NRC JURISDICTION OF FUSION POWER

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May 1995

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Prepared for the
U.S. Department of Energy
Office of Fusion Energy
and for the
University of California - San Diego
Fusion Energy Research Program
Under DOE Contract No. DE-FC03-95ER554299
and under UCSD Subcontract No. 1008-7479

DISCLAIMER

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INTRODUCTION

It is of interest to fusion program managers to know how current federal law might impact the regulation of the next generation fusion machines. For the purposes of this report, "next generation fusion machines" will be taken to include ITER and the Demo (Demonstration Fusion Reactor). Accordingly, a review of federal law was conducted to determine to what extent the Nuclear Regulatory Commission (NRC) may have jurisdiction over the licensing of ITER and/or a demonstration fusion power reactor.

FORMATION OF THE AEC

Licensing and regulation of atomic energy activities was established in the United States when the Atomic Energy Act of 1954[1] created the Atomic Energy Commission (AEC). Certain parts of the Act, discussed below, show that the AEC's scope clearly includes not only the fission process, but also the fusion process.

The Atomic Energy Act of 1954, § 3.c, states that one of the purposes of the act is to provide for:

> "a program for Government control of the possession, use, and production of atomic energy and special nuclear material, whether owned by the Government or others ...."[2]

In discussing the purposes of the act, the Congressional Committee Report states:

> "The bill specifies that the Commission [AEC] shall carry out programs ... of controlling atomic energy and special nuclear material ...."[3]

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1 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954).

2 Atomic Energy Act of 1954 of 1954 (Public Law 703, Act of August 30, 1954), Chapter 1, § 3.c; amended by Public Law 88-489, 88th Congress, 2nd Session, approved August 26, 1964).

3 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Report of the Joint Committee on Atomic Energy.

The Atomic Energy Act of 1954, § 11.c, defines "Atomic Energy" as:

> "The term 'atomic energy' means all forms of energy released in the course of nuclear fission or nuclear transformation."[4]

In discussing the definition of "atomic energy," the Congressional Committee Report states:

> "This definition includes both fission and fusion types of nuclear reactions."[5]

As can be seen, Congress clearly expected the AEC to be involved in the licensing process of fusion reactors.

The Atomic Energy Act of 1954 states that the duties of the Advisory Committee on Reactor Safeguards (ACRS) includes:

> "The Committee [ACRS] shall review safety studies and facility license applications referred to it and shall make reports thereon, shall advise the Commission [AEC] with regard to the hazards of proposed or existing reactor facilities and the adequacy of proposed reactor safety standards, and shall perform such other duties as the Commission [AEC] may request."[6]

In discussing the ACRS, the Congressional Committee Report states:

> "The main reason for making this Committee [ACRS] a statutory committee was to insure that any features of new reactors would be as safe as possible. This subject was felt to be so important as to require a committee established by statute."[7]

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4 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Chapter 2, § 11.c.

5 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Report of the Joint Committee on Atomic Energy.

6 Atomic Energy Act of 1954 of 1954 (Public Law 703, Act of August 30, 1954), Chapter 3, § 29 (§ 29 was added by Public Law 85-256, Act of September 2, 1957; amended by Public Law 95-209, Act of December 13, 1977).

7 Public Law 85-256, Act of September 2, 1957, Report of the Joint Committee on Atomic Energy.

For the ACRS, their legislated role in fusion power development is not so clear. An interpretation is required. The NRC could interpret the law such that, the role of the ACRS does include reviewing the safety of fusion power.

SOURCE MATERIAL AND SPECIAL NUCLEAR MATERIAL

The Atomic Energy Act of 1954, § 11.z, defines "Source Material" as:

> "The term 'source material' means (1) uranium, thorium, or any other material which is determined by the Commission [AEC] pursuant to the provisions of section 61 to be source material; or (2) ores containing one or more of the foregoing materials, in such concentration as the Commission [AEC] may by regulation determine from time to time."[8]

Chapter 7 (§ 61 through § 69) of the Atomic Energy Act of 1954 discusses source material. The methodology used to determine additional source materials is stated in § 61 as follows:

> "The Commission [AEC] may determine from time to time that other material is source material in addition to those specified in the definition of source material. Before making such determination, the Commission [AEC] must find that such material is essential to the production of special nuclear material and must find that the determination that such material is source material is in the interest of the common defense and security, and the President must have expressly assented in writing to the determination. The Commission's [AEC's] determination, together with the assent of the President, shall be submitted to the Joint Committee [on Atomic Energy] and a period of thirty days shall elapse while Congress is in session (in computing such thirty days, there shall be excluded the days on which either House is not in session because of an adjournment of more than three days) before the determination of the Commission [AEC] may become effective: *Provided, however,* That the Joint Committee [on Atomic Energy], after having received such determination, may by resolution in writing waive the condition of or [sic] all or any portion of such thirty-day period."[9]

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8 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Chapter 2, § 11.z (amended by Public Law 85-256, Act of September 2, 1957; amended by Public Law 89-645, Act of October 13, 1966 - the amendments changed the subsection designation from § 11.s to § 11.x and from § 11.x to § 11.z)

9 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Chapter 7, § 61.

The Atomic Energy Act of 1954, § 11.aa, defines "Special Nuclear Material" as:

> "The term 'special nuclear material' means (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission [AEC], pursuant to the provisions of section 51, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material."[10]

In discussing the definition of "special nuclear material," the Congressional Committee Report states:

> "'Special nuclear material' is defined to mean plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission [AEC] determines to be special nuclear material pursuant to the provisions of Section 51. The latter section is so constructed that materials essential to fusion processes could be found to be special nuclear materials in addition to materials essential to fission processes."[11]

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10 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Chapter 2, § 11.aa (amended by Public Law 85-256, Act of September 2, 1957; amended by Public Law 89-645, Act of October 13, 1966 - the amendments changed the subsection designation from § 11.t to § 11.y and from § 11.y to § 11.aa)

11 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Report of the Joint Committee on Atomic Energy.

Chapter 6 (§ 51 through § 58) of the Atomic Energy Act of 1954 discusses special nuclear material. The methodology used to determine additional special nuclear materials is stated in § 51 as follows:

> "The Commission [AEC] may determine from time to time that other material is special nuclear material in addition to those specified in the definition of special nuclear material. Before making such determination, the Commission [AEC] must find that such material is capable of releasing substantial quantities of atomic energy and must find that the determination that such material is special nuclear material is in the interest of the common defense and security, and the President must have expressly assented in writing to the determination. The Commission's [AEC's] determination, together with the assent of the President, shall be submitted to the Joint Committee [on Atomic Energy] and a period of thirty days shall elapse while Congress is in session (in computing such thirty days, there shall be excluded the days on which either House is not in session because of an adjournment of more than three days) before the determination of the Commission [AEC] may become effective: *Provided, however,* That the Joint Committee [on Atomic Energy], after having received such determination, may by resolution in writing waive the condition of all or any portion of such thirty-day period."[12]

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12 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Chapter 6, § 51.

In discussing the reason for § 51, the Congressional Committee Report states:

> "It should be noted that the scientific basis on which the first Commission [AEC] determination is to be based — namely, the release of substantial quantities of atomic energy — permits the inclusion in this category ... of materials essential to fusion processes as well as those essential to fission processes."[13]

ABOLISHMENT OF THE JOINT COMMITTEE ON ATOMIC ENERGY

Public Law 95-110[14] abolished the Joint Committee on Atomic Energy and transferred its functions and responsibilities "... to the committees of the Senate and the House of Representatives which, under the rules of the Senate and the House, have jurisdiction over the subject manner of such reference."[15]

With the formation of the NRC and DOE (discussed later in this report), both agencies have the authority to initiate the process for designating new special nuclear materials and new source materials. However, DOE has decided not to undertake the arduous process of getting approval to make Tritium a special nuclear material and rather in DOE Order 5633.3A[16] classifies Tritium as "Nuclear Material"[17]. This classification has no basis in law and only applies to facilities that are required to conform to DOE Order 5633.3A.

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13 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Report of the Joint Committee on Atomic Energy.

14 Public Law 95-110 (Act of September 20, 1977) repealed Chapter 17, § 201, § 202, § 203, § 204, § 205, § 206 and § 207 from the Atomic Energy Act of 1954; and added Chapter 20, § 301, § 302 and § 303 to the Atomic Energy Act of 1954.

15 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Chapter 20, § 301.b.

16 DOE Order 5633.3A, "Control and Accountability of Nuclear Materials," February 12, 1993.

17 DOE Order 5633.3A; Attachment 2, Definition 33, page 4; and Chapter I, Figure I-1, page I-2.

With the development of fusion power reactors that breed Tritium, the NRC has several options open to it:

- The NRC could do nothing,
- The NRC could increase its control of Tritium safeguards and inventory in a fashion similar to what the DOE implemented in DOE Order 5633.3A, or
- The NRC could increase its control of Tritium safeguards and inventory by undergoing the approval process to declare Lithium a source material and Tritium a special nuclear material. If under this option the NRC's petition is denied by the President or the Congress, the other two options remain viable.

PRODUCTION FACILITY AND UTILIZATION FACILITY

The Atomic Energy Act of 1954, § 11.v, defines "Production Facility" as:

> "The term 'production facility' means (1) any equipment or device determined by rule of the Commission [AEC] to be capable of the production of special nuclear material in such quantity as to be of significance to the common defense and security, or (2) any important component part especially designed for such equipment or device as determined by the Commission [AEC]."[18]

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18 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Chapter 2, § 11.cc (amended by Public Law 85-256, Act of September 2, 1957; amended by Public Law 89-645, Act of October 13, 1966 - the amendments changed the subsection designation from § 11.p to § 11.t and from § 11.t to § 11.v)

The Atomic Energy Act of 1954, § 11.cc, defines "Utilization Facility" as:

> "The term 'utilization facility' means (1) any equipment or device, except an atomic weapon, determined by rule of the Commission [AEC] to be capable of making use of special nuclear material in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public, or peculiarly adapted for making use of atomic energy in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public; or (2) any important component part especially designed for such equipment or device as determined by the Commission [AEC]."[19]

In discussing the definition of "utilization facility," the Congressional Committee Report states:

> "'Utilization facility' has a definition parallel to that of 'production facility' but based on the utilization of atomic energy rather than on the production of special nuclear material."[20]

If the NRC does take the option to undergo the approval process to declare Lithium a source material and Tritium a special nuclear material, and is granted approval, then the NRC will have several additional options regarding fusion facilities which employ these materials. They could decide that such fusion facilities should be considered utilization facilities. In addition, if significant Tritium breeding capability exists, the NRC could decide that such fusion facilities should also be considered production facilities.

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19 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Chapter 2, § 11.cc (amended by Public Law 85-256, Act of September 2, 1957; amended by Public Law 89-645, Act of October 13, 1966 - the amendments changed the subsection designation from § 11.v to § 11.aa and from § 11.aa to § 11.cc)

20 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Report of the Joint Committee on Atomic Energy.

FORMATION OF NRC AND DOE

The Energy Reorganization Act of 1974[21] left the Atomic Energy Act of 1954 largely intact but abolished the AEC and transferred its functions under the Atomic Energy Act of 1954 to two newly created agencies, the Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA). The Department of Energy Organization Act of 1977[22] transferred all of the functions of ERDA and its Administrator to the Department of Energy (DOE).

Pending a definitive recodification of the Atomic Energy Act of 1954 in the light of the Energy Reorganization Act of 1974, it is necessary to read and interpret the provisions of the former by reference to the latter. The following analysis of the above discussed sections is based on the Report by the Senate Committee on Government Operations[23] with DOE being substituted for ERDA. Page references are to the Senate Report.

- **§ 11.c** — The definition is applicable to both DOE and NRC. [page 83]

- **§ 11.v, § 11.z, § 11.aa, § 11.cc, § 51, § 61** — While the definitions are applicable to both DOE and NRC, the determinations are the responsibility of DOE "only in regard to facilities and materials not subject to licensing and related regulatory control" by the NRC. [pages 83 - 84]

- **§ 29** — The ACRS is transferred to the NRC. [page 83]

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21 Energy Reorganization Act of 1974 (Public Law 93-438, Act of October 11, 1974).

22 Department of Energy Organization Act of 1977 (Public Law 95-91, Act of August 4, 1977).

23 Senate Report No. 93-980, 93rd Congress, 2nd Session (1974).

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In discussing the formation of the NRC, § 202.2 of the Energy Reorganization Act of 1974 states:

> "[T]he Nuclear Regulatory Commission shall ... have licensing and regulatory authority ... to the following facilities of the Administration [i.e., then ERDA, now DOE] ... demonstration nuclear reactors — except those in existence on the effective date of this Act — when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor."[24]

In discussing § 202, the Congressional Committee Report states:

> "Section 202 extends the licensing and regulatory authority of [NRC] beyond the present provisions of the Atomic Energy Act [of 1954] to include certain reactors ... that will be owned and operated by [DOE]."
>
> "The committee intends this subsection to be a major enhancement of the new regulatory commission's [NRC's] authority, enabling it to develop early expertise in the new generations of nuclear technology as they approach commercial application."
>
> "[T]he committee believes it is essential for [NRC] to have the capability to develop expertise in reactor safety earlier in the developmental process than is now the case for the AEC Regulatory Division. The expected result will be to speed up the eventual licensing of new commercial reactors and other commercial nuclear facilities ...."
>
> "It is the intent of the committee to exclude from such regulation, research reactors, test reactors, safety reactors, such as the LOFT, and small experimental reactors which are exploratory in nature, and which are not yet part of a demonstration program."[25]

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24 Energy Reorganization Act of 1974 (Public Law 93-438, Act of October 11, 1974), Title II, § 202.2.

25 Senate Committee on Government Operations (Senate Report No. 93-980, 93rd Congress, 2nd Session (1974)).

With respect to pre-demo reactors (i.e., "pre-demo" as defined by § 202.2 of the Energy Reorganization Act of 1974, are reactors that are **not** operated as part of the power generation facilities of an electric utility system, **nor** operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor), it seems that the intent of Congress is that the NRC need not be "in the loop" at that stage. TFTR for example, would not meet the "intent criterion" for the NRC to be involved. Equally clear, however, a demonstration fusion power reactor would require a license from the NRC (as was the case for the Clinch River Breeder Reactor Project, which was applying for a Construction Permit from the NRC at the time it was canceled).

The question becomes, therefore, at what point is the NRC required to get involved in the fusion development program, given the sequence of major devices presently envisioned in the national energy strategy for fusion?

With regard to ITER, the following statements appear in recent ITER publications:

ITER EDA Agreement and Protocol 1

"The overall programmatic objective of ITER, which shall guide the EDA, is to demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes. ITER would accomplish this objective by demonstrating controlled ignition and extended burn of deuterium-tritium plasmas, with steady-state as an ultimate goal, by demonstrating technologies essential to a reactor in an integrated system, and by performing integrated testing of the high-heat-flux and nuclear components required to utilize fusion energy for practicable purposes."[26]

ITER Pamphlet

"ITER will embody most of the essential features of the heat-generating core for a fusion power plant and will produce about 1,000 megawatts, or more, of thermal power (heat). This level would represent about 30 to 50 percent of the heat produced in a present-day electrical power plant."

"ITER will be a major contributor to the basis for designing and building a demonstration fusion power plant that will generate electricity. The goal of the U.S. National Energy Strategy is to have such a demonstration plant in operation by about 2025."[27]

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26 ITER EDA Agreement and Protocol 1, Article 1, ¶ 2, ITER EDA Documentation Series No. 1, IAEA, Vienna, 1992

27 "International Thermonuclear Experimental Reactor — Working Together to Make Fusion a Reality,"

When these statements about ITER are measured against the criterion "...when operated ... for the purpose of demonstrating the suitability for commercial application of such a reactor...." which is part of the criteria of § 202.2 of the Energy Reorganization Act of 1974, it can be seen that it is ambiguous whether an NRC license for ITER would be required. ITER is considered by many to be a research and/or test reactor. Under such a classification, the Congressional Committee Report excluded such reactors if they *"... are not yet part of a demonstration program."* (emphasis added)

DOE Pamphlet DOE/ER-ITER-0004, 1993, Page 3.

This portion of the Energy Reorganization Act of 1974 has never been invoked and thus remains a gray area. However, there is precedence in the courts for differentiating between the name/classification of an item and its use/function. In one such famous case, the US Supreme Court decided that although the tomato is biologically classified as a fruit, it shall be considered as a vegetable with respect to the Tariff Act of March 3, 1883, since consumers use tomatoes as a vegetable rather than as a fruit. The detailed arguments make interesting reading.[28]

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28 Nix v. Hedden; No. 137; Supreme Court of the United States (149 U.S. 304; 37 L. Ed. 745; 13 S. Ct. 881); submitted April 24, 1893; decided May 10, 1893.

> "This was an action, brought February 4, 1887, against the collector of the port of New York, to recover back duties, paid under protest, on tomatoes imported by the plaintiff from the West Indies in the spring of 1886, which the collector assessed under 'Schedule G. — Provisions,' of the Tariff Act of March 3, 1883, c. 121, imposing a duty on 'Vegetables, in their natural state, or in salt or brine, not specially enumerated or provided for in this act, ten per centum ad valorem'; and which the plaintiff contended came within the clause in the free list of the same act, 'Fruits, green, ripe or dried, not specially enumerated or provided for in this act.' 22 Stat. 504, 519."
>
> "The court, upon the defendant's motion, directed a verdict for him, which was returned, and judgement rendered thereon. 39 Fed. Rep. 109. Tomatoes are 'vegetables' and not 'fruit,' within the meaning of the Tariff Act of March 3, 1883, c. 121."

Mr. Justice Gray, after stating the case, delivered the opinion of the court. (149 U.S. 306; 37 L. Ed. 746; 13 S. Ct. 882)

> "The single question in this case is whether tomatoes, considered as provisions, are to be classed as 'vegetables' or as 'fruit,' within the meaning of the Tariff Act of March 3, 1883."
>
> "Botanically speaking, tomatoes are the fruit of the vine, just as are cucumbers, squashes, beans and peas. But in the common language of the people, whether sellers or consumers of provisions, all these are vegetables, which are grown in kitchen gardens, and which, whether eaten cooked or raw, are, like potatoes, carrots, parsnips, turnips, beets, cauliflower, cabbage, celery and lettuce, usually served at dinner in, with or after the soup, fish or meats which constitute the principal part of the repast, and not, like fruits generally, as dessert."
>
> The attempt to class tomatoes with fruit is not unlike a recent attempt to class beans as seeds, of which Mr. Justice Bradley, speaking for this court, said: 'We do not see why they should be classified as seeds, any more than walnuts should be so classified. Both are seeds in the language of botany or natural history, but not in commerce nor in common parlance. On the other hand, in speaking generally of provisions, beans may well be included under the term 'vegetables.' As an article of food on our tables, whether baked or boiled, or forming the basis of soup, they are used as a vegetable, as well when ripe as when green. This is the principal use to which they are put. Beyond the common knowledge which we have on this subject, very little evidence is necessary, or can be produced.' Robertson v. Salomon, 130 U.S. 412, 414. Judgement affirmed."

RECENT DEVELOPMENTS

A draft bill,[29] presently undergoing hearings, would require all new DOE nuclear facilities to be licensed by the NRC. This includes any radioactive waste management facilities as well as production or research reactors. It appears that DOE and NRC officials are amenable to the draft bill, although NRC Chairman Selin has reservations about the bill's broad language and lack of additional NRC funding to cover the additional oversight responsibilities.[30, 31, 32, 33]

If this bill is passed, and if ITER is built in the United States as a DOE facility, then depending on the exact nature of the bill's language, not only the NRC, but also the DOE, could determine that ITER is a nuclear facility and should be NRC regulated.

If ITER and/or a demo fusion power reactor should be built in the United States as a non-DOE facility (i.e., an international facility, appropriately defined), it may be difficult to obtain an NRC license since § 103.d of the Atomic Energy Act of 1954 states:

> "No license may be issued to an alien or any corporation or other entity if the Commission [NRC] knows or has reason to believe it is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government."[34]

Thus if either ITER or a demonstration fusion power reactor were to be built in the U.S. involving foreign money and input, it could result in a licensing difficulty under § 103.d if DOE does not sponsor the facility.

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29 H.R. 3920, sponsored by House Natural Resources Committee Chairman George Miller (D–California), House Natural Resources Subcommittee on Energy and Mineral Resources Chairman Richard Lehman (D–California), House Energy and Commerce Subcommittee on Energy and Power Retiring Chairman Philip Sharp (D–Indiana) and Representative Peter DeFazio (D–Oregon).

30 Nucleonics Week article, "Miller Plans to Regulate New, Existing DOE Facilities," Vol. 34, No. 51, December 23, 1993.

31 Nucleonics Week article, "Bill to Regulate New, Existing DOE Facilities to be Introduced," Vol. 35, No. 7, February 17, 1994.

32 Inside NRC article, "Bill Would Give NRC Oversight Over Any New DOE Nuclear Facility," Vol. 16, No. 5, March 7, 1994.

33 The Energy Daily article, "Selin Says No Thanks To Broader Regulatory Role," Vol. 22, No. 45, March 9, 1994.

34 Atomic Energy Act of 1954 (Public Law 703, Act of August 30, 1954), Chapter 10, § 103.d.

CONCLUSION

Among the major fusion facilities planned by DOE, it seems clear that the NRC would have jurisdiction over a demonstration fusion power plant built in the United States. It is not so clear for a pre-demo facility like ITER. There are many unknowns, including but not limited to, congressional actions and/or court intervention. It is thus not possible to conclude at this time, based on the existing legislative and regulatory record, whether the NRC would exercise jurisdiction over ITER. It is not too early, however, to begin to influence the process.