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Approaches addressing the integration of different risks

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The levels of dose and the financial costs may not be the only relevant factors - Example of ventilation measures in a uranium mine.



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Historical Perspective

- From 4th European ALARA Workshop (2000):
 - To review the approaches to risk management
 - Single and multiple risks
 - To identify the significant factors in decision making
 - Technical, legal, economic, social, health impact, ethical
 - To examine how different parties perceive risk and how they impact on the risk management process
 - Regulatory, corporate and worker level
 - **Has any of this changed?**



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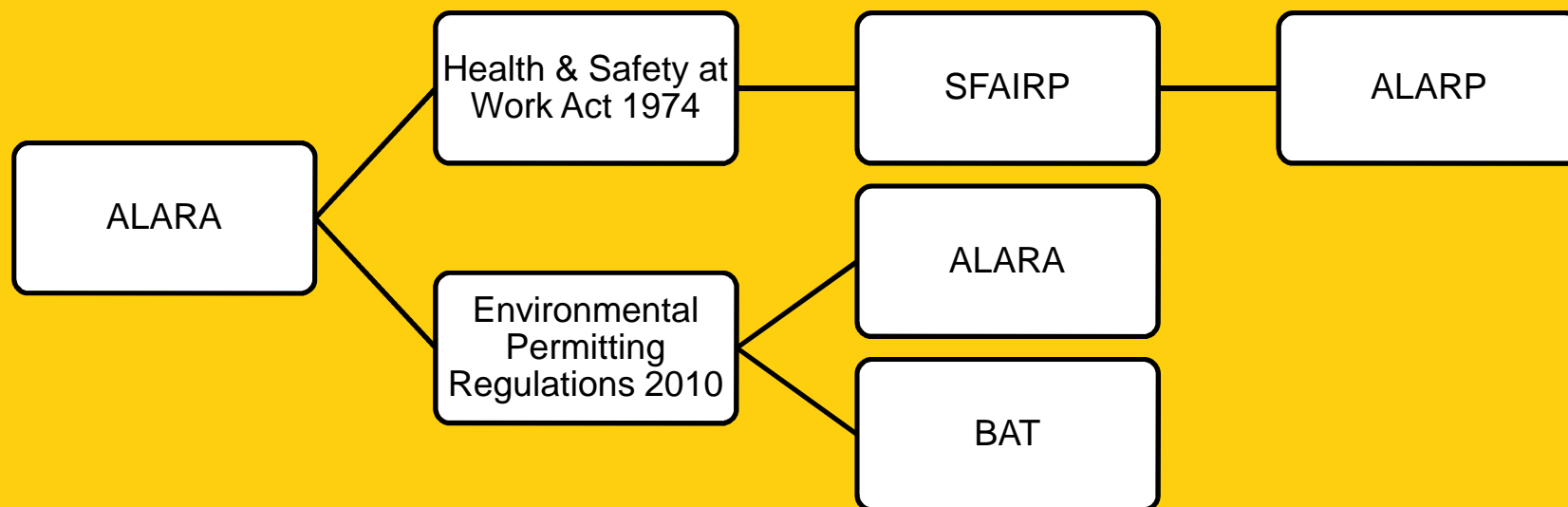
Where are we now?

- ALARA - a concept familiar to all?
 - With variable rigour
- A common glossary of risk terminology?
 - Probably not
- Harmonised approach to risk management
 - Probably not
- Commitment to Safety Culture (application of ALARA)?
Regulators, management, and workforce?
 - Perhaps



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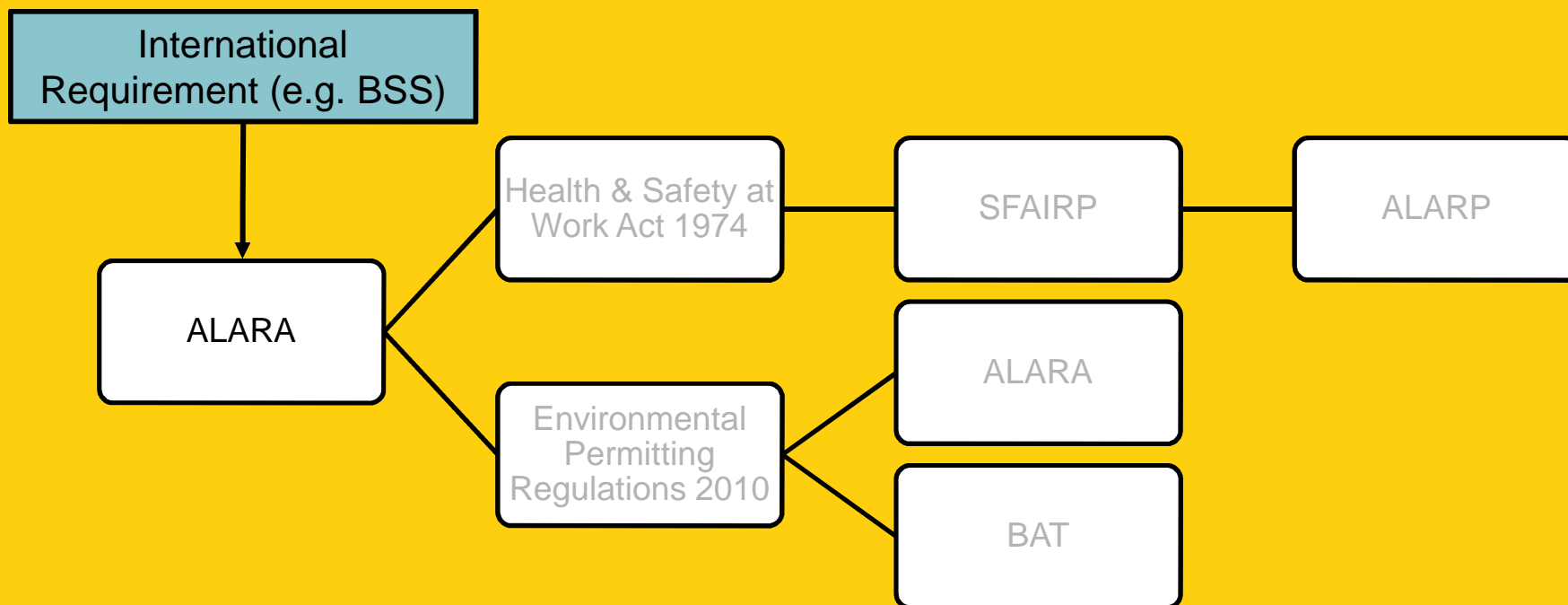
ALARA in the UK Regulatory Regime





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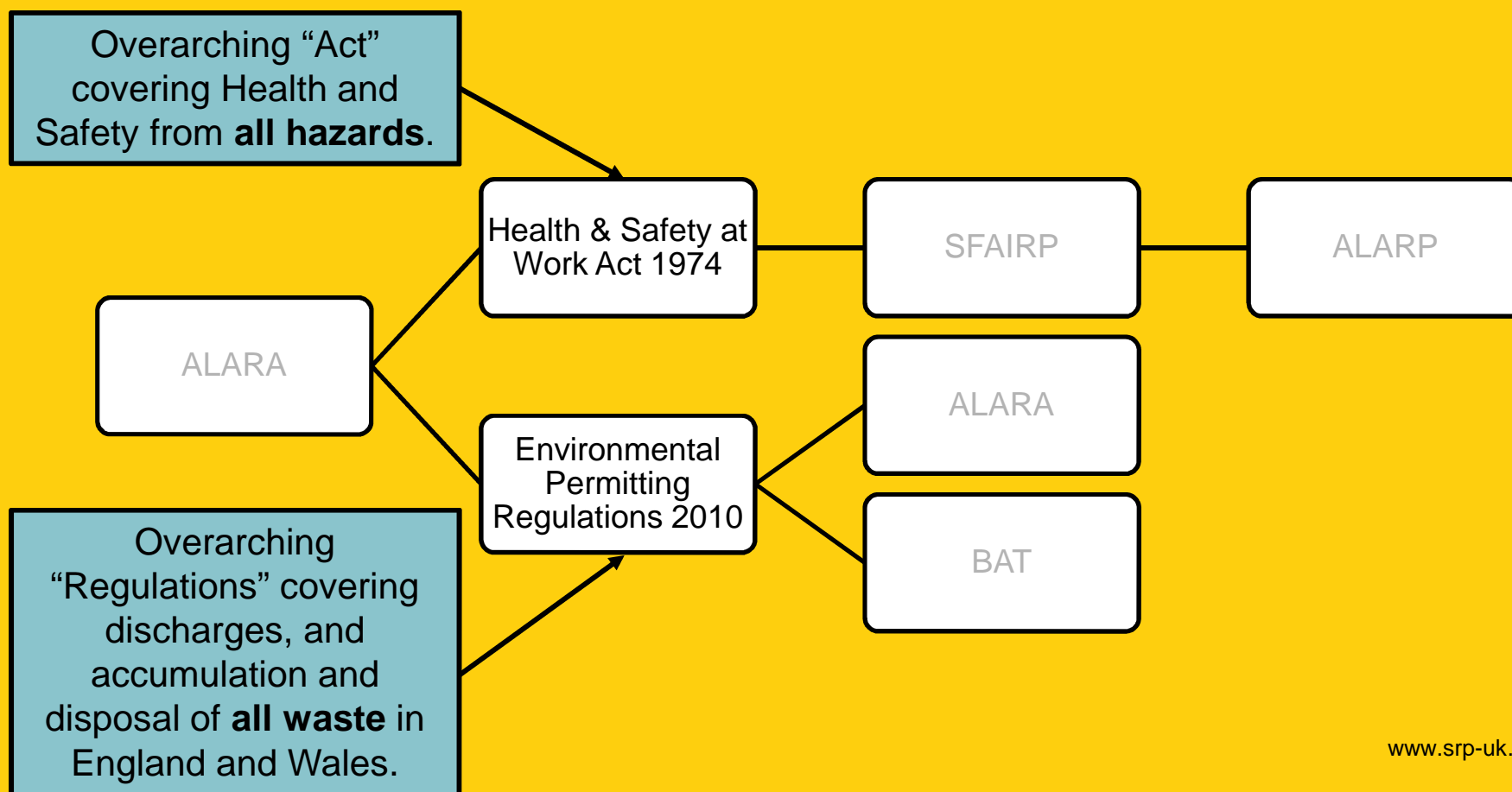
ALARA in the UK Regulatory Regime





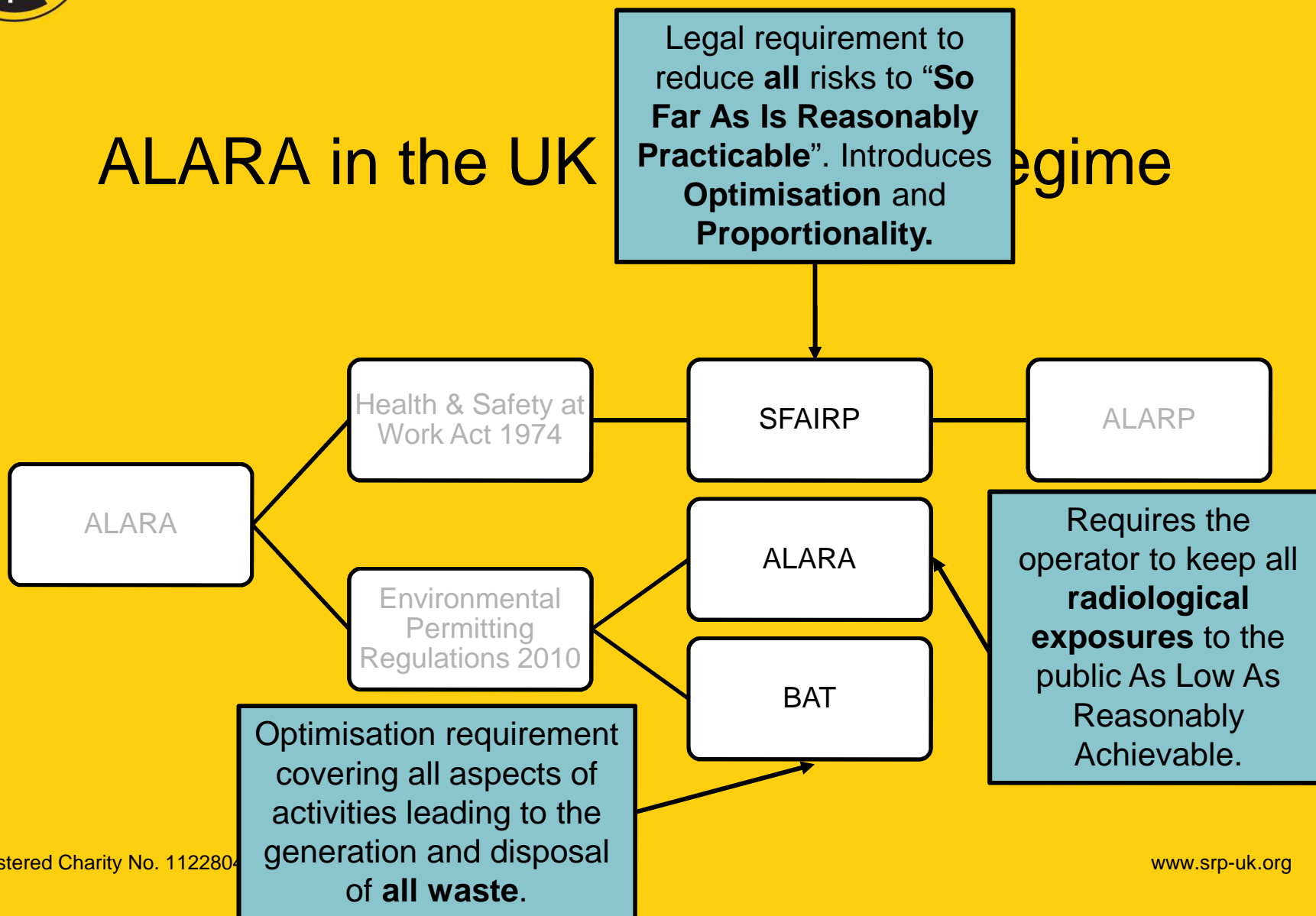
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ALARA in the UK Regulatory Regime





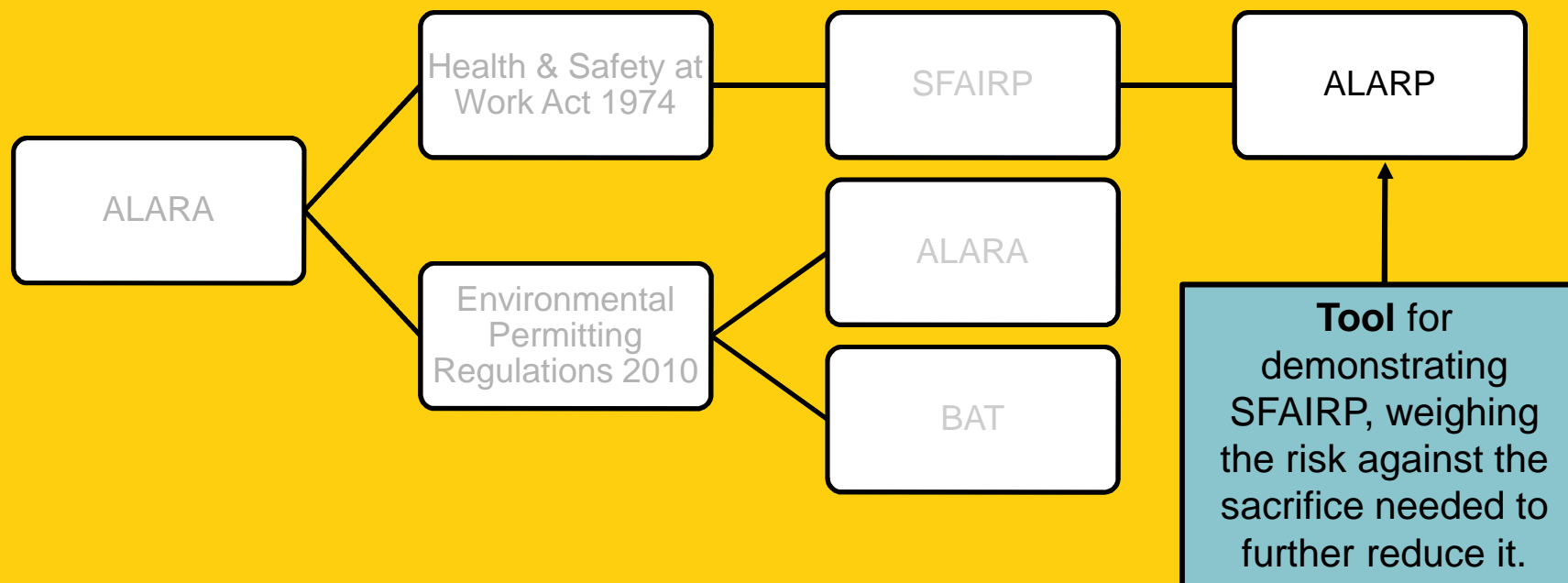
ALARA in the UK Regime





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ALARA in the UK Regulatory Regime





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Integration of different risks in the UK

- High Hazard Industries (Nuclear, Oil and Gas, Rail etc.) are **Heavily Regulated**.
- Nuclear Industry most heavily regulated. Gold Standard in UK Health & Safety.
 - Significant effort in the **integration of different risks as part of the ALARP Argument**.
- What about the Lower Hazard Industries or Medical Sector? Is there an **all risk approach**?
- It appears there is **not yet a consistent approach across industries** for the treatment, yet alone integration of risks. For instance Deterministic vs Probabilistic Treatment of Risks in different sectors.



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The Nuclear Industry and Safety Case

- The Safety Case is a requirement in UK Law (Health and Safety at Work Act and Nuclear Installations Act).
- NIA requires a site licence to be issued prior to the construction and operation of a Nuclear Facility.
- A set of 36 Standard Conditions, covering design, construction, operation and decommissioning, is also attached to each site licence.
- **Safety Case** - The documentation that demonstrates how the operators meets these License Conditions and has reduced the risks to ALARP.
- It **covers all hazards and risks**. Not just Nuclear or Radiological.
- **A learning opportunity for other sectors?**



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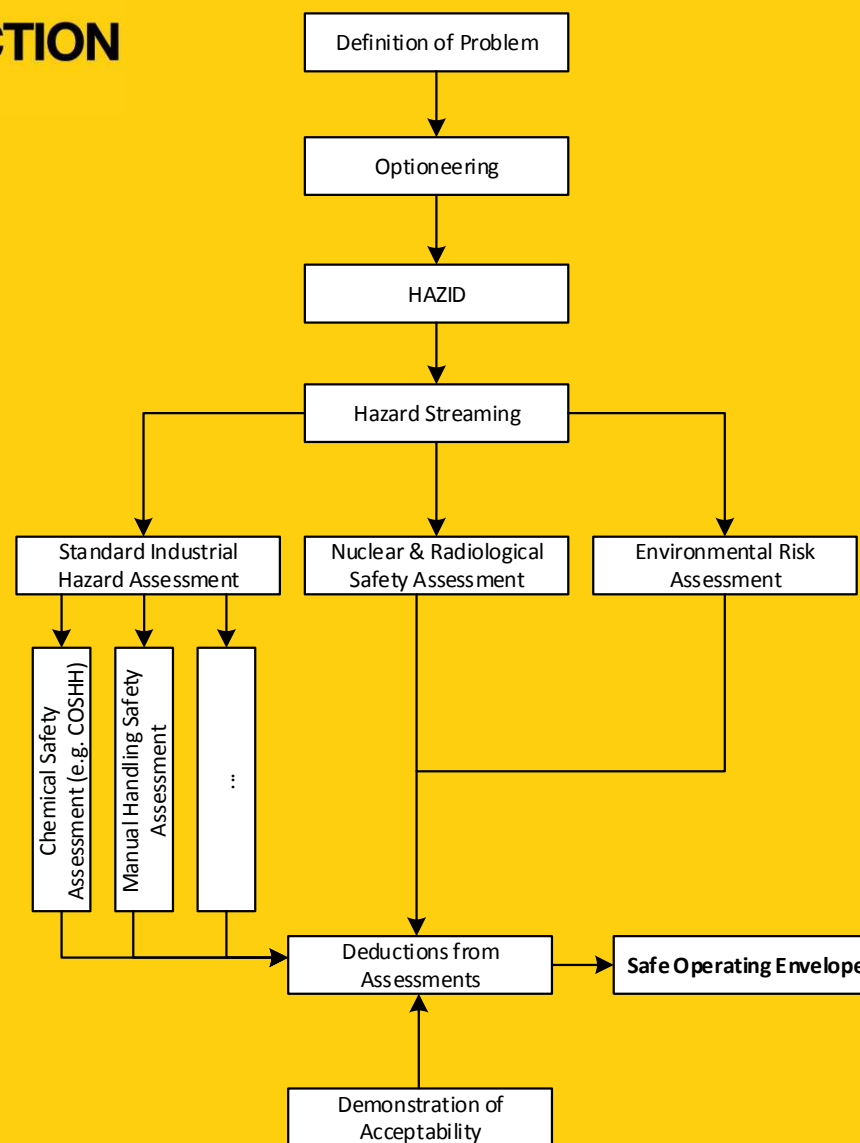
Safety Case, Risk Assessment & System of Protection

- The Safety Case has a strong link to the Radiological Risk Assessment and System of Protection. However this is applied to all hazards:
 - **Justification** - Is the risk of the associated hazards justifiable?
 - **Optimisation** - Have the risks been reduced to ALARP?
 - **Limitation** - Are the consequences of any exposure below the relevant legal limits?
- Is there an opportunity to apply this to all risks across all sectors?



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Example Modern Standards Safety Case Process Map





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Optioneering

- Provides the **foundation to the ALARP argument.**
- Key Steps:
 - Define Requirements
 - Identify Options
 - Define Selection Criteria - Assurance (including Radiological Safety, Conventional Safety, Environmental Risks), Engineering, Business etc.
 - Analyse Options - Assess against criteria
 - Scoring and Ranking
 - Down Selection - Identify Preferred Option(s)
- Recording and reporting of the above provides an auditable trail that underpins the justification and supports the ALARP argument.



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Hazard Identification (HAZID)

- A Safety Case or Risk Assessment requires a systematic method of hazard identification. This provides a means of **testing the preferred option**.
- The hazard identification process must identify all significant hazards, i.e. those that could lead to loss of life, injury or ill health to a facility worker, on-site worker and member of the public. Potential hazards include radiological and standard industrial hazards (conventional hazards). Combinations of hazards must also be considered (where these can not be eliminated by the design).
- In addition, all releases that could potentially pollute the environment must also be identified.



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Hazard / Safety Assessments

- Regardless of the Hazard Type whether Nuclear / Radiological, Industrial or Environmental in nature a **proportionate approach** should be undertaken to assessing the hazard.
 - For those hazards capable of causing a significant consequence (fatality or a number of serious injuries) it is **reasonable** to undergo additional assessment to **understand the potential fault sequences and consequences**, and to correctly determine the relevant safety controls.
 - Those hazards with a lower consequence are less likely to require an in depth assessment to identify any controls.



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Hazard / Safety Assessments

- **Relevant Good Practice** should be applied to all hazards as a minimum.
- Those hazards capable of causing a significant consequence may require specialist assessments tailored to the hazard type. For instance explosive hazards.
- It should be noted that in certain cases controls put in place to limit or reduce the risk associated with one hazard type, may also be used to limit or reduce the risk associated with another hazard type. (e.g. Chemical and Radiological Contamination Hazards). In such cases it is important to make sure any **claims placed on the control are recorded** in both hazard assessments.



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Deductions from Assessments & Safe Operating Envelope

- The output of the various assessments **in combination** are used to define the Safe Operating Envelope.
- This includes **Bounding Conditions**, Engineered and/or Managerial Safety Controls (and requirements placed on the controls, including **maintenance**), which are to be implemented by the facilities safety management arrangements.
- Bounding Conditions are key physical parameters which inform the operators of specific limits of safe operation.



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Demonstration of Acceptability

- As part of the Hazard / Safety Assessments claims are placed on Engineered Controls and Managerial Controls.
- These claims need to be substantiated in order to demonstrate they can be met.
- The extent of substantiation is proportionate to the level of risk reduction and confidence required for the safety measure. This may range from compliance with relevant standards, to a more in-depth assessment of failure modes or through limiting factors.



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Challenges with the Integration of Risks

- **Balancing the risks** associated with multiple hazards. For instance during the optioneering phase one option may result in a reduction in the radiological risks but an increase in the risks associated with industrial hazards.
 - Careful selection of Criteria and make sure any reasoning behind Scoring and Ranking, is well documented and defensible.
- There is **no one consistent approach** for assessing risks across industries, and differences even within specific industries (e.g. Nuclear).
 - Knowledge sharing across industries and within industries.



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Challenges with the Integration of Risks

- Regulators encouraging the use of best practice approaches as part of their expectations.
- Management of **materials with multiple hazards** such as uranium, which is both Radiologically and Chemically Toxic.
 - Identify the dominant health detriment from that particular form of the material in a particular situation, and use this as the primary basis for identifying the controls (e.g. for Depleted / Low Enrichment Uranium the Chemical Toxicity Dominates).
 - Due consideration should be taken that the form may change as part of the initiating event leading the hazard being realised.
 - A check should be made to ensure the identified controls for the dominant health detriment, also are suitable and sufficient to control the other hazards.



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Summary

- The UK Nuclear Industry has placed significant effort of the integration of different risks as part of the ALARP Argument.
- However, there is not yet a consistent approach across industries or even within the sector.
- Can the System of Protection be applied to all hazards?
- Challenges associated with balancing the risks from multiple hazards.
- Work still to be done!
 - Opportunities to improve how we exchange experiences.



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Any

Questions?