



EAN ADMINISTRATIVE BOARD AND STEERING GROUP MEETINGS AGENDA

20TH JUNE 2018

*The Meetings will take place at CEPN (28 rue de la Redoute – 92260 Fontenay aux Roses).
It will start at 10.00 and will end at 16.00.*

ADMINISTRATIVE BOARD MEETING

AB Members

1. Financial aspects:
 - Presentation of the final budget 2017.
 - Presentation of the proposed budget 2018.
2. Election of the Bureau;
3. Follow-up of actions decided at last AB; Membership

*S. Andresz,
S. Andresz, AB Members*

AB Members

AB Members

STEERING GROUP MEETING *(start around 11.00 am)*

1. Topical presentation: *The Monetary Reference Value of the man-sievert; Results of an International Survey*

S. Andresz

Implementation of the EAN Strategic Agenda 2015 – 2020

2. Mid-term evaluation of the Strategic Agenda: where are we now?
3. Increasing the visibility of EAN:
 - 3.1 Publication and recent activities:
 - o Publication of the Conclusions & Recommendations from 17th EAN Workshop
 - o Implication of EAN in ANNETTE Summer School
 - o Progress in the ALARA Book
 - 3.2 Update on the 18th EAN Workshop (2019)
 - 3.3 EAN Newsletters (issue 41; Autumn 2018)
 - 3.4 Proposal for surveys:
 - o 'Relevant liquid' for radioactive substance permitting regime (from PHE)
 - o The implementation of the 'graded approach' for workplaces (considering NORM, radon etc.)
4. Information and discussions on EAN sub-networks and working groups
 - Creation of the African ALARA Networks
5. Relation with other organizations
 - News from IRPA 2018 The Hague *(if relevant)*
 - Update on the relation with ICRP
 - Implication of EAN in European Project/organization (CONCERT, European Radiation Protection Week, etc.)
6. All Other Businesses (AOB)

All Members

S. Andresz

*S. Andresz
F. Vermeersch
(+ALARA Culture WG)
Programme Committee
All Members*

P. Croüail

*F. Vermeersch
All Members
All Members*

All Members

OPTIMISATION OF RADIATION PROTECTION (ALARA): A PRACTICAL GUIDEBOOK

Fernand VERMEERSCH (chairman EAN)

5th European IRPA Congress
4 - 8 June 2018
The Hague, The Netherlands

Encouraging Sustainability
in Radiation Protection



European ALARA Network

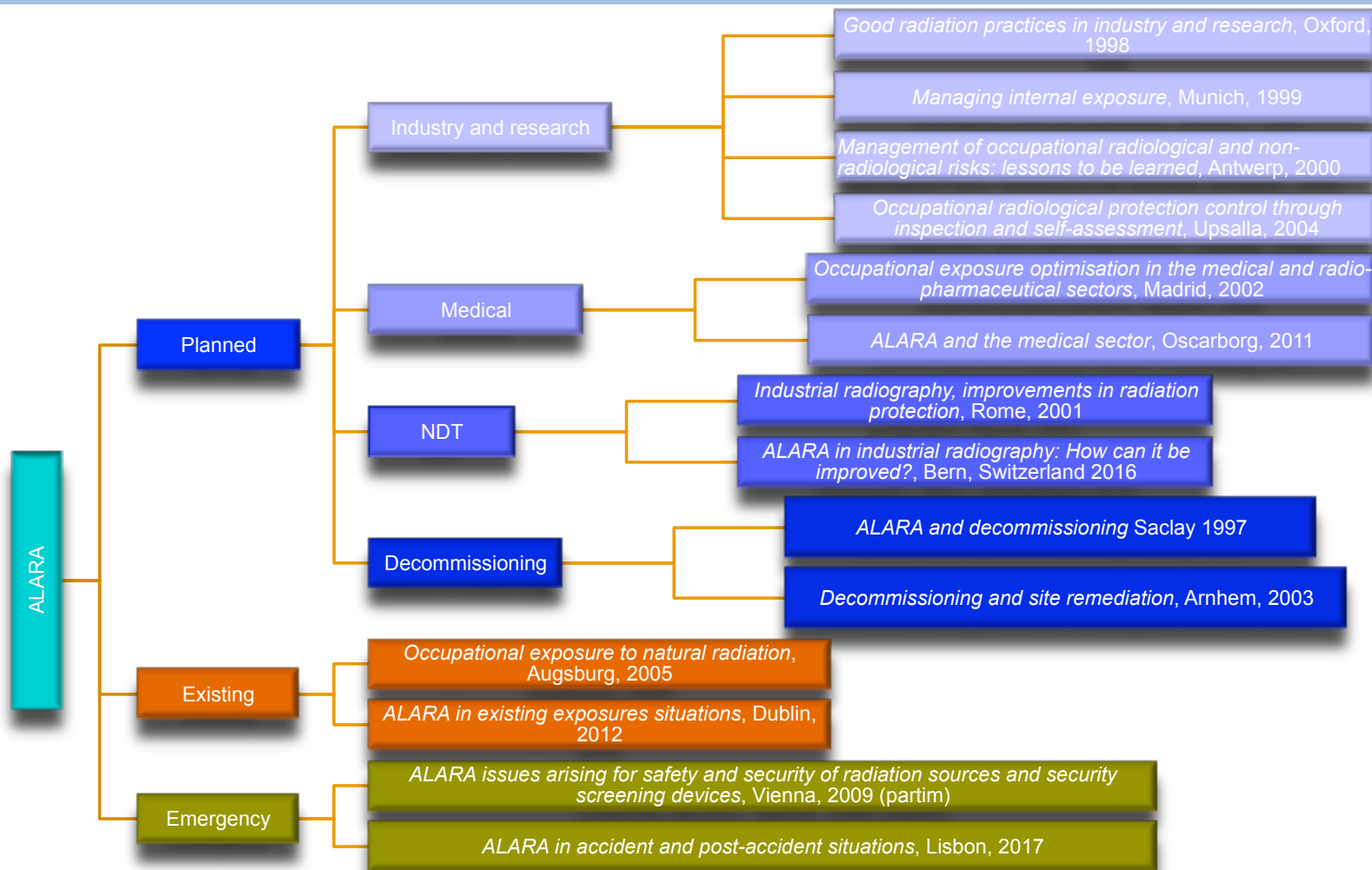
- European ALARA Network (EAN),
 - foster specific European research on topics dealing with optimization of radiation protection
 - facilitate the dissemination of good ALARA practices within European industry, research and medical sectors.
- Objectives
 - Promote a wider and more uniform implementation of the ALARA or optimisation principle for the management of worker, public and patient exposures in all exposure situations
 - Provide a focus and a mechanism for the exchange and dissemination of information from practical ALARA experiences,
 - Identify and investigate topical issues of common interest to further improve the implementation of ALARA.

European ALARA Network

EAN in 2016-2018:

- 18 Members (organizations) in Europe
- working groups
- active sub-networks (ERPAN, EAN_{NORM}, ...)
- relations with other RP organisations
 - NERIS, EUTERP, ISOE, Liason with ICRP
- Workshops
 - Important tool for exchange and dissemination

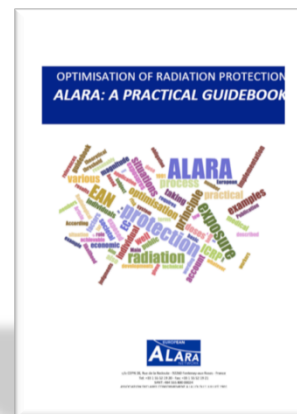
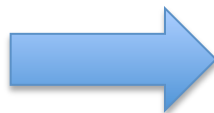
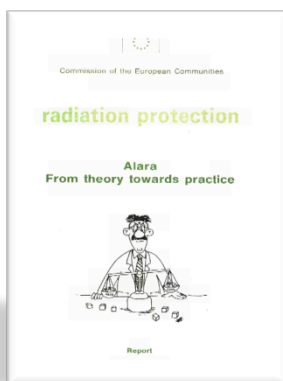
EAN has organized 17 workshops since 1996



Workshop n°18 on Site Clean Up and Decommissioning, March 2019

EAN WG ON ALARA CULTURE

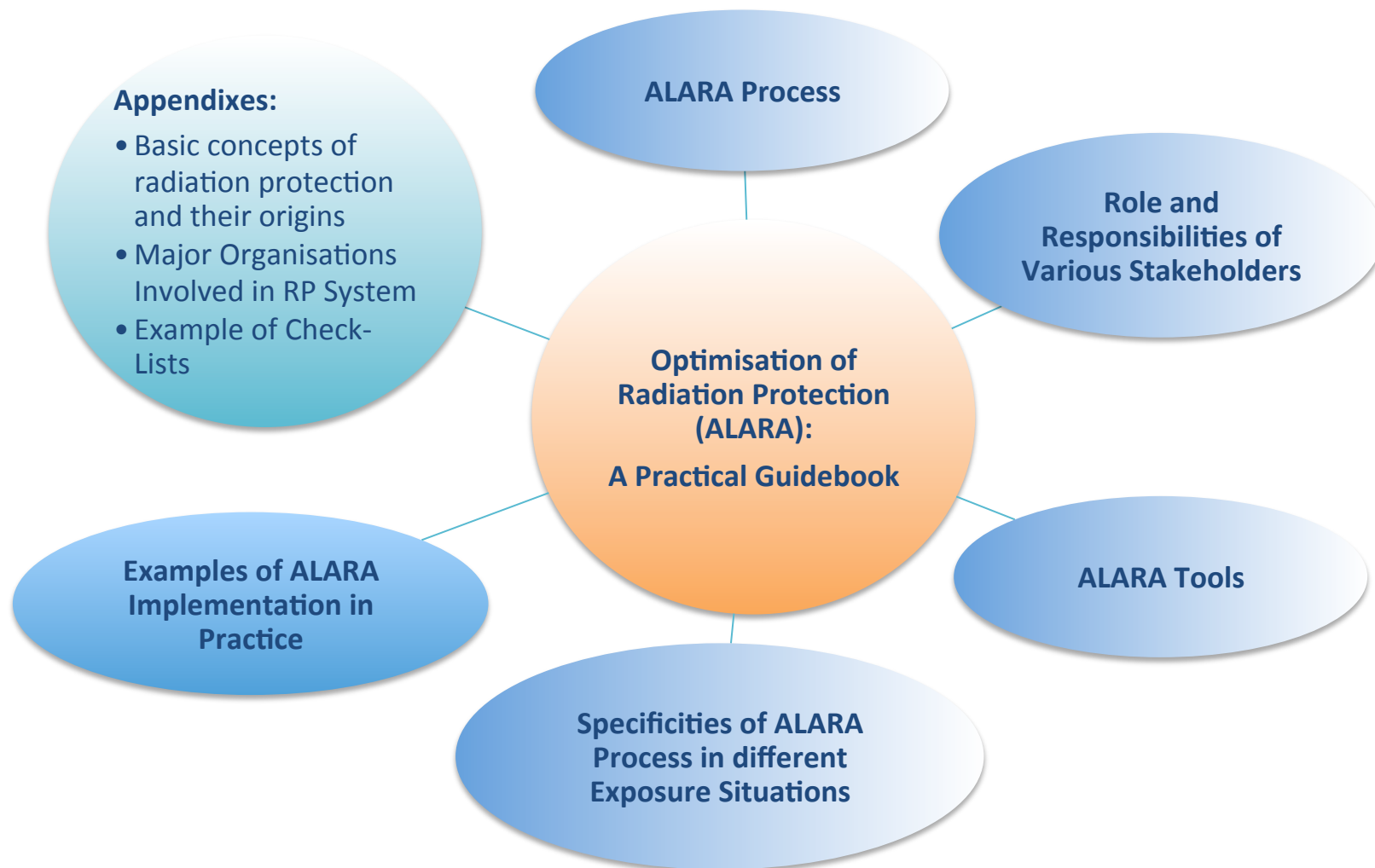
- Created in 2009 (first meeting in October)
- Elaboration of a paper on
« The Development and Dissemination of ALARA Culture »
 - Presented at IRPA 13- Glasgow in May 2012
- Decision to elaborate an update version of the book
 - « ALARA from Theory towards Practice » (published by EC in 1991)
 - ALARA: A PRACTICAL GUIDEBOOK



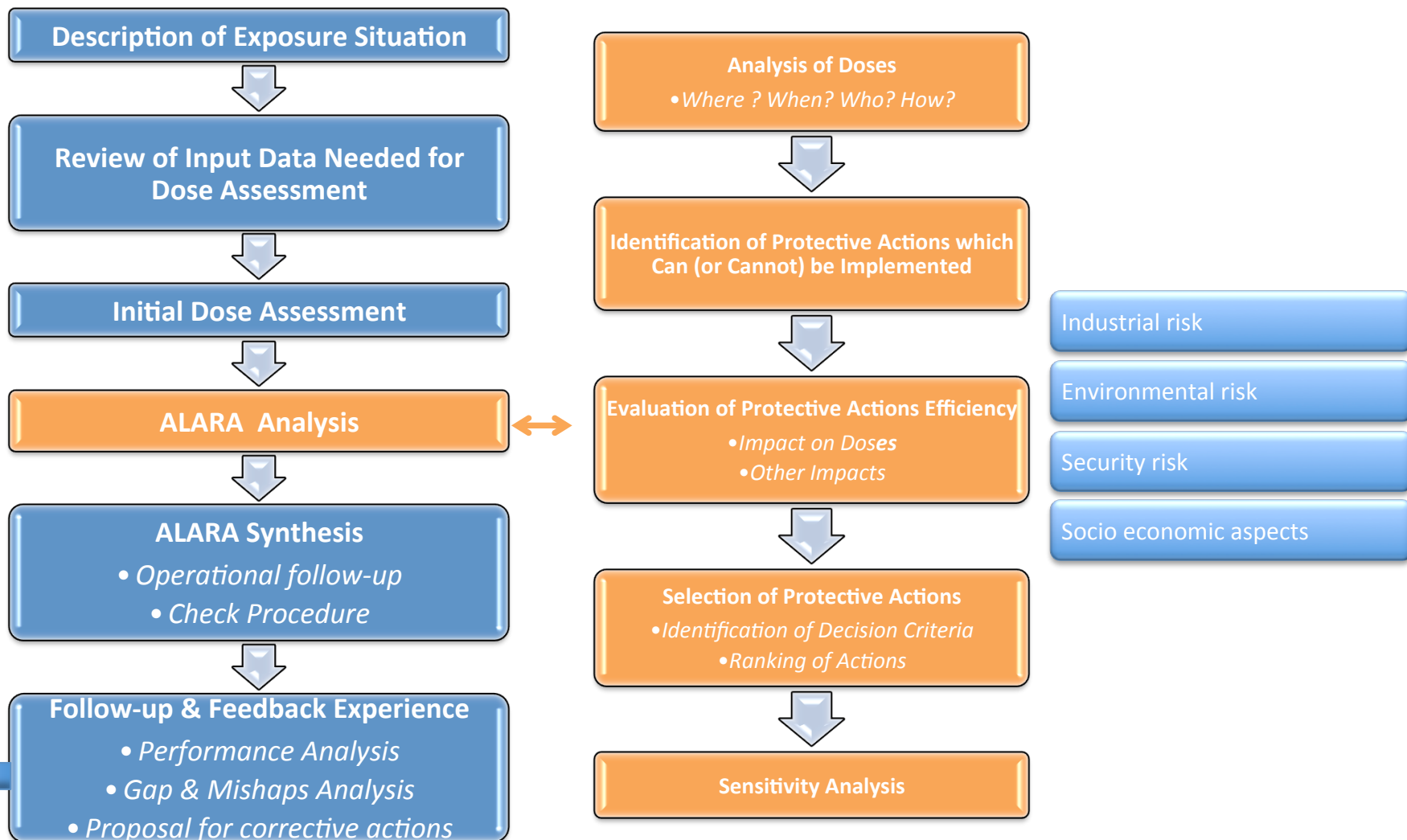
TARGET AUDIENCE

- | | |
|--|-----------------------------|
| ○ Competent authorities | ○ Professional associations |
| ○ Manufacturers, suppliers and designers | ○ Exposed workers |
| ○ Licensees | ○ Public |
| ○ Radiation protection professionals | ○ Patients |

Content of the book



The ALARA PROCESS



Acceptable level of risk



Role and Responsibilities of Stakeholders

Attitudes towards managing radiological risk
at the individual and/or organisational level

A questioning attitude

Did I do what I could to save doses? is the management committed to the introduction of new technologies to save doses or prevent accidents?,...

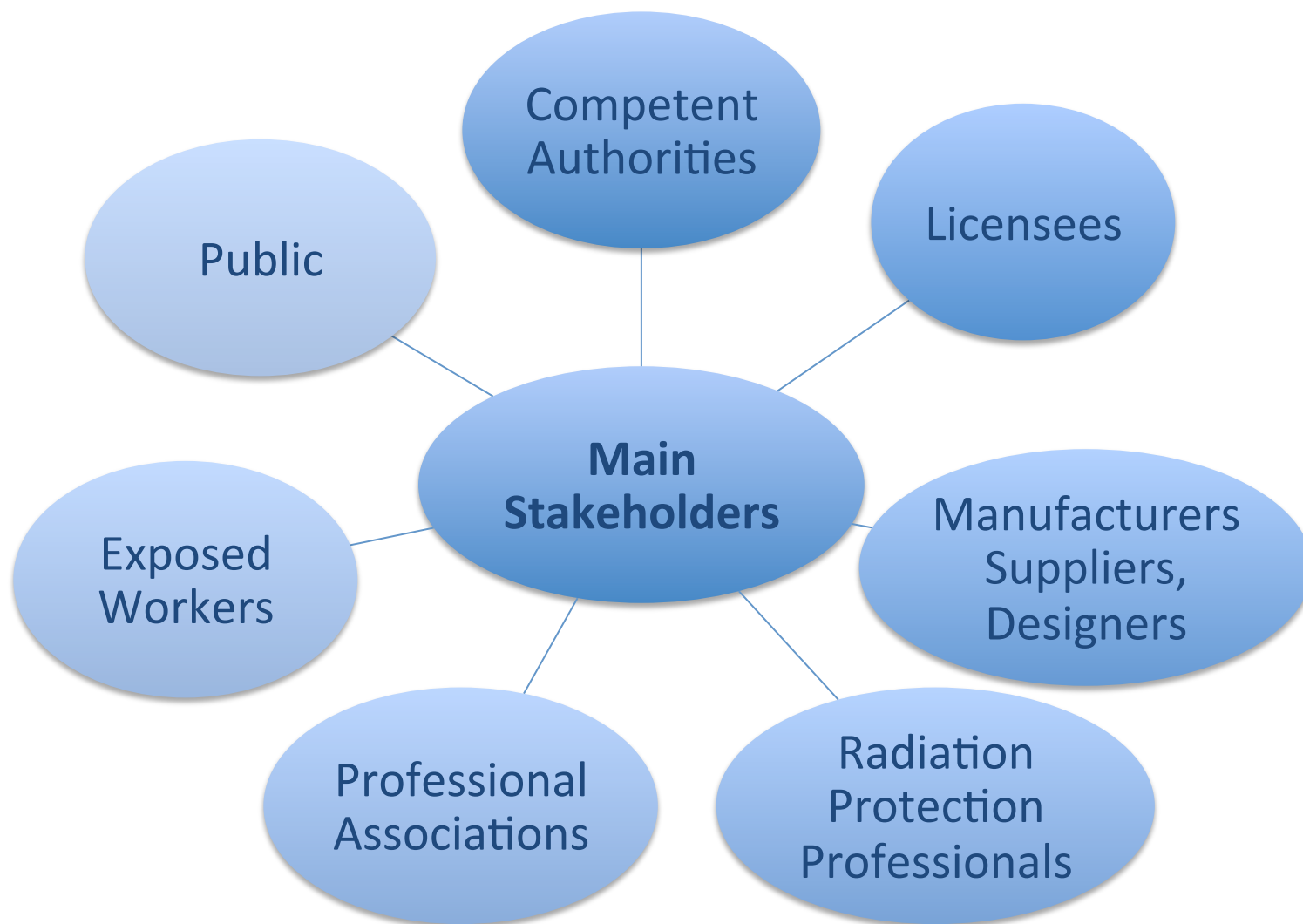
Openness and transparency

Open to changing habits, reporting mishaps, explaining radiation protection options,...

Commitment to dose reduction

Appropriate individual behaviour in the presence of radiation sources, willingness to invest in protection measures,...

Role and Responsibilities of Stakeholders



ALARA Tools



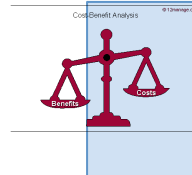
**Dose Constraints
and Reference
Levels**

Annual limit	New Workers	Average (mSv)
	2 month	2
	3 month	0.6
1	3 month, 2 HP	0.07 0.03
10	3 month	0.9
	2 month, 1 month	1 0.2
	2 month, 3 month	1 0.2

**Dose Tables
Dose monitoring**



**Software tools
Dose modelling**



**Decision Aiding
Techniques**



**Organisational
Structures**



**ALARA Review,
Audits**



**Education and
Training**

Specificities of ALARA Process According to Exposure Situation

Planned Exposure Situations

Occupational exposures in nuclear and industrial field

- Long experience
- Specific RP/ALARA organisations
- Structured approach

Public exposure from planned activities

- Usually less formal approach
- Search for “minimisation”
- Use of dose constraint

Specificities of ALARA Process According to Exposure Situation

Existing Exposure Situations

- Natural background of radiation (radon, ...)
 - Residual radioactive material from a nuclear or radiological emergency
-
- Potential for optimisation varies a lot according to the situations
 - National, regional and sites specific reference levels
 - Pro-active identification of stakeholders
 - Self-help protective actions

Specificities of ALARA Process According to Exposure Situation

Emergency Situations

- Public Exposure
- Emergency workers / responders

- Integration into the planning stage of protection strategies and during emergency
- Active involvement of stakeholders (authorities, police, fire fighters, etc.) in the planning stage
- Lessons learned from past accidents

Specificities of ALARA Process According to Exposure Situation

The Medical Field

Education and training

Occupational exposures

- Dose reduction techniques according to the type of procedure and technique applied
- Radiology, nuclear medicine, radiotherapy

Patients

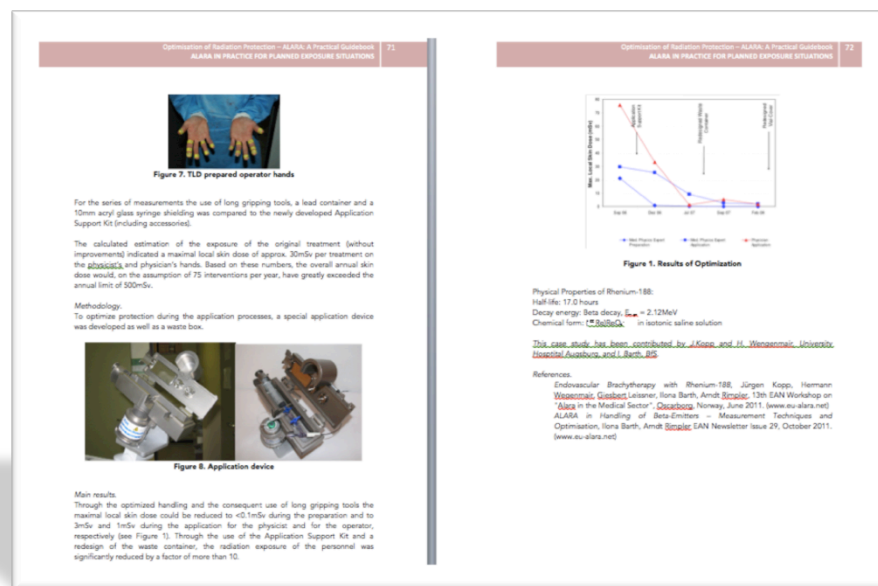
- Justification of exposure
- Dose reduction techniques

Comforters and carers

- Usually very low doses
- Information, appropriate instructions

Examples

- Illustration in all exposure situations
- All examples are gathered from presentations / publications during various Congresses / Workshop
- Presented in a structured way
 - What is the example illustrating
 - Context
 - Methodology
 - Results
 - Lessons learned



APPENDIXES

Basic Concepts of Radiation Protection and their Origins

- Health effects
- Justification
- Optimisation
- Limitation
- Exposure situations

Major Organisations Involved in the RP System

- Elaboration of scientific basis
 - UNSCEAR, BEIR
- Elaboration of system of protection
 - ICRP, ICRU
- Other organisations involved in standard, regulation, recommendations
 - EURATOM, IAEA, WHO,..
 - Networks, Professional Associations,...

Example of Check-Lists

- Identification of protective actions
- Pre/post job ALARA review
- Audits,
- ...

Monetary Value of the Man-Sievert

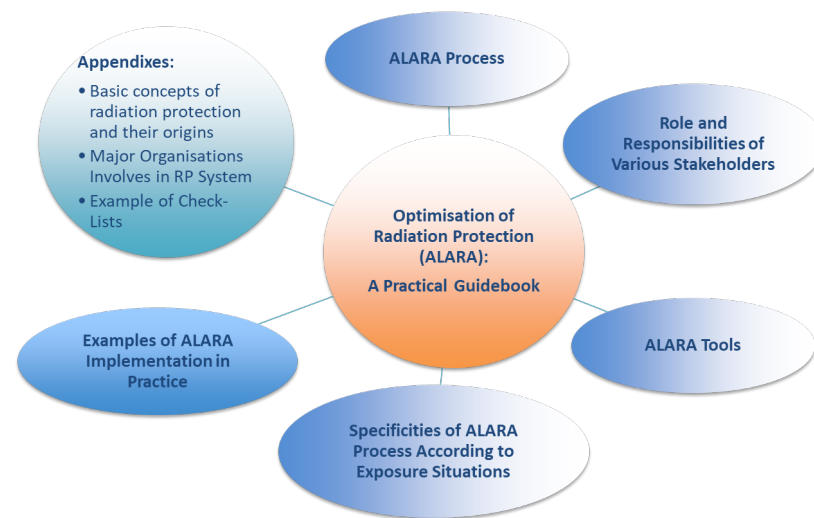
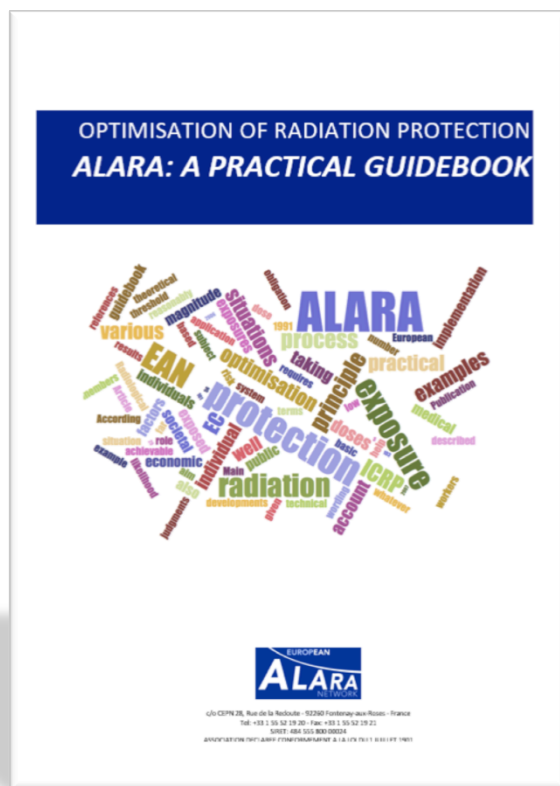
- Reference value based on the "human capital approach"
- Proposal of a system based on increasing value with individual dose level
- Example of values in nuclear field

A practical guide book

Finalisation of the book

A last review by the members of EAN is in progress

Publication date October 2018 as a downloadable pdf file



TARGET AUDIENCE

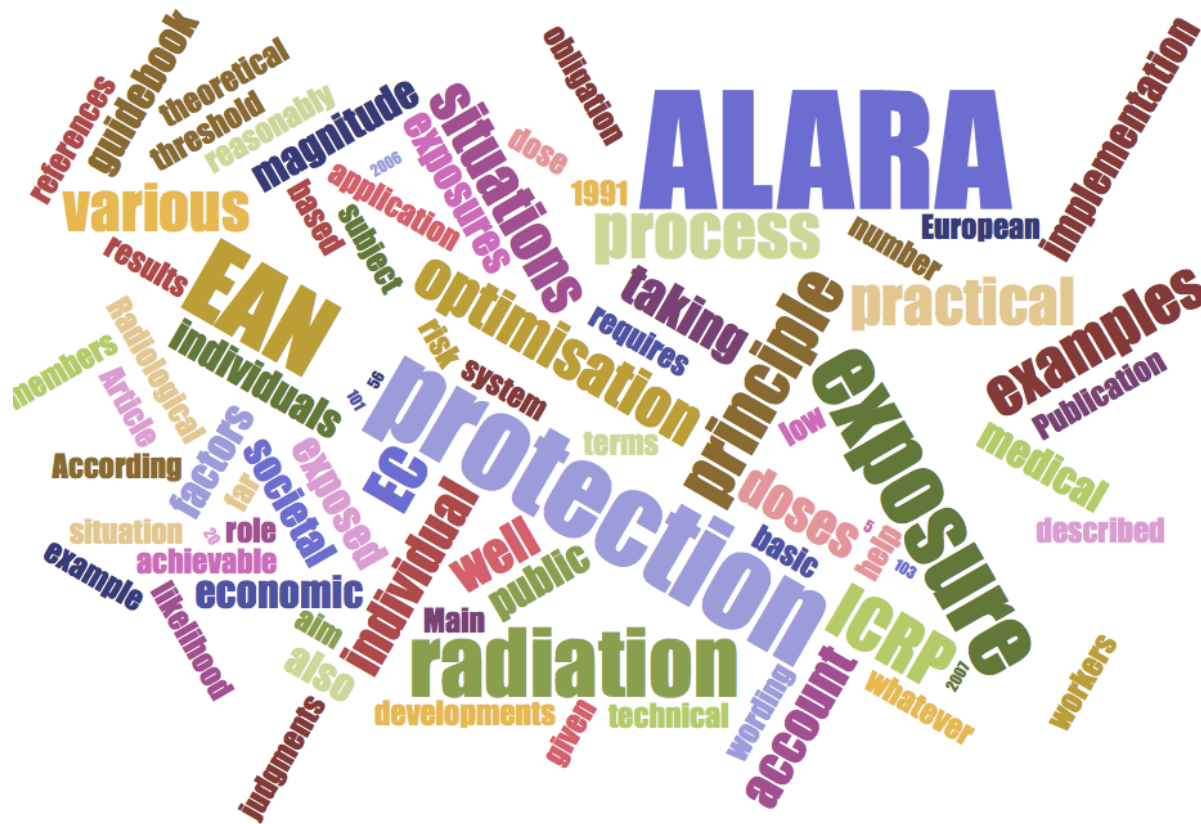
- Competent authorities
- Manufacturers, suppliers and designers
- Licensees
- Radiation protection professionals
- Professional associations
- Exposed workers
- Public
- Patients

Thanks to

- The members of the Working Group who contributed to the elaboration of this Guidebook are the following:
 - Sylvain ANDRESZ (CEPN, France),
 - Sotiris ECONOMIDES (EEAE, Greece),
 - Frank HARDEMAN (SCK•CEN, Belgium),
 - Cristina NUCCETELLI (ISS, Italy),
 - Serena RISICA (retired from ISS, Italy),
 - Caroline SCHIEBER (CEPN, France),
 - Annemarie SCHMITT-HANNIG (BfS, Germany),
 - Fernand VERMEERSCH (SCK•CEN, Belgium).
- The Working Group Members wish to thank all those who helped in the elaboration of this book, providing advice, examples, and psychological support. They particularly thank Mr Peter Shaw, Ms Helena Janzekovic and the members of the European ALARA Network Steering Group.

Thank you for your attention

Questions ?



Personal Online Dosimetry Using computational **Methods (PODIUM)**

Partners: SCK·CEN, UPC, HMGU, LU, PHE, EEAE, SJH

The PODIUM project is part of [CONCERT](#) European Joint Programme for the Integration of Radiation Protection Research under Horizon 2020.



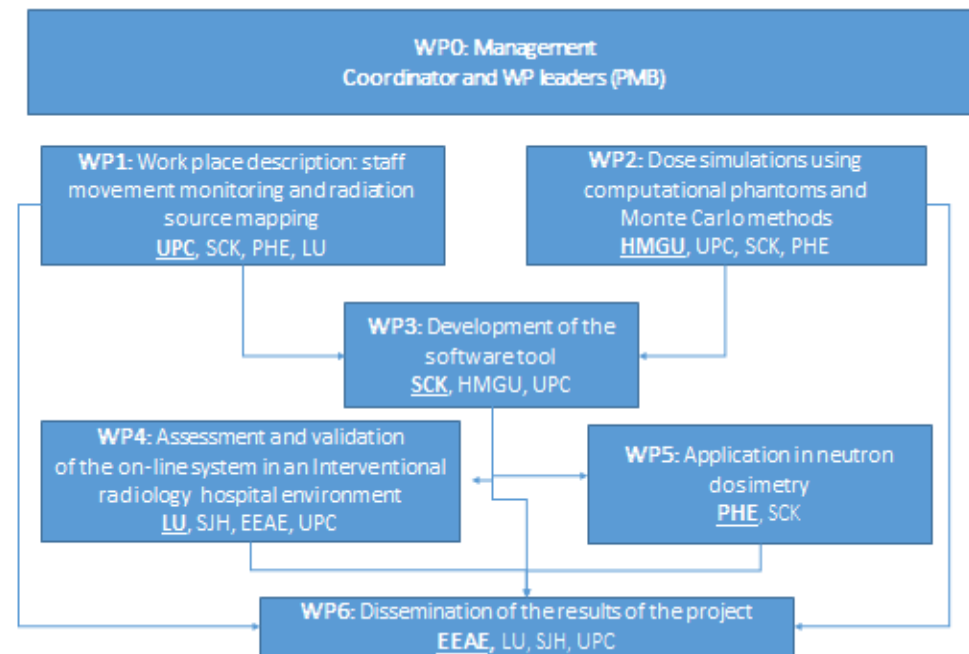
Objectives

- To improve occupational dosimetry by an innovative approach
- To develop an online dosimetry application based on computer simulations
- To have more reliable dose measurements in more complex and inhomogeneous fields
- To eliminate the use of passive dosimeters by overcoming the problems and the uncertainties that arise from their use
- To increase the awareness among workers
- To improve the application of ALARA principle in all working conditions



Workpackages (WPs)

- ❖ WP0: Management
- ❖ WP1: Dose simulations input: staff movement monitoring and radiation field mapping
- ❖ WP2: Dose simulations using computational phantoms and Monte-Carlo methods
- ❖ WP3: Development of the online dosimetry application
- ❖ WP4: Assessment and validation of the online dosimetry application in hospitals
- ❖ WP5: Assessment and validation of the online dosimetry application in mixed neutron-gamma workplace fields
- ❖ **WP6: Dissemination of the project results**





Dissemination of the project results

➤ How?

- ✓ Preparation of a 2-day workshop

➤ When?

- ✓ Q4 of 2019

➤ Objectives?

- ✓ To present the general outline of optimization in occupational exposure in interventional radiology and mixed neutron and gamma workplaces
- ✓ To inform and educate occupationally exposed workers on the application of the ALARA principle
- ✓ To present the advantages of online dosimetry systems in routine practice
- ✓ To present the online application developed within the project

➤ Interested parties?

- ✓ Radiation protection experts
- ✓ Medical physics experts
- ✓ Radiation protection officers
- ✓ Dosimetry services
- ✓ Regulators, etc.



For further information, click the link below:

<https://podium-concerth2020.eu/>





Public Health
England

Protecting and improving the nation's health

Review of the UK's regulatory framework governing the management of radioactive liquids

Purpose

To review the UK approach of regulating liquid discharges, particularly those containing very low levels of radionuclides.

The review is not limited to one particular industry; it will include all industries, e.g. nuclear, non-nuclear and NORM.

The work will consist of 5 main tasks with the aim being to complete the work by the end of 2018.

Task 1 Statement of current UK approach and regulatory framework

Task 2 International policy constraints and standards

Task 3 Review of arrangements in other countries

Task 4 Identify issues and problems with current regime

Task 5 Propose changes to the current UK framework

Questionnaire

Aim is to learn from experience in other countries

5 questions

To give some guidance we have included an example of a questionnaire completed from the perspective of the UK.

Sending this questionnaire to principally regulatory authorities and government departments but we welcome responses from any person who is able to answer these questions.

If you are able to respond, we would be grateful if you could send responses **by the 31st July.**

Feedback from questionnaire

Information from this process will be compiled to produce a publicly available report.

All information collated will be attributed by country rather than who responded.

We will share the report with respondents and other interested parties such as the IAEA.

It is hoped that this information could usefully inform future guidance on this topic.

Further information

Please contact

KELLY.JONES@PHE.GOV.UK or call Kelly on (44) 1235 825268

Funded by :



Department for
Business, Energy
& Industrial Strategy

In collaboration with:



ICRP Main Commission session with Special Liaison Organizations

Contribution of the European ALARA Network

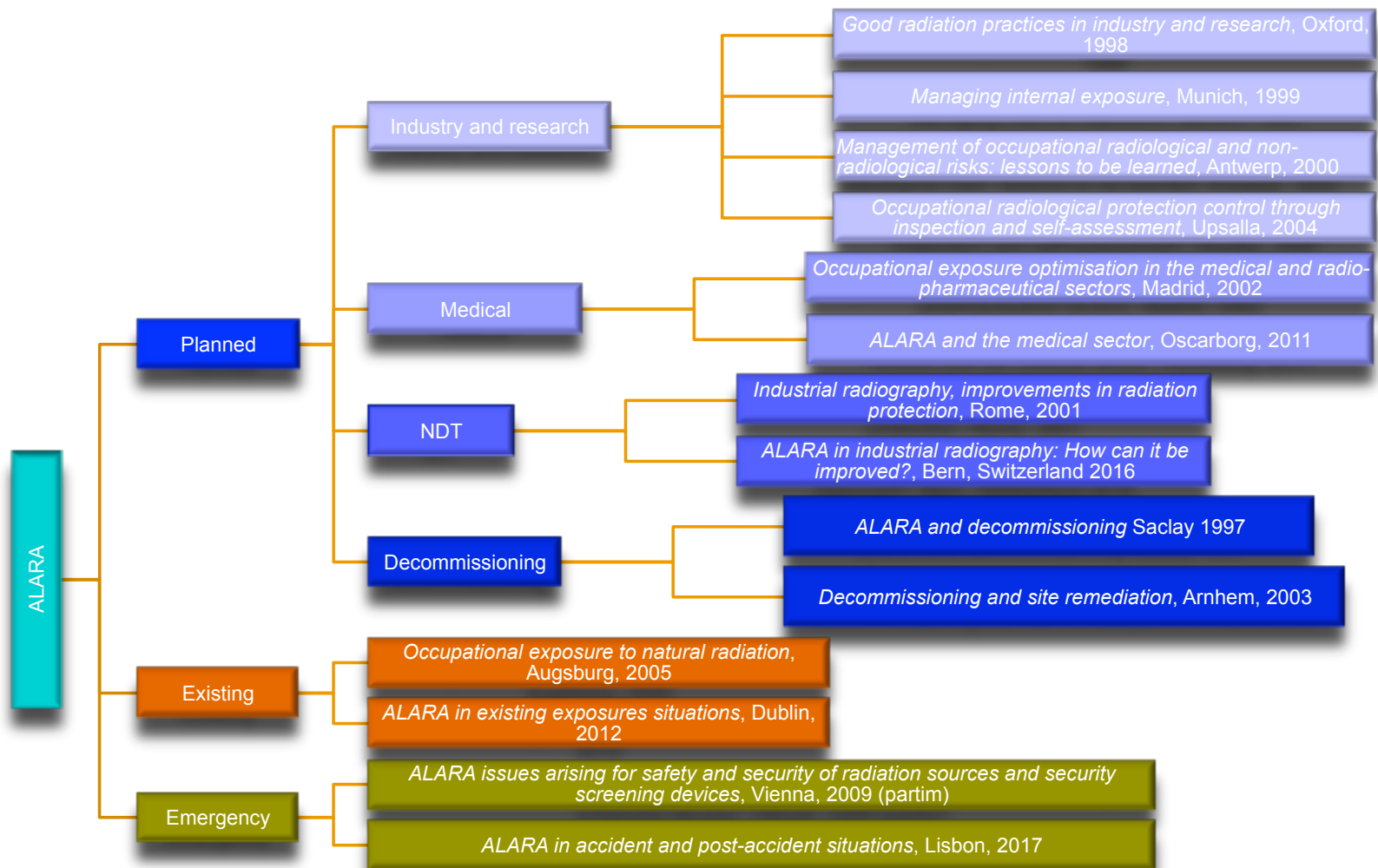
Paris (Marne-la-Vallée), 9 october 2017)

The European ALARA Network

EAN in 2016-2017:

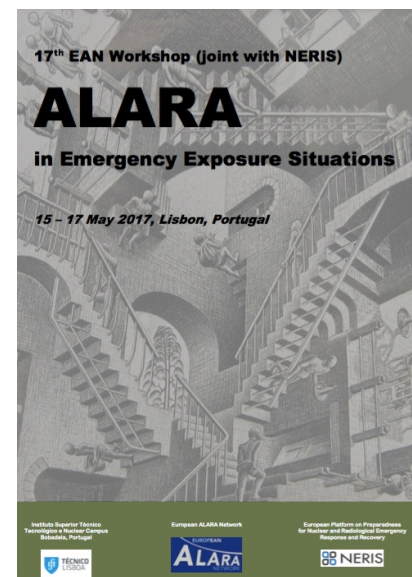
- 18 Members (organizations) in Europe
- + working groups
- + active sub-networks (ERPAN, EAN_{NORM}, ...)
- + in relation with other organisations ... Including ICRP !
- Objectives are to promote implementation of ALARA in all ES and provide mechanism for exchange/ dissemination of ALARA (notably through workshops)

EAN has organized **17** workshops since 1996



Workshop on **ALARA** in emergency exposure situations

- Why?
 - ICRP and EU-BSS emphasis to apply ALARA in EES
 - ICRP discussion on acceptability, tolerability + ethics
 - Re-examine the challenges in applying ALARA in EES, taking the experience from Fukushima
- Jointly organized with NERIS
- Took place at IST, Portugal, May 2017
- 60 participants from 17 countries
- Presentations + working groups



EAN 17th workshop

- **Guidance on emergency preparedness** (IAEA, ICRP, WHO, CRPPH and EC) : justification, optimisation and stakeholders involvements are key points but vary with time and circumstances $\Rightarrow$ which circumstances have most influence ?
- **Mitigation measures** (national+local arrangements). Mostly driven by RP factors with the aim to (over)protect. $\Rightarrow$ non-RP factors + flexibility needed to achieve 'ALARA'
- **Reference Level.** A tool for selecting the mitigation measures and drive optimisation $\Rightarrow$ Wide array of interpretation! Issue of *derived* RL. Flexibility also needed (RL $\neq$ limit)

EAN 17th workshop

- **Dose assessment and monitoring (software).** To prepare and assess the consequences. Help in decision-making. Hypothesis, conservatism, etc. ⇒ need to highlight the uncertainties and manage them
- **Stakeholders.** A transversal topic that need more flesh
- **RP culture, training, communication.**
 - Workers : training +++
 - Public: develop RP culture in peace time. In accident: confidence is easy to loose, hard to overcome
 - In affected territories : do not *taught* RP, but give tools to allow people to *understand* it. Only way people can make informed decision and adapt their behaviour

EAN 18th workshop

- **ALARA for site-clean up and decommissioning**
- Jointly organized with International System of Operating Exposures (www.isoe-network.net)
- 1st quarter of 2019, at Marcoule (FR) or Bruges (BE)

EAN ALARA Book

- **Broadcast elements of ALARA culture**
- Concepts of the ALARA process + (many) examples from EAN members experience, workshops etc.
- ⇒ The EAN *Sacred Book*
- (definitive) deadline for publication : February 2018 (in .pdf)

EAN is also ...

- A bi-annual newsletter, widely distributed :



- A new logo, that match with our objectives
- A new website

EAN and ICRP

- Observer in ICRP TG106 (mobile HASS)
- Can act as a liaison between ICRP and the RP in-the-field (surveys, working groups etc.)

Thank you



2017 Meeting of senior representatives of organisations in formal relations with ICRP

Geneva, Switzerland November 17, 2017

IAEA

Activities of the European ALARA Network

1. Introduction

The strategic agenda of the European ALARA Network for 2015-2020 emphasises stakeholder involvement and the exchange of practical experiences in radiation protection optimisation between professionals, the authorities and the public.

The 17th workshop on ALARA in emergency exposure situations took place 15-17 May 2017 in Lisbon, Portugal and was organised jointly with NERIS. The workshop focussed on the practical application of ALARA in emergency exposure situations as put forward by ICRP and the EU-BSS. The challenges of applying ALARA in EES were re-examined taking the experiences of Fukushima into account.

The ALARA book is still under further development by the EAN ALARA culture working group, a review by the Commission is also an element of collaboration between EAN and the Commission.

The 18th European ALARA Network workshop will cover the topic of ALARA for site-clean up and decommissioning and will be jointly organised with the International System of Operating Exposures(www.isoe-network.net). The workshop is planned to take place in the 1st quarter of 2019, at Marcoule (FR) or Bruges (BE).

2. Feedback from the 17th European ALARA workshop “on ALARA in emergency situations.”

The workshop was used as a forum to present the latest recommendations and guidance from key international organisations (namely AIEA, ICRP, WHO, EC and NEA/CRPPH) with regard to the management of EES. There are many common aspects and notably an emphasis on the concepts of “justification” and “optimisation” of the radiological protection strategy. Exposures shall be maintained below “dose criterion” set in advance (different labels may exist: reference level, action levels etc.). The importance of the “involvement and consultation with interested parties” (stakeholders) is also commonly identified and advocated.

Some organisations recognise that the amount of factors to be considered in a protection strategy is huge (radiological factors plus economical, societal, ethical etc.) and their relative importance will vary with time and according to the circumstances. It is noticeable that there is no consensus between the organisations in the definition of the different phases of an accident (timeline) and the criteria for the transition from one phase to another. Still, we can globally distinguish between the “planning”, “urgent”, “intermediate” and “recovery” phases.

The working groups of the workshop considered following issues formulated in the working group theme’s

- Can the ALARA principle be fully applied in Emergency Exposures Situations for members of the public?
- Can the ALARA principle be fully applied in Emergency Exposures Situations for occupational exposed individuals?

- Predict the unpredictable. How to ensure that emergency plans are optimal from a radiation protection point of view? (2 groups)

A summary of their discussions and recommendations is given in issue 40 of the European ALARA Newsletter. The working group's presentations are available on the EAN website (<http://www.eu-alara.net/>).

3. THE ALARA BOOK

The continuous technological developments in ionising radiation applications and the increasing number of exposure situations highlight the need for further actions to develop and disseminate ALARA culture. At the same time, the number of radiation protection specialists with relevant knowledge and experience is decreasing due to retirement.

Therefore, there is a need to re-establish the elements that constitute ALARA culture (exposure situations, attitudes, responsibilities etc) in order to facilitate its practical implementation. That's why the EAN working group on ALARA culture is preparing a publication "Optimisation of radiation protection (ALARA): a practical guidebook". This guidebook will contain the following elements:

- Basic concepts of radiation protection and their origins
- The ALARA process and the ALARA procedure
- Elements supporting the approach
- Actors and their responsibilities
- Examples of ALARA implementation in practice

The ALARA Book is in the process of completion we aim to have the book ready in February 2017.

4. 18th European ALARA Network workshop on ALARA for site-clean up and decommissioning

The next ALARA workshop will deal with site-clean up decommissioning where we will revisit the topics of the 1st EAN workshop "[ALARA and Decommissioning](#)", Saclay, France, December 1997. The workshop will be organised in the 1st quarter of 2019 at Marcoule (FR) or Bruges (BE).

Dr. Fernand Vermeersch
Chairman of the
European ALARA Network



International Radiation Protection Association

1 May 2018

To all Associate Societies

Dear Colleagues,

ICRP Consultation on the draft report “The Use of Effective Dose as a Radiological Protection Quantity”

You should be aware that ICRP have just issued a draft report as above, for public consultation. The document can be found on the ICRP website: <http://www.icrp.org/page.asp?id=382>

There are perhaps two key points to consider in this draft. First is the idea that effective dose can be used as a rough indicator of risk in some circumstances. The report tries to outline when this is and is not reasonable. Second, the draft proposes to stop using equivalent dose as an important radiological protection quantity. In addition the report comments on the use of collective dose in the context of risk projection. Of course there may also be other issues of interest to societies and practitioners.

IRPA is prepared to respond to ICRP as ‘The International Voice of the Radiation Protection Profession’. We would therefore wish to receive any comments and suggestions from the Associate Societies on any aspects of this draft report. In order to meet ICRP’s 3 August deadline **we will need to receive your comments no later than 13 July.**

Please respond to the IRPA Executive Officer (leguen@irpa.net), copied to the President (coates@irpa.net).

With best regards

Roger Coates

Roger Coates
IRPA President

Copied to: IRPA Executive Council
Associate Societies

IRPA Executive Office

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NORM: EU Directive Implications beyond EU Borders



Nick Tsurikov
CALYTRIX
CONSULTING PTY LTD

DEFINITION

The definition of NORM:

Radioactive material containing no significant amounts of radionuclides other than naturally occurring radionuclides

AND:

Material designated in national law or by a regulatory body as being subject to regulatory control because of its radioactivity.



Three lists of 'industries of interest'

- EU: Article 23 and Annex VI of the 2013 Directive (building on the Title VII of the 1996 Directive)
- IAEA: Safety Report No.49 (Assessing the need for radiation protection in mining and mineral processing), 2006
- Australia: Safety Guide for NORM, RPS-15, 2008

Whilst the lists are generally similar, there are some important differences.



NORM: EU Directive Implications beyond EU Borders

3

Three lists of 'industries of interest'

Industry	EU	IAEA	Australia
<u>The same in all three sources:</u>			
Thorium compounds and products			
Niobium			
Oil and gas production			
Titanium pigment			
Thermal phosphorus			
Phosphate fertilisers			
Phosphoric acid production			
Zircon and zirconia			
Coal fired power plants			
Iron and steel			
Tin, lead, copper			
Mining ores other than uranium ore			



NORM: EU Directive Implications beyond EU Borders

4

Three lists of 'industries of interest'

Industry	EU	IAEA	Australia
DIFFERENCES:			
Rare earths	From monazite only		From all minerals
Tantalum	✓	-	✓
Geothermal energy	✓	-	✓
Cement, clinker ovens	✓	-	-
Water treatment	Only ground water		All water
Aluminium	-	✓	✓
Zinc, lead	-	✓	-
Scrap metal recycling	-	-	✓
Tunnelling	-	-	✓
Building industry	✓ (Annexes 8 & 13)	-	✓
Paper and pulp production	-	-	-
Hydraulic fracturing	-	-	-



NORM: EU Directive Implications beyond EU Borders

5

Levels applicable

Comparison given in the EU RadPro-157 (2010):

List of radionuclides of "natural origin" grouped according to the ratios of values in RS-G-1.7 and RP 122 Part I

Ratio up to ...	Nuclides
0.01	Th-231
0.1	Bi-210, Th-234
1	Ra-223, Ra-224, Th-227, U-234, U-235, U-238
10	K-40, Th-228, Th-230
100	Pb-210, Po-210, Ra-226, Ra-228, Ac-227, Th-232, Pa-231

Now 2013 EU Directive and IAEA BSS 2014 are aligned:

TABLE A PART 2

Naturally occurring radionuclides

Values for exemption or clearance for naturally occurring radionuclides in solid materials in secular equilibrium with their progeny:

Natural radionuclides from the U-238 series	1 kBq kg ⁻¹
Natural radionuclides from the Th-232 series	1 kBq kg ⁻¹
K-40	10 kBq kg ⁻¹



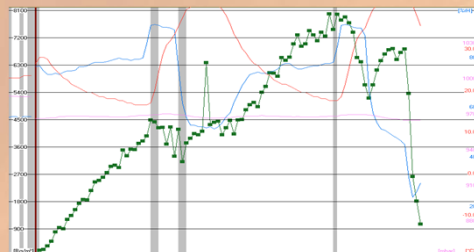
NORM: EU Directive Implications beyond EU Borders

6

The radiation levels measured are far from “low”



Monazite deposit in Australia, gamma ~ 140 - $180 \mu\text{Sv/h}$
20 mSv/year may be reached in two weeks



Build-up of ^{222}Rn in a container with mineral containing only 1.2 Bq/g of ^{238}U , up to $8,000 \text{ Bq/m}^3$
20 mSv/year may be reached in one month



Abandoned U and Th plant in Ukraine, gamma up to $1300 \mu\text{Sv/h}$



20 mSv/year may be reached in two days

NORM: EU Directive Implications beyond EU Borders

7

Additional serious safety hazards are very often present



Nest of feral bees in a rusted drum with NORM, Australia
 ~ 20 bites = 50% fatality



NORM waste mixed with chemicals, asbestos and mercury, Asia



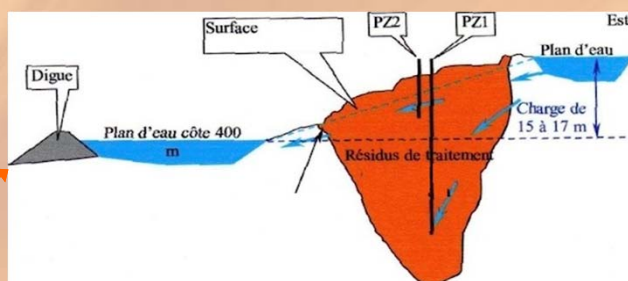
Wall cracks in an underground mine



NORM: EU Directive Implications beyond EU Borders

8

There are many environmental hazards as well, such as acid mine drainage



Acid mine drainage, pH~4.5, $^{226}\text{Ra} \sim 7 \text{ Bq/L}$, Africa



NORM: EU Directive Implications beyond EU Borders

9

Detection of radioactivity at EU border crossings

Relevant to the transport of all NORM, whether it is exempted from the Transport Regulations or not.

Issue:

The concentrations of radionuclides may cause elevated gamma radiation levels outside the packages (e.g. sea containers). The equipment that is used at border crossings and in ports worldwide easily detects these levels.



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Detection of radioactivity at EU border crossings

Solution:

The transport documentation for a particular material must contain detailed information about the concentrations of naturally occurring radionuclides in this material, irrespective of its classification.

MATERIAL SAFETY DATA SHEET Monazite concentrate

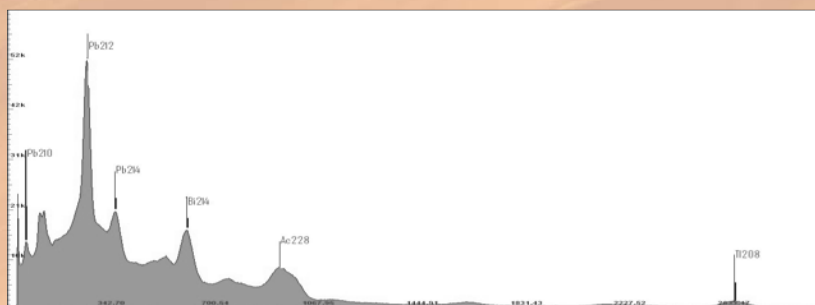
1. PRODUCT AND COMPANY IDENTIFICATION

Product Identification

Product names : Monazite

Company Identification

Company :
Address :
Telephone Number :
Fax Number :
E-mail address :



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Potential adoption of the 2013/59/EURATOM into the regulation of a non-EU country

- Regulators in the francophone countries tend to rely more on the documents from the EU, which are immediately available in French, and not on the IAEA ones.
- Typically, only Safety Standards of the IAEA are translated into six official UN languages.
- The IAEA documents are not translated into the languages such as Portuguese.

It is, therefore, quite possible that the text of the EU Directive (or some parts of it) will be adopted into the regulations in some developing countries.



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Potential adoption of the 2013/59/EURATOM into the regulation of a non-EU country

Reference levels:

Article 7.2

- *The choices of reference levels shall take into account both radiological protection requirements and societal criteria. For public exposure the establishment of reference levels shall take into account the range of reference levels set out in Annex I.*
- *Annex 1: Without prejudice to reference levels set for equivalent doses, reference levels expressed in effective doses shall be set in the range of 1 to 20 mSv per year for existing exposure situations*

However, without even looking into any annexes: Article 12.2

- Member States **shall** set the limit on the effective dose for public exposure at **1 mSv in a year**.



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Potential adoption of the 2013/59/EURATOM into the regulation of a non-EU country

Even if there is an argument about planned or existing exposure situations – in each and every case (except abandoned ‘legacy’ sites), the same 1 mSv/year will still apply.

Article 100.3 on existing exposure:

Existing exposure situations which are of concern from a radiation protection point of view and for which legal responsibility can be assigned shall be subject to the relevant requirements for planned exposure situations and accordingly such exposure situations shall be required to be notified as specified in Article 25(2).

It should be noted that §3.4 of the IAEA 2014 BSS contains similar requirements.



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The Problem

“Precautionary principle”: in dealing with potentially hazardous technologies the benefit of the doubt must go to the public and not to technologies.

The combination of this principle with the uncertainty about health effects of low level ionising radiation means that *a theoretical possibility* “a small dose may cause harm” is transformed into *an axiom* “a small dose most definitely will cause harm”.

The implementation (basically, copying) of Article 12.2 of 2013 EU Directive into the regulations in developing countries could (and most likely will) lead to the diversion of limited funds from other more important health problems of the population as a whole.



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The Problem

→ Over-regulation results in billion dollar costs, despite Linear-No-Threshold dose response model still being just a hypothesis, not a conclusively proven fact.

“Each human life hypothetically saved by implementing the US Nuclear Regulatory Commission’s regulations costs about \$2.5 billion. Such costs are absurd and immoral when compared to the costs of saving lives by immunisation against measles, diphtheria and pertussis, which in developing countries range between \$50 and \$99 per one life saved.” (Z. Jaworowski, 1998)



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The Problem

Radiation is not the only low-level risk that is over-regulated. There appears to be an obsession with regulating relatively low risks and an overall blindness to diseases such as measles, malaria and tuberculosis, and to other potentially fatal dangers, such as prescription opioids and alcohol.

Developing and applying regulations intended to reduce risk from minor or hypothetical hazards (such as low-level radiation) –

1. Gives elected officials an opportunity to say “we are here to protect you”,
2. Provides support for the scientific research that may not be needed, and for the government departments that, in some cases, have much more staff that is necessary, and
3. Appeases BANANA’s – people of the following opinion: “Build Absolutely Nothing Anywhere Near Anything”.



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Possible solution...?

NORM are existing exposure situations, because the source is not deliberately introduced, it already exists when a decision on control is taken; concentration and dissemination of radionuclides are incidental. ...some control is needed and should be provided; the level of protection should be commensurate with the risk. (J-F Lecomte, NORM-VIII, 2016)

This may not entirely correct. If the decision is made to open a new mine, bring up the ore that is rich in uranium and thorium and process it – the source is deliberately (albeit incidentally) introduced. Each and every new operation dealing with NORM appears to deliberately introduce the source.



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Possible solution...?

It can be argued that the source is not deliberately introduced, it was already existing – but what about the situation when radioactivity concentrations are increased thousands of times, making the NORM material dangerous?

Linking the planned exposure situation with the possible use of material for its radioactive properties also may not be a good idea.

Following a similar logic it could be argued that nuclear fuel is also NORM, as both ^{238}U and ^{235}U were already existing – just the ratio has changed during enrichment...

Yes, ^{235}U may have been introduced for its radioactive properties, but ^{238}U in depleted uranium – wasn't.

- So – is depleted uranium a NORM residue/waste?



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Possible solution...?

Two possibly absurd situations:

A worker is spending half the time in a copper flotation circuit, and another half – in uranium processing circuit. What is the exposure situation then?

Two ^{226}Ra atoms floating in the river side by side, one is from the farmer's field (fertilizer use), another one – from a 'nuclear' facility. Then:

- The one from the farmer's field is more or less "harmless" (NORM, existing exposure situation), but –
- Another one (exactly the same) acquires some magic powers and must be managed properly (nuclear, source is deliberately introduced, planned exposure situation).



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Possible solution...?

Maybe, similar to the three bands for workers:

- Less than 1mSv/y
- From 1 mSv/y to a few mSv/y
- From a few mSv/y to 20 mSv/y

a recommendation can be made on the application of the reference levels to the industries dealing with NORM?

A typical operator would always be of the opinion of “just give me the number that I should not exceed”. The “practice – intervention” concept was not well understood, and the introduction of variable reference level will, undoubtedly, result in a confusion for many regulators, who would simply use “the lowest denominator” of 1 mSv/year...



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Problem 2 – verbatim adoption of limiting values

Table Limits for radioactive materials in drinking water

SI No.	Radioactive material	Unit	Concentration (max)
i)	Gross <i>alpha</i> activity	pCi/l	1
ii)	Gross <i>beta</i> activity	pCi/l	15

Africa: 15 times less than US EPA. There is no laboratory in the country capable of measuring such low levels

WHO, Guidelines for Drinking Water Quality, 2011:

*Screening levels for drinking-water below which no further action is required are **0.5 Bq/litre for gross alpha activity** and 1 Bq/litre for gross beta activity. ...**The screening level for gross alpha activity is 0.5 Bq/litre (instead of the former 0.1 Bq/litre).***

BUT – draft regulations from one of the countries in West Africa:

*Le seuil de contrôle recommandé pour **l'activité alpha globale est de 0,1 Bq/l**. Le seuil de contrôle recommandé pour l'activité bêta globale est de 1,0 Bq/l.*

Copied directly from Annex III of the Council Directive 2013/51/Euratom of 22 October 2013 laying down requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption.

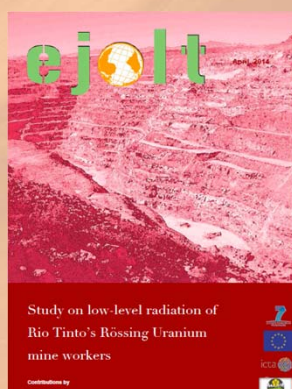
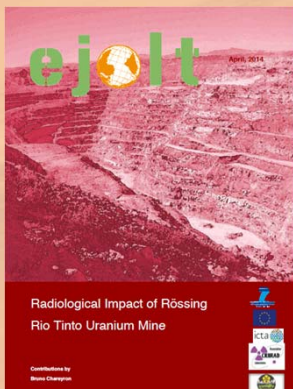


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Problem 3 – advice by EU experts to developing countries

Namibia: Two reports by Environmental Justice Organisations, Liabilities and Trade (EJOLT), supported by the EU, 2014



?



The National Radiation Protection Authority of Namibia was not aware of visits to the country and of the reports themselves.

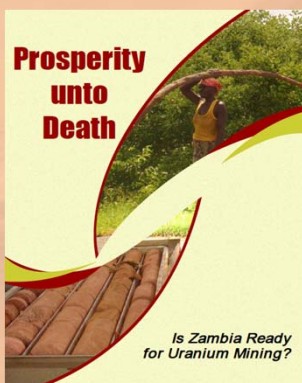


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Problem 3 – advice by EU experts to developing countries

Zambia: A report financed by Norwegian Church Aid, 2010



?



National Institute
for
scientific and industrial research



The National Institute for Scientific and Industrial Research and Environmental Management Agency of Zambia were not aware of a visit to the country and of the report.



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Problem 3 – advice by EU experts to developing countries

Gabon – 2010 report by Ecologic Institute, Germany, requested by European Parliament



Centre National de Prévention et de Protection contre les Rayonnements Ionisants (CNPPRI) was not aware of the visit to the country, the report and its contents.

No radiation monitoring equipment was taken by experts for the visit to Gabon, thus no conclusions of the report could be verified.

Niger – only a desktop study of documents was carried out.



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Problem 3 – advice by EU experts to developing countries



?

From visits to all accessible areas of the site and from the numerous discussions with the site personnel and the members of the public in 2011 it appears that these photographs were taken relatively long time ago, when the remediation of the site was still in progress...



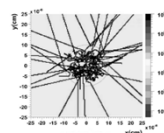
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Problem 3 – advice by EU experts to developing countries

ECRR

2010 Recommendations
of the European Committee
on Radiation Risk



The Health Effects of Exposure to Low
Doses of Ionizing Radiation

Regulators' Edition: Brussels 2010

ECRR

EUROPEAN COMMITTEE ON RADIATION RISK
COMITE EUROPEEN SUR LE RISQUE DE LA RADIATION
AVENUE DE LA FAYENCE 10
B-1150 BRUXELLES
BELGIUM
admin@euradcom.org

GUIDANCE NOTE NO. 2003/1
CRITERIA FOR "CLEARANCE":
CONTROLLING THE RELEASE OF SOLID
MATERIALS OF VERY LOW AVERAGE
ACTIVITY FOR REUSE, RECYCLING AND
DISPOSAL
June 2003

European Committee on Radiation Risk (ECRR)

An **informal** committee formed in 1997 following a meeting by the European Green Party at the European Parliament to review the 96/29 Euratom Directive. However –

Relatively often presented by some EU experts and local environmental organisations in Africa and Asia as the last and definitive word of European Community on the issue of radiation protection.

Result →

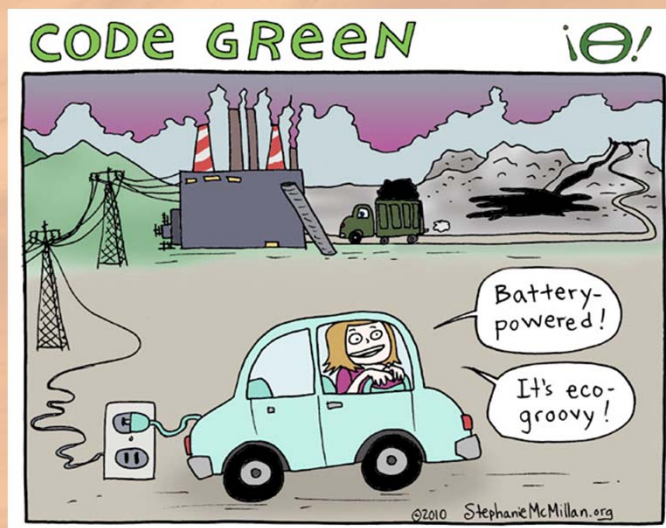


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Another potential implication of the 2013 Directive

Outsourcing of 'NORM' industries out from the EU



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An example

Each turbine requires ~0.5 tonnes of neodymium for the magnet BUT –

~**300-400 tonnes** of ore needs to be mined, crushed, leached and processed to get enough material for one magnet.

Generating **200-250 tonnes of radioactive waste** in the process.



A typical mobile phone would need about **3 kg** of radioactive ore for the magnet, speaker, screen...



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Conclusion and questions for consideration

1. There are areas of high natural radiation background in Africa and Asia, where annual exposure of the public may reach 7-8 mSv/year.

But –

- How many African and Asian children will not have malaria or other badly needed vaccinations because the health budget would be re-directed to keep everyone under 1 mSv/year?



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Conclusion and questions for consideration

2. Having a predominantly service economy, importing everything may not be as good as some people think...

As the former Australian Liberal Party Leader J. Hewson said in 2015:

With an economy that is 68 per cent services, the entire country is basically sitting around serving each other cups of coffee...

Thus –

What are the world-wide and, subsequently, local health and environmental implications of production of nice, clean and green products for the EU elsewhere, where the controls over radiation are either at a low level or may not exist at all... ?



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The reference monetary value of the man-sievert Outcomes of an ISOE survey

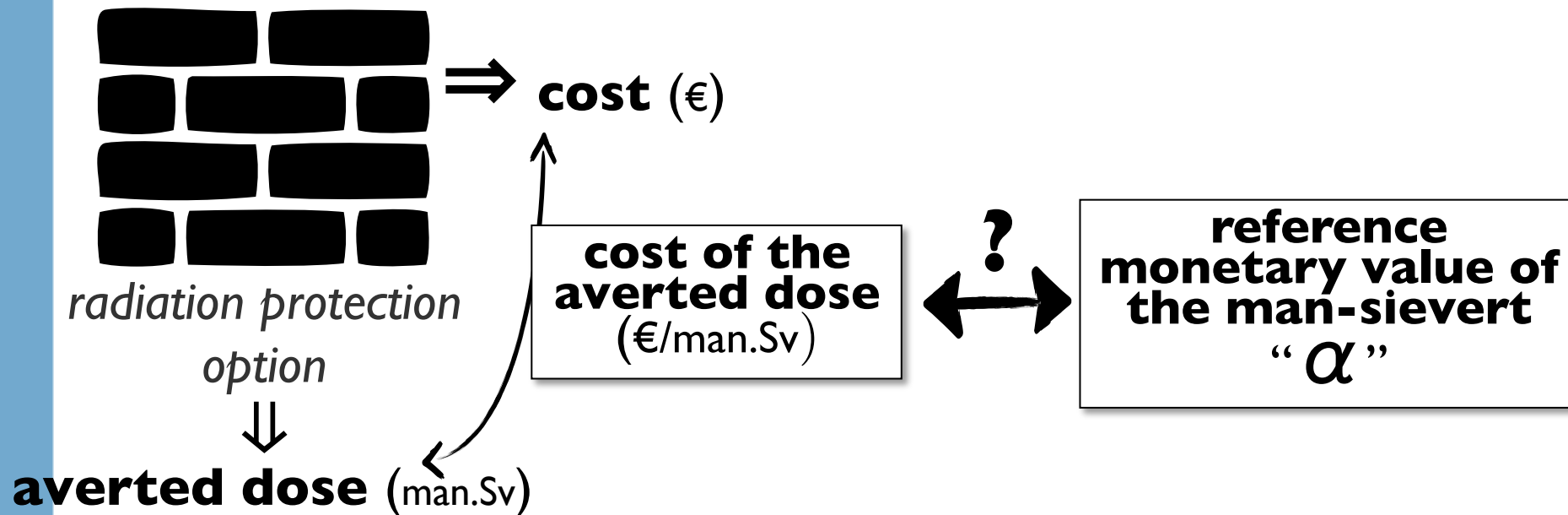
Sylvain ANDRESZ¹, Caroline SCHIEBER¹, Thomas JOBERT²

¹ Nuclear Evaluation Protection Centre (CEPN), France

² EDF/Direction Technique de la DIPNN, France

ISOE Symposium, Uppsala

26th June 2018



α : “the amount you agree to spend *a priori* to avoid a unit of collective dose”

⇒ To assess the ‘reasonableness’ of a radiation protection decision, give priority and objectivity to the decision

Who use the concept? For what purposes? Values?



With the data from Asian + North America ISOE Technical Centres:

⇒ **18 regulatory bodies**

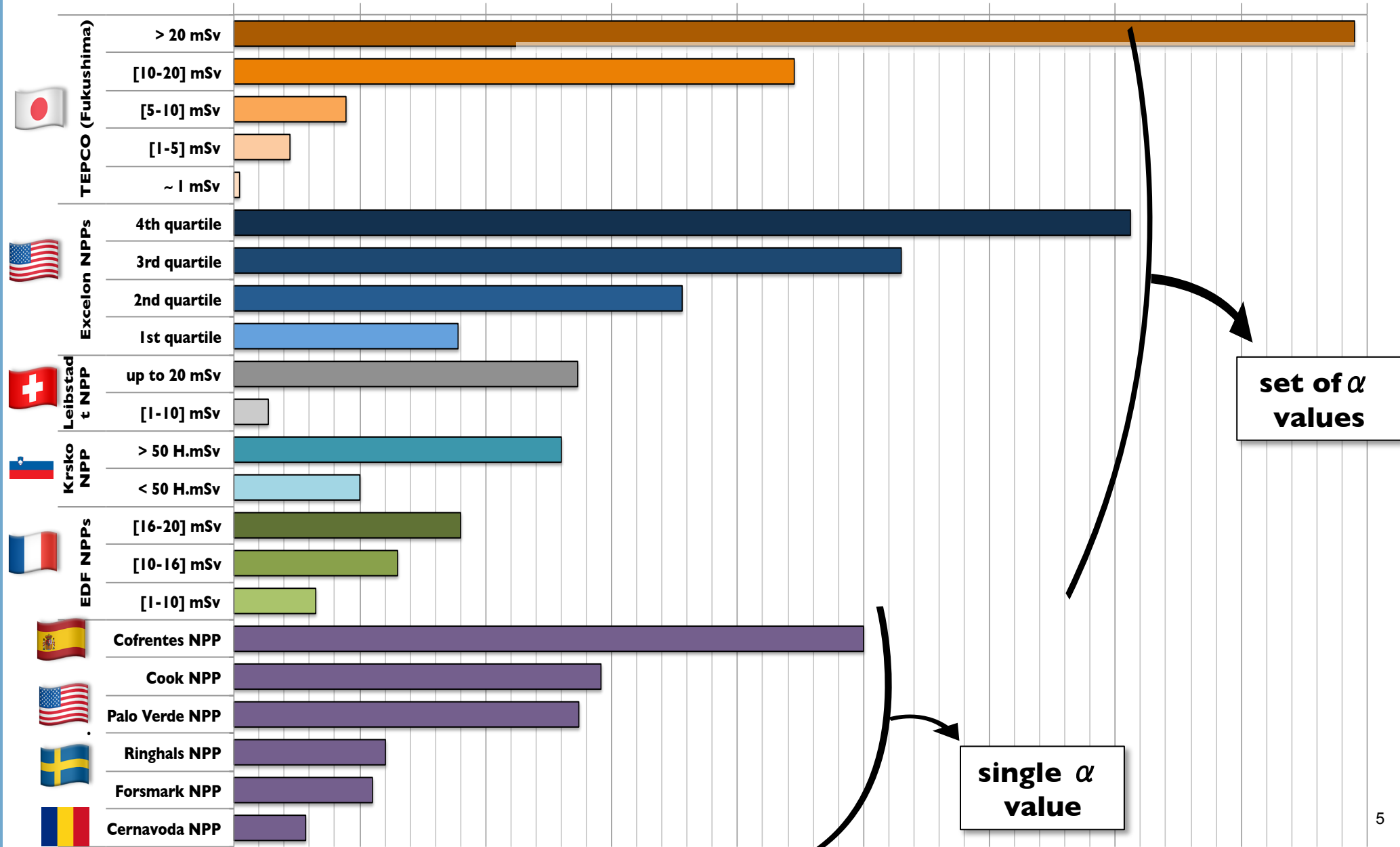
⇒ **21 utilities and NPP** (~ 220 reactors)

Answers from regulatory bodies

Countries	α values
Belarus, Belgium, Canada, China, Finland, France, Germany, Japan, Lithuania, The Netherlands, Slovenia, Spain, Sweden, Switzerland, Ukraine	
United Kingdom	⇒ To be based on a value of 3 millions € ₂₀₁₇ (general value; associated with the prevention of a cancer)
Czech Republic Slovakia	⇒ Several α values are recommended and appeared in regulatory documents ⇒ 7 values are proposed, depending on the level of exposure and the exposure situation ⇒ From 30 to 600 € ₂₀₁₆ /man.mSv

α (€₂₀₁₇/man.mSv)

0 1000 2000 3000 4000 5000 6000 7000 8000 9000



set of α values

single α value

- From **446 to 5,000 €/man.mSv** – Median = 1,200 €/man.mSv



⇒ Different **economics context** between the countries

⇒ **Updates $\pm$ recent**

but these cannot be the only explanations!



⇒ Essentially: **different approaches** for setting α

- ‘human capital’ method (Cernavoda NPP)
- Value of Statistical Life + annual costs of a worker (Cook NPP)
- α set by considering the values of other utilities (Vattenfall)



⇒ **Local radiation protection situation** can also be taken into account

- Ex. α linked with the INPO ranking (Exelon (hybrid system))

Answers from utilities & NPP Analysis – set of α values



⇒ α increases with the **level of exposure**

Allow to spend more as the level of exposure increase

- Level of exposure are expressed very differently
- Dependence of $\alpha_{min}, \dots, \alpha_{max}$ with the **calculation model** :

Ex. EDF: $\alpha(d) = \alpha_{ref} \cdot (d/d_0)^a$; $d_0 = 1 \text{ mSv}$, $a = 0,5$

TEPCO
5 bands of individual exposure; 1-50 mSv

Leibstadt NPP
2 bands of individual exposure; 1-20 mSv

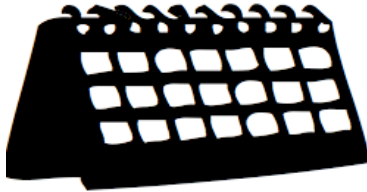
Krsko NPP
2 bands of collective exposure; 50 H.mSv

EDF
3 bands of individual exposure; 1-20 mSv



Some tendencies since the previous ISOE surveys:

- The concept have been maintained or introduced (TEPCO, Japon)
- Increase of some values (USA, Sweden)
- New methods to set α : Statistical Value of Human Life, feedback from other utilities



⇒ Used **1-10 times/year/organisation**

⇒ Several examples of uses described

- *Major modification, large scale project, chemical decontamination of system/circuit, power reduction*
- *Give priority to modifications on a long-term perspective*



⇒ **Only for 'important' decisions** with radiation protection + economic + management etc. impacts

⇒ Radiation Protection Department first involved to elaborate the cost-benefit analysis ; the decision is then taken at higher level

“

A tool that allow more objectivity and transparency in the decision

”

— A tool among many [*many*] other decision factors

Setting and using the reference value of the man-sievert *A synthesis*



At the Gustavinum museum, Uppsala, Sweden

Setting and using the reference value of the man-sievert

A synthesis

- **Introduced in 1973, disseminated and still in use**
- **Comparing the collected values is not easy**
 - different economic conditions, approaches (single vs. set), RP conditions, calculation etc.
- **Used by Radiation Protection Department to give objectivity to the decision in a complex decisional context**
- **An help for the decision, not a decision cutting-value**
- **Trends:**
 - A sustainable use of α over the years; regular updates + introduction
 - Appearance of more overall methods for setting α
- **In-line with trends in other sectors:**
 - *Judgment-value* (Thomas, P.J., Stupples, D.W., and Alghaffar, M.A., Pro. Saf. Env. Prot. 2006)
 - *Value in Health Journal*, « Everything has a cost » (SFSE congress, France, 2017)

Setting and using the reference value of the man-sievert *A synthesis*



Annexe – Methods for setting alpha value

- **(1) Human capital**
- **Estimation of the output that is lost to society on the premature death** (based on the GNP/inhabitants and/or cost of workers)
 - This is purely economic, and contain no allowance for other costs (e.g. cost to be spend due to the cancer) and subjective value (e.g. pain, suffering etc.)
 - Ex. GNP/inhabitant = 34,300 € (France) ; ICRP risk coefficient $4.2 \cdot 10^{-5} \text{ Sv}^{-1}$; number of years lost due to cancer: 16 years (cf. ICRP Publication 103):

$$34,300 \times 4.2 \cdot 10^{-5} \times 16 = 23 \text{ €/H.mSv}$$
 - This is a minimum; can be increased with *aversion*: $\alpha(d) = \alpha_0 \times (d/d_0)^a$, $a = 1.5$
- **(2) Implied or revealed preference**
- **Retrospective analysis of decisions of protection that have been implemented and how much has been spent to reduce the risk**
 - To deduce an implicit socially-acceptable value of life
 - But very specific to the risk, population, decision-maker, ground of decision etc.

Annexe – Methods for setting alpha value

- **(3) Willingness to pay**
- **How much are individuals willing to pay to avoid a given amount of risk?**
- **Determined by tailored survey + (meta-)analysis**
- An overall approach, considered the most theoretically sounded, to evaluate the “Statistical Value of Human Life”
- Ex. 3.14 M€ in France (Quinet, 2013); 3M€ on average in OECD countries (OECD, 2012); 9M\$ for US NRC etc.

