Towards Fusion Energy: the UK Government's Proposals for a Fusion Regulatory Framework

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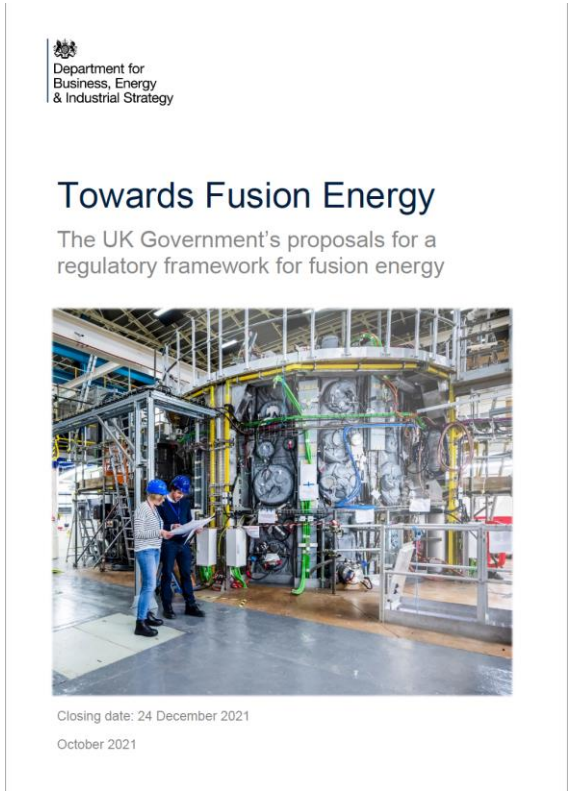
Towards Fusion Energy

- UK Government published a Green Paper and Strategy with proposals for the regulatory framework for fusion energy (1st Oct 2021).

- Green Paper covered topics of relevance to this meeting, including:
  - Safety & Regulation
  - Security
  - Safeguards
  - Liabilities



Aims and Objectives

Aims of the Green Paper:

- The Government wants to clarify the regulatory framework for fusion energy now to provide confidence to industry, investors and the public.

View of the Joint European Torus (JET) facility © UKAEA

Objectives for a successful regulatory framework for fusion energy:

- **Safety**: Maintain human and environmental protections, in a way that is proportionate to the hazards and risks involved.
- **Transparency**: Ensure transparency to enhance public assurance.
- **Innovation**: Make the UK the best place in the world for commercialising fusion energy through enabling regulation that offers certainty to fusion developers and investors.

Content of the Green Paper

The UK Government's Green Paper looks at:

- Whether the existing regulatory framework for fusion will be appropriate and 'fit for purpose' over the next 20-30 years, and whether an alternative approach and/or regulator may be more appropriate

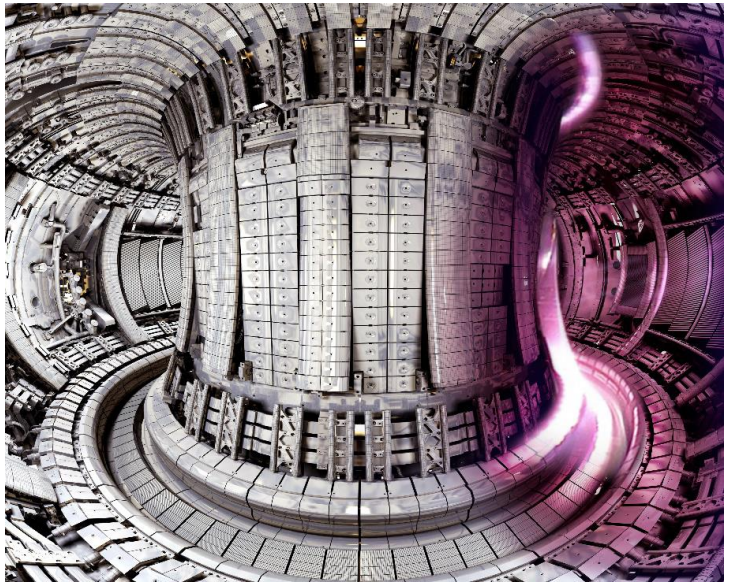
- Whether existing regulatory provisions should be amended and new provisions introduced, in order to ensure that the associated hazard and risks are effectively managed by the fusion sector and to provide clarity and certainty for industry and the public

- How the regulatory framework and related policy areas should evolve as fusion technology is developed

Current approach to regulating fusion

Current Regulations:

- Fusion research and development in England is regulated by the Environment Agency (EA) and the Health and Safety Executive (HSE) as a "radiological substances activity".
- Goal-setting approach
- Devolved regulators have equivalent powers.
- Current approach recognised as fit for purpose by regulators and wider fusion industry.



Inside the Joint European Torus (JET), EUROfusion

Hazards of Fusion Energy Facilities

- Like any industrial process, there are risks to workers, the public and the environment which need to be mitigated through regulation.

- Hazards include tritium, activated materials and waste, magnetic fields, toxic substances

- From UKAEA Fusion Safety Authority literature review to assess worst case scenarios, the Government has concluded that **the maximum hazard of fusion is of a similar magnitude to other major industrial activities successfully regulated by EA and HSE.**
    - Unmitigated or hypothetical accident scenarios in the aviation, oil and gas industries could have similar or worse consequences, involving multiple fatalities and/or severe environmental damage.

UKAEA's Materials Research Facility (MRF) prepares and examines samples of radioactive materials to assess their performance © UKAEA

Uncertainty and UK regulation

- Fusion is a developing technology and fusion power plants are yet to exist to provide safety data.
- There are still elements of uncertainty around the overall hazard of fusion power plants.
- But the **risk-based and goal-setting approach of UK regulators** enables them to be adaptable and innovative in determining whether a fusion facility is managing the risks proportionately and effectively in the face of technological uncertainty.

Working with hazardous material © UKAEA

Main proposals

1. To maintain the UK's existing, goal-setting regulatory approach to operational permitting of fusion facilities – the Government believes that this is broadly appropriate for the level of hazard of fusion energy facilities and would provide a proportionate consenting and permitting regime
2. To clarify fusion's status with regards to existing nuclear regulations and introduce new provisions necessary for the efficient, effective and proportionate regulation of fusion power plants
3. To work with the regulators to consider whether and how enhanced engagement and new guidance for fusion developers could help support the safe and rapid deployment and commercialisation of fusion energy technology

Proposals to cover at least the prototype generation of fusion energy facilities

Policy will remain under review – particularly if technology choices of fusion developers has significant implications for overall fusion hazard

Table of proposals (1)

Topic	Why is action necessary?	The Government's Proposals	Intended outcomes
Regulatory Justification of Fusion	Fusion energy production is not currently a "justified activity".	UKAEA's STEP programme should develop and submit an application for the operation of fusion power plants to be a justified activity, working with the wider fusion industry in doing so.	If approved by the Justifying Authority, fusion energy production becomes a justified practice, and therefore is a permissible use of ionising radiation in the UK.
Fusion and the definition of a nuclear installation	The existing legislative definition of "nuclear installation" was not developed with fusion in mind and could be clearer in whether or not it applies to fusion power plants, to remove the risk of inconsistency and disruption.	The Government will legislate to confirm that fusion power plants would not be legally defined as nuclear installations.	Provide clarity on the overall regulatory regime for fusion power plants in the UK.
Planning process for a fusion power plant	The currently assumed planning process for fusion power plants in England would be inefficient and make fusion an outlier compared to the planning process for other electricity producing facilities.	The Government will develop a Fusion Policy Statement to align the planning process for fusion power plants with other nationally significant infrastructure projects and electricity producing facilities.	Establish a more efficient planning process for fusion power plants.
Fusion and Third Party Liabilities	There is no existing requirement for a fusion power plant operator to hold insurance provisions that could sufficiently cover costs arising from accidents to guarantee third party claims can be met (although claims could still be brought).	The Government will consider whether and how to introduce an appropriate liability regime for fusion.	Make sure that third party costs arising from any fusion accident would be met by the fusion operator, and that the cost of the necessary insurance provisions is proportionate to the liabilities involved.

Table of proposals (2)

Topic	Why is action necessary?	The Government's Proposals	Intended outcomes
Regulatory Engagement	There is no formal process for additional engagement in the design phase between fusion developers and regulators, nor specific guidance to ensure fusion developers' understanding of regulatory obligations.	Regulators should consider options for formalised engagement processes and guidance specific to fusion power plants, using the Government's proposed definition on page 56 to identify the facilities in scope.	Ensure regulatory compliance, build technical capability of regulators and reduce the costs of commercialising fusion technology in the UK.
Public Engagement	While there are multiple opportunities for the public to engage during the regulatory process, there is no explicit obligation for fusion power plant developers to engage with the public about their designs or facilities to enhance transparency	Regulators should consider whether there should be additional opportunities for the public to be consulted during the regulatory process. Fusion developers should ensure that they engage fully and transparently with the public at the appropriate stages.	Maximise public confidence in the regulatory framework for fusion.
Cyber Security	Fusion power plant developers would not be legally required to adhere to current cyber security regulations for energy infrastructure or nuclear installations, potentially leaving operators vulnerable to cyber attacks.	The Government will consider what would be proportionate and appropriate cyber security regulations for a fusion power plant.	Ensure the safe and secure operation of a fusion power plant, in line with existing cyber security policy around energy infrastructure.

Table of proposals (3)

Topic	Why is action necessary?	The Government's Proposals	Intended outcomes
Nuclear safeguards	Tritium is not defined as a source or special fissionable material by the IAEA and is not covered by nuclear safeguards. Tritium sourced from Canada is covered under UK-Canada nuclear cooperation agreement. This would not apply to tritium produced in future fusion power plants. There also may be other safeguards implications beyond tritium as fusion technology develops.	The Government will keep safeguards in the context of fusion under review, with the planning assumption that the ONR would be responsible.	Uphold UK compliance with international treaty obligations in respect of safeguards
Radioactive Waste Management and Decom-missioning for Fusion	Though there would be no High Level Waste produced by fusion power plants, there is uncertainty on how much waste will be produced and what classification that waste would fall under. However, no major changes are directly required to existing policies or regulations on waste or decommissioning	The Government will keep policy on fusion waste and decommissioning under review as fusion develops.	In line with existing policies, ensure that radioactive waste from fusion is minimised and handled safely and in proportion to the hazards involved, and ensure that the decommissioning of fusion power plants is undertaken as safely and as efficiently as possible
Export controls	No set guidance or framework for fusion technology generally, though there are existing provisions for particular substances (e.g. tritium) and materials.	The Government will work with experts, regulators and other organisations to consider whether further guidance should be developed.	Enable UK industry to export fusion technology and promote best practice to international partners.
Regulatory Capacity and Capability	Over the coming decades, regulators would need to build technical capability to regulate fusion power plants.	Regulators should monitor the growth of the sector and increase capability accordingly, bringing in specialist expertise as required.	Ensure regulators have the technical capability to regulate fusion power plant effectively

Other factors

- **Regulatory harmonisation** will be essential for global development and deployment of fusion –this requires sustained international engagement.

- To successfully commercialise fusion, **public understanding** of and support for fusion energy is crucial. Trust in regulatory measures will be a key factor in that support.

Illustration of UKAEA fusion scientists and engineers. © UKAEA

Links

Regulation Green Paper: https://www.gov.uk/government/consultations/towards-fusion-energy-proposals-for-a-regulatory-framework

Fusion Strategy: https://www.gov.uk/government/publications/towards-fusion-energy-the-uk-fusion-strategy

UKAEA Tech Report: https://scientific-publications.ukaea.uk/wp-content/uploads/UKAEA-RE2101-Fusion-Technology-Report-Issue-1.pdfLinksOfficial