SUMMARY OF ENGAGEMENT ON FUSION ENERGY SYSTEMS

Following Commission direction in SRM-SECY-20-0032[1] to develop options for licensing and regulating fusion energy systems, the U.S. Nuclear Regulatory Commission (NRC) staff began extensive stakeholder engagement[2] to obtain input on the potential hazards posed by fusion energy systems and to receive feedback on developing options. This included six NRC public meetings held from January 2021 through June 2022, with presentations delivered by the stakeholders listed in table 1; a joint public workshop sponsored by the NRC, the U.S. Department of Energy (DOE), and the Fusion Industry Association (FIA); NRC staff participation in the White House summit, "Developing a Bold Decadal Vision for Commercial Fusion Energy," on March 17, 2022, and the follow-on DOE workshop; international engagement through bilateral government-to-government interactions and International Atomic Energy Agency (IAEA) activities; a Commission meeting,[3] coordination with the Organization of Agreement States, and inclusion of Agreement State representatives on the NRC's fusion working group; and technology introduction meetings with many private fusion energy companies seeking to commercialize their designs.

Table 1 Stakeholders that Presented on Fusion Topics at NRC Public Meetings

Presenter	Affiliation	Presenter	Affiliation
Patrick White	-	Jeff Merrifield	Pillsbury
Bob Mumgaard	Commonwealth Fusion Systems	Sid Fowler	Pillsbury
Tyler Ellis	Commonwealth Fusion Systems	Rich Hawryluk	Princeton Plasma Physics Laboratory
Derek Sutherland	CT Fusion	Dave Babineau	Savannah River National Laboratory
William Sowder	Electric Power Research Institute	Diego Saenz	State of Wisconsin
Andrew Holland	FIA	Megan Shober	State of Wisconsin
Brian Grierson	General Atomics	Michl Binderbauer	TAE Technologies
Michael Cappelo	General Fusion	Sally Forbes	U.K. Atomic Energy Authority
David Kirtley	Helion	Ian Streatfield	U.K. Environment Agency
Sachin Desai	Helion	James Taylor	U.K. Health and Safety Executive
Michael Hua	Helion	Parag Vyas	U.K. Regulatory Horizons Council
Jennifer Uhle	Nuclear Energy Institute	Edward Lewis-Smith	U.K. Department of Business, Energy & Industrial Strategy

1 SRM-SECY-20-0032, "Staff Requirements—SECY-20-0032—Rulemaking Plan on 'Risk--Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors (RIN-3150-AK31; NRC-2019-0062)," dated October 2, 2020 (Agencywide Documents Access and Management System Accession No. ML20276A293).

2 For more information on these interactions see the NRC's public web page on fusion activities at https://www.nrc.gov/reactors/new-reactors/advanced/policy-development/fusion-energy.html.

3 See meeting materials for the "Briefing on Regulatory Approaches for Fusion Energy Devices" at https://www.nrc.gov/reading-rm/doc-collections/commission/tr/2022/index.html.

Thomas Davis	Oxford Sigma	Laila El-Guebaly	University of Wisconsin-Madison

NRC staff also held regular meetings with DOE Fusion Energy Sciences staff members to gain insights into DOE activities related to fusion research and development as well as the oversight of DOE fusion facilities.

Stakeholder Feedback

The majority of stakeholder feedback received by the NRC staff, during interactions and public meetings or submitted in writing, was aligned with a desire to license and regulate fusion energy systems using a byproduct material approach, as evidenced in the presentations from stakeholders at the NRC's public meetings described above and the correspondence received by the staff.

Some stakeholders suggested that a consolidated framework for fusion energy systems contained within its own part of Title 10 of the *Code of Federal Regulations* (10 CFR) would be preferable in the long term. However, they recommended deferring any further evaluations and development of such a framework until experience is gained with the early licensing and operation of fusion energy systems under the NRC's byproduct material framework.

The stakeholders widely viewed the utilization facility approach as a burdensome option that would create significant regulatory uncertainty as the NRC staff develops an extensive rulemaking to tailor a framework originally developed for fission reactors to the hazards posed by fusion energy systems. However, a subset of stakeholders believed such a framework would provide the most assurance of appropriate protection of public health and safety for large, complex, commercial-scale fusion energy systems.

Several stakeholders recently submitted written correspondence to the Commission and the NRC staff related to the regulation of fusion energy systems:

- letter from Helion Energy: "Classification of Fusion Devices as Particle Accelerators; and Supplementing Common Defense & Security Discussions," dated August 12, 2022 (ML22243A083)
- letter from Commonwealth Fusion Systems: "Developing a Regulatory Framework for Fusion Energy Systems," dated August 16, 2022 (ML22230D055)
- letter from New Energy Times: view on regulation for nuclear fusion reactors, dated August 24, 2022 (ML22245A014)
- letter from the FIA: FIA views regarding the appropriate regulatory framework for fusion energy, dated August 25, 2022 (ML22238A292)
- letter from General Fusion supporting the FIA's views on fusion regulation, dated September 9, 2022 (ML22252A199)

Findings of the National Academies of Science, Engineering, and Medicine

The National Academies of Science, Engineering, and Medicine (NAS) issued the report "Bringing Fusion to the U.S. Grid,"[4] in 2021. The NAS looked at key requirements for the deployment of fusion energy systems to support the transition to a low-carbon emission electrical marketplace by 2050. One of the areas reviewed by the NAS was the NRC's regulatory process and the three options for licensing and regulating fusion energy systems under consideration. The NAS made the following three findings:

(1) A regulatory process that minimizes unnecessary regulatory burden is a critical element of the Nation's development of the most cost-effective fusion pilot plant.

(2) Because existing nuclear regulatory requirements for utilization facilities (10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities") are tailored to fission power reactors, they are not well suited to fusion technology.

(3) The current regulatory framework used for radiation protection and byproduct material provided under 10 CFR Part 20, "Standards for Protection Against Radiation," and 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," is well suited to fusion technology.

International Perspectives

Many international regulators are currently assessing their ability to develop and regulate fusion technologies. The NRC staff is engaged bilaterally with many of them, as well as with the IAEA's work to develop a technical document on fusion regulatory approaches worldwide. Through these interactions, the NRC staff has learned that many countries are looking to either take a more material-centric approach or right-size their fission-based frameworks to support the licensing and regulation of fusion energy systems. The following documents provide examples of these approaches:

- RSP-762.1, "Review of the Canadian Nuclear Safety Commission's Regulatory Framework for Readiness to Regulate Fusion Technologies: Task #5 Final Overview Report" issued March 2022[5]

- "Towards Fusion Energy: The UK Government's response to the consultation on its proposals for a regulatory framework for fusion energy," issued June 2022[6]

4 See National Academies of Sciences, Engineering, and Medicine, "Bringing Fusion to the U.S. Grid," issued 2021 at https://doi.org/10.17226/25991.

5 See https://nuclearsafety.gc.ca/eng/resources/research/research-and-support-program/research-report-abstracts/research-report-summaries-2020-2021.cfm#RSP-762-1.

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