UK Fusion Regulation

Health and Safety Executive (HSE) and the Environment Agency (EA)

Fusion Industry School - Oxford, September 2026

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Fusion Technical Lead

Environment Agency

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Content

- UK fusion regulation
- Introduce the HSE and EA
- Through life regulation
- Recent developments and guidance

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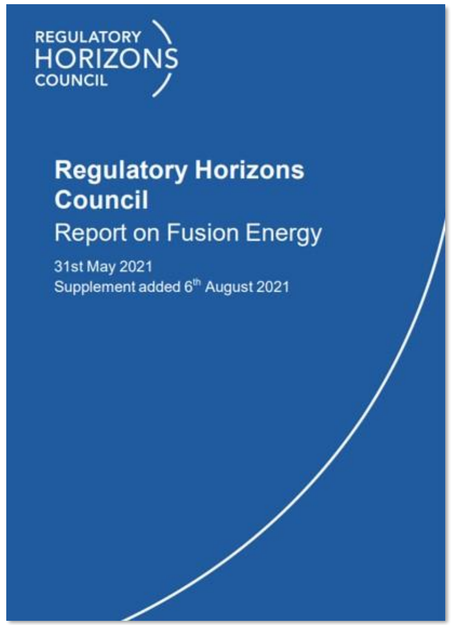
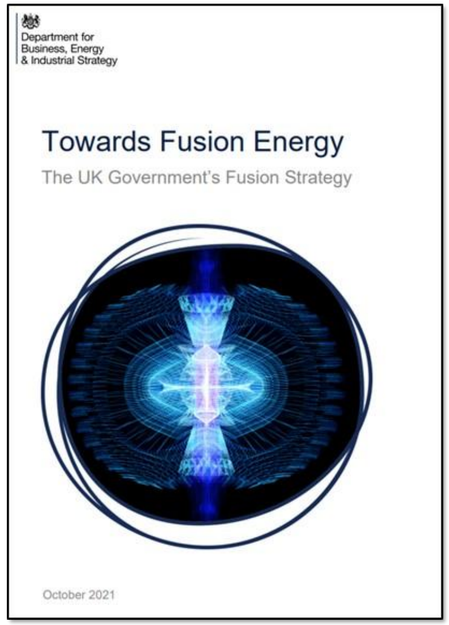
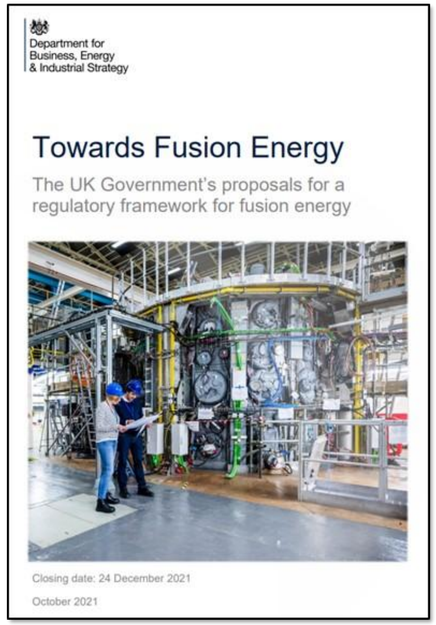
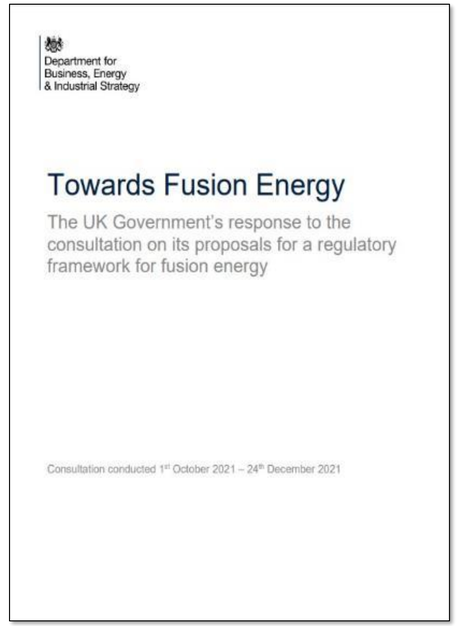
UK Policy and Regulation Development









Supporting Evidence: Safety and Waste Reports

- Key factors informed the UK government decision, including:
  - fusion's inherently safer profile
  - the need for a holistic hazard approach
  - avoiding public association with nuclear regulation
  - the risk of disproportionate regulation under fission frameworks

UK Atomic Energy Authority

Technology Report – Safety and Waste Aspects for Fusion Power Plants

Fusion Safety Authority

UKAEA-RE(21)01

Issue 1
September 2021

UK Government and Fusion Regulation

Energy Act 2023

CHAPTER 52

CONTENTS

PART 1

LICENSING OF CARBON DIOXIDE TRANSPORT AND STORAGE

CHAPTER 1

LICENSING OF ACTIVITIES

General functions

1 Principal objectives and general duties of Secretary of State and economic regulator

Licensable activities

2 Prohibition on unlicensed activities
3 Consultation on proposals for additional activities to become licensable
4 Territorial scope of prohibition
5 Exemption from prohibition
6 Revocation or withdrawal of exemption

Grant and conditions of licences

7 Power to grant licences
8 Power to create licence types
9 Procedure for licence applications
10 Competitive tenders for licences
11 Conditions of licences: general
12 Standard conditions of licences
13 Modification of conditions of licences
14 Modification of conditions under section 13: supplementary
15 Modification by order under other enactments

Fusion energy

156 Fusion energy facilities: nuclear site licence not required

(1) Section 1 of the Nuclear Installations Act 1965 (restriction of certain nuclear installations to licensed sites) is amended as follows.

(2) After subsection (2) insert—

"(2A) Subsection (1) does not apply to a fusion energy facility.

(2B) In subsection (2A), "fusion energy facility" means a site that is—

(a) used for the purpose of installing or operating any plant designed or adapted for the production of electrical energy or heat by fusion, and

(b) not also used for the purpose of installing or operating a nuclear reactor."

UK Government and Fusion Regulation

- Following the UK government's 2021 Fusion consultation, the Energy Act 2023 confirmed that fusion would not be regulated under the Nuclear Installations Act due to its lower risk profile compared with fission.

- **HSE and EA both regulate fusion powerplants**.

- HSE and EA will develop fusion regulation from first principles while engaging with the Office for Nuclear Regulation (ONR) as needed.

- ONR will continue to have a role in areas such as radioactive material transport, while HSE and EA draw on their extensive experience regulating a broad range of industries, and scales, including complex facilities such as JET.

Technology and Fuel Agnostic Approach

- Regulations and the requirements which operations must adhere to will be proportionally based on the hazards which are created on site, along with any potential offsite impact.

- Some hazards will be common across all sites and designs, however some unique hazards will be technology specific.

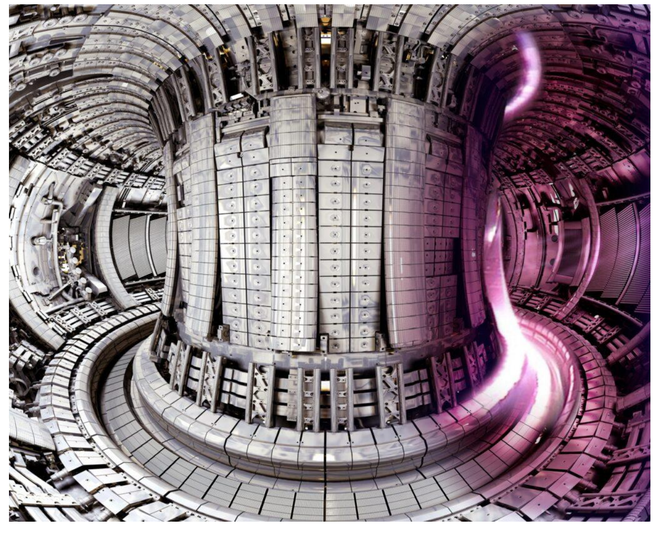
- Routes for regulatory engagement at various levels of design maturity for fusion power plants

EA and HSE Regulatory Experience of Fusion Activities

- Experience in regulating UKAEA Culham Centre for Fusion Energy
  - Joint European Torus (JET), started operations in 1983 and ceased in 2023
  - Permitted/consented as a “non-nuclear” operator
- Other fusion operators, e.g. First Light Fusion, Tokamak Energy
- Early engagement with UK Fusion Energy’s Spherical Tokamak for Energy Production (STEP)

<u>Key Learning</u>

- Goal-setting regulation allows flexibility
  - Important for a research and development site where changes may be rapid
  - Conduct operations within a “safe” regulatory envelope
- Early engagement is needed for changes requiring regulatory permission
  - Understanding improves application of a graded approach



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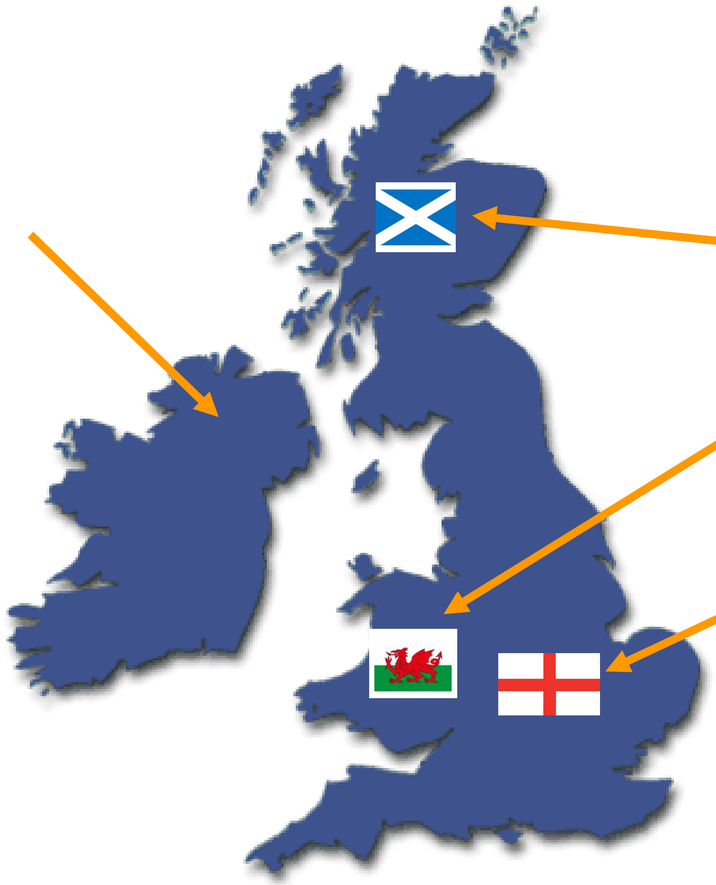
Health and Safety Regulators

hseni
CONTROLLING RISK TOGETHER



HSE
Health & Safety Executive

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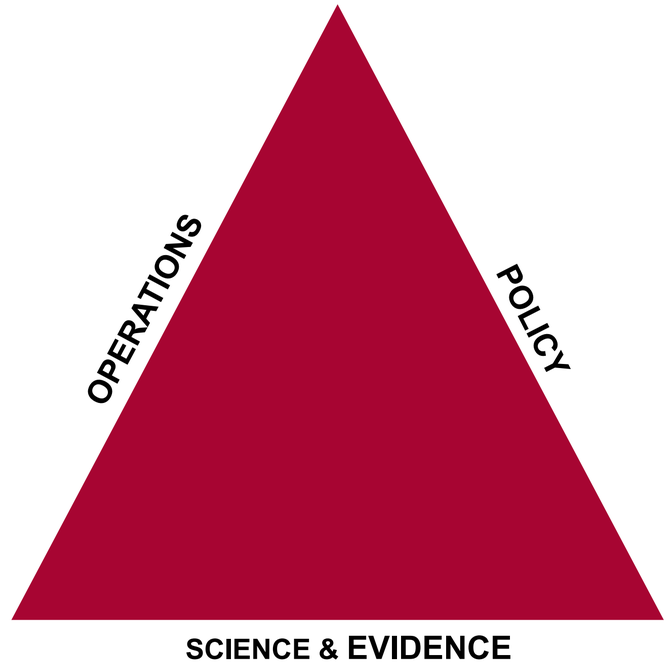
The Health and Safety Executive (HSE)

- UK Government policy lead for occupational health and safety

- The regulator in Great Britain (GB) for the risks arising from work to workers and others

- HSE is unique as a regulator. It has three equal and complementary functions:
  - Policy
  - Operations – inspection and enforcement
  - Science and technical evidence



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HSE Approach to Regulation

Independent, evidence-based regulator, and develop regulatory approaches from first principles.

Maintain engagement with industry as it develops to inform our understanding, including around site inventory.

Goalsetting legislation, it is for the duty holder to assess and manage risks

- in most instances we do not prescribe what duty holders are required to do.
- Goalsetting regulations scale to varying risks.

Risks must be managed “so far as is reasonably practicable”. HSE keeps its regulations under review, both for well established and “new” industries.

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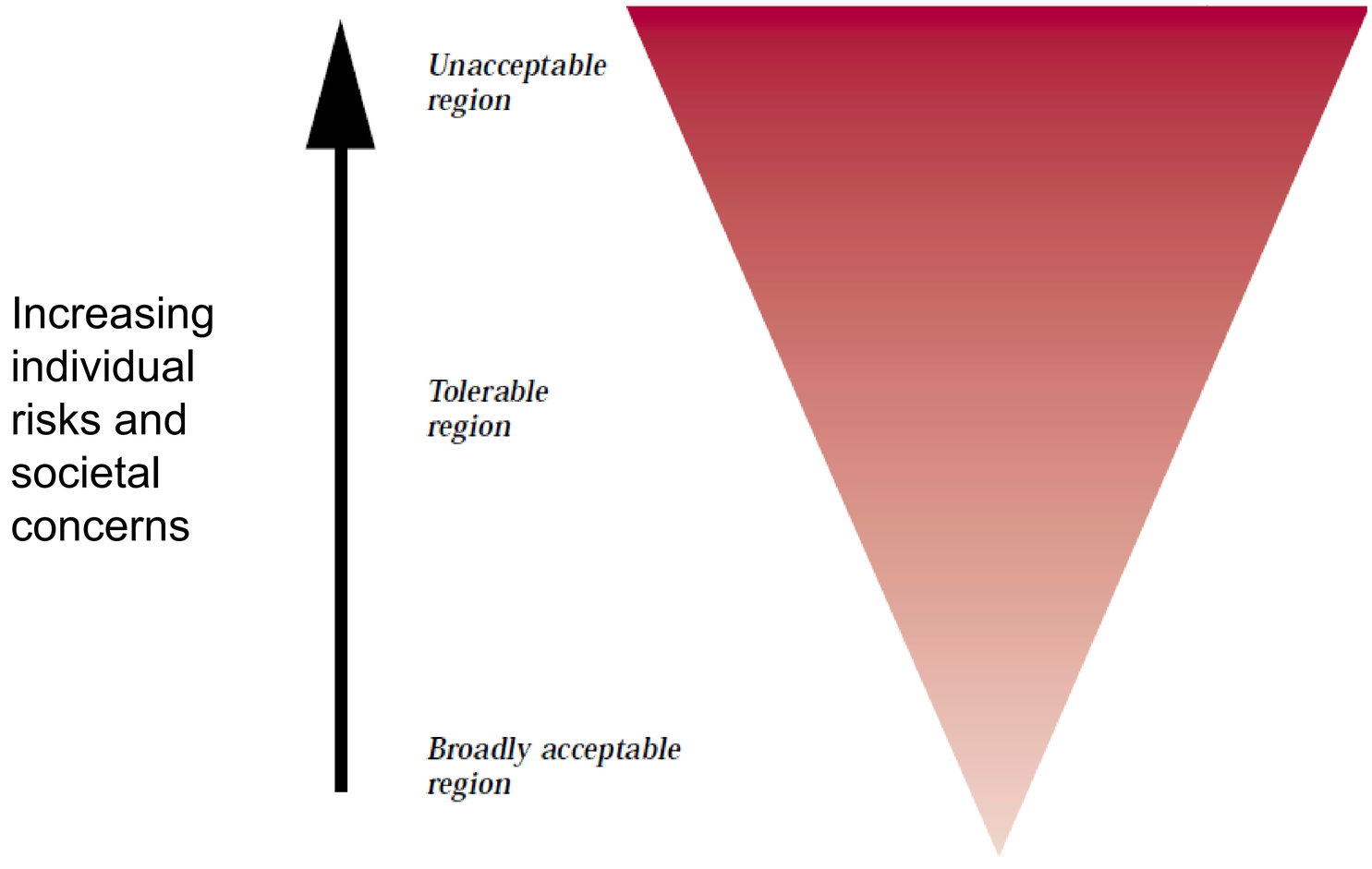
HSE's Tolerability of Risk Framework



Unacceptable region:
risks are unacceptable whatever the benefits

Tolerable region:

risks are tolerated because of the benefits secured, provided the risk is kept as low as reasonably practicable (ALARP) and is not unduly high

Broadly acceptable region:
comparable to risks in daily life, reasonably practicable measures should be taken

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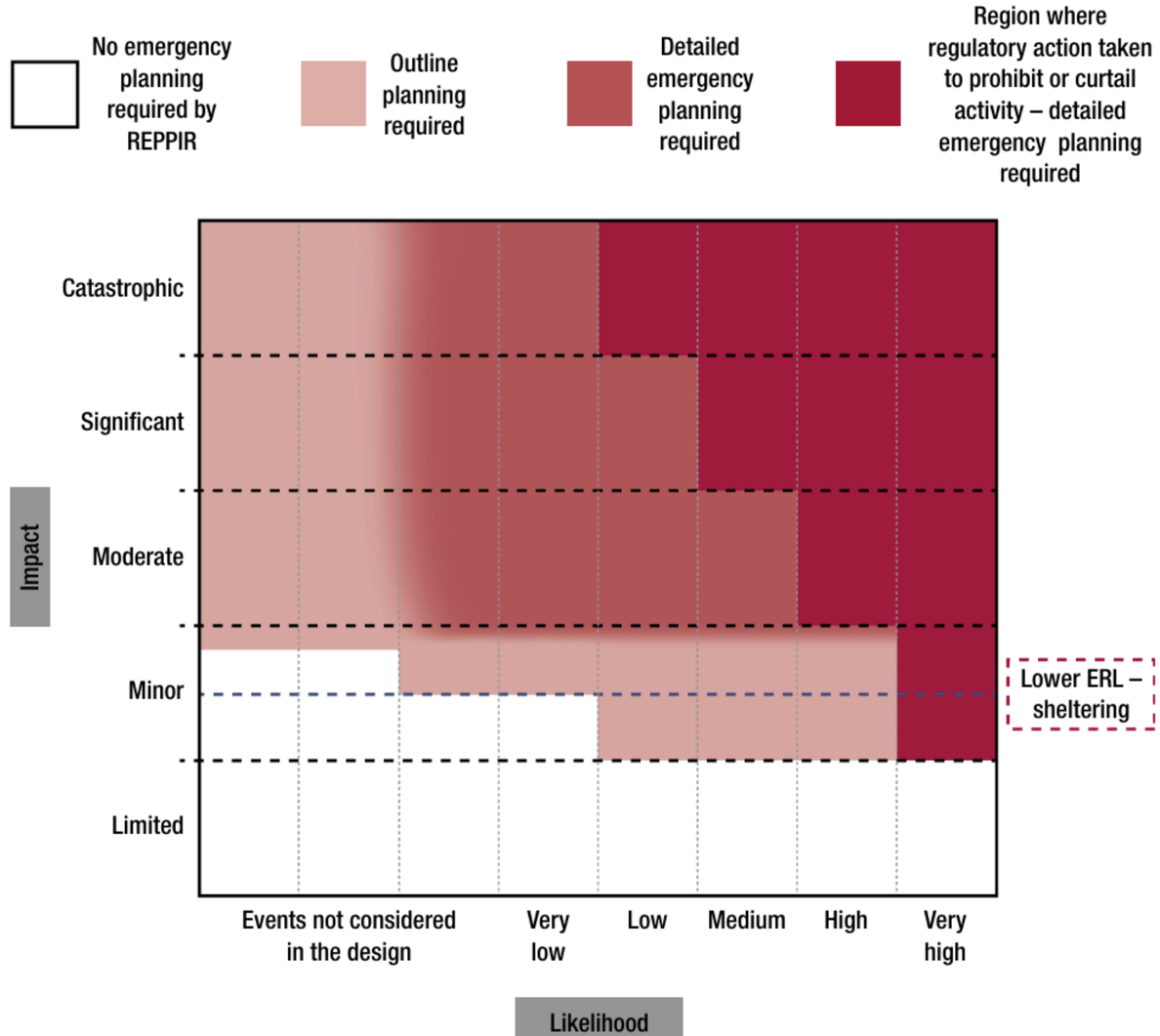
REPPIR Risk Framework



Health and Safety Legislation Applicable to Fusion

(Non-exhaustive)

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Ionising Radiation

Ionising Radiation Regulations 2017

Radiation (Emergency Preparedness and Public Information) Regulations 2019

Non-Ionising Radiation

Control of Electromagnetic Fields at Work Regulations 2016

Control of Artificial Optical Radiation Regulations 2010

Conventional Health and Safety

Construction (Design and Management) Regulations 2015

Control of Substances Hazardous to Health Regulations 2002

Pressure System Safety Regulations 2002

Dangerous Substances and Explosive Atmospheres Regulations 2002

Electricity at Work Regulations 1989

Provision and Use of Work Equipment Regulations 1998

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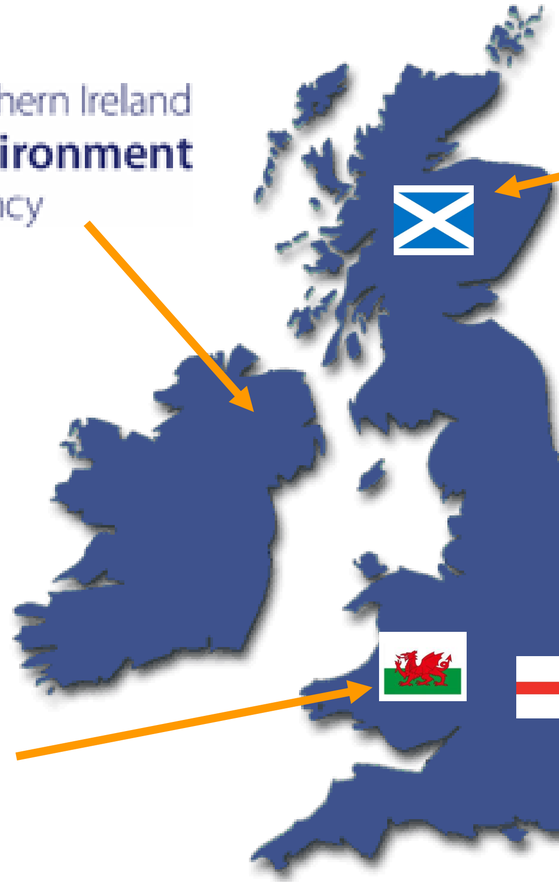
Environmental Regulators

NIEA Northern Ireland Environment Agency
www.ni-environment.gov.uk



SEPA Scottish Environment Protection Agency

Environment Agency

Cyfoeth Naturiol Cymru Natural Resources Wales

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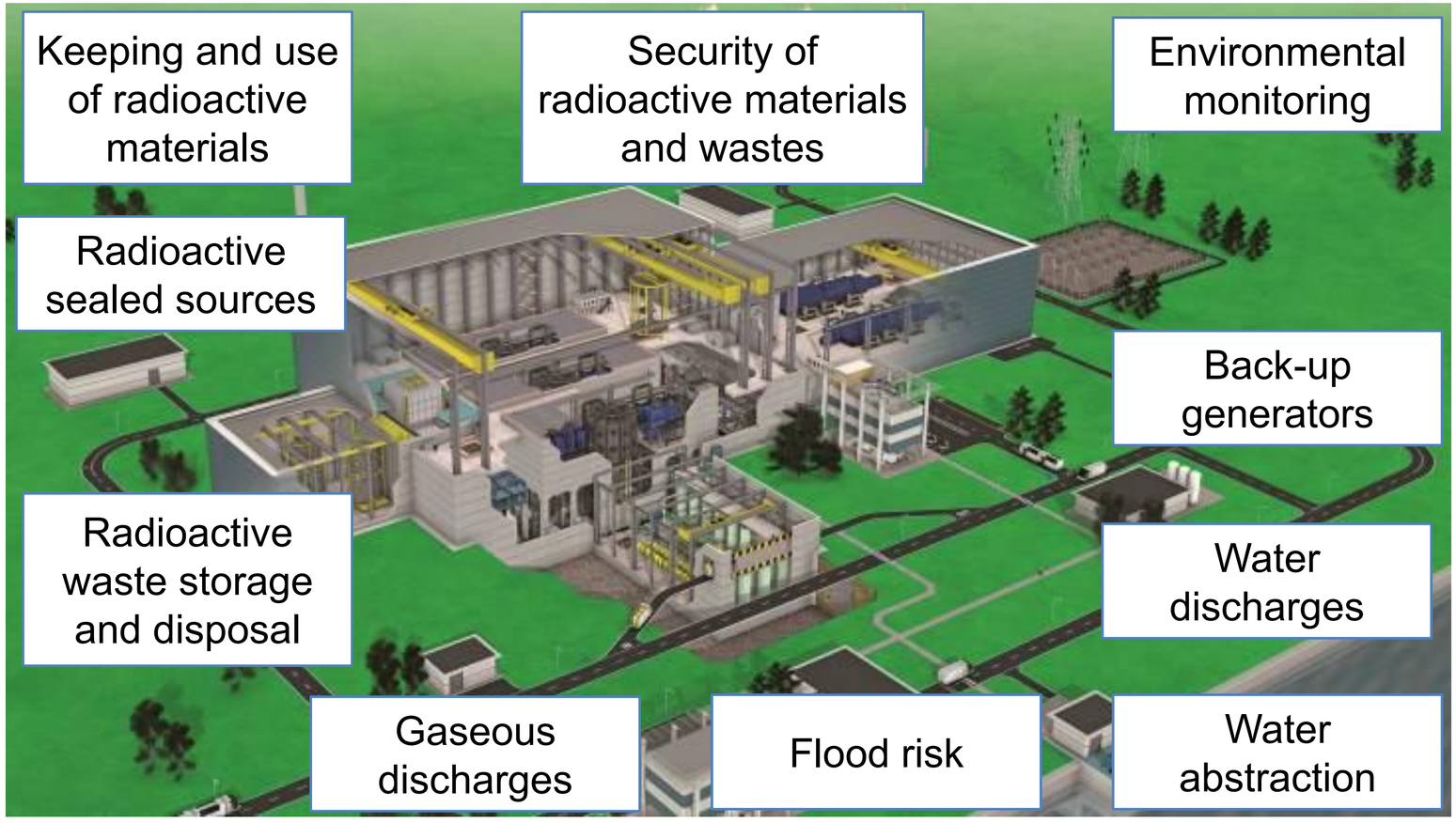
The role of the Environment Agency in Regulating Fusion Sites

- Lifecycle approach
- Conventional as well as radiological hazards
- Goal-setting regulation of radiation based on ICRP pillars and OSPAR
- Regulation of other pollutants often standards based

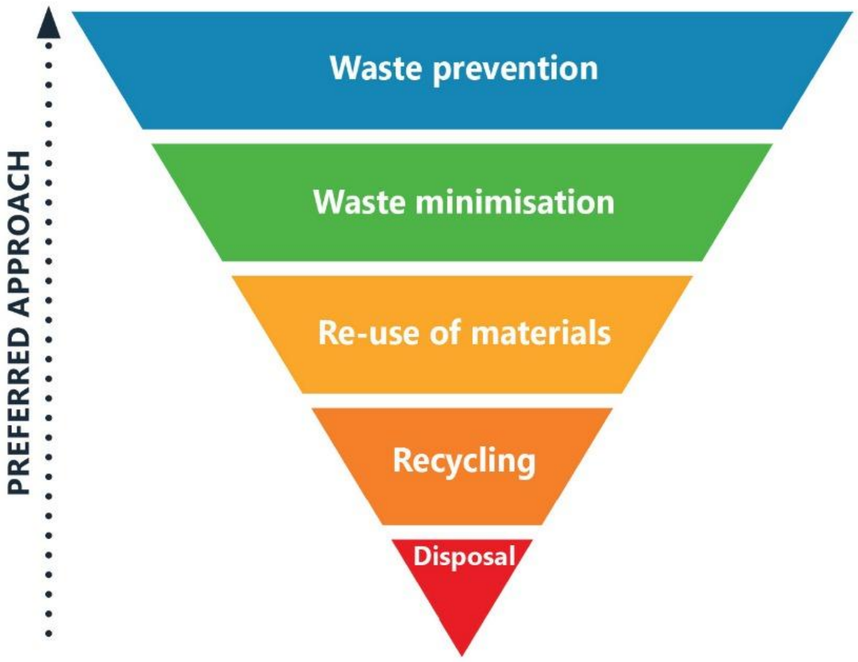


Environmental protection of the public and wildlife

Environment Agency Regulation of Radioactive Substances

Permitting for:

1. Keeping and use of sealed and unsealed sources
    - Includes physical security
2. Accumulation (storage) and disposal of radioactive waste
    - Apply the waste hierarchy
    - Must be demonstrably As Low As Reasonably Achievable (ALARA)
        - Goal-setting approach applying Best Available Techniques (BAT)
    - Public dose limit = 1 mSv/year
    - Dose constraints:
        - 0.5 mSv/year from a site
        - 0.3 mSv/year from a single source



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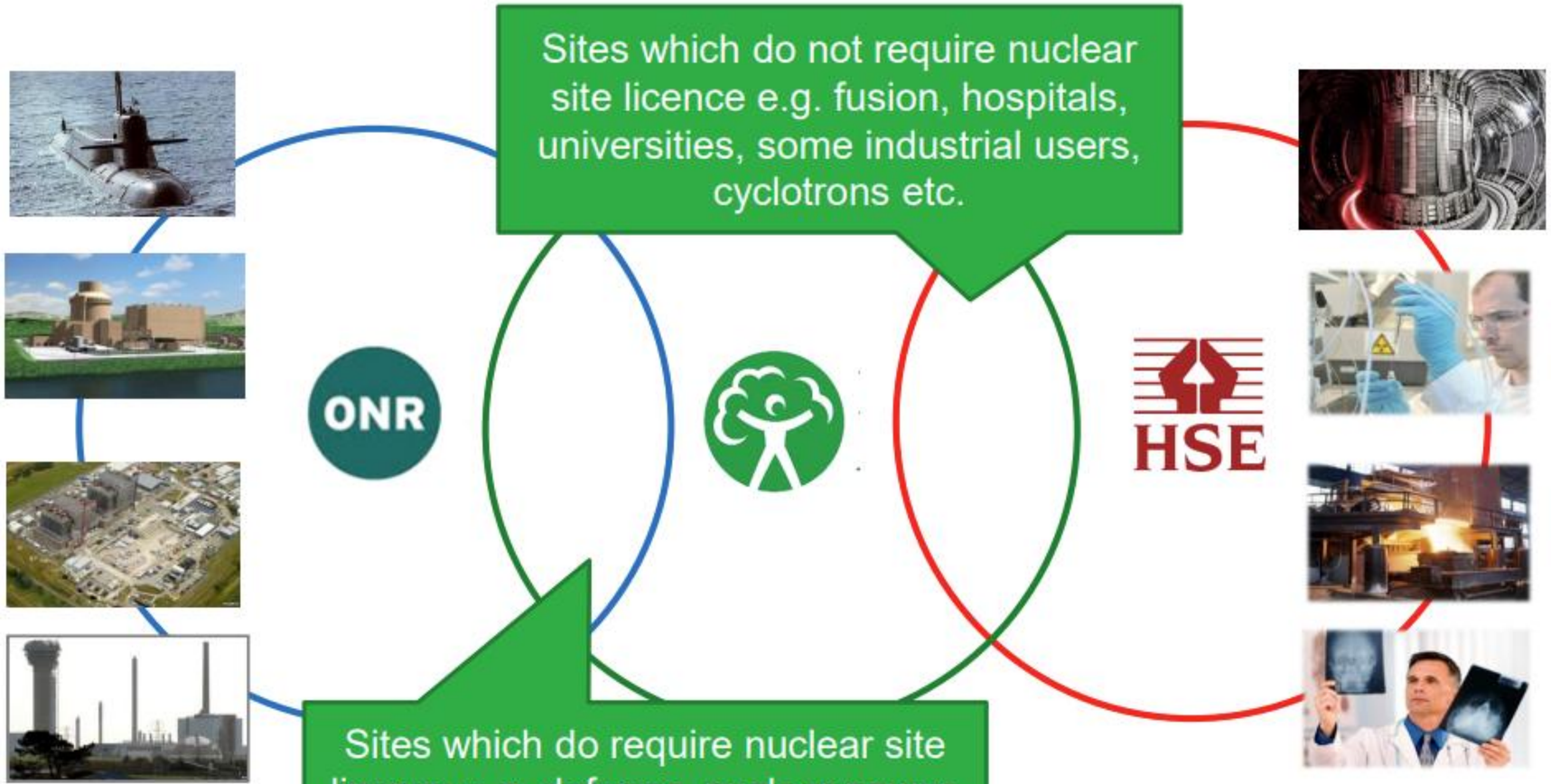
UK Regulatory Framework for RSR



* ONR will continue to have a role in regulating aspects such as radioactive substances transport for fusion energy.

Justification

STATUTORY INSTRUMENTS

2004 No. 1769

HEALTH AND SAFETY

ENVIRONMENTAL PROTECTION

The Justification of Practices Involving Ionising Radiation Regulations 2004

Made - - - -	*8th July 2004*
Laid before Parliament	*9th July 2004*
Coming into force	*2nd August 2004*

Theory | Design | Construction | Operation | Maintenance | Modification | Decommissioning

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Development Consent

Department for Energy Security & Net Zero

Overarching National Policy Statement for Energy (EN-1)

Presented to Parliament pursuant to Section 9(8) of the Planning Act 2008

EN-2 natural gas electricity generation
EN-3 renewable electricity generation (both onshore and offshore)
EN-4 gas supply infrastructure and gas and oil pipelines
EN-5 the electricity transmission and distribution network)
EN-7 nuclear electricity generation
EN-8 Fusion

Theory | Design | Construction | Operation | Maintenance | Modification | Decommissioning

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Environmental Permitting Regulations 2016

Sch 9 - Waste operations
Sch 10 - Landfills
Sch 21 - Water discharge activities
Sch 22 - Groundwater activities
Sch 23- Radioactive substances activities
Sch 25 - Flood Risk Activities
Sch 25A - Medium Combustion plant
Sch 25B - Specified generators

Theory | Design | Construction | Operation | Maintenance | Modification | Decommissioning

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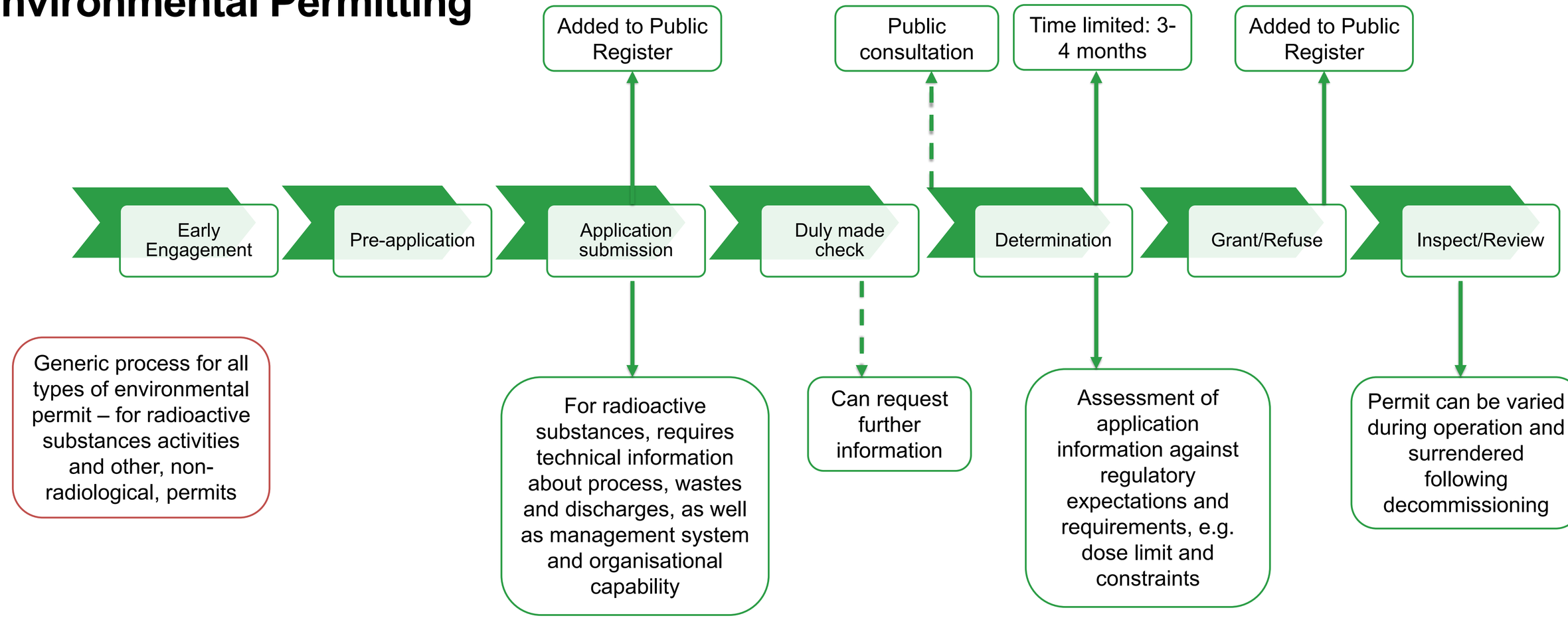
Environmental Permitting



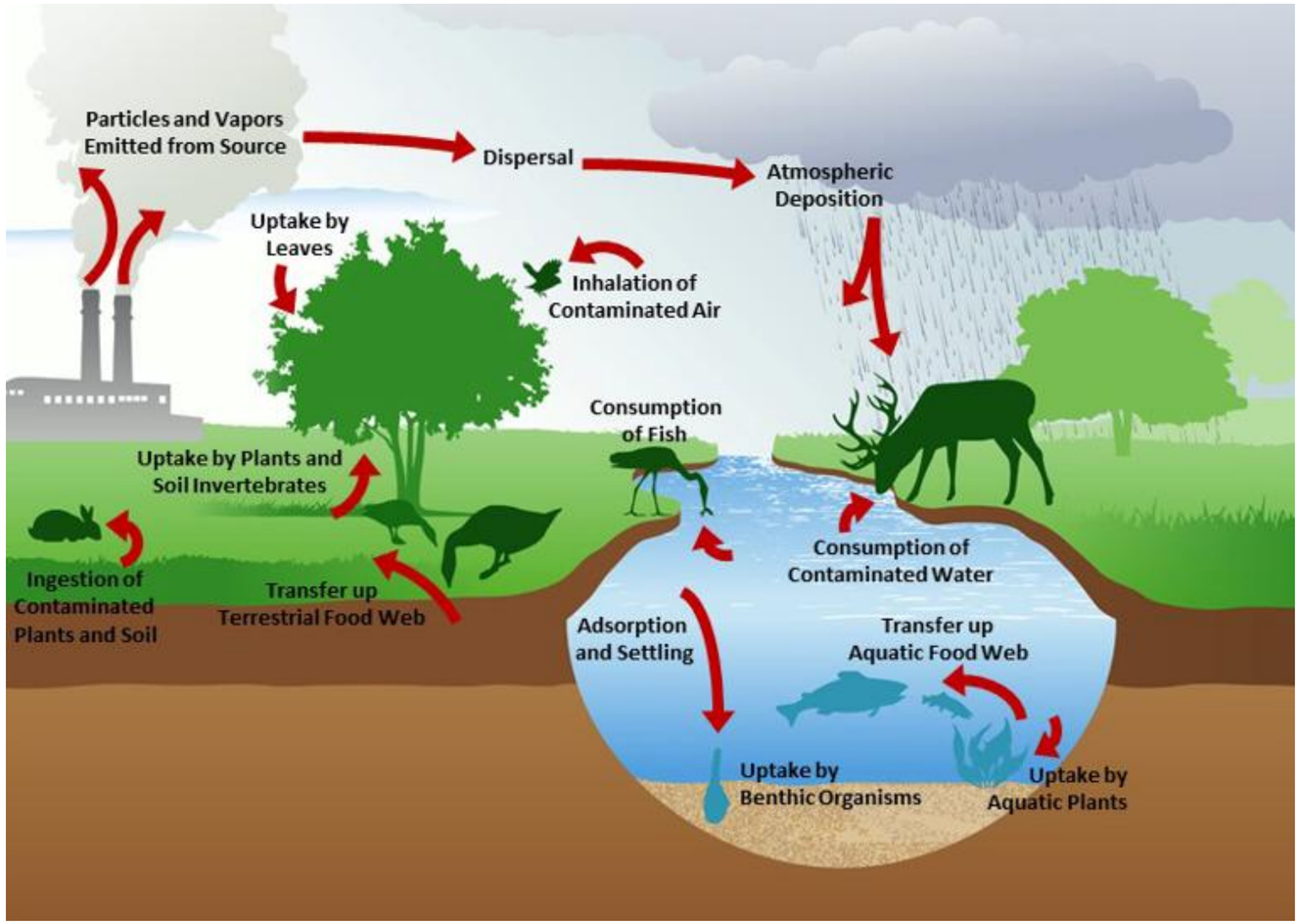
Assessment of BAT

- Graded approach (proportionality)
- Look for:
  - Systematic approach
  - Documented method
  - Lifecycle approach
  - Design for decommissioning
  - Use of data: waste quantification to show waste minimisation
  - Use of the waste hierarchy
  - Justification for using codes and standards

Theory | Design | Construction | Operation | Maintenance | Modification | Decommissioning

Dose Assessment

- Estimate doses from planned radioactive discharges.
- Assess representative exposed people and pathways.
- Assess impacts on non-human biota
- Use conservative, evidence-based environmental models.
- Compare predicted doses with regulatory criteria.
- Inform permitting decisions and discharge limits.

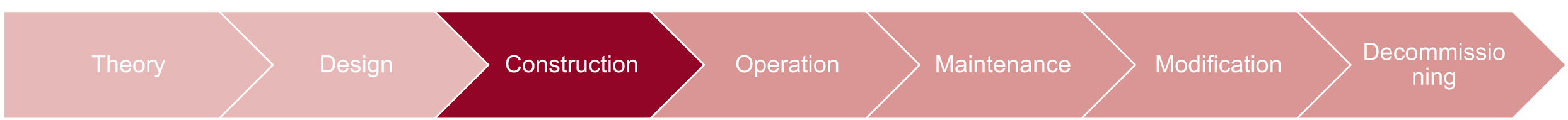


Safety Regulation during construction

- Regulated under the Construction (Design and Management) Regulations 2015
  - Sets out roles and responsibilities on construction projects
  - Hazard specific legislation still applies

- Fusion Energy Facilities will be large scale construction projects, requiring notification to HSE (F10)

- If subject to Control of Major Accident Hazard Regulations 2015 (COMAH) a pre-construction safety report is required for upper tier sites.

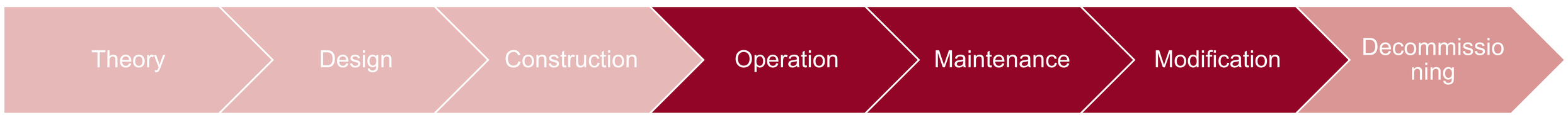


Safety Regulation Prior to Operation

- Operators will submit any necessary IRR consent applications prior to operation, which includes a site inspection from HSE.

- Operators will also carry out a REPPIR assessment where necessary to identify, mitigate, and plan for any offsite risks, coordinating with Local Authorities.

- If subject to Control of Major Accident Hazard Regulations 2015 (COMAH) a pre-operation safety report is also required for operators of upper tier sites.



Sch23 - Environmental Permit

STATUTORY INSTRUMENTS

2016 No. 1154

ENVIRONMENTAL PROTECTION, ENGLAND AND WALES

The Environmental Permitting (England and Wales) Regulations 2016

Made - - - - 11th December 2016

Coming into force in accordance with regulation 1(1)

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General

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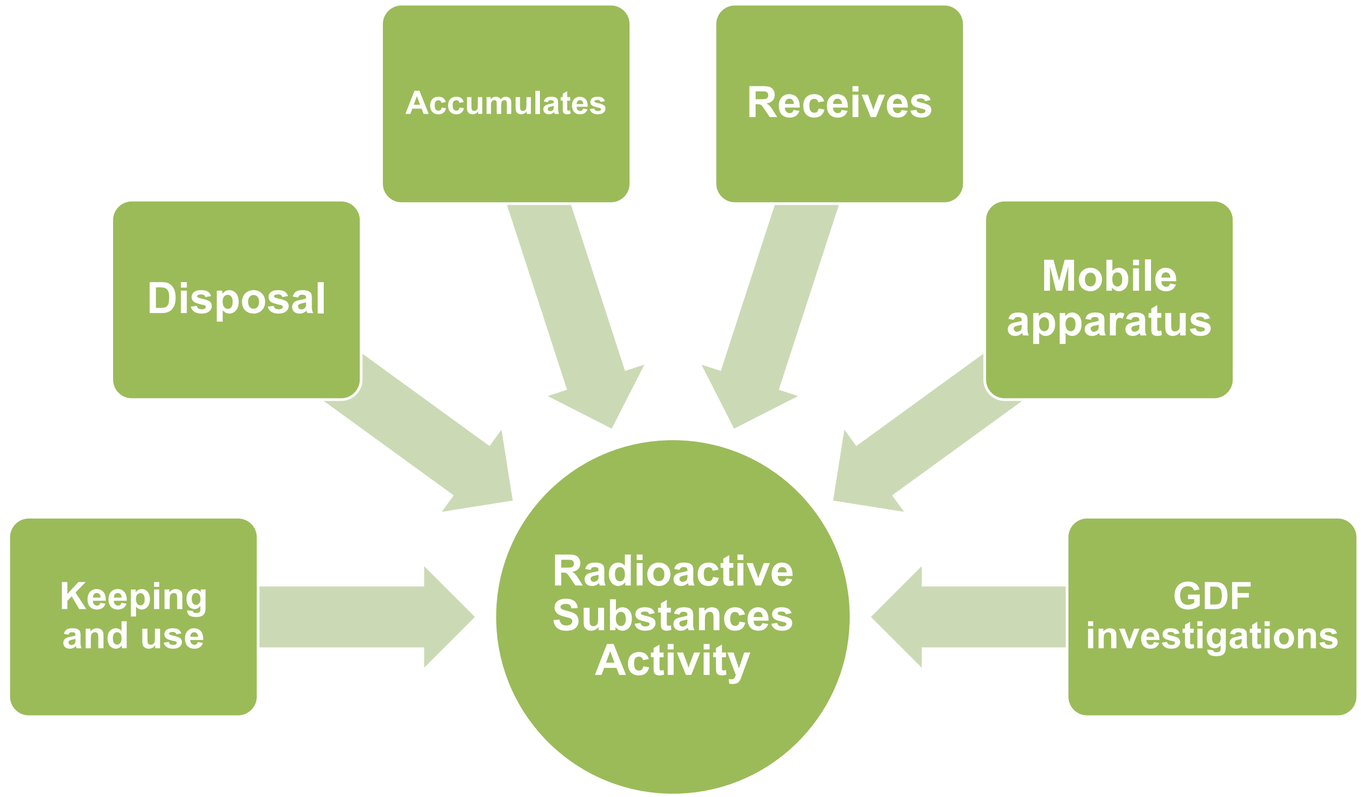

Theory | Design | Construction | **Operation** | Maintenance | Modification | Decommissioning

Standard EPR Permit Conditions for RSR Operators

Management	General management
Operations	Permitted Activities and site definition
	Operating Techniques
	Improvement and information programme
	Pre-operational conditions
	Receipt of radioactive waste & accumulation
Disposal of radioactive waste and monitoring	Disposal of radioactive waste
	Monitoring
Information	Records
	Reporting
	Notifications
	Interpretation
Schedules	Operations
	Holdings of Unsealed Sources & Accumulation of radioactive waste
	Disposal of radioactive waste and monitoring
	Reporting
	Notification form
	Interpretation
	Site Plan

Theory | Design | Construction | **Operation** | Maintenance | Modification | Decommissioning

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Compliance Assessment Activities

- Site inspection
- Audit
- Check monitoring or sampling
- Review reports and data
- Review operator's procedures

Theory → Design → Construction → **Operation** → Maintenance → Modification → Decommissioning

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Non-Compliance → Enforcement

Score	Definition
CCS 1	Would have the **potential** to have a major environmental impact
CCS 2	Would have the **potential** to have a significant environmental impact
CCS 3	Would have the **potential** to have a minor environmental impact
CCS 4	Has no **potential** to have an environmental impact

- Prosecution
- Formal caution
- Enforcement Undertaking
- Warning Letter

Theory → Design → Construction → Operation → Maintenance → Modification → Decommissioning

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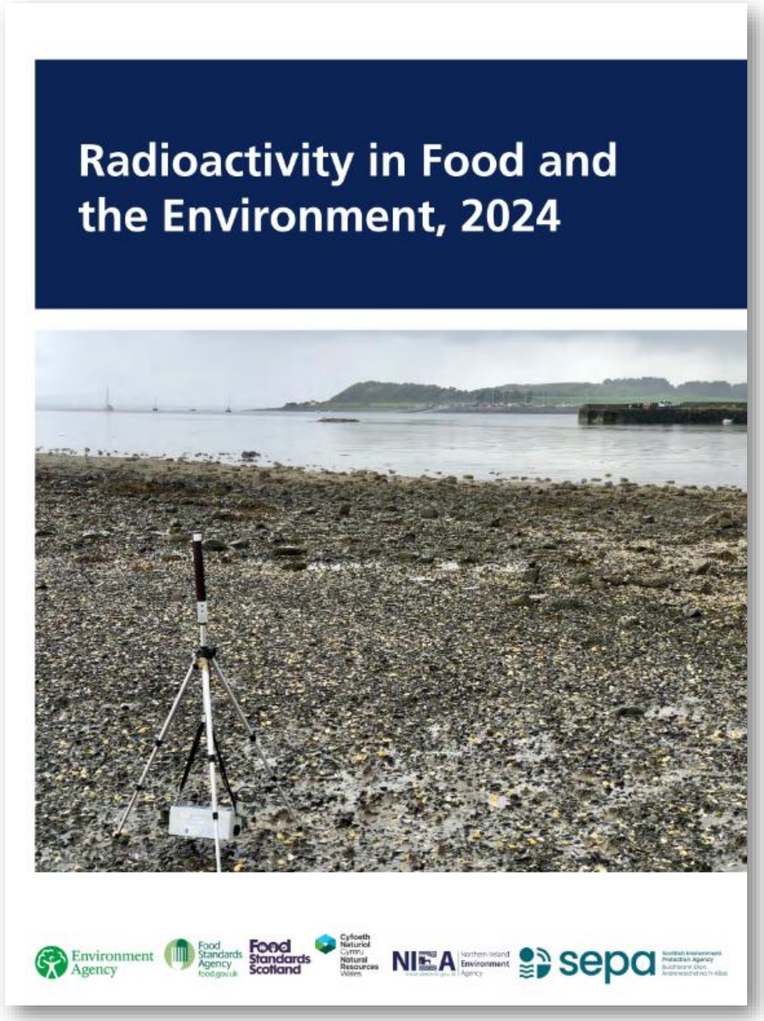
Independent Monitoring

- Annual Report
- Provides public assurance
- Assurance of Operator Monitoring



Theory → Design → Construction → Operation → Maintenance → Modification → Decommissioning

Gaining Experience from JET Decommissioning

- Considering future waste inventories against currently available and postulated waste infrastructure
- Lessons from other complex decommissioning missions e.g. nuclear

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Points and Views to Note:

UK keeps regulations under review, in both mature and novel industries, to ensure they are effective and proportionate.

Any individual site and design would be assessed on its own merits.

Fundamental principle is that it is for dutyholders to assess and manage the risks.

Under a first principles approach, increased understanding as industry develops should define approach

The UK is an active member of IAEA as global understanding develops for fusion.

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Policy paper

Fusion regulation landscape

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Recent Information and Practical Next Steps

HSE Health and Safety Executive

Home › Topics

Fusion energy facilities

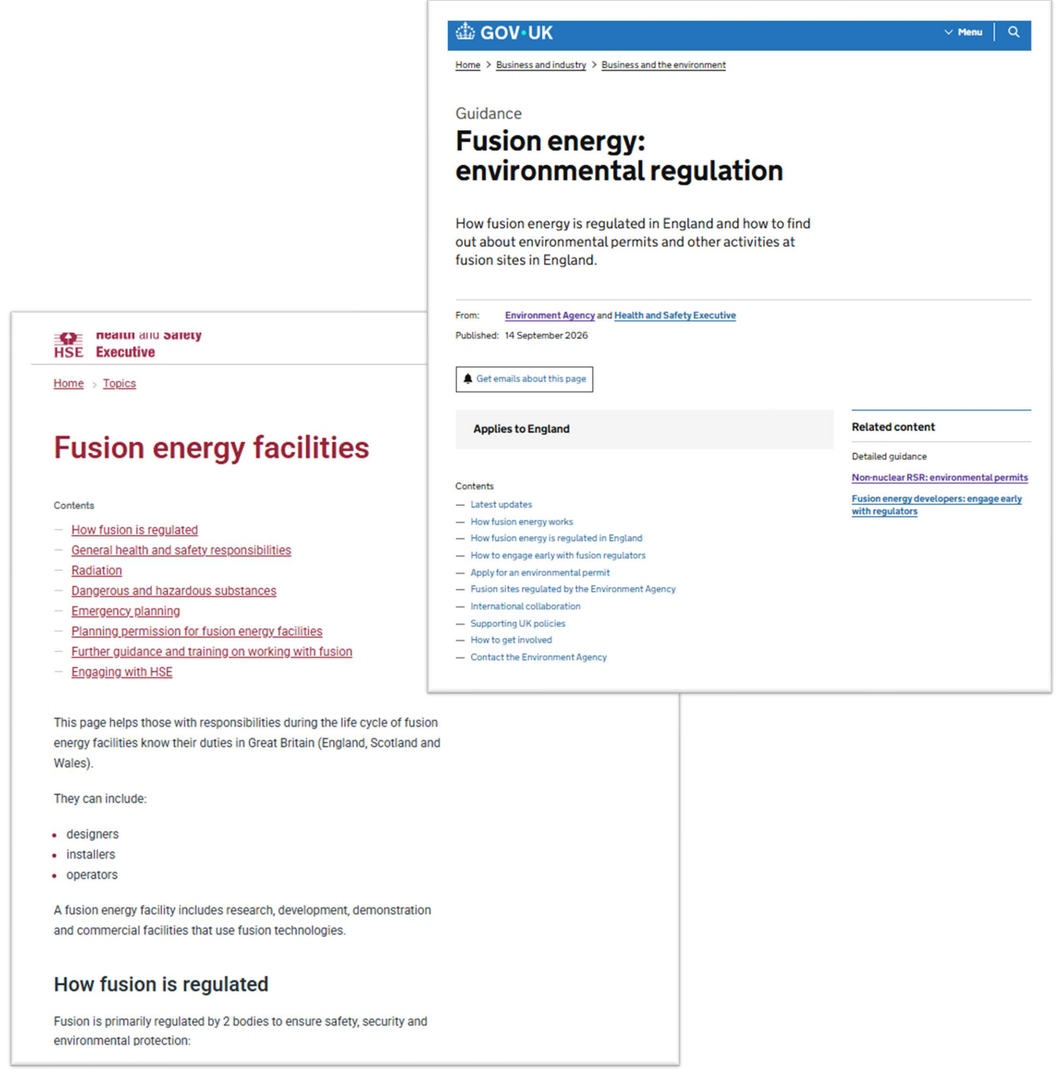
- DESNZ Published the Regulatory Landscape Document
  - Sets out the requirements of fusion developers as they move towards operation
  - Includes land use planning, justification, permits and consents. Dutyholders remain responsible for being aware of and compliant with all their legal obligations.
- HSE and Environment Agency have published respective fusion landing pages
  - HSE has published a fusion energy facility landing page on its website. This signposts dutyholders to further information on some of their legal duties.
  - Environment Agency have published information on GOV.UK about their regulation of fusion facilities, including around relevant permits

Initial Engagement Process

- HSE and Environment Agency have web pages describing how developers can engage with regulators

- This includes information on:
  - When it is appropriate point to seek to engage
  - How to contact the regulators
  - The purpose and focus of initial engagement, around mutual understanding.

- HSE and the Environment Agency will hold any proposed introductory meetings jointly where appropriate.



https://www.hse.gov.uk/fusion/index.htm

https://www.gov.uk/guidance/fusion-energy-environmental-regulation

Fusion Engagement Day

- HSE and EA will host a Fusion Engagement Day in early 2027.

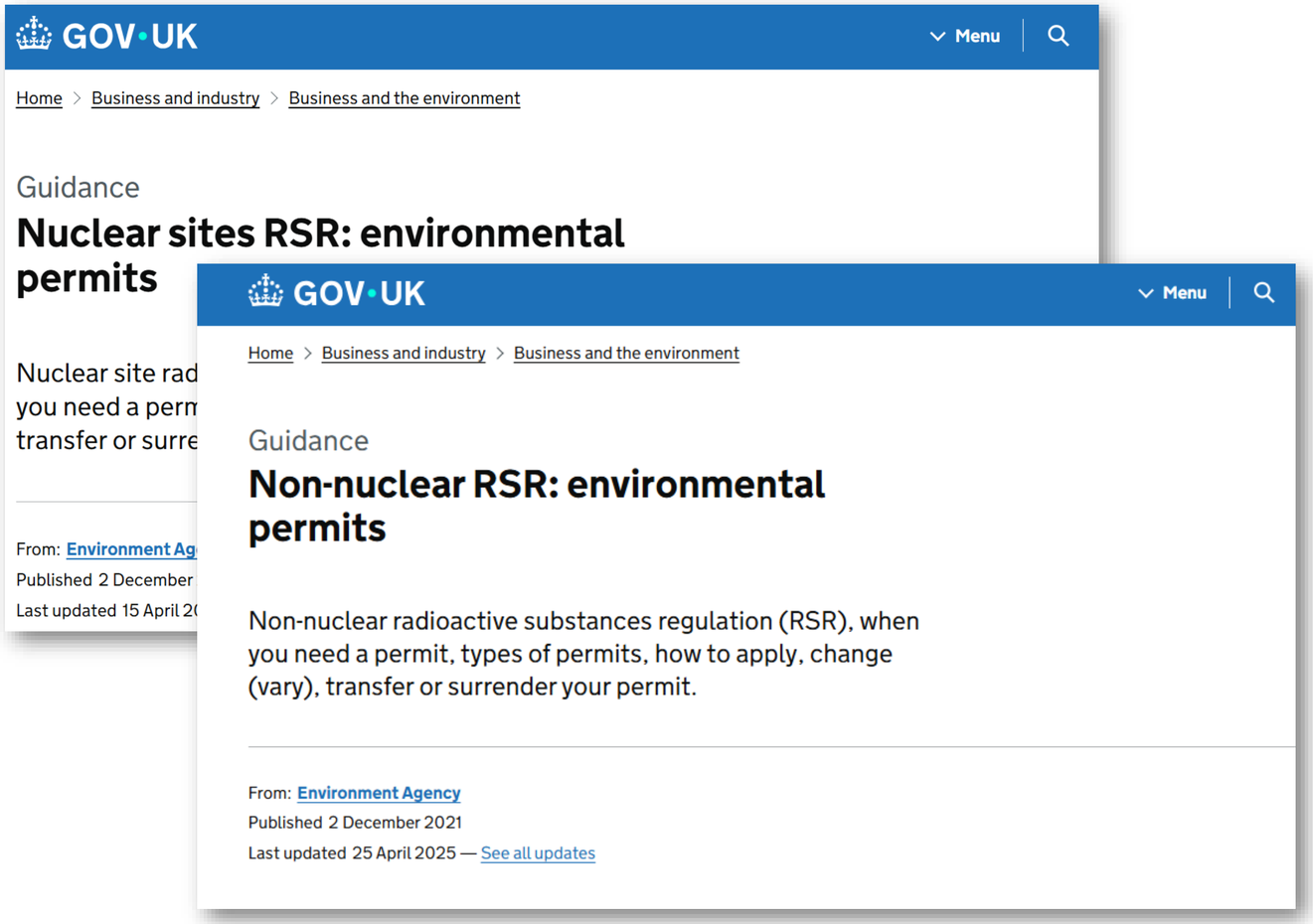
- This will bring together industry, academia, regulators and others

- This event will focus on
  - Our roles as regulators
  - Engaging with the fusion industry, and how industry can collaborate
  - Occupational, environmental and societal hazards applicable to fusion

- We will also have collaboration with others such as the UK Atomic Energy Authority on the scientific evidence base.

Published Guides

- **England and Wales**



- **Scotland**

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Guidance

RSR permits for nuclear licensed sites: how to comply

Published 13 February 2020

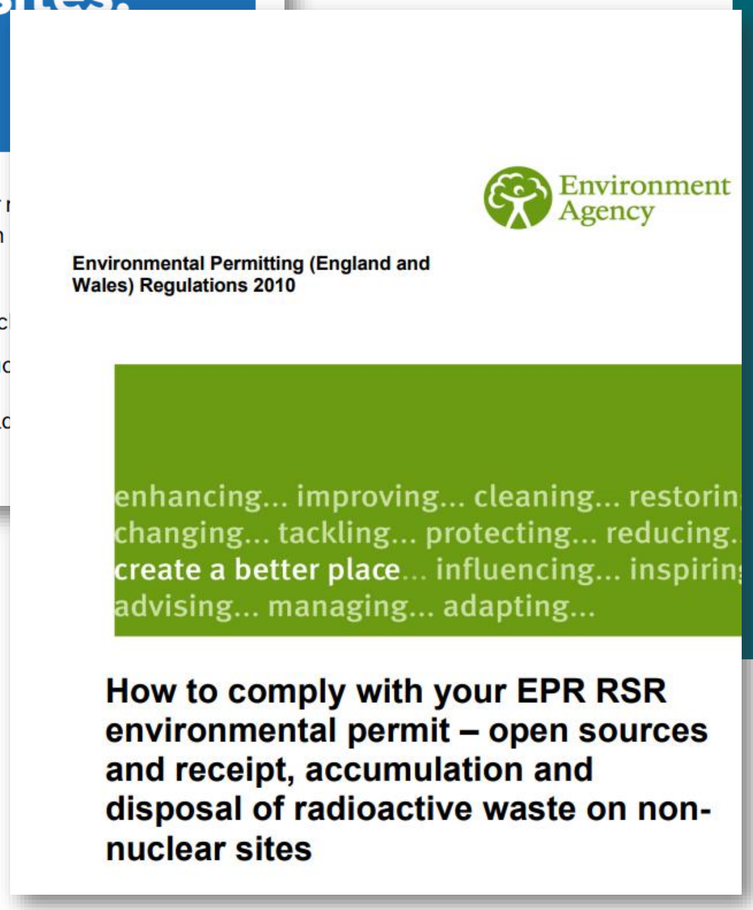
Contents

Purpose of this guidance
Regulatory approach for RSR permits
Management conditions
Operations conditions
Disposal conditions
Monitoring conditions
Information conditions

This guidance is for operators with an environmental permit for r
activities on nuclear licensed sites. It explains the conditions in
regulation (RSR) permits for:

- receiving and disposing of radioactive waste on and from nuc
- tenants who keep or use unsealed radioactive sources on nuc

Operators that keep or use mobile radioactive apparatus should
guidance on keeping or using sealed sources, where relevant.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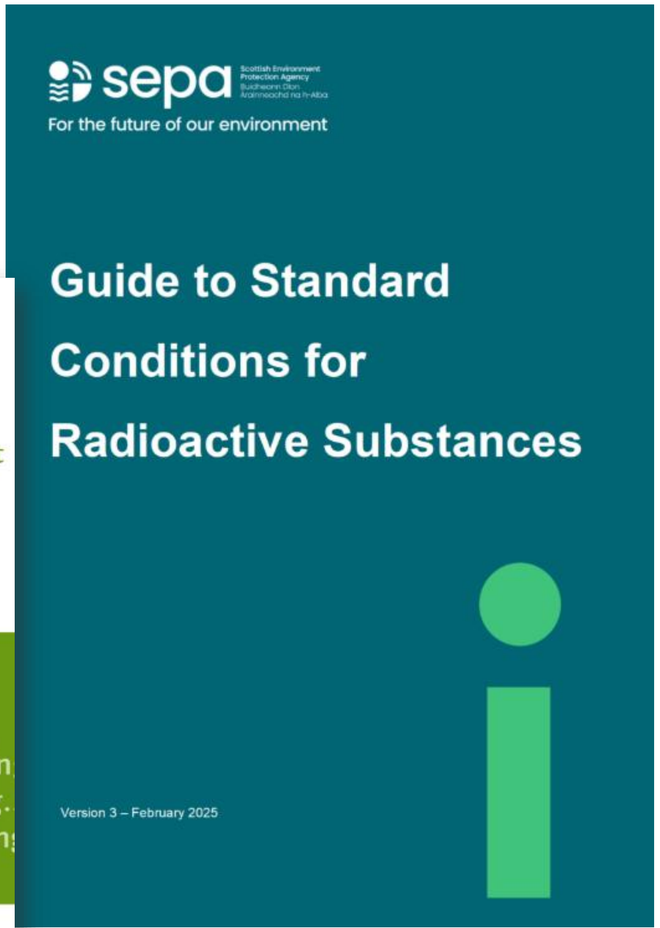
Environmental Permitting (England and Wales) Regulations 2010

enhancing... improving... cleaning... restorin
changing... tackling... protecting... reducing.
create a better place... influencing... inspirin
advising... managing... adapting...

How to comply with your EPR RSR environmental permit – open sources and receipt, accumulation and disposal of radioactive waste on non-nuclear sites


sepa Scottish Environment Protection Agency Buidheann Dìon Àrainneachd na h-Alba

For the future of our environment

Guide to Standard Conditions for Radioactive Substances

Version 3 – February 2025

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Any Questions?

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