The Society for Radiological Protection

"Role of Safety Culture and ALARA in the optimisation of Radioactive Waste Management in a New Nuclear Build"

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Formed in 1963, with over 2,200 members world wide. We are the largest RP professional body in Europe, and second largest in the world.

We were awarded our Royal Charter in 2007 and are the UK Associate Society of the International Radiation Protection Association (IRPA).

We offer a range of scientific meetings, conferences workshops and seminars, and are actively involved in Public Outreach.

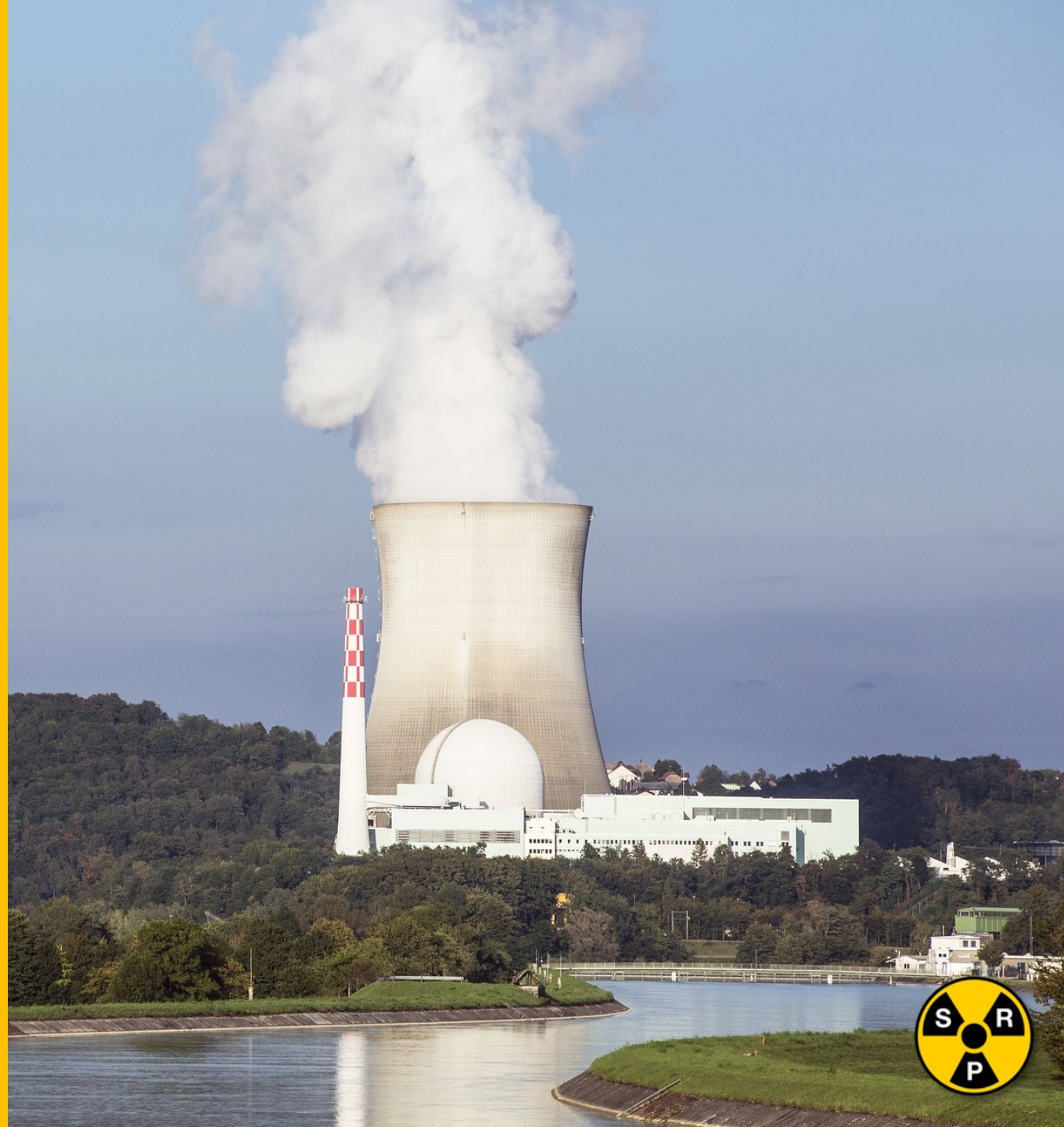
We have 4 Grades of Membership, for individuals at all stages of their careers, and offer professional recognition (CRadP, IRadP, TechRadP).

We actively engage with Regulators and Government and various international bodies to ensure the views of our membership are recognised.

"promote the science and art of radiation protection and allied fields for the public benefit"

INTRODUCTION

- The “optimisation” principle is at the core of radiation protection. It is often referred to as ALARA, short for keeping all doses “As Low As Reasonably Achievable”.
- This applies not only to people working with radiation but also the public. For this reason it has a key role to play in radioactive waste management.
- The integration of ALARA into the design of New Nuclear Build can ultimately:
  - Reduce Doses to Workers and the Public
  - Reduce Environmental Impacts
  - Reduce the Quantity of Radioactive Waste Generated and Disposed of during Operation and Decommissioning.



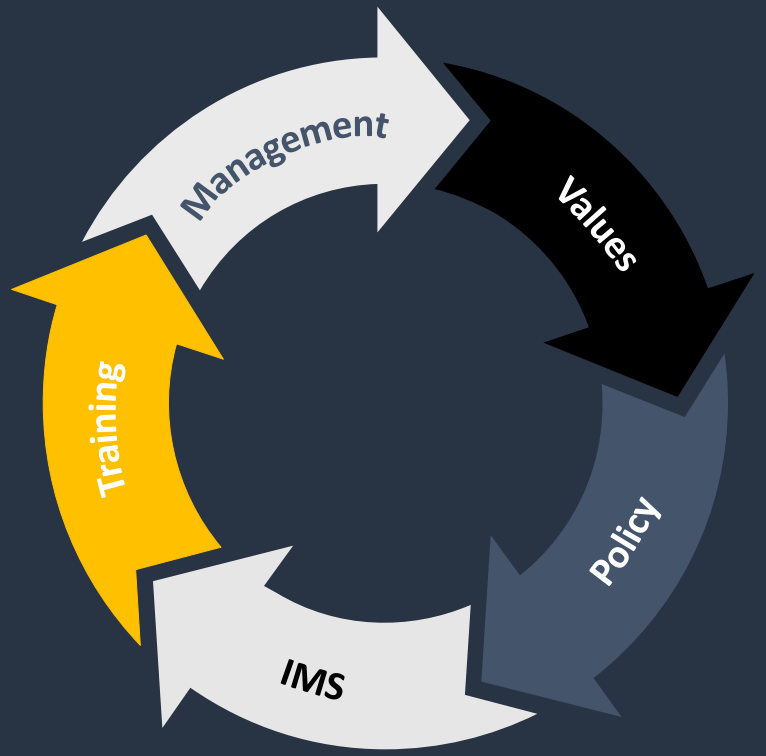
HISTORICAL OVERVIEW OF ALARA

- The **ICRP** system of radiological protection is based on 3 principles, **Justification**, **Optimisation** and **Dose Limitation**.
- Throughout the 1980s and early 1990s there was a focus on the development of an understanding of ALARA using quantitative decision aiding techniques, such as cost-benefit analysis.
- It soon become clear that, whilst the development of structured approaches provided 'tools' to pursue ALARA, this did not necessarily achieve anything in practice unless there was a will to positively pursue the ALARA principle.
- Over the years, the commitment to ALARA has become part of what we would now recognise as **Safety Culture**.

It is important that the effort devoted to the ALARA study should be proportional to the costs of implementation and the potential dose savings.

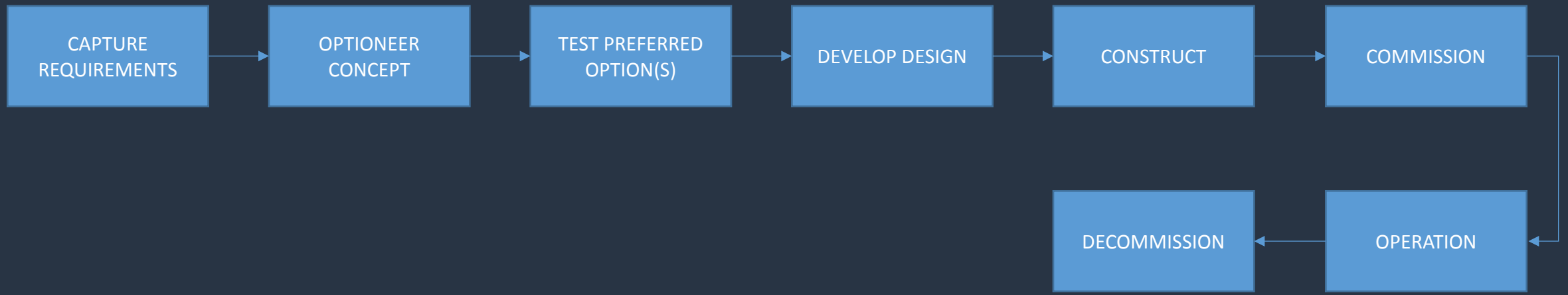
INTERGRATING SAFETY CULTURE

- Creating an integrated “Safety Culture” requires:
  - Individual Commitment to Safety - e.g. Personal Accountability
  - Management Commitment to Safety - e.g. Respectful Work Environment
  - Management Systems - e.g. Work Processes & Continuous Learning.
- Due to the large complexity and scale of these new build projects, heavy utilisation of a supply chain is required.
- As such ensuring that the Safety Culture flows down and is embedded into the Supply Chain is crucial.

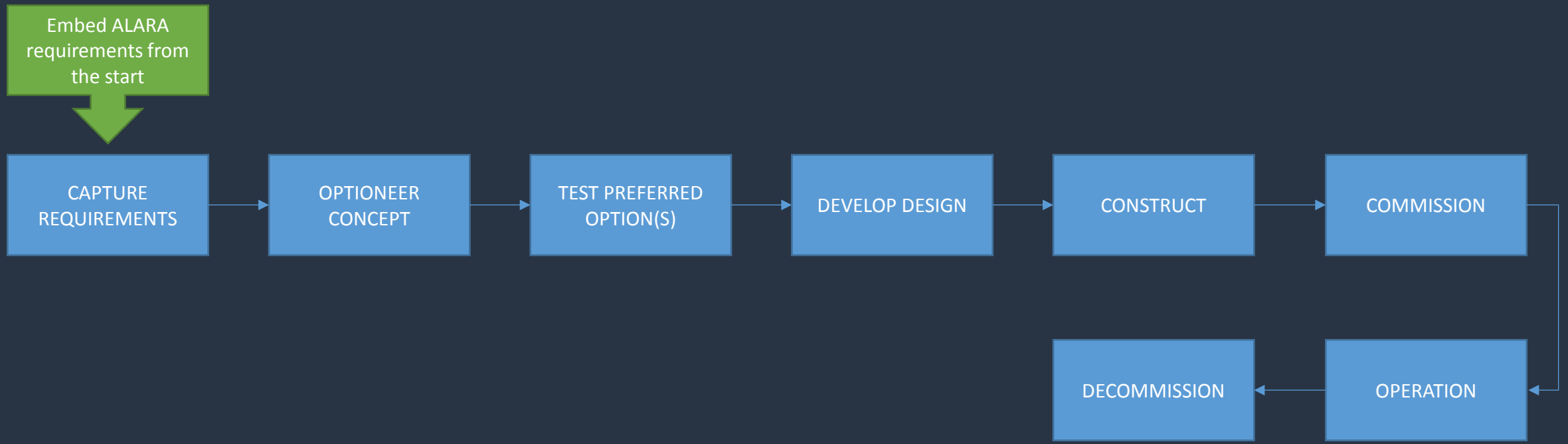


ESTABLISHMENT OF AN “ALARA” FRAMEWORK

- Crucial to the integration of ALARA as part of Safety Culture requires an established framework that:
  - Ensures ALARA is considered from the very start of the concept design and throughout the facility lifecycle.
  - That ALARA considers the impacts not only to the worker, but the environment (Public, Flora and Fauna) from ALL hazards.
  - That the when making decisions that impact Operational Performance, the impact to Construction, Commissioning and Decommissioning is also considered.
  - There is a clear, defendable audit trail to the decision making process.
  - Relevant stakeholders engaged and inform the process at the right time.



APPLICATION OF “ALARA” THROUGHOUT FACILITY LIFECYLE



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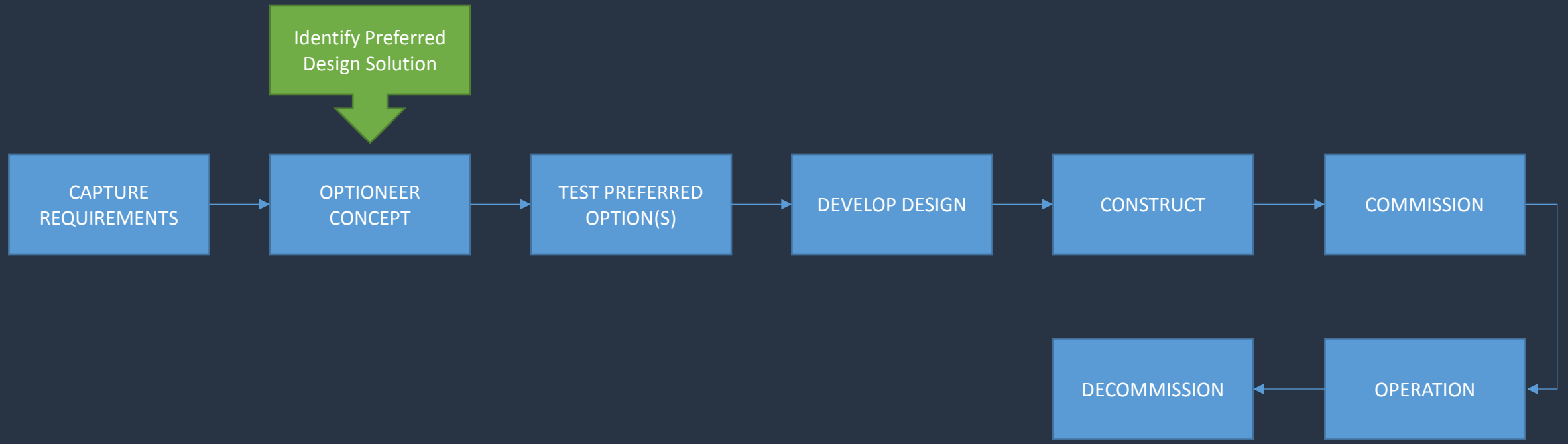

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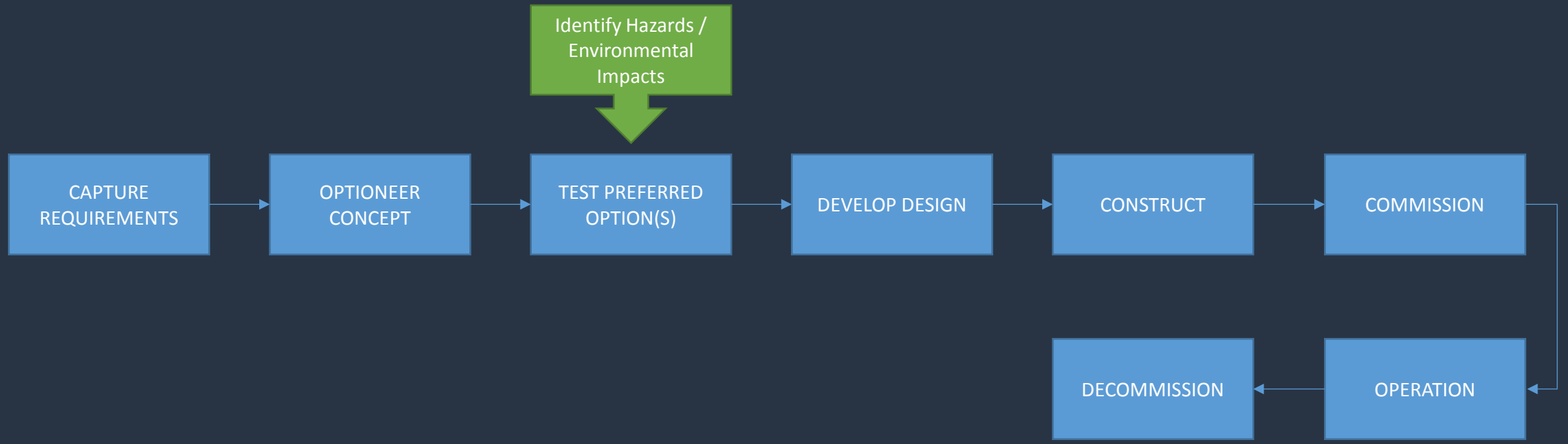

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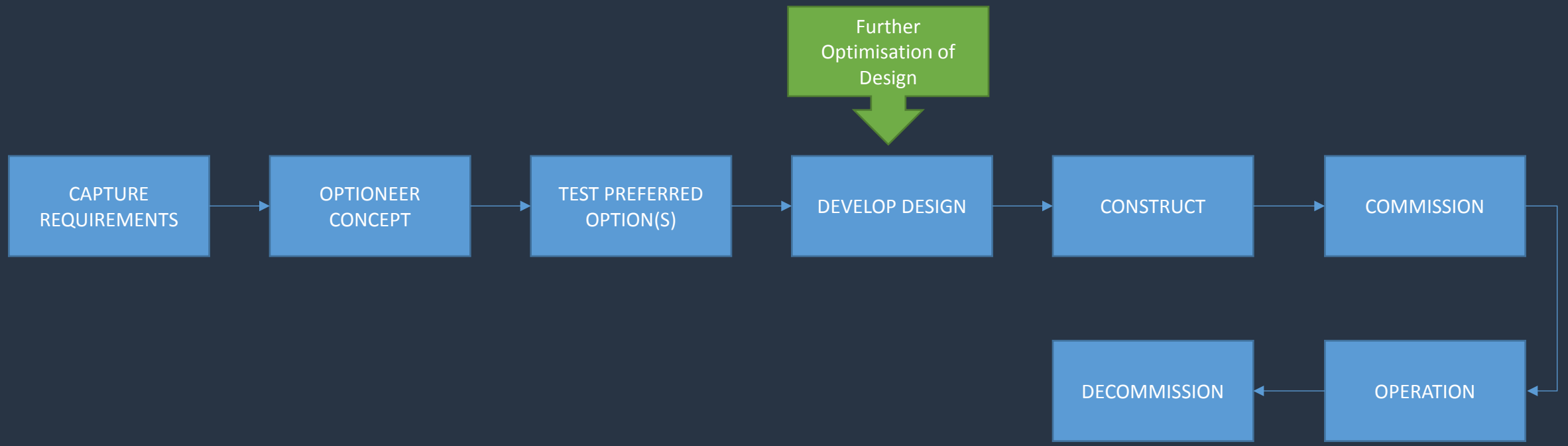

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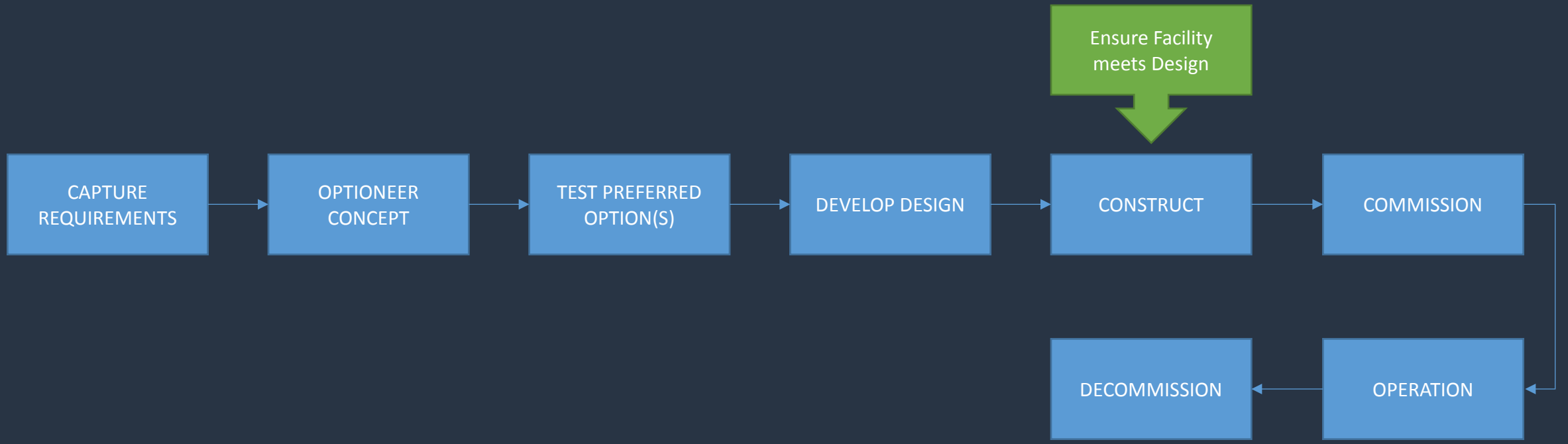

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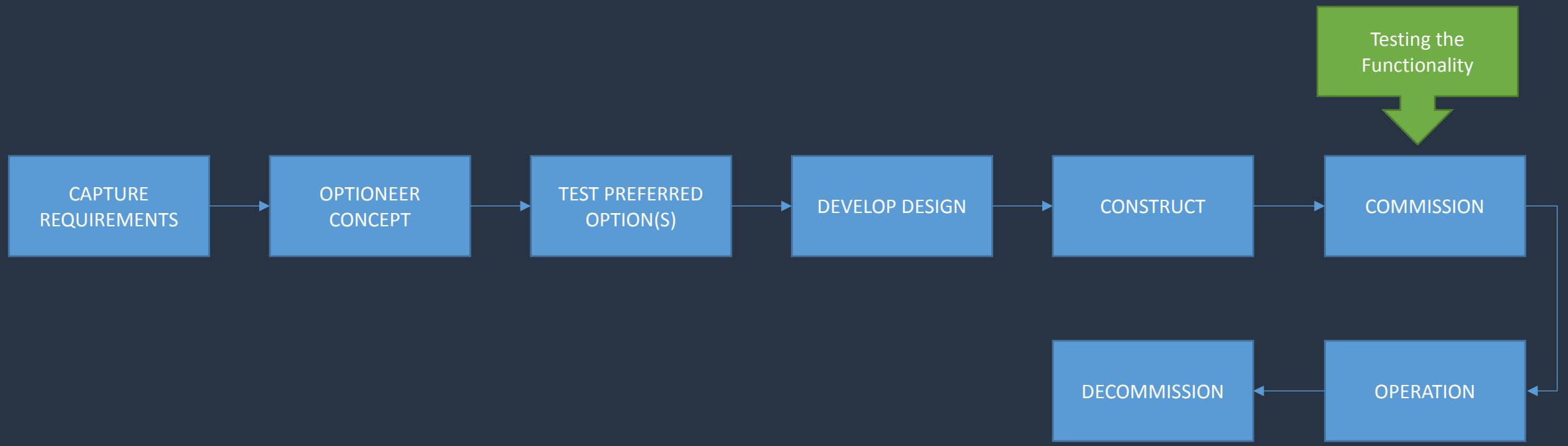

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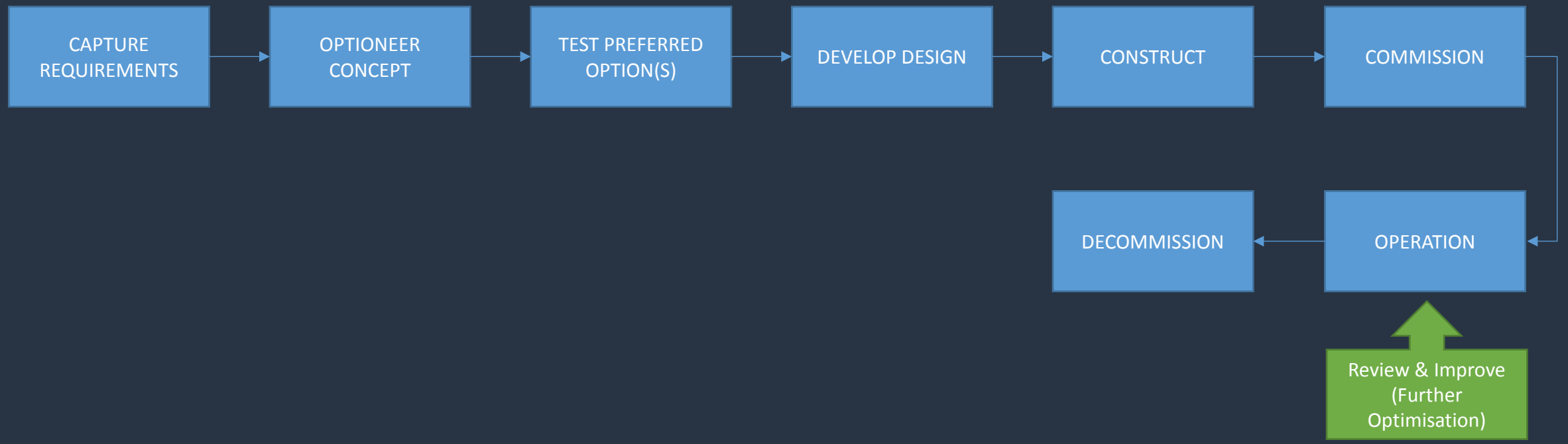

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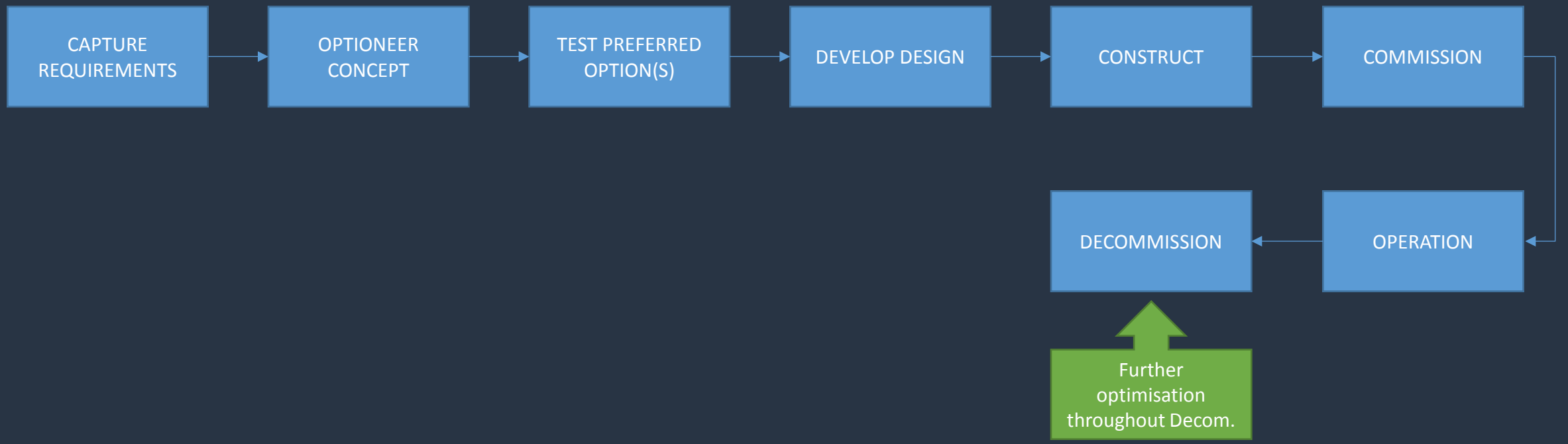
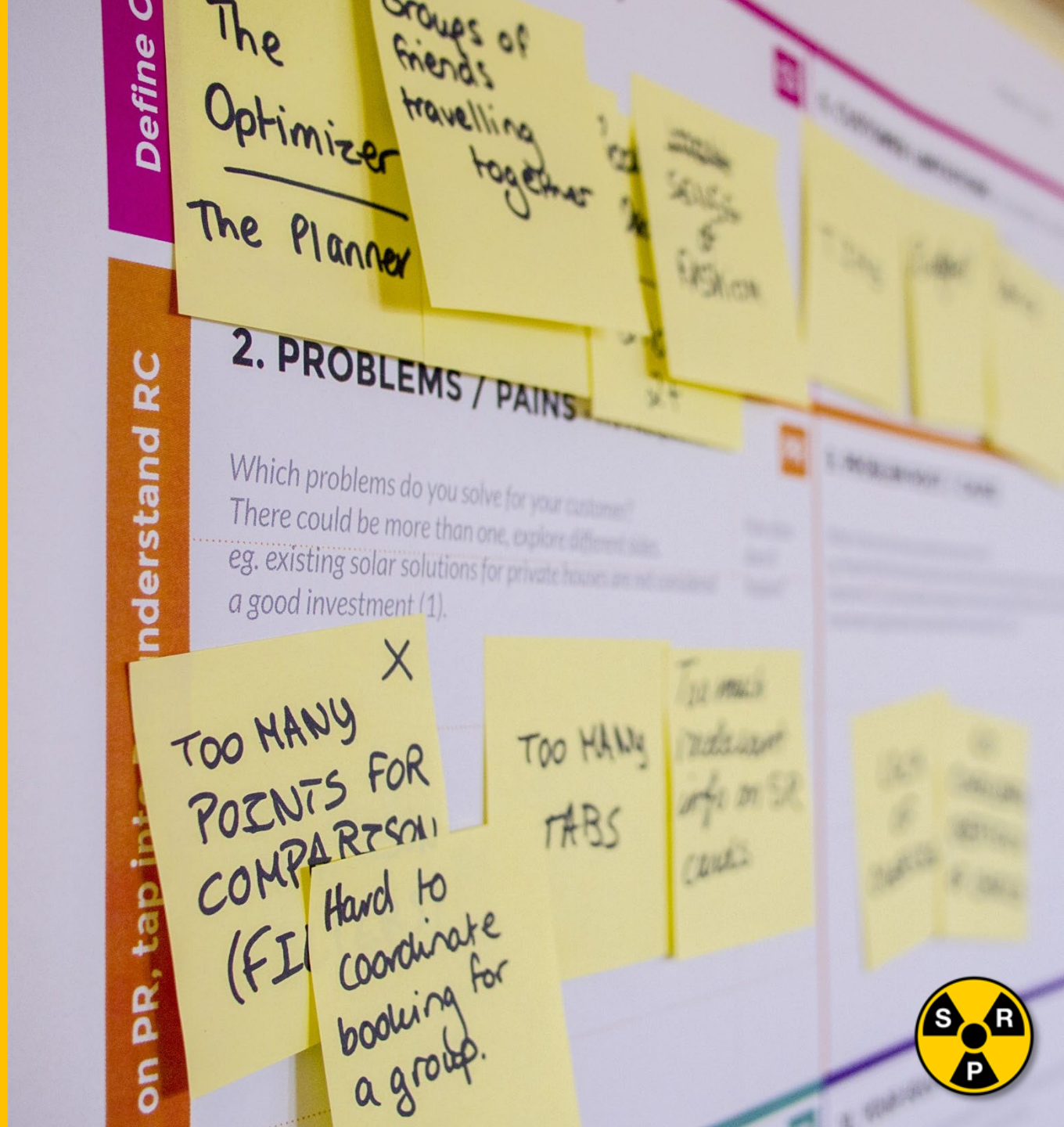


APPLICATION OF “ALARA” THROUGHOUT FACILITY LIFECYLE

KEY REQUIREMENTS

- A range of requirements needs to be captured and feed into the concept design. This includes:
  - Functional Requirements
  - Safety Requirements
    - Protection of the Worker from **ALL hazards** (not just radiological)
  - Environmental Requirements
    - Environmental Performance
    - Protection of the Public and Environment from harmful discharges.
    - Minimisation of waste generated during Operation and Decommissioning.
  - Decommissioning Requirements
    - Ease of Decontamination & Dismantling
    - Reduce the complexity and risks during decommissioning.



OPTIONEERING PREFERRED SOLUTION

- Key Steps:
  - 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 ALARA argument.

'Brainstorming' - where relevant experts sit together and write down their ideas for factors and options.

TESTING PREFERRED OPTION AND DESIGN DEVELOPMENT

- A systematic method of hazard identification provides a means of **testing the preferred option**.
- The 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 throughout the Lifecyle of the facility.
- Where multiple preferred options were identified during the optioneering stage, this process will normally help in the selection of a single preferred option.
- It is important that much like the optioneering assessment, the process should be accurately recorded

TESTING PREFERRED OPTION AND DESIGN DEVELOPMENT

- The identified hazards can then be assessed to look at how the risks can be optimised in a proportionate manner taking consideration of:
- Relevant Good Practice (RGP)
  - It includes engineered safety measures and management arrangements.
  - Typically RGP is demonstrated via compliance with approved codes of practice, International Standards and National Standards.
  - RGP has to be met as a minimum. Often sufficient but what else could be done to reduce risks to ALARA?
- Hazard Management Strategy

Eliminate the Hazard

Use a different process

Reduce the Hazard

Use less inventory

Isolate the Hazard

Passive Shielding and Containment

Control the Hazard

Active engineered protection e.g. safety shutdown system

Protect against the hazard

Mitigation e.g. filters, bunds

Discipline staff to avoid the Hazard

Managerial process, e.g. Use PPE, set a dose objective.

CONSTRUCTION AND COMMISSIONING

- During the Construction and Commissioning Stages it is important to ensure the facility meets the design, and any safety or environmental claims are substantiated.
- Where there are deviations these need to be recorded and if required rectified. Noting these can impact waste quantities both during operation and decommissioning.
- Records of the construction, installation and commissioning need to be produced and retained. Consideration should be given the production of videos during construction of how parts of the plant are put together / layout. This would be useful in the operational and decommissioning phases.

OPERATION

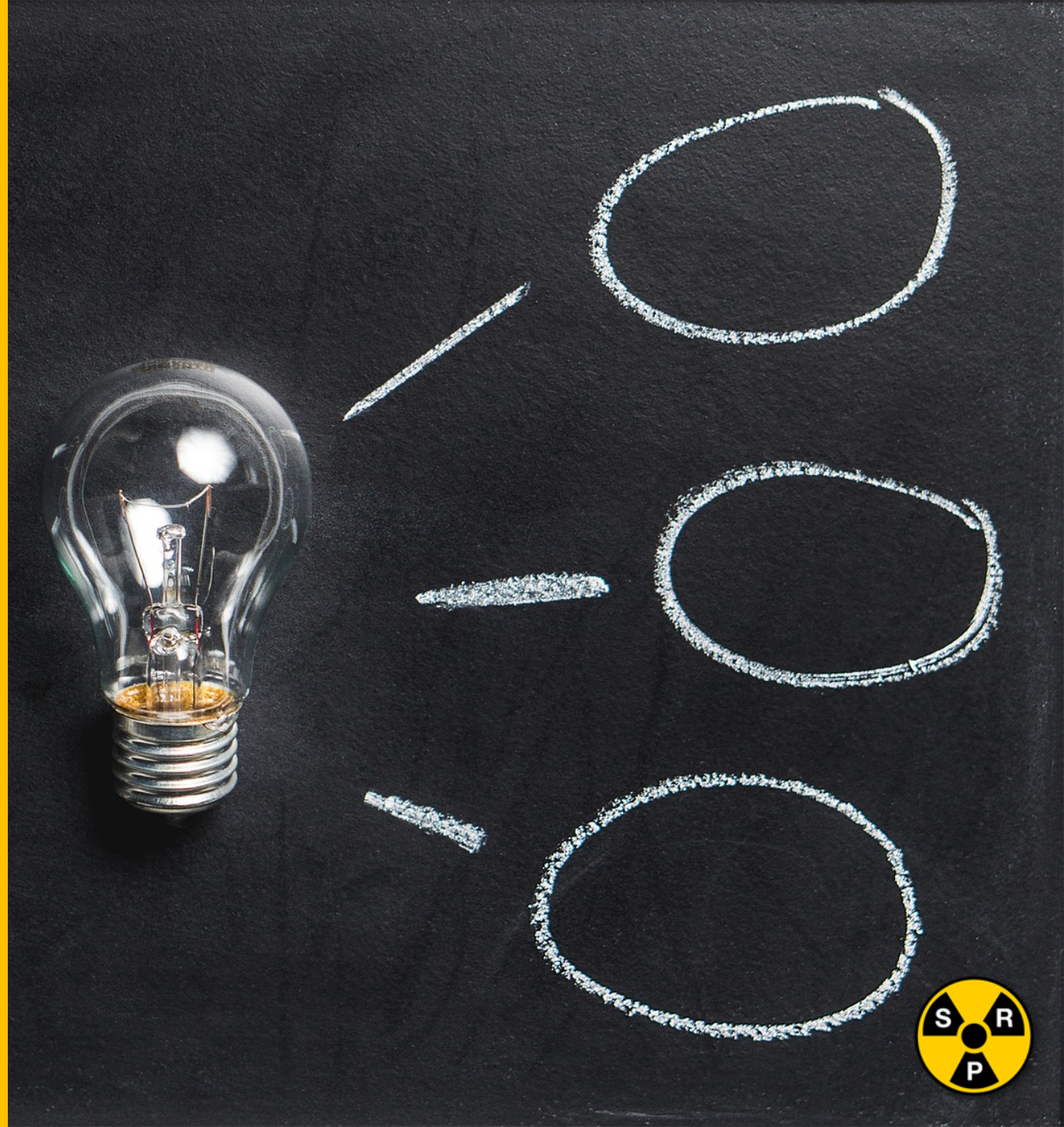
- Throughout operation it is important that:
  - Performance is continually reviewed and where appropriate improved (including Safety and Environmental Performance).
  - Any modifications are appropriately recorded and justified as ALARA (including considering impacts to Decommissioning and Waste Quantities).
  - Records throughout the preceding stages of the Lifecyle are maintained.

DECOMMISSIONING

- By embedding ALARA into the design of the facility from the concept this yields the greatest reduction in radioactive waste generation during operation and decommissioning.
- However it is important that consideration is given at the decommissioning stage into what further reductions can be achieved via the tools and techniques utilised. In particular noting technological changes that may impact the attainment of ALARA.

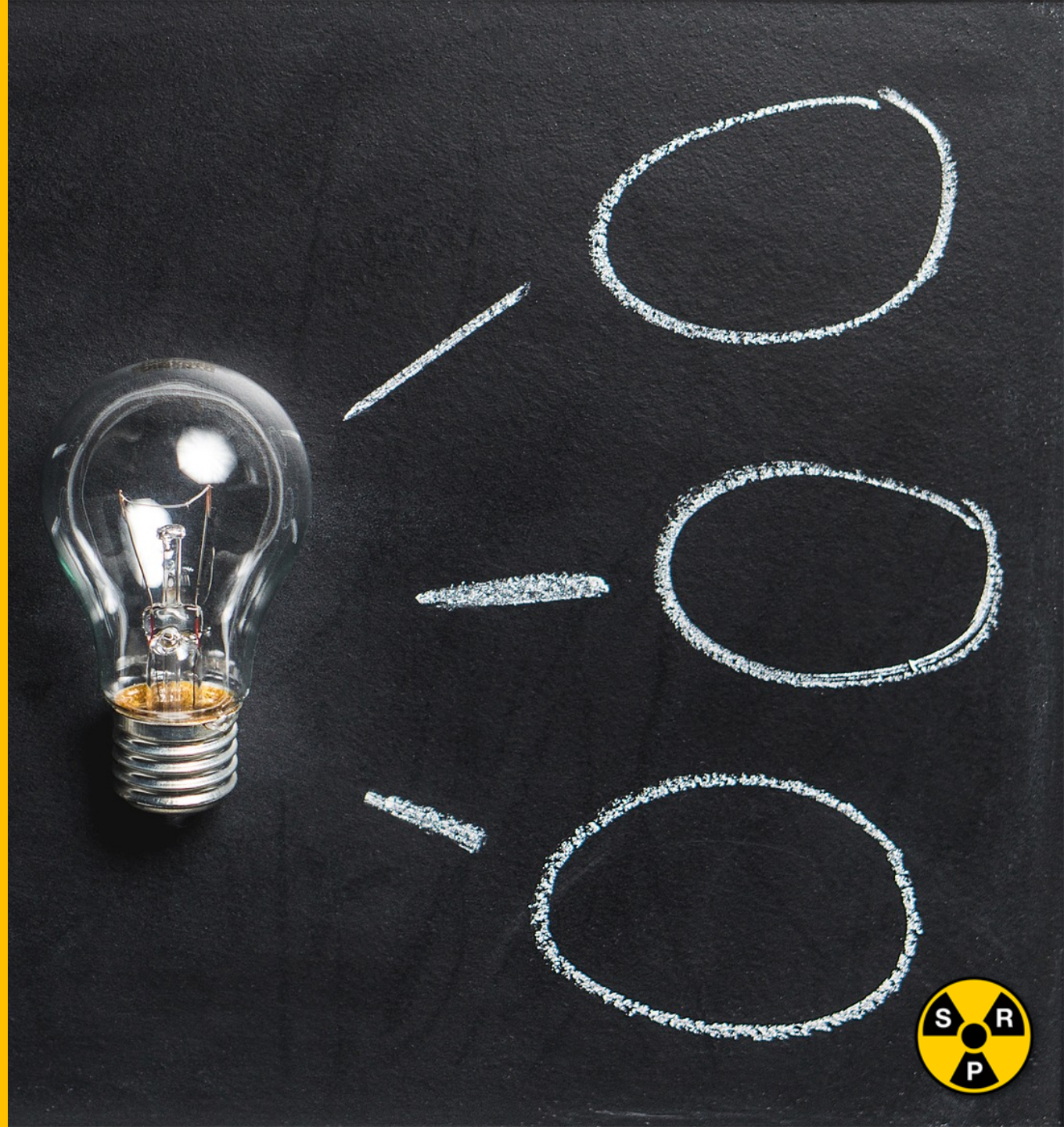
KEY CHALLENGES

- The embedding of ALARA into the entire facility Lifecycle does not come without its challenges including:
  - ALARA being integrated too late in the design stage where options have been foreclosed.
  - Focus being on the Operational Considerations leading to lack of consideration of Decommissioning Wastes.
  - The design of a large facility with large quantities of process plant being segmented leading to a loss in the holistic ALARA argument.
  - Focus being on perceived risk rather than actual risks leads to an increase in Non Radiological Hazards and wastes.



KEY CHALLENGES

- Application of proportionality and reasonableness.
- Design, Implementation and Maintenance of the Integrated Management System through the lifetime of the facility.



Thank you for listening!

Any

Questions?