Practical implementation of ALARA

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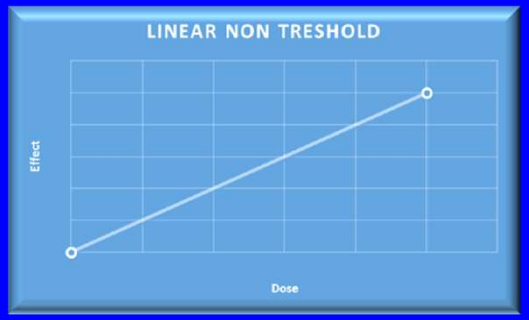
IRPA workshop on reasonableness in the implementation of the ALARA principle

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 → LNT, Precautionary, Limited resources → ALARA
  - Dose limits

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

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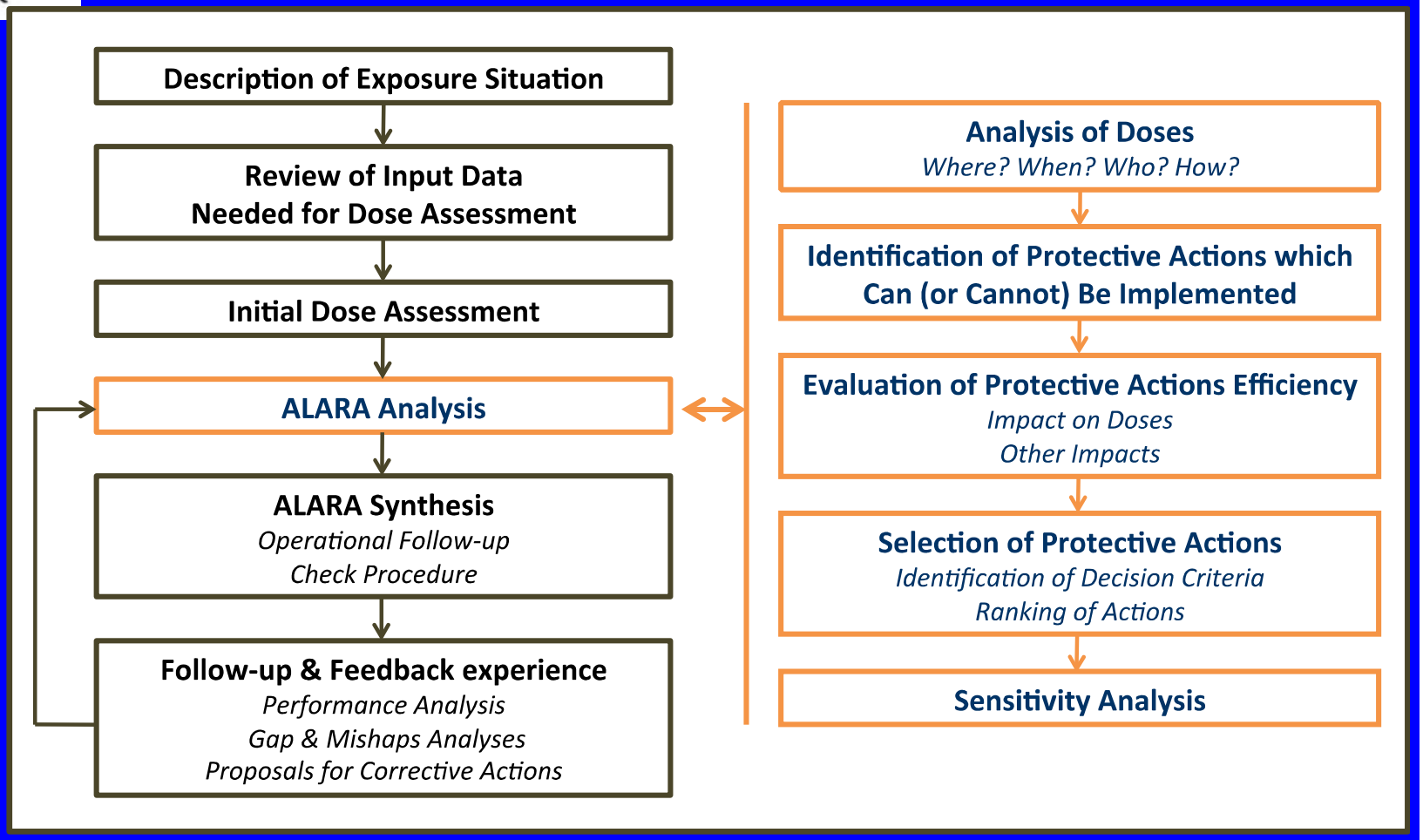
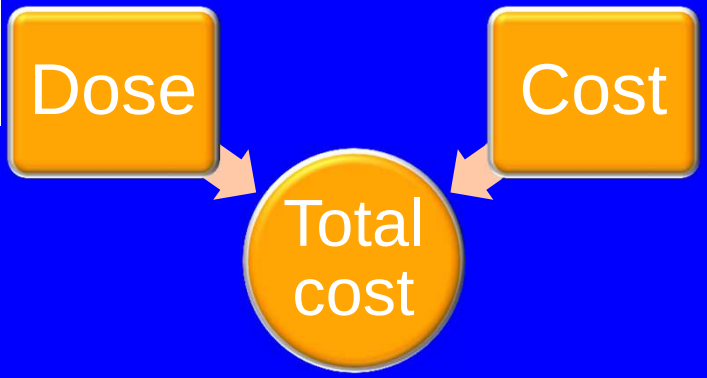
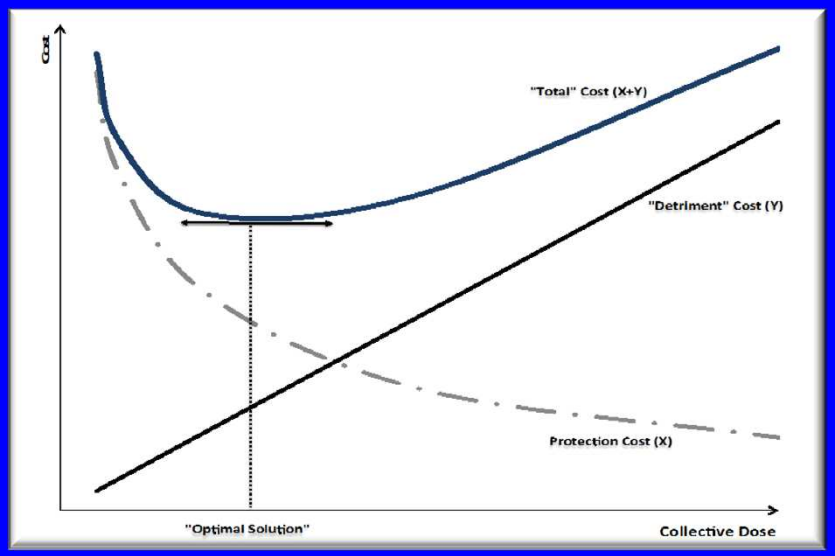
Optimizing in practice

- The ALARA proces



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





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

Multi-criteria analysis

Used to handle factors that are difficult to quantify

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

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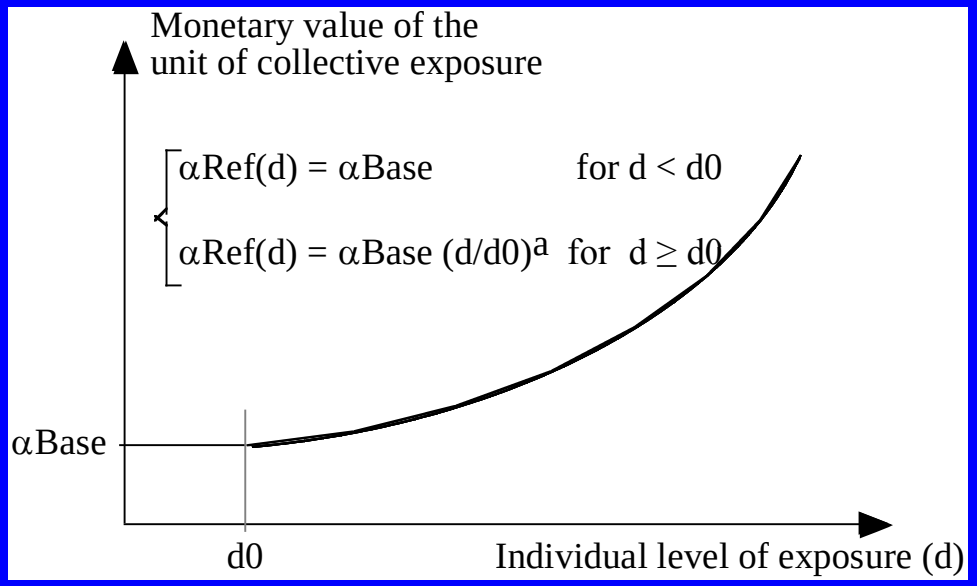
Monetary values
risk aversion

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 then background, seen as important doses by the workers
10 to 20	Treated as important doses where efforts for dose reduction are considered important

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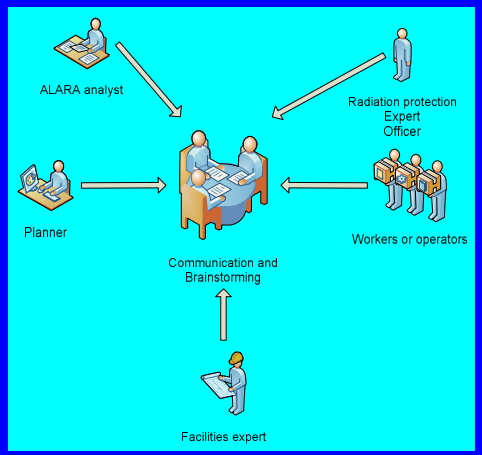
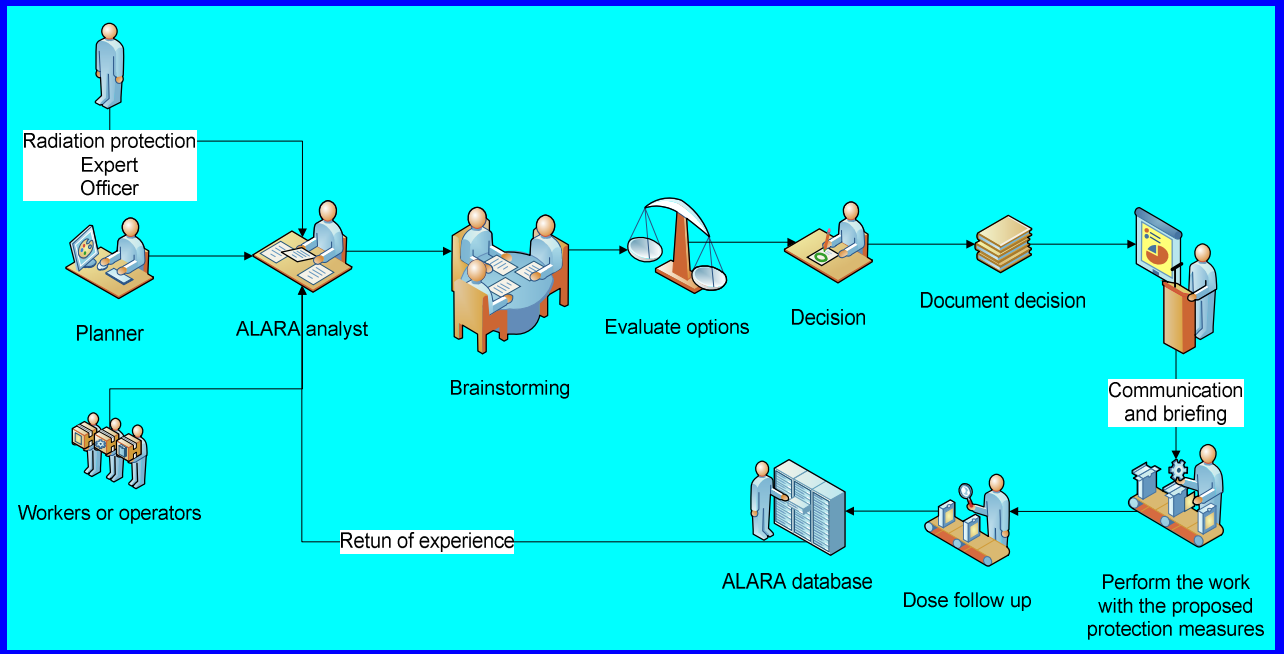
Planned exposure situation industry and research

- 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 staf, patients, carers, comforters**
- **Occupational exposure**
  - Optimization through
    - Design of the facilities, work places
    - Individual monitoring
    - PPM
    - Procedures for save 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

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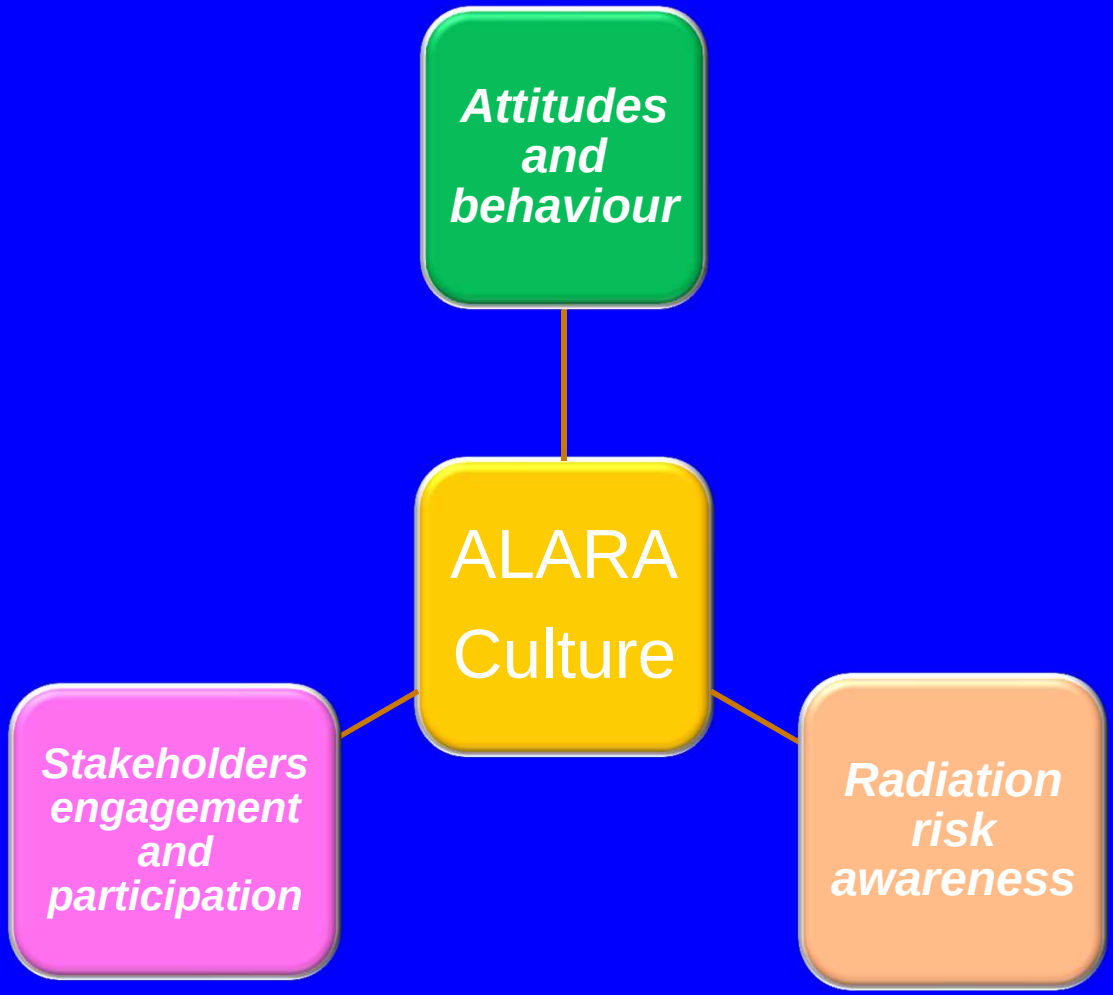
ALARA culture in the guidance to reasonable protection levels



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Radiation risk awareness

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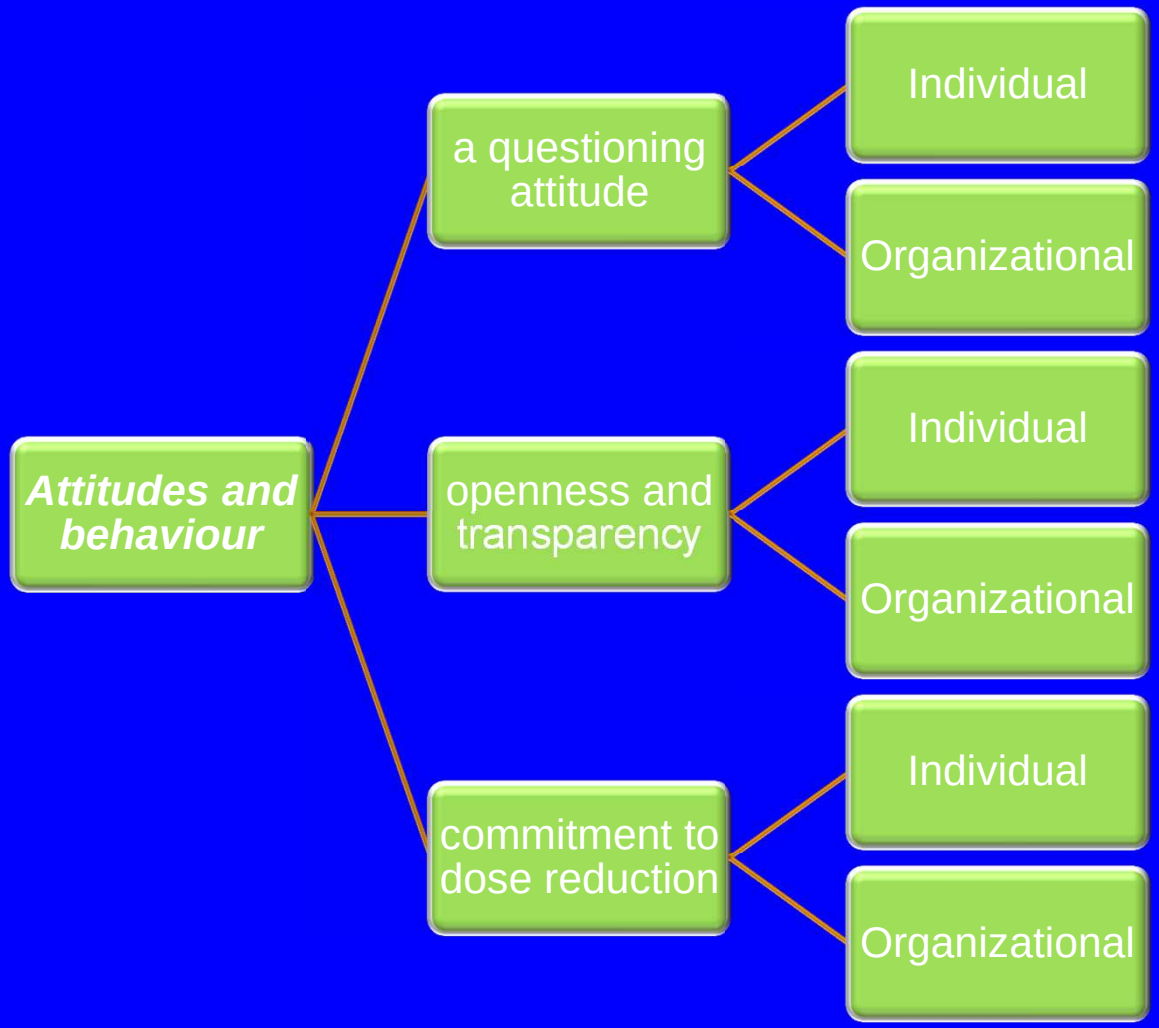
Attitudes and behaviuors



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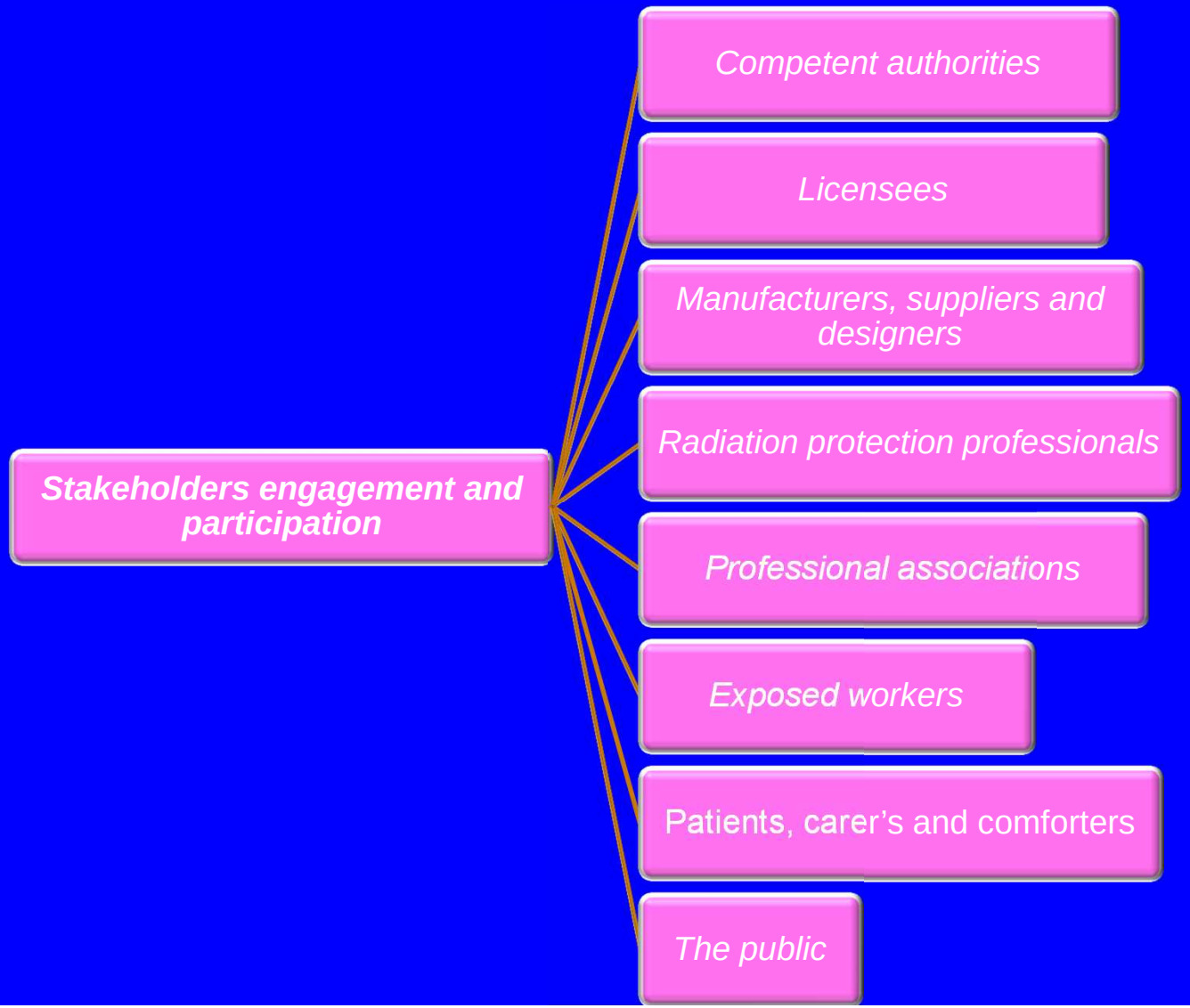
Stakeholders engagement and participation



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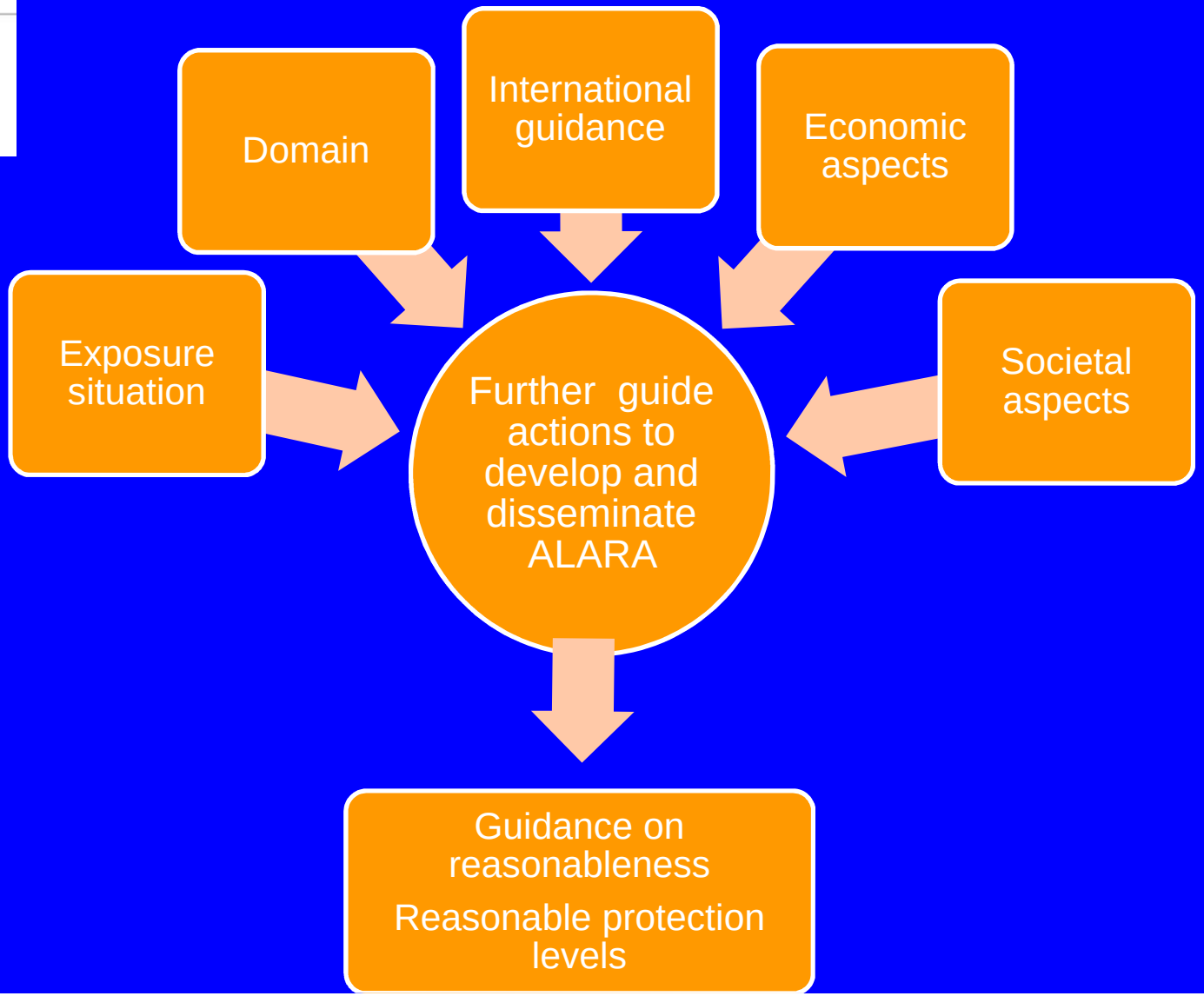
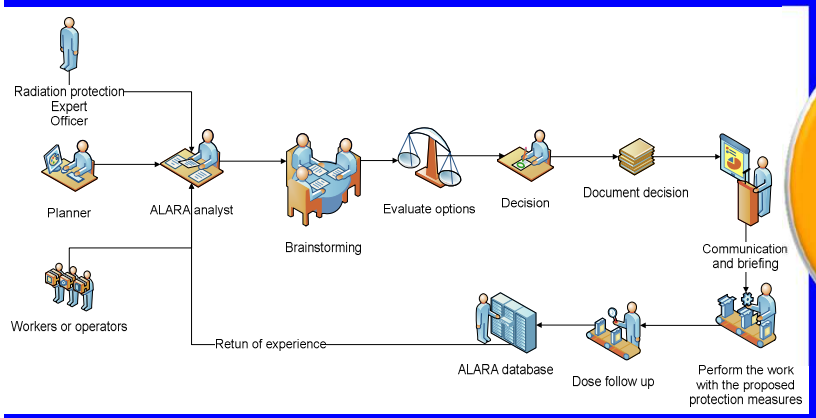
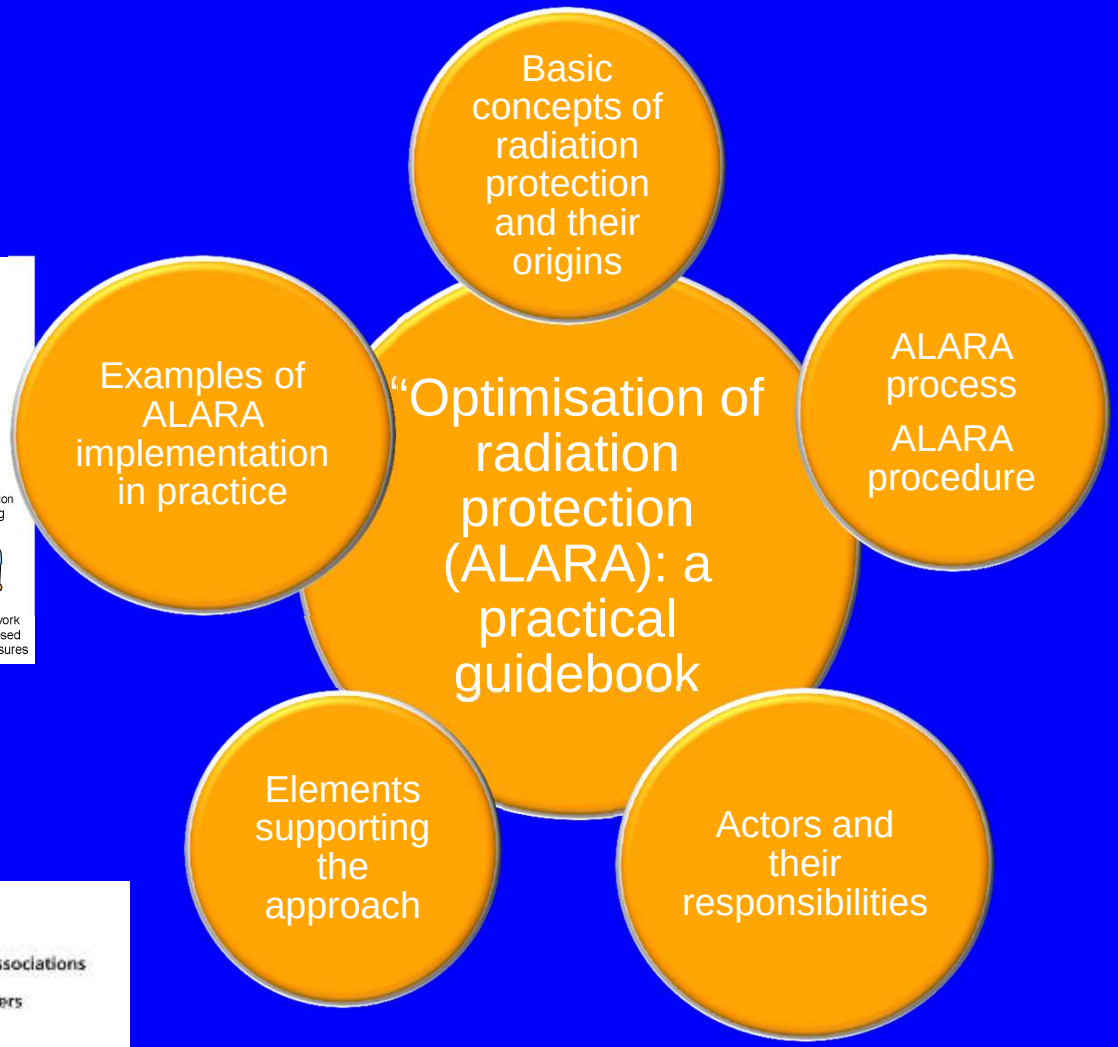
Conclusion



ALARA culture working group





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Thank you for your Attention

Questions ?