

Research Needs Workshop (ReNeW)

Regulation and Licensing: Issues for Control Systems

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Changing Impact of Regulation and Licensing on Control Systems

Regulations and Licensing will have a different and greater impact on control systems for burning plasmas, DEMO, and operating fusion reactors than they have had in the past on DoE fusion experiments. Up to the present, fusion experiments in the US have been governed by DoE regulations and licensing procedures. The impact of that on control systems has been that control systems have been one of many systems involved in assuring worker safety, environmental protection, and protection of the investment in the facility. Facilities now being planned which will be neutron-activated and will regularly process radioactive materials will have more safety requirements imposed on them. Future facilities oriented toward commercial power plants will have even more requirements imposed on them which will have impacts on the control system. Furthermore, the transition to commercial power plants will include a transition from the DoE regulatory environment to the NRC regulatory environment. Present NRC regulations are not suitable for fusion energy. Work has begun, but must be expanded, on the task of defining optimal regulations and licensing requirements that will be applied to DEMO and be adopted by the NRC for regulation of fusion power plants. Aspects of that work must be performed by the fusion energy control systems community.

Technical Requirements for Resolution

Both DoE and the NRC provide requirements, but not prescriptions for being licensed to operate. When budgets have allowed, both agencies have written guidelines for meeting the requirements. The guidelines provide processes that are generally believed by the agency staff to be likely to result in products that will meet the requirements; however, the agencies recognize that products could be produced by processes that are not the same as those in the guidelines, and yet the products still meet the requirements. Therefore, the guidelines are not themselves requirements.

The primary way in which this impacts control systems is that both DoE and the NRC have many safety requirements, but few “control” requirements. Both agencies derive safety requirements of their own and from other agencies, such as OSHA and the EPA. There are two main impacts of the safety requirements on control systems. First, control systems must support the overall plant meeting the safety requirements as well as controlling the facility so as to prevent damage. Second, strictly machine control aspects of the control system must not interfere in any way with the meeting of safety requirements by the control system.

The issue is that DoE and NRC regulations diverge in the extent and nature of the safety requirements. DoE safety requirements refer to many OSHA requirements for worker safety and EPA requirements for public safety. DoE adds to those safety requirements in areas that the other agencies do not cover or cover in insufficient detail, such as safe operation of high field magnets. NRC safety regulations do much the same, except that they impose safety and security requirements related to transuranic elements that DoE

fusion requirements do not impose, and they lack safety requirements for systems that fission power plants do not have, such as magnets and cryogenics.

The issue that requires resolution is that for fusion power plant licensing and operation, the NRC regulations must be revised to cover the systems present in fusion power plants which are lacking from fission power plants, and the regulation of radioactive materials for public safety must be tailored to suit the low probability and minor consequences of accidents at a fusion plant with respect to a fission plant, lest the wholesale application of fission power plant radioactive materials rules stifle fusion power plant licensing.

Because control systems affect all other systems in a facility, the control community must be involved in the revision of the NRC regulations.

Research Thrust Elements

DEMO will be in an interesting regulatory position in that it will probably be regarded as an experiment, and therefore, it will probably be designed according to DoE safety regulations. However, if DEMO is to be of any value to power companies, it must meet the regulations that are imposed on power companies that come from the NRC. That means that the work to be done in the present Pre-DEMO era must include assisting the NRC with the preparation of regulations for fusion power plants as much as it must include the maturation of technologies. In addition, the Pre-DEMO development of regulations must proceed in concert with the study of burning plasmas and the maturation of technologies. The results of burning plasma studies and technology maturation will affect the regulations that need to be produced. Therefore, it will not be acceptable for regulators to simply write rules based on what our present knowledge may lead them to think might happen that will require regulation. Instead, the development of regulations must be performed by teams that are part of Pre-DEMO studies and technology maturation, and which include equal representation by regulators and technologists. Furthermore, based on the author's observations of the magnitude of the impact of government regulations on the aerospace industry, the author believes it will be insufficient to rely on volunteer work by non-governmental standards organizations to get the needed regulations written. The regulation generation process must be a funded activity, and must be an integral part of the studies of burning plasmas and the maturation of technologies. The author foresees that not only will it be necessary for the regulation preparation teams to track and understand technical developments in Pre-DEMO fusion science; but also, it is quite possible, and indeed is even likely, that some fusion science experiments may be required primarily to resolve regulatory issues, and only secondarily to provide technical results. The author also believes that it will be important for the regulation development side of the regulation development teams to include both DoE and NRC members.

In summary, for DEMO to be a success, a formal, funded effort must be made in the Pre-DEMO era to produce fusion power plant safety regulations and licensing requirements based on public needs and fusion science understanding to be gained in the Pre-DEMO era. This effort will have many teams, of which a key team will be concerned with control systems. The teams involved in the effort must include technologists from the fusion science effort and regulators from both DoE and the NRC, and the teams must work closely with the technical activities, even to the point of being involved in experiment planning.