Development of a Methodology for an Environmental Safety Case in the UK

Lucy Bailey
UK Nirex Limited

nirex

Overview

- UK Context
- Environmental Safety Case Definition
- Who is the ESC for?
- Aims and Scope of the ESC
- Proposed Methodology
- Presentation

nirex

UK Context

- Consultation by independent Committee on Radioactive Waste Management
- Government endorsed deep geological disposal as preferred long-term management solution for higher-level radioactive wastes in UK on 25 October 2006
- Site to be selected by volunteer process

nirex

UK Regulatory Requirements

"In the event that a repository is developed, an application, supported by an Environmental Safety Case ("ESC"), for an authorisation under the Radioactive Substances Act 1993 (RSA '93) to dispose if radioactive waste would need to be made to the Agency."

"*The Agency wishes to establish an understanding of the development of the ESC*"

Agreement for Scrutiny of the Work of Nirex by the Environment Agency, 2003

nirex

What is an ESC?

- UK Environment Agency definition:

  "*A document or set of documents, submitted in support of an application for an authorisation under Section 13 of RSA'93, demonstrating that the public and the environment are sufficiently protected from hazards which may arise as a result of the disposal of radioactive wastes.*"

nirex

Who is the ESC for?

- Regulators
  - Environment Agency and Scottish Environmental Protection Agency
  - Nuclear Installations Inspectorate (NII)
  - Department for Transport
- Scientific Community
  - Academic Community
  - Learned societies
- Policy makers
  - UK Government advisors
- Public
  - Local authorities, e.g. Nuclear Legacy Advisory Forum (NuLeAF)
  - Potential host communities
  - Individuals interested in UK Government consultation programme

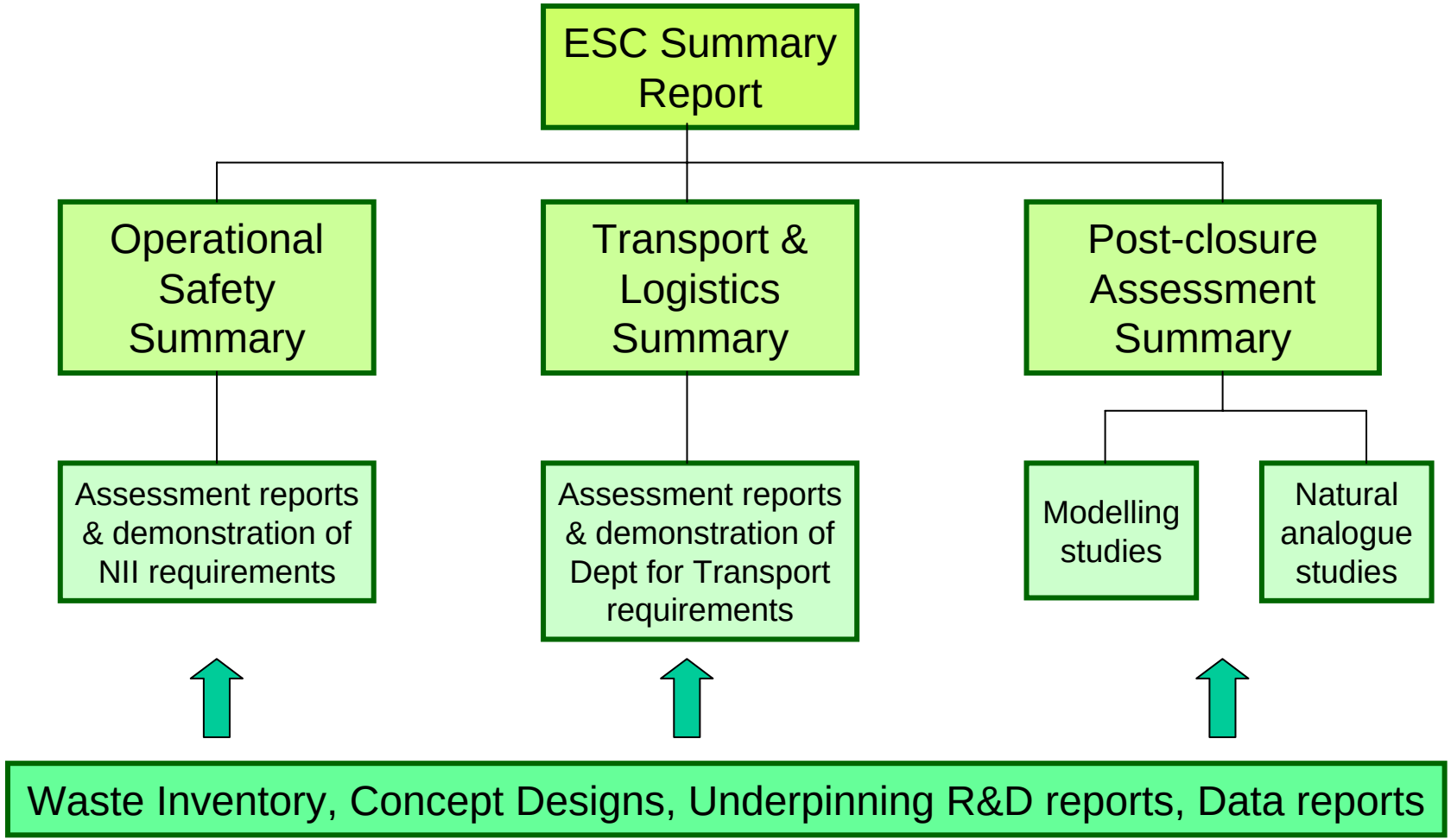
nirex

Scope of the ESC

- Operational, transport and post-closure safety and environmental implications of a geological repository
- Disposal of ILW, HLW and other nuclear materials (in different facilities or co-located)
- Arguments and analyses (qualitative and quantitative, including natural analogues) to build confidence in safety of geological disposal
- Evidence from wide range of sources
- Assurance of safety over all timescales
- Generic – not related to any specific site

nirex

Proposed Structure for the ESC



nirex

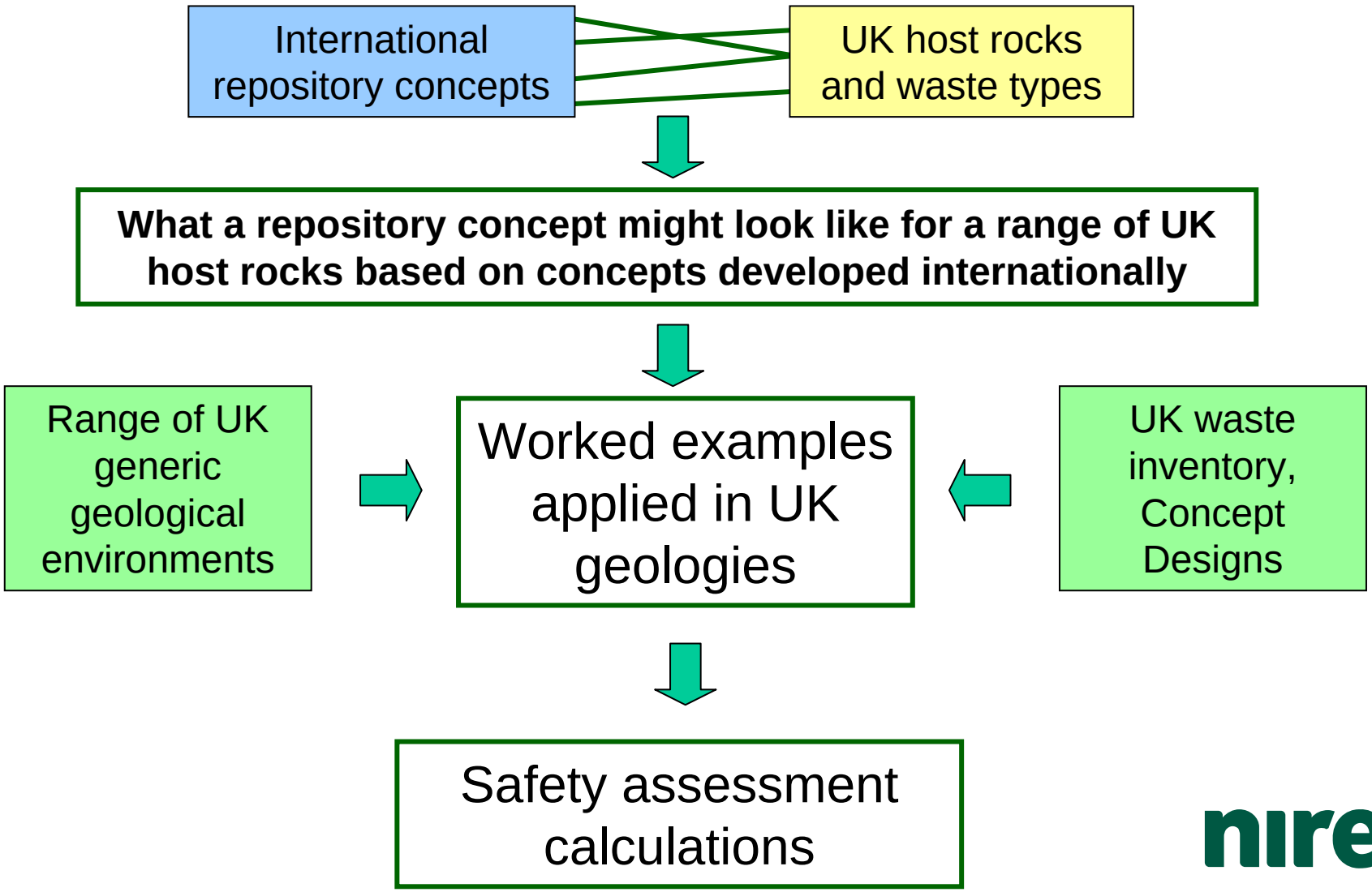
Evolution of the ESC

- First version:
  - Generic, to give examples of how deep disposal could be implemented in UK geology
- Subsequently….
  - updated to be site-specific and concept-specific
  - to support planning and licensing applications

Modular approach to ease updating, safety arguments largely constant

nirex

Proposed Methodology for a Generic Safety Case



nirex

Multi-factor Safety Case

Multi-barrier

Multiple lines of reasoning

Safety functions

- Containment in waste canister
- Wasteform, packaging
- Chemical barrier
- Geological barrier

Intrinsic safety

Safety arguments

- Natural analogue studies
- Numerical modelling
- Demonstration experiments
- Complementary indicators

Safety assurance

Environmental Safety Case

nirex

Presentation of Multi-factor ESC

- Confidence in stability and safety of different components
- Uncertainty associated with barrier performance may increase over time
- Radioactive decay reduces hazard

Timeframes-based approach

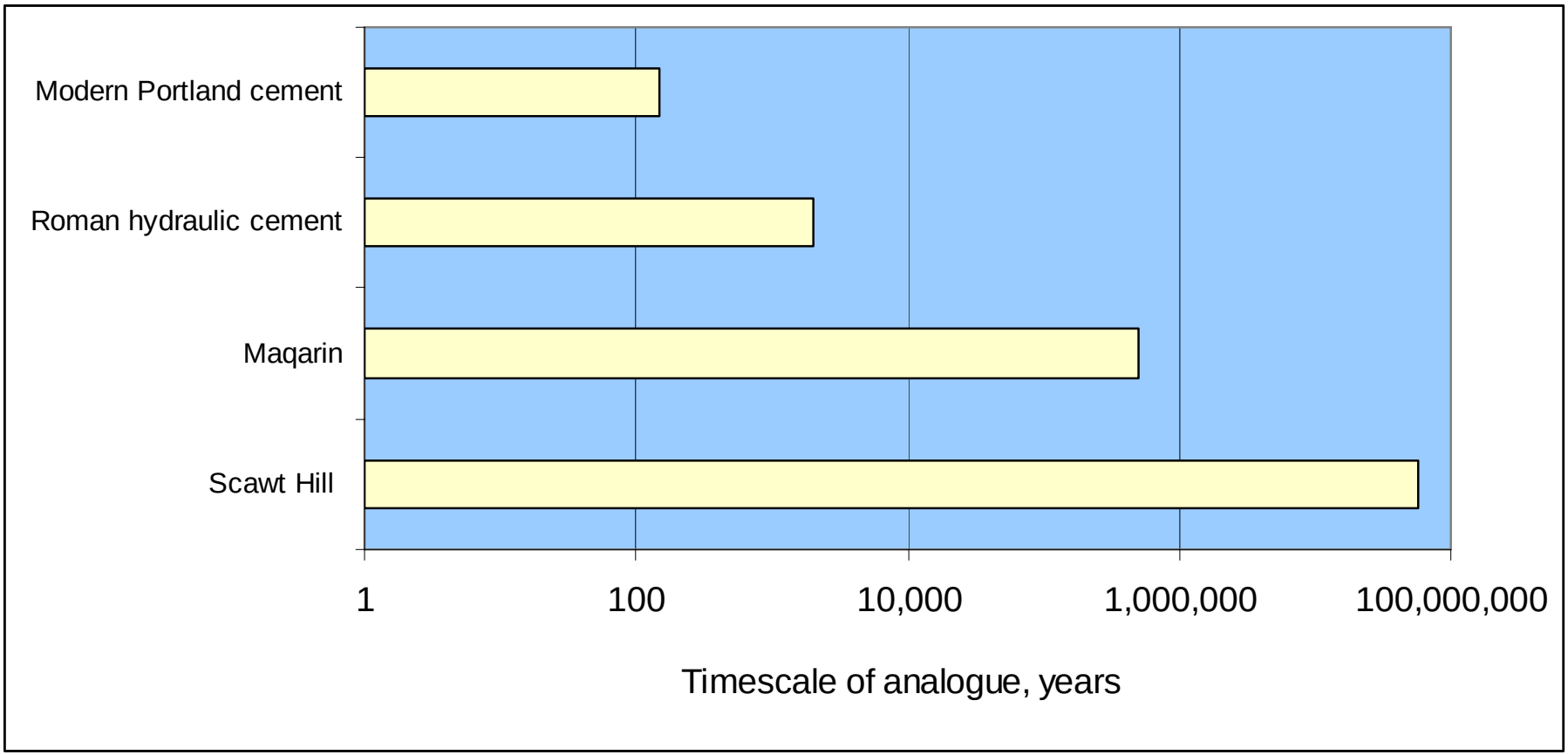
nirex

Timescales for Analogue Studies

- Historical – timescale over which historical records available (up to around 1000 years, e.g. Domesday book written in 1086 survives today)
- Archaeological – timescale over which anthropogenic evidence available (up to few tens of thousands of years)
- Geological – very distant timescales (extending millions of years into past) for which evidence only available from natural systems

nirex

Timescales for Cement Analogues



nirex

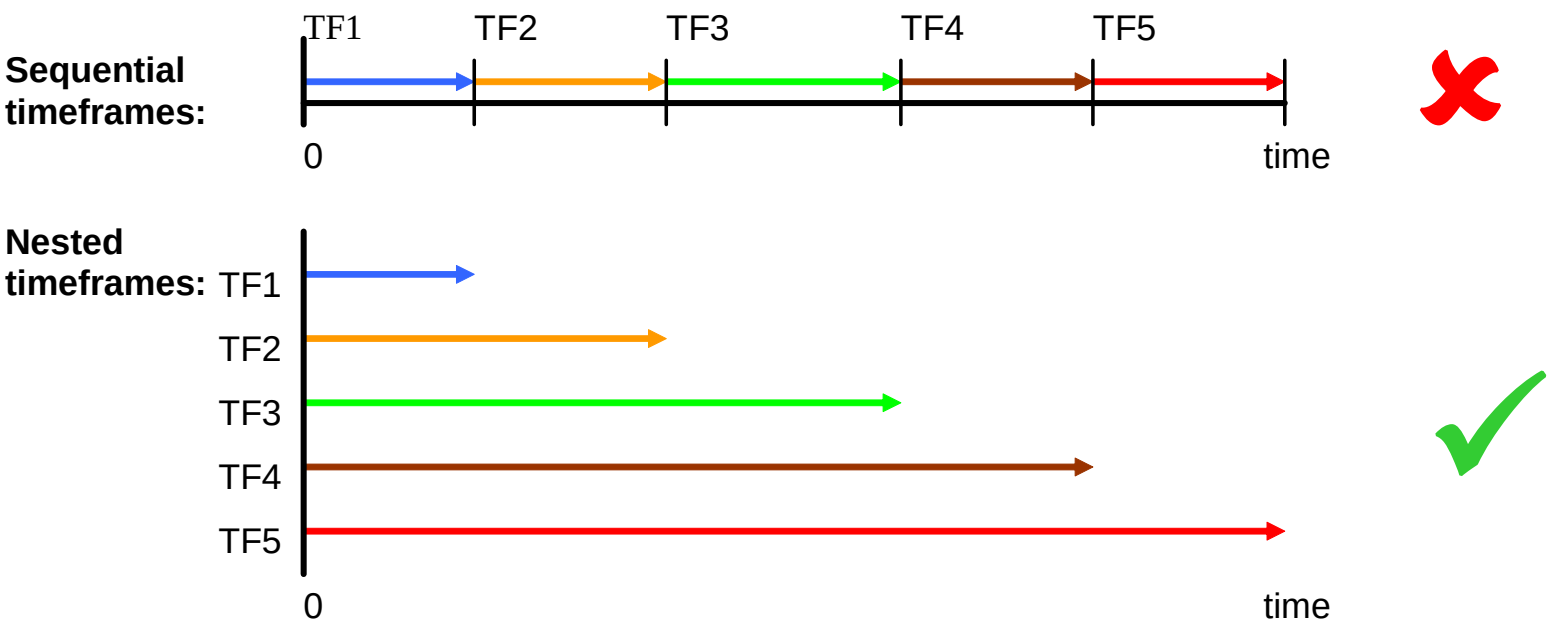
Safety Case Timeframes

Appropriately defined timeframes give simultaneous focus to:

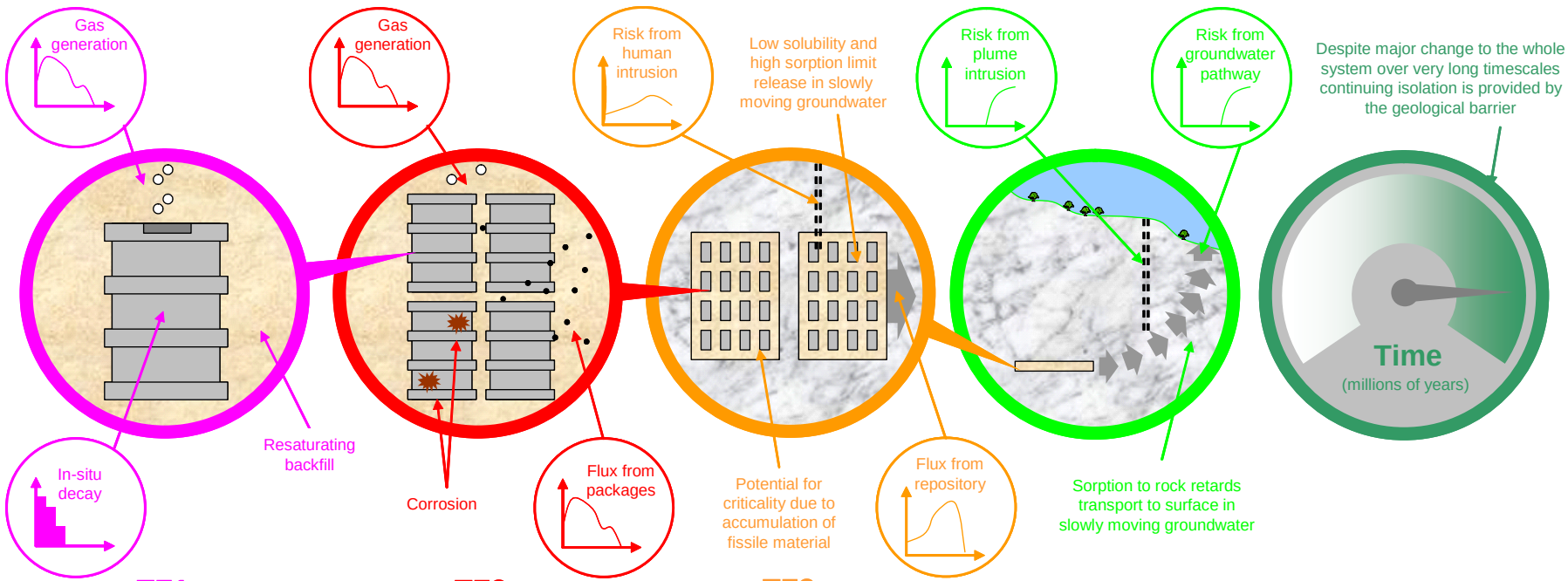
- main safety functions and barriers
- timescales over which they are most important
- natural analogue evidence relevant to the safety functions and their timescales of operation
- development of models on appropriate spatial scales to represent the safety functions

nirex

Timeframes Philosophy



Timeframes for Cementitious ILW Concept



nirex

Summary – Main Benefits of ESC Proposals

- Multi-factor safety case drawing on wide range of safety arguments and analyses
- Hierarchical safety case that communicates to different audiences, including regulators and the public
- Builds an appreciation of evolution of repository system over different timeframes and describes those timeframes in context of historical, archaeological and geological evidence
- Flexibility to develop to address different stages of repository development programme

nirex