
The UK Government's proposals for a regulatory framework for fusion

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UK Fusion Strategy

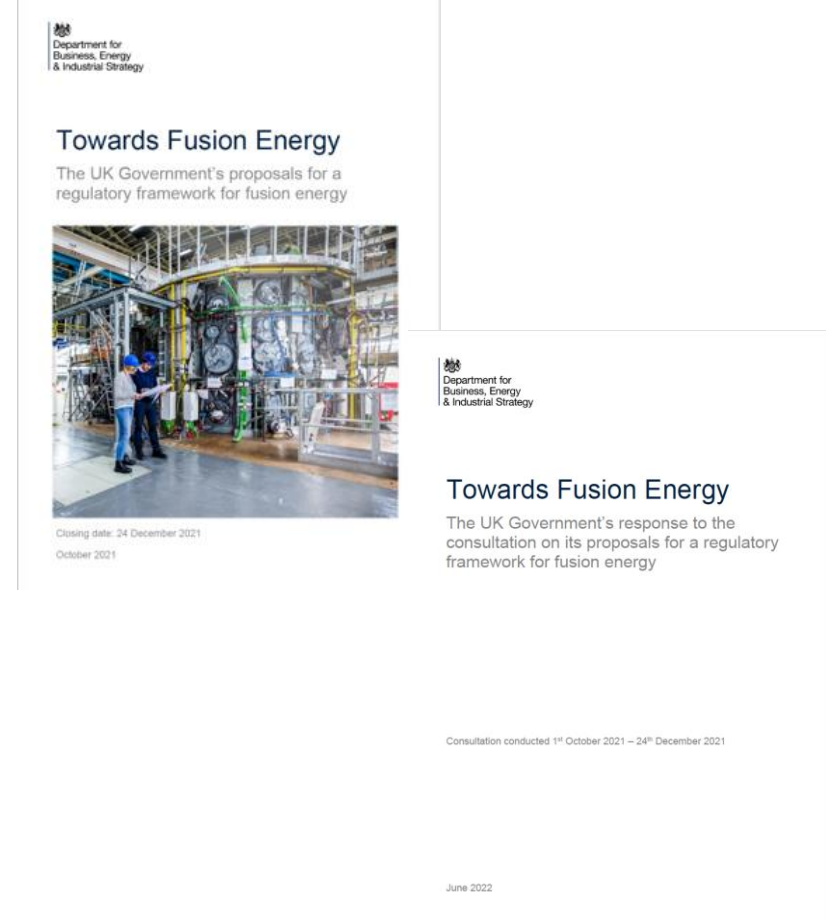
Goals of the Fusion Strategy:

- UK to demonstrate the commercial viability of fusion by building a prototype fusion power plant in the UK that puts energy into the grid (STEP designed, developed and built by 2040).
- UK to build world-leading fusion industry which can export fusion technology around the world.
- To achieve this, the UK will work to secure leadership in fusion across three pillars – international, technical and commercial.



Regulatory Framework

- UK Government published proposals for a regulatory framework in the Green Paper Towards Fusion Energy.
- 58 responses to the consultation from the public, industry, academia & other fusion stakeholders around the world.
- UK Government published its response to the consultation in June 2022.



Consultation aims

The Green Paper sought views on the following broad areas:

- Whether the existing regulatory framework for fusion will be appropriate and 'fit for purpose' over the next 20-30 years.
- Whether existing regulatory provisions should be amended and new provisions introduced.
- How the regulatory framework and related policy areas should evolve as fusion technology is developed.



Representation of UKAEA working with hazardous material © UKAEA



Consultation objectives

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



Illustration of STEP prototype power plant facility. © UKAEA



Fusion Regulation Green Paper

Current Regulations:

- The safety of fusion research and development (R&D) in Great Britain is regulated by the Health and Safety Executive (HSE) and in Northern Ireland (NI) by NIHSE as a "radiological substances activity".
- Environmental regulation of fusion R&D in the UK is undertaken (as a devolved matter with separate regulators for England, Northern Ireland, Scotland and Wales) as a "radiological substances activity".
- Current goal-setting approach recognised as fit for purpose by regulators and wider fusion industry.



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



Fusion Hazards

Fusion Technology and Hazards

- Government position is clear: regulatory framework should be proportionate to the hazards involved.
- Like any major industrial process, there are risks to workers, the public and the environment which need oversight through regulation.
- Most significant (radiological) hazards are tritium and activated materials – these are critical to identifying ‘bounding accident scenarios’ through which we can determine overall proportionality.
- Important to note that fusion hazards are both radiological and non-radiological, with potentially complex interactions. A fusion regulatory framework will need to be able to manage this.
 - This was looked at in more detail in a technical annex to the government’s response to the consultation.



Accident Scenarios

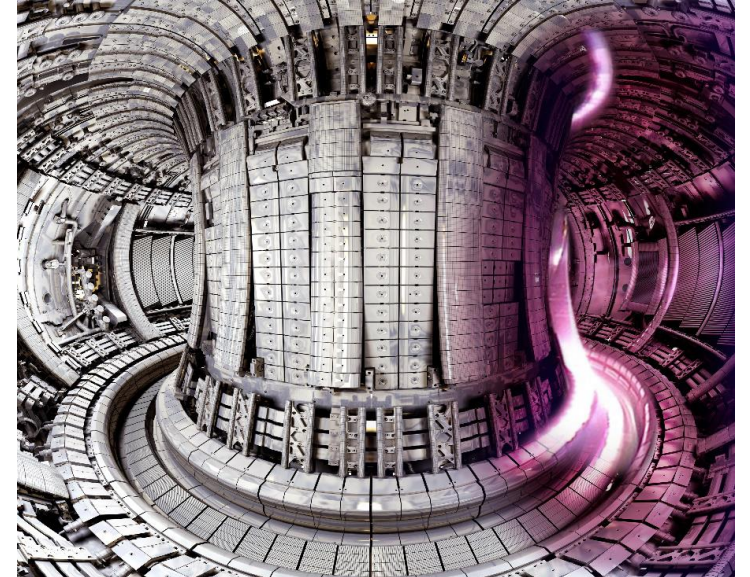
- UKAEA Fusion Safety Authority provided technical support to HM Government in considering hazards and their implications.
- Conducted a literature review of studies into potential accident scenarios to understand implications of damage to confinement systems.
- While information is limited, we have very high confidence in the bounding examples.
- From this, the Government has concluded that **the maximum hazard of fusion is of a similar magnitude to those associated with other major industrial activities successfully regulated by EA and HSE.**



Fusion Regulation Green Paper

The Government's proposals are:

1. To **maintain the existing regulatory approach** to operational permitting of fusion facilities (led by EA and HSE in England).
2. To **clarify fusion's status with regards to existing nuclear regulations** and introduce new provisions, regulatory processes and guidance if necessary.
3. To **keep the fusion regulatory framework under review** on the basis of the remaining uncertainties.



Inside the Joint European Torus (JET), EUROfusion



Consultation responses

- **The majority of respondents agreed with the Government's assessment of the hazard of a fusion energy facility** – that the overall hazard profile will be comparable with other facilities regulated by the Health and Safety Executive and environmental regulators in the UK, such as a large chemical plant.
- Most respondents noted the significant inherent differences between traditional nuclear power (fission) and fusion energy facilities, with fusion involving no chain reaction, nuclear meltdown risk or the most hazardous category of radioactive waste.



Hazard Assessment and Regulators

The concerns raised by a minority of respondents who disagreed with the Government's hazard assessment fell mostly into two categories:

1) Increased hazard compared to current R&D facilities

The Government's proposals recognised that the hazards of future fusion energy facilities would be greater than current R&D facilities. Some respondents suggested that the uncertainties and complexities associated with fusion required an even more conservative approach to understanding fusion hazards and potential accident scenarios. However, based on its analysis and the evidence received during the consultation, the Government remains confident that the hazard of fusion energy facilities does not warrant a change in regulator.

2) Regulatory capability and capacity

Some respondents were concerned about current regulators' technical understanding and ability to handle the complexity of fusion technology. The Government is confident that the regulators can build the necessary capability over the coming years in time to ensure the effective regulation of fusion energy facilities and is ready to offer necessary support.



Government Decisions

- **Future fusion energy facilities will be regulated under the legal framework already in place for fusion.**
- Fusion energy facilities will be regulated by the Health and Safety Executive (HSE) and the Environment Agency (EA), or equivalent devolved regulator.
- This decision recognises that the regulators will build understanding and capability in fusion over the coming years, given this is a complex and emerging technology.



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



Government Decisions

- **This regulatory approach will apply to all planned fusion prototype energy facilities in the UK.**
- Some respondents, particularly fusion developers, noted that the 10 year review period proposed in the Green Paper introduces new uncertainty.
- The decision for current regulators to retain responsibility for fusion will be applicable to all planned fusion prototype energy facilities in the UK.
- The Government remains prepared to re-visit its decisions on fusion regulation if compelling evidence is presented that shows the hazard of fusion energy facilities would be far beyond the projected overall hazard as assessed in the Green Paper.



Government Decisions

- **The Government will legislate to make clear in law the regulatory treatment of fusion energy.**

Energy Bill [HL]

EXPLANATORY NOTES

Explanatory notes to the Bill, prepared by the Department for Business, Energy and Industrial Strategy, have been ordered to be published as HL Bill 39—EN.

EUROPEAN CONVENTION ON HUMAN RIGHTS

Lord Callanan has made the following statement under section 19(1)(a) of the Human Rights Act 1998:

In my view the provisions of the Energy Bill [HL] are compatible with the Convention rights.

ENVIRONMENTAL STATEMENTS

Lord Callanan has made the following statements under section 20(2)(a) and (3) of the Environment Act 2021.

In my view—

(a) the Energy Bill contains provision which, if enacted, would be environmental law, and

(b) the Bill will not have the effect of reducing the level of environmental protection provided for by any existing environmental law.



Next Steps

The Government is putting in place a programme of work with safety, security and environmental experts, regulators and industry, to take forward its plans for regulation. This will include:

- Fusion specific guidance
- A Fusion National Policy Statement
- A position on the applicability of third party liabilities to fusion
- Developing approaches to safeguards / export controls



Illustration of UKAEA fusion scientists and engineers. © UKAEA



Next Steps

The programme of work will also address:

- Maintaining separation and independence between regulators and fusion developers/operators
- Reflecting the diversity of fusion technologies in the regulatory framework
- Regulatory implications around supplementary systems and infrastructure of a fusion energy facility
- Policy and/or regulatory requirements associated with the financing of both the development and decommissioning of fusion energy facilities



Multilateral international engagement

International Atomic Energy Agency (IAEA)

- As leading experts in fusion, the UK Atomic Energy Authority (UKAEA) is a key contributor to the IAEA's Fusion Power Plant Regulation and Fusion Safety Design Principles.
- The UKAEA is a leading participant of IAEA technical meetings, including INPRO study.
- The UKAEA, alongside UK regulators, provides regular contribution to IAEA technical documents (TECDOCs).

Agile Nations

- The UK is one of the founding members of the Agile Nations, an inter-governmental regulatory cooperation network designed to foster co-operation on innovative regulatory practice.
- The UK is proposing to create a fusion regulation working group.



Links

Fusion Strategy

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1022540/towards-fusion-energy-uk-government-fusion-strategy.pdf

Government response to consultation

<https://www.gov.uk/government/consultations/towards-fusion-energy-proposals-for-a-regulatory-framework>

UKAEA technology report

<https://scientific-publications.ukaea.uk/wp-content/uploads/UKAEA-RE2101-Fusion-Technology-Report-Issue-1.pdf>



Illustration of UKAEA fusion scientists and engineers. © UKAEA

