think, act, review)

Theme 2: Case studies

- Processes improved, eg:
  - Pins on vehicle loading area to stop packages moving/rolling
  - Removable shielding to be available for prep of high dose rate packages
- It is a continuous process to reduce dose rates

Theme 3: Incidents, accidents and emergency response

- Impact of radiation exposure from waste transport should be explained/delivered to traffic managers, police, fire department etc
- Information about the transport of Fukishima waste material was disseminated widely – drivers but also residents on roads that were used for transport
- Surface dose rates above 100 μSv/h around waste vehicle then shielding was introduced

Theme 3: Incidents, accidents and emergency response

- Instance of a lost 19 GBq Cs-137 source used for level monitoring on a road in Australia
- Strong government cooperation to assist RioTinto (who took ownership)
- Implemented disaster plan to be able to be able to use countries resources (ANSTO, ARPANSA and defence) to find it
- Vibration had caused initial break of the gauge, then full separation of the gauge on the journey to Perth

Theme 3: Incidents, accidents and emergency response

- Unsuitable screws for the gauge
- Poor testing for the industrial package (vibration not tested as if in situ)
- New designs not necessarily better
- No requirement for ensuring source has arrived – just that the package is tracked
  - Pre- and post- TI should be checked for non-routine transports
- RioTinto have been complemented by the regulatory authorities and no breaches – manufacturer still being investigated

Theme 3: Incidents, accidents and emergency response

- Training should involve practical element? – mandatory in France
- Simulation work means trainees can “have a go” without worrying about doses
- Poor practices can be identified, eg:
  - Remember to approach the package with radiation monitor switched on
  - Remember to monitor all sides of the package (including top!)

Theme 3: Incidents, accidents and emergency response

- RELIR (French language) and OTHEA (English language mirror) provides information on incidents that have occurred
  - Training resource
  - Learn from experience – encourage good practice
  - Free to use
  - Anonymised
- Please can incidents be shared with RELIR/OTHEA so they can be added to the database to be use by others

Theme 4: Transport of medical and radiopharmaceutical sources

- CuriumPharma delivers class 7 packages to 60+ countries and 190 000 packages a year
- Radiation protection required for classification, packing, shipment documentation (and stowage), carrier responsibilities, consignee responsibilities
- Implementation of robots/conveyors for specific processes have significantly reduced doses, eg collective dose was 140 mSv/y and now 90 mSv/y

Theme 4: Transport of medical and radiopharmaceutical sources

- Studies important to identify high risk areas (eg more medical transports in UK) and doses to workers/members of the public
- Future could involve transport of radiopharmaceuticals by drones
- There are hub hospitals in the UK that take receipt of radiopharma and redistribute to other hospitals
- Life Couriers send more than 185 000 packages all over the world each year
  - The radiation protection organisation is different in France to Belgium

Theme 4: Transport of medical and radiopharmaceutical sources

- Things to remember with transport:
  - Drivers shouldn't accept package if not happy with it
  - Labels should be clearly written
  - Labels should match UN number
  - Packages should be secured in the vehicle
  - Remember to keep the attention on the radiation protection
- Italy have online software which gives "cradle to grave" recording of radioactive materials
  - All movements must be recorded

Key themes and topics

Key themes

- Highly regulated domain on transport
- Enhanced focus on RP for the workers
  - Licensing of the activities related to transport (handler)
  - Requirement of a formal RPP
- Techniques for the training and education
  - Virtual techniques
  - Learning from return of experience
  - Awareness and understanding of the risk
  - Do’s and don’ts

Safety culture

http://www.eu-alara.net/

Key themes

- Real optimisation yes, stimulated by the formal RPP
  - Distance, shielding, time
    - DHL, Curium
    - Dose evaluation by measurement
    - Dose estimates
    - Layout of the workplace
- Defining defence in depth
  - Based on root cause analysis of incidents

Key themes

- Learn from incidents (big or small!)
  - Regulators want to know and have a conversation
  - Let the community know so they can learn
  - RELIR/OTHEA
- Planning your work properly is important
  - Risk assessments
  - ALARA book
- On the site good to have an independent review/audit by the RPE based on the comprehensive risk assessment
  - Don’t forget other health and safety risks

What are the recommendations?

20th Workshop – recommendations

- WG 1 & 2 (regulations): 3 recommendations
- WG 3 & 4 (RPP): 8 recommendations

- 11 recommendations in total

Regulations recommendations

- There are working groups for transport in EU and mediterranean
  - Can provide information/help
  - Make sure these are distributed so people know they exist (were originally formed by the IAEA and now are separate groups)
- Better communication between operators and regulators
  - Network events between operators and CA
- Timely revision of RPP – optimise RPP by regular review

RPP recommendations

- Training should be given to emergency responders – authorities to ensure this happens? Guidance given?
- Internal audits should be carried out
- Encourage reporting of deviations
- Phone numbers should be given in the vehicles to use in emergency situations - Where in the vehicle? Easily accessible?
- Promote harmonisation of processes across Europe
  - Harmonise optimisation processes

RPP recommendations

- Harmonisation of the training requirements across Europe?
  - How many days?
  - Who requires it?
  - Refresher period?
  - Guidance could be given on training requirements?
  - Good/bad feedback?
- Dosemeters should be used - how do we know the doses without taking measurements? (note - how well would this work for very low doses in reality?)
- Portals in airports – if we use them what should we do if there is a high result? Guidance document?

The way forward

- Synthesis of conclusions and recommendations will be formulated based on the feedback from the presentations, WG's and discussions and dialogues
- Published on the EAN website and in the newsletter

Thanks to the Programme Committee

CROUAIL Pascal	CEPN	France
DRAAISMA Folkert	NRG	The Netherlands
KABRT Franz	AGES	Austria
LOPES Julie	CEPN	France
LORIOT Gwenaelle	CEA-INSTN	France
OKYAR Burçin	IAEA	Austria
VENOSO Gennaro	ISS	Italy
VERMEERSCH Fernand	SCK CEN	Belgium
VONLANTHEN Patrick	SFOPH	Switzerland
WOODWARD Laura	UKHSA	United Kingdom

Proposed workshop for 2026…

ALARA in design:

- Small modular reactors (SMRs)
- Research Reactors
- Accelerators
- Hot cell facilities
- Etc…

ALARA consideration during build and operational phases?

Possible venue: SCK CEN Mol, Belgium

Thanks to NRG

A big thank you to the team at NRG PALLAS for being wonderful hosts for this EAN Workshop

Folkert Draaisma

Gertruud Schaper - Schuitemaker

Thank you!

Thank you for your participation

PowerPoints will be added to the EAN website shortly

Feedback link will be emailed out ☺