



Practical implementation of ALARA

Fernand VERMEERSCH

Caroline SCHIEBER

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IRPA workshop on reasonableness in the
implementation of the ALARA principle



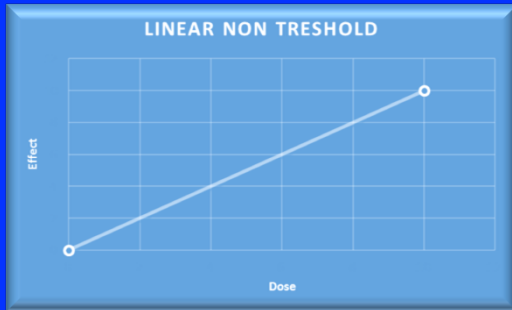
Introduction

- Practical implementation of ALARA
 - Exposure situations
 - Planned, existing and emergency situations
 - Domains
 - Industry & research
 - Medical
 - NORM
 - Public



ALARA principle RP bases

- Linear dose-effect with no threshold (stochastic health effects)



- Basic principles of radiation protection
 - Justification
 - Optimisation
 - Dose limits

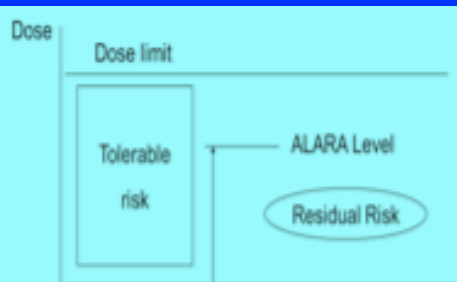


LNT
Precautionary
Limited resources

ALARA



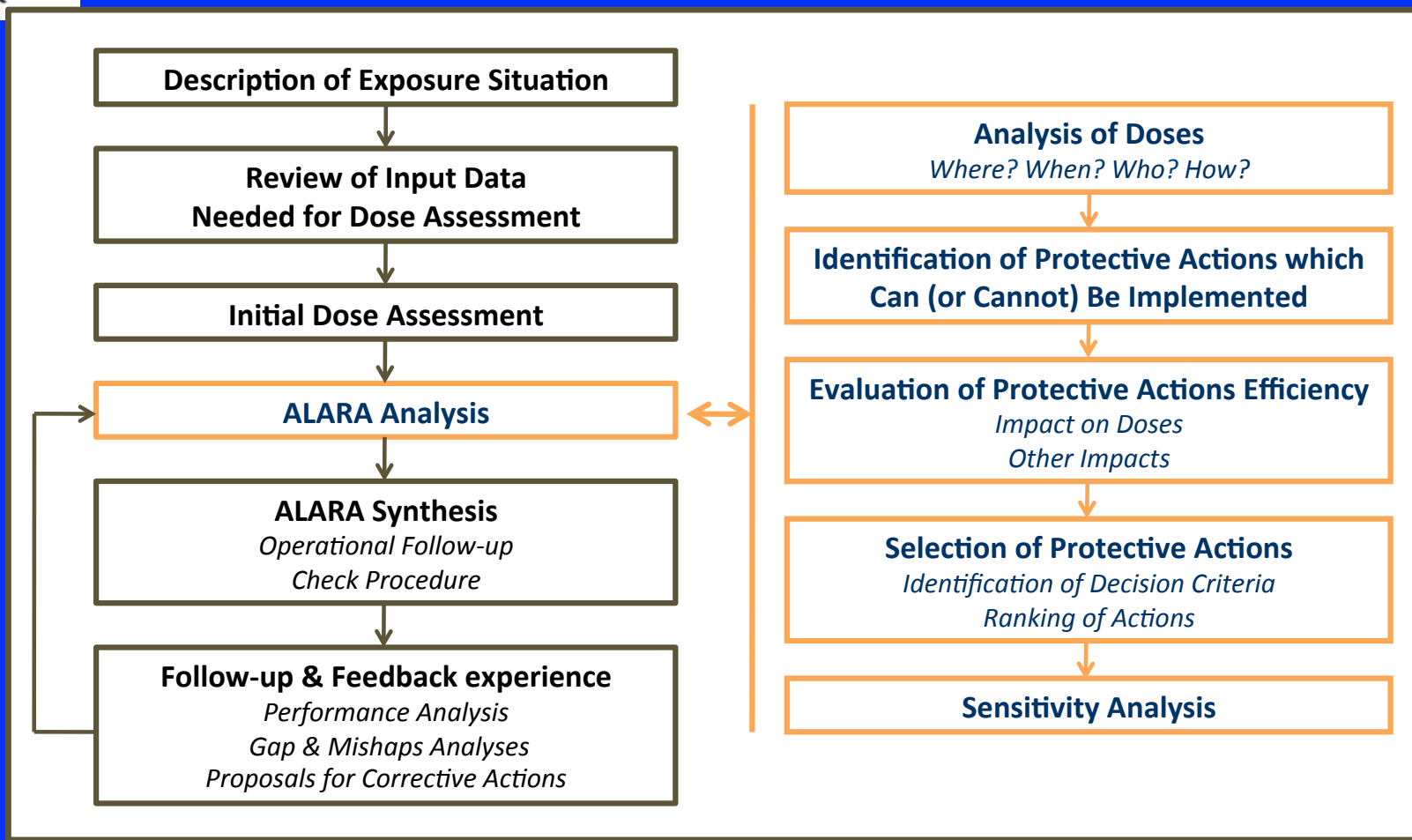
ALARA is an obligation of means
and not an obligation of results



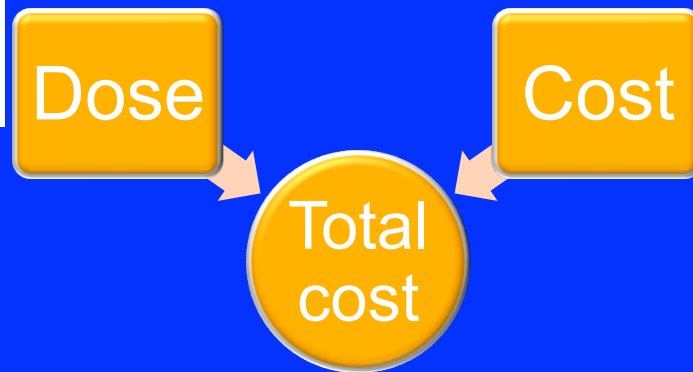


Optimizing in practice

● The ALARA proces



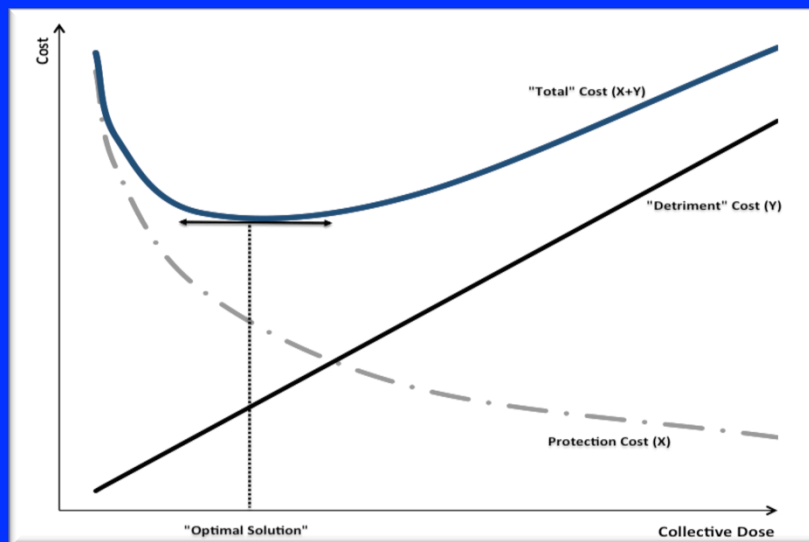
Selection of protective actions Cost-benefit / multi-criteria analysis



What is reasonable ?

Multi-criteria analysis

Used to handle factors
that are difficult to
quantify



$$U_i = \sum_j k_j u_{ij}$$

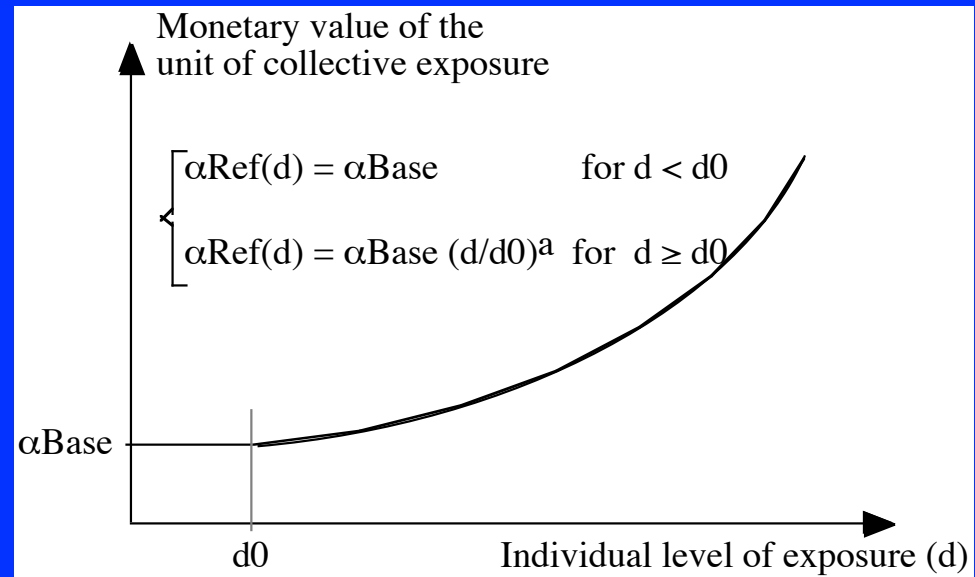
$$TotalCost = Cost + \alpha_{base} \cdot CollectiveDose$$



Monetary values risk aversion

α_{base}

Monetary value/man.Sv



$$\alpha_{iref} = \alpha_{base} \left(\frac{d_i}{d_0} \right)^a$$



Taking into account risk aversion
(continuous function or dose bands)



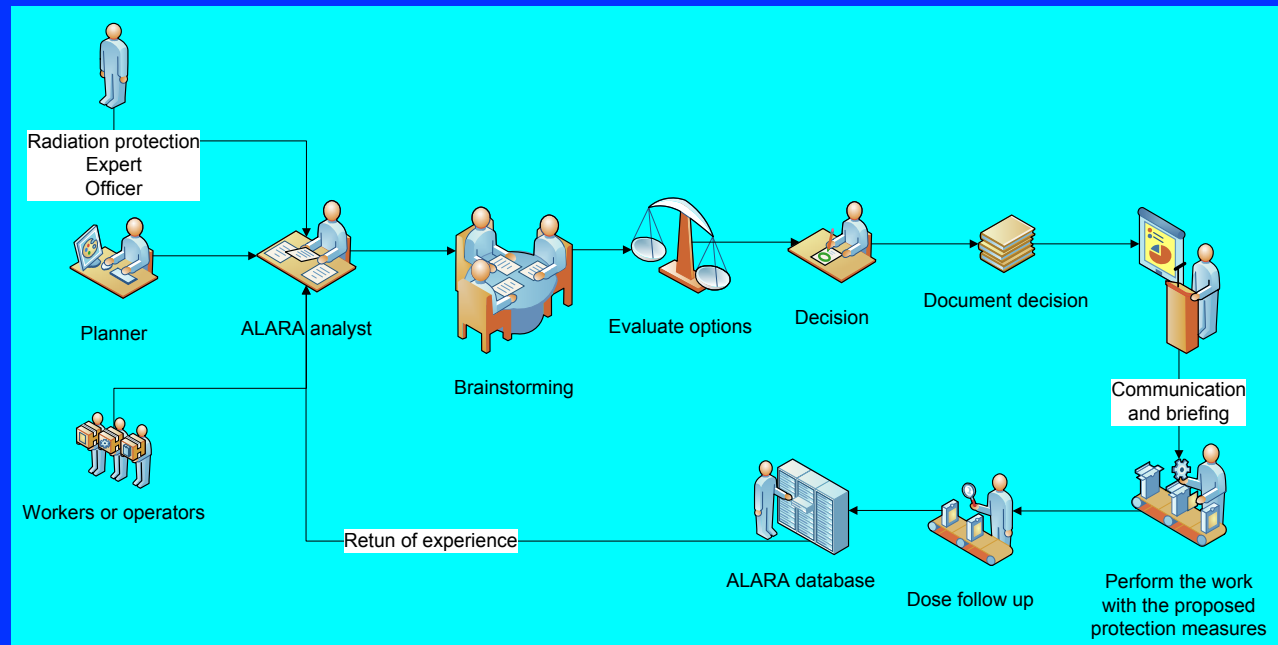
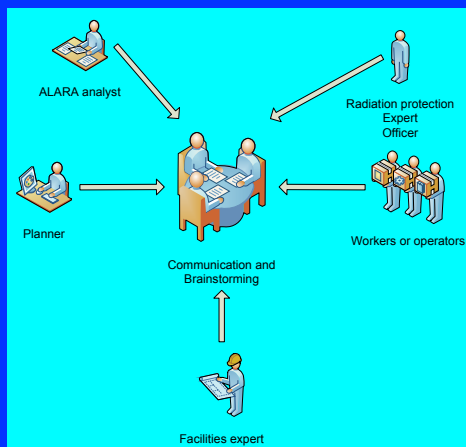
Rationale for dose classes

Dose band (mSv)	Rationale
0 to 1	1 mSv, acceptable risk, Limit for the public, Minimal effort
1 to 2	Mostly composed of multiple small exposures, difficult to reduce
2 to 5	Already seen by workers as important, still comparable with background values
5 to 10	Higher than background, seen as important doses by the workers
10 to 20	Treated as important doses where efforts for dose reduction are considered important



Planned exposure situation industry and research

- Well defined structures
- Large feedback experience
- Clear understanding of the risk
- A uniform knowledge base





Existing exposure situations

- **Definition**

- An exposure that already exist when a decision to control the exposures has to be taken.
 - Radon, management of contaminated area's, NORM,...

- **Stakeholders**

- Specific to each type of situation
- Not a uniform knowledge base, different risk perception

- **Implementation of ALARA**

- Reference levels (sometimes interpreted as limits)
- Importance of individual behaviors to help people to reduce their dose => Practical RP Culture
- Difficult by regulation only
- Encouragement
 - Influencing attitudes and individual behavior trough E&T and information



Emergency situations

- **Definition**
 - Urgent action to limit or reduce the unwanted consequences (exposures)
- **Stakeholder**
 - Not a uniform knowledge base, different risk perception, specificity of "new exposed" workers (responders) usually not trained in RP
- **Implementation**
 - Complicated
 - Integrate protection strategies into the planning stage as well as during the implementation of the emergency response
- **Elements used in the ALARA process**
 - Scenario evaluations
 - Generic intervention levels for pre-defined actions
 - Sheltering, Evacuation, Iodine prophylactics,...
 - Predetermined emergency zones
 - Evolution towards Safety demonstrations for new installations to mitigate consequences (avoiding off-site emergency measures, protective measures limited in area or time)

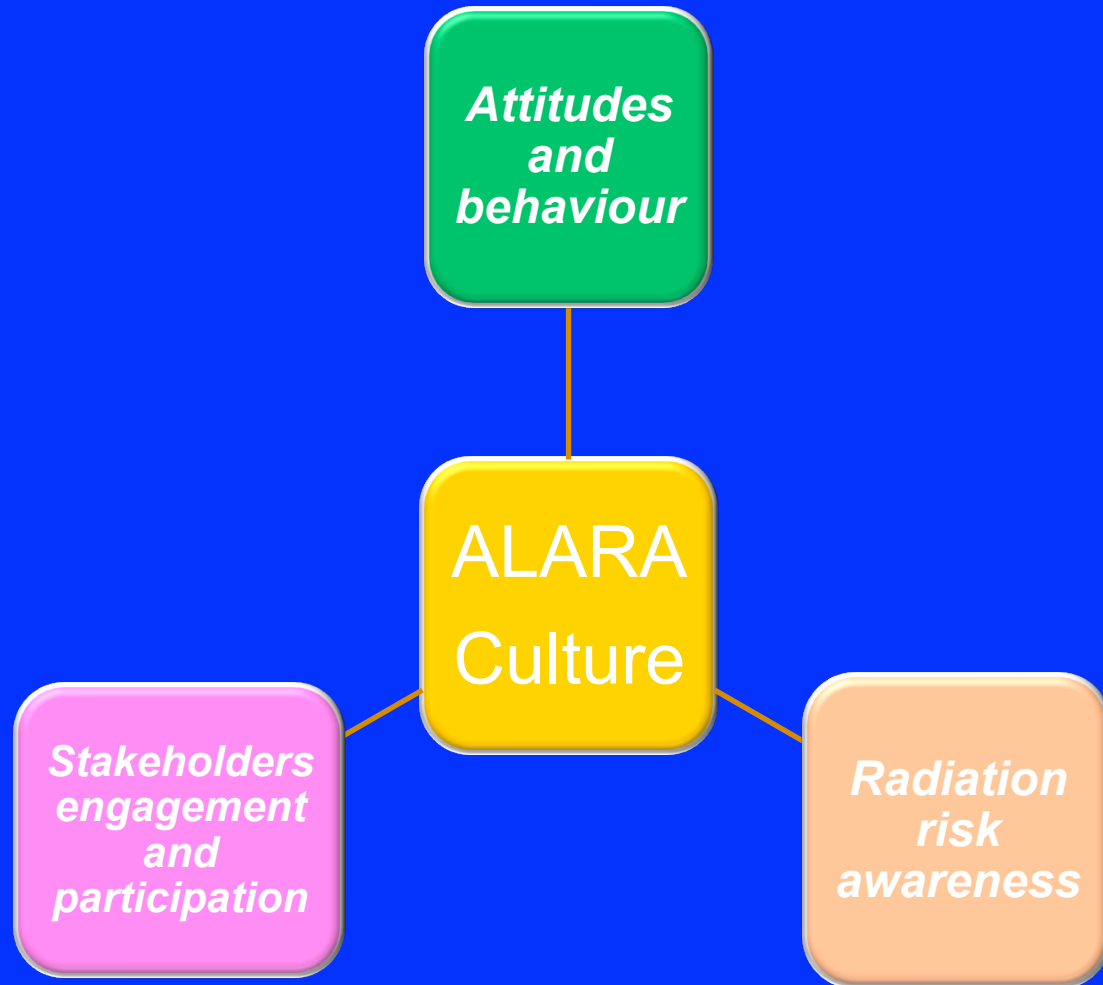


Medical exposures

- **Diagnostic and therapeutic procedures**
- **Stakeholders → medical staff, patients, carers, comforters**
- **Occupational exposure**
 - Optimization through
 - Design of the facilities, work places
 - Individual monitoring
 - PPM
 - Procedures for safe handling of radiopharmaceuticals
 - Procedures for handling incidents and accidents
- **Patient exposures**
 - Justification of the exposure
 - No dose limitation
 - DRLs assist in the optimization of protection by helping to avoid unnecessarily high doses to the patient. The system for using DRLs includes the estimation of patient doses as part of the regular quality assurance programme.
 - Comparison of techniques
- **Optimizing dose to carer's and comforters**
 - Mainly by proper information to the carer's and comforters

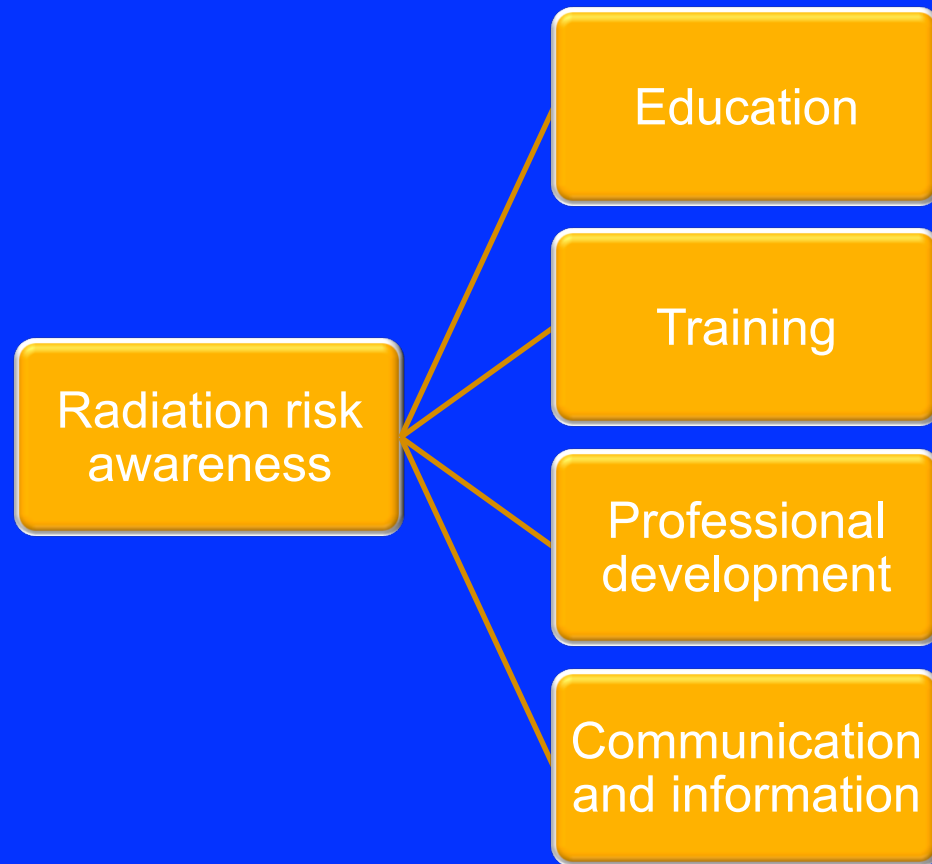


ALARA culture in the guidance to reasonable protection levels

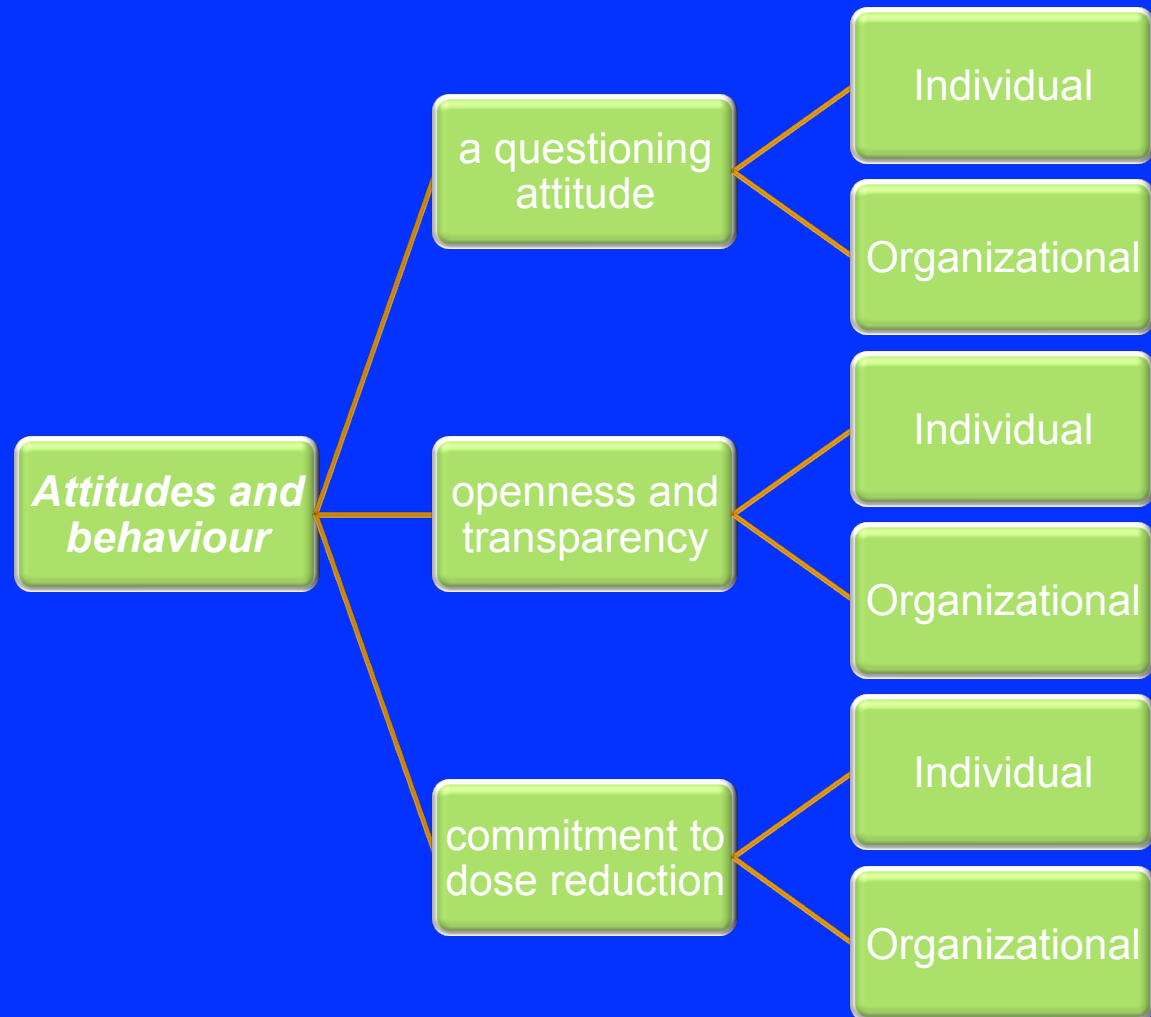




Radiation risk awareness

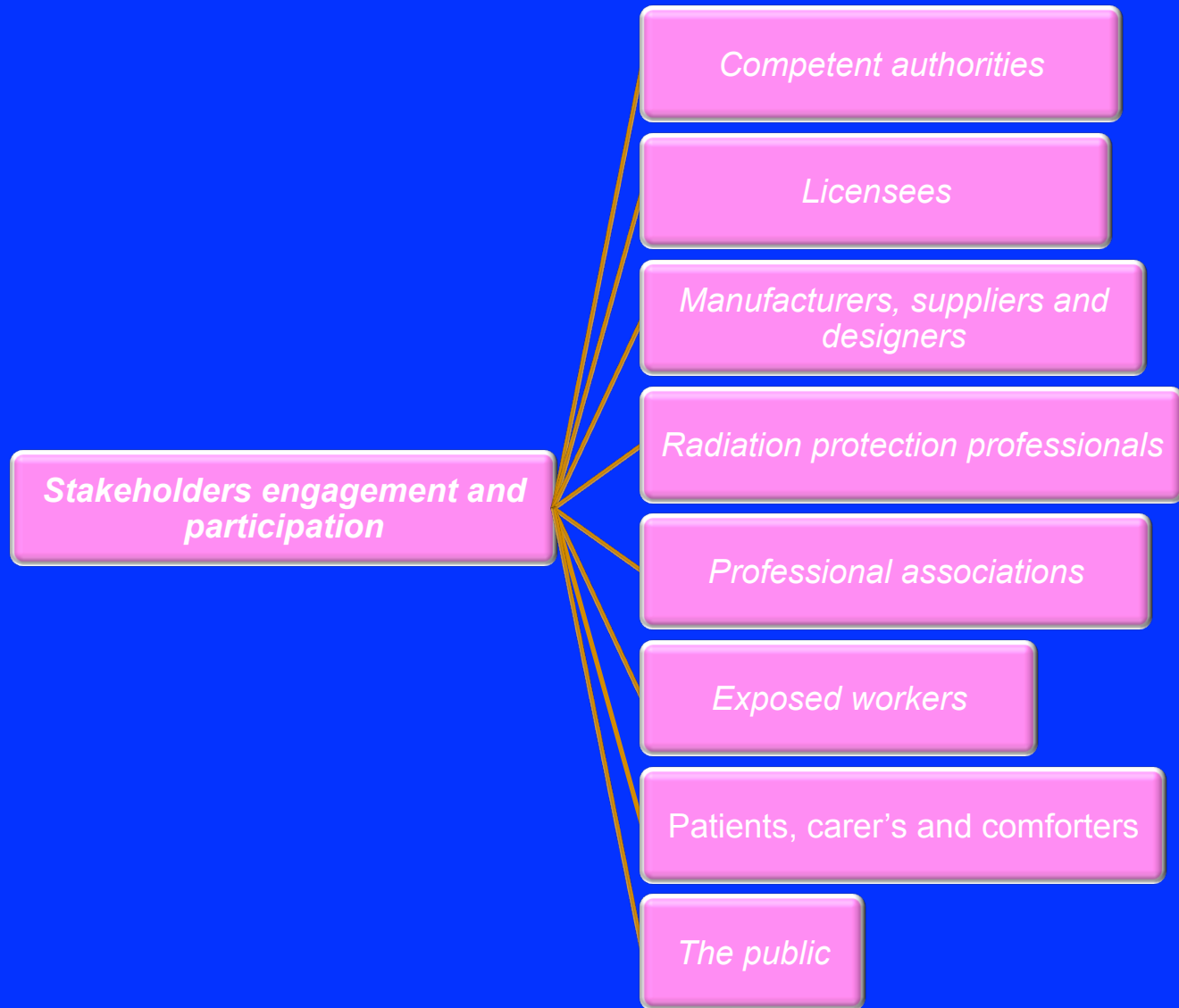


Attitudes and behaviours



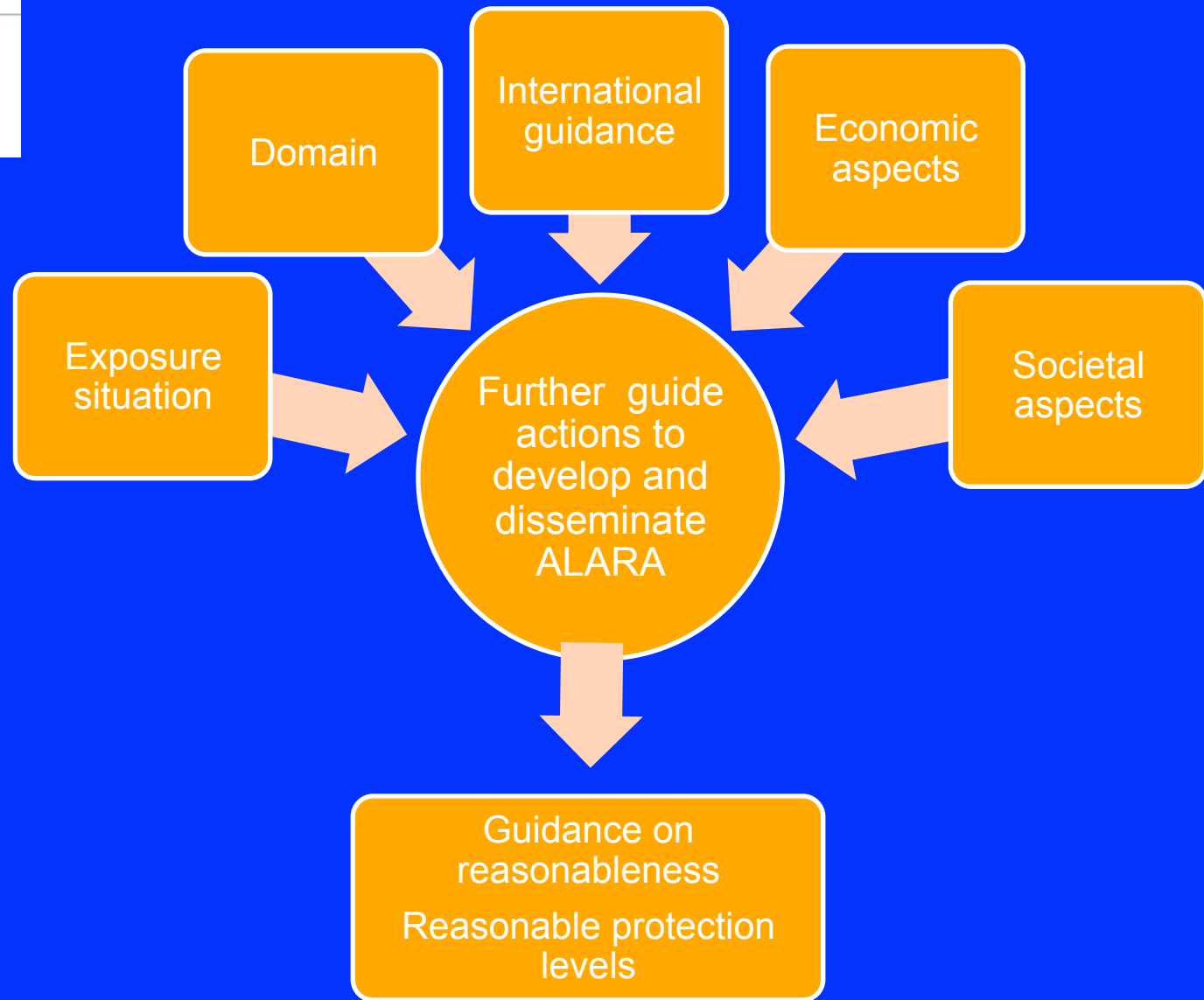


Stakeholders engagement and participation



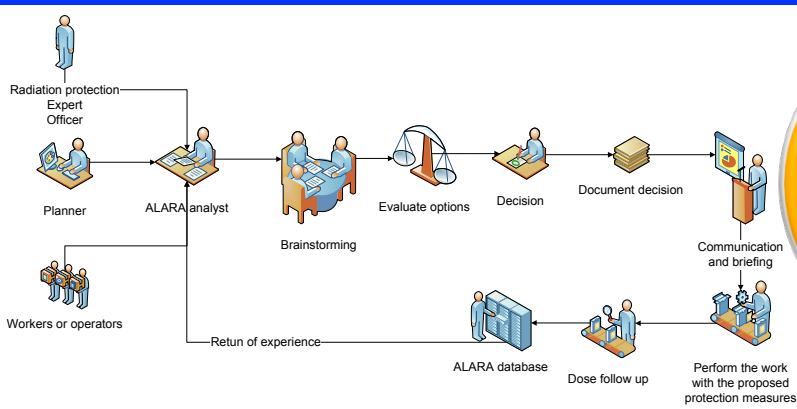


Conclusion





ALARA culture working group



Examples of
ALARA
implementation
in practice

“Optimisation of
radiation
protection
(ALARA): a
practical
guidebook

Basic
concepts of
radiation
protection
and their
origins

ALARA
process
ALARA
procedure

Elements
supporting
the
approach

Actors and
their
responsibilities





**Thank you for your
Attention
Questions ?**