NRR
EDO

From: Amy Cubbage
To: Bergman, Thomas
Date: 10/1/02 4:08PM
Subject: Re: Urgent! Request for info on rx designs

Tom,

The attached was provided as input to OIP for the Chaiman's recent trip. We added a chart which shows all of the review schedules. Let me know if you need anything else.

Amy

>>> Thomas Bergman 10/01/02 03:02PM >>> EDO
I'm prepping a slide pkg for Travers. He wanted just a little background info for each of the designs under review (e.g. acronym defined, power level, type of reactor, any unique design features). Based on my limited knowledge, I've laid out a format with some examples in the attached.

I'd appreciate if you could complete this background info. very brief. Note that if you already have something similar (hint, hint, if not ;-)), I think something was recently prepped for Merrifield for example, that would work too. Send me that in lieu of the attached if that would be less work.

Probably need by noon tomorrow. Thanks. Sorry for the short turnaround.

CC: NRR_NRLPO

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AP1000

Westinghouse applied for design certification of the AP1000 design on March 28, 2002, after completing a pre-application review phase that lasted approximately 18 months. The Westinghouse AP1000 passive advanced light-water reactor design is based on the AP600 design, which was certified in December 1999. The AP1000 is a larger version of the AP600 and is an approximately 1100 megawatt electric pressurized water reactor plant design in which passive safety systems are used for the ultimate safety protection of the plant. (The "1000" designation is the projected cost ($/kW) of the nth operating plant.) The pre-application review focused on four topics chosen by Westinghouse: (1) the applicability of the AP600 testing program to the AP1000 design, (2) the applicability of the AP600 analysis codes to the AP1000 design, (3) the expected acceptability of requesting three exemptions that were granted for the AP600, and (4) the acceptability of using the design acceptance criteria (DAC) approach (in lieu of providing detailed design information) in the instrumentation and controls, human factors engineering, and piping design areas. The staff completed its pre-application review as documented in its letter to Westinghouse, dated March 25, 2002, on the first three issues and in a Commission Paper, dated April 1, 2002, on the DAC issue. The staff found that, in general, the AP600 testing program and analysis codes are applicable to the AP1000 design (some non-trivial exceptions were noted and will need to be resolved prior to design certification), the three exemptions are expected to be justifiable, and the proposed use of the DAC approach is acceptable. Based on the similarities in designs of the AP600 and AP1000, Westinghouse and the NRC staff expect efficiencies to be gained during the design certification review (as compared to a generic design certification review). The staff issued its current best-estimate schedule for completion of the AP1000 design certification review in a letter dated July 12, 2002. The staff expects to complete the final design approval in October 2004 and the associated rulemaking in December 2005. As of October 1, 2002, the staff has completed its acceptance review and issued the requests for additional information in accordance with the schedule.

GT-MHR

The Gas Turbine-Modular Helium Reactor (GT-MHR) design is a 300-MWe helium reactor design based on the high temperature gas-cooled reactor (HTGR) technology. The GT-MHR design uses helium as the coolant and employs refractory fuel. The ceramic-coated particles in the GT-MHR design are contained in fuel compacts that are inserted in graphite fuel elements. The current design allows for up to four 300 MWe modules per common control room. The design is currently being jointly developed by the U.S. and the Russian Federation (under DOE sponsorship) for disposition of weapons grade plutonium. It is expected that the pre-application phase will start soon, and it is estimated that it will take approximately 22 months from the initial exploratory discussion on the GT-MHR design between the NRC and General Atomics.

ESBWR

The General Electric (GE) ESBWR is a 1380 MWe reactor, using natural circulation for normal operation, with passive safety features. This design is based on the certified Advanced BWR (ABWR) and the Simplified BWR (SBWR) designs. A public meeting was held on June 20 and 21, 2002 to begin the pre-application review for the ESBWR design. The scope of the pre-application review will include an assessment of the technology basis for passive safety systems and the analysis methodology for transients and accidents. The staff plans to complete the pre-application review in the fall of 2003 and expects GE to submit an application for design certification in early 2004.

ACR-700

The Advanced CANDU Reactor (ACR-700) is a 731 MWe light-water-cooled reactor with two steam generators and four heat transport pumps. Similar to previous CANDU designs, the ACR-700 utilizes a heavy water moderator. However, this is the first reactor design in the CANDU series to have a negative void reactivity coefficient. The ACR-700 also uses slightly enriched uranium fuel, light water coolant, a separate heavy water moderator, computer-controlled operation and on-power refueling. A public meeting with Atomic Energy of Canada Limited (AECL) was held on July 24, 2002, to discuss the ACR-700 design and the proposed pre-application review. A public meeting was held on September 25 - 26, 2002, which included a series of technical presentations by AECL. At this meeting, AECL provided a proposed review plan which is currently being evaluated by the staff. In addition the staff is working on developing an approach regarding the appropriate level of coordination between the NRC, the Canadian Nuclear Safety Commission (CNSC), and the Nuclear Installations Inspectorate (NII) as the three regulatory agencies will be performing a simultaneous licensing of the design.

IRIS

The International Reactor Innovative and Secure (IRIS) is a 100-335 MWe integral light water reactor with all reactor coolant piping and heat transport systems located inside the reactor vessel. The IRIS design emphasizes proliferation resistance and enhanced safety. The request for IRIS pre-application review was received on July 11, 2002, and Westinghouse proposed an initial meeting with the NRC in September to cover the IRIS design as well as the proposed scope of the pre-application review. The current Westinghouse schedule calls for the preliminary design to be completed at the end of 2002 and the design certification application to be submitted in 2007.

SWR-1000

The SWR-1000 is a Framatome ANP 1000 MWe boiling water reactor that uses passive safety features. The design is based on a Siemens concept (now Framatome ANP). The request for an SWR-1000 pre-application review was received on May 31, 2002. Framatome intends to submit materials for a pre-application review in mid-2004 and to submit an application for design certification by the end of 2005. Prior to the submittal of the pre-application material, Framatome expects to hold several meetings with the staff to identify and clarify issues related to the certification process and on matters of particular importance to the SWR-1000 design. For example, in an August 15, 2002, meeting, Framatome ANP will discussed the adequacy of the research and testing already completed and currently planned to support the SWR-1000. The staff plans to visit principal test facilities in FY 2003 that were used and will be used to conduct testing to support the application. The facilities are mainly in Germany.

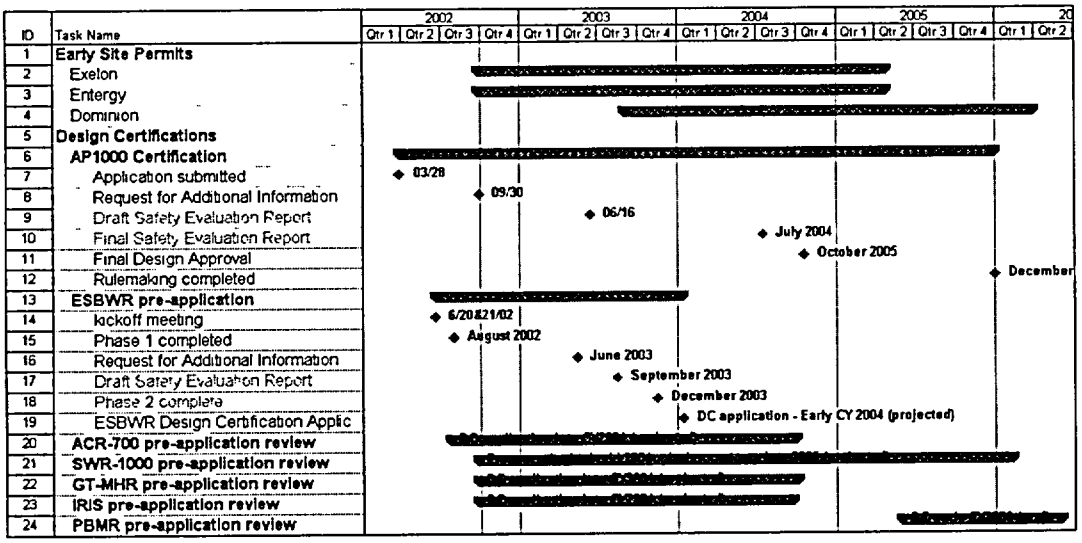
PBMR

The Pebble Bed Modular Reactor (PBMR) is a modular HTGR that uses helium as its coolant. In December 2000, Exelon requested a pre-application review of the PBMR design. During 2001 and early 2002, the staff conducted a series of public meetings with Exelon to discuss topics related to the pre-application review. Topics of discussion included legal and financial issues, Exelon's proposed risk-informed licensing approach, and issues related to the PBMR design, such as containment vs. confinement, source term, fuel quality, and high temperature materials. In April 2002, Exelon decided not to continue with the pre-application review of its PBMR design. The South African company PBMR Pty., which is developing the PBMR design, has recently expressed interest in restarting pre-application activities with the NRC. In early August, PBMR Pty. discussed its future plans for a certification review of the PBMR with NRC management. PBMR Pty. indicated that they plan to request a pre-application review of the

design to begin in 2005, and submit a design certification application in 2006. PBMR Pty. also discussed several major design differences that have evolved, including an eight-module configuration instead of 10, an increase in power to 165 MWe per module, 10 years storage of spent fuel in the plant (with additional storage capability in onsite concrete silos), and a fixed central reflector column. PBMR Pty. expects to start the construction of the South African demonstration unit in November 2005 and to complete construction in October 2007.

There are several issues which apply to all new reactor designs that need to be considered. It is expected that advanced reactors will be required to provide the same level of protection to the public that is required for current generation light water reactors (LWR). More likely, enhanced margins of safety and simplified, inherent, passive, or other innovative means to accomplish their safety functions will be utilized. The staff is currently developing a paper to raise the policy issue of what the security requirements should be for new reactors. In this paper the staff has recommended an interim approach to performing ongoing reviews. The staff will provide a second paper that will evaluate alternatives given a set of factors, including foreign experience. In addition, since advanced reactors (especially PBMR, GT-MHR, IRIS, and ACR-700) are new designs, the current probabilistic risk assessment (PRA) experience will need to be expanded to capture the new technology. Limitations of current PRA experience include system modeling approaches and associated underlying hypotheses (e.g., treatment of passive systems), failure data, and risk metrics used (e.g., core damage frequency or large early release may not be the best figure of merit for some proposed advanced reactor designs). The probabilities and failure modes of passive systems and the digital instrumentation and control (I&C) systems in advanced reactor designs need to be determined for incorporation into the PRA since digital systems typically have not been considered in past PRAs. Also, some advanced reactor designs have identified that up to 10 modular units will operate at a site with a centralized control room. The PRA tool needs to address potential interactions among the multiple units and potential effects of smaller operator staffs in a common control room under potential common cause initiators, such as seismic events. Operators will be expected to concurrently control multiple modules, which may be in different operating states, from a common control room. In relation to HTGRs, license applicants are expected to propose that modular HTGRs be licensed to operate with a non-leak-tight "confinement" structure rather than a traditional leak-tight, pressure retaining containment structure. Therefore, licensing of the design will require the applicant's capability to demonstrate fuel fission product retention behavior under all licensing basis conditions.

The NRC is involved in several activities to help facilitate international exchange. NRC technical staff have visited countries with HTGR experience, including Germany, Japan, China, South Africa, and the United Kingdom. These visits focused on technical and safety issues associated with HTGR fuel performance and qualification, nuclear-grade graphite behavior, and high-temperature materials performance. Technical exchanges and international agreements are currently being discussed in several areas, including graphite behavior, high-temperature materials research, fuel performance, and codes and standards. Also, in April 2002, NRC staff attended the High Temperature Reactor Technology (HTR) Conference in the Netherlands to start a coordinated research project (CRP) in the area of "Advances in HTGR fuel technology development." In June 2002, Dr. Makuteswara Srinivasan from the Office of Research began a three-month assignment at NII. He will be working with NII on several tasks to acquire knowledge on graphite including the behavior of graphite under high temperatures and irradiation conditions. He will have access to the ongoing and past research on high temperature graphite materials at the University of Manchester and the data and technical information from the DRAGON experiments performed on graphite and fuels in the UK. In return, NII will send a materials/structural integrity expert from their staff to the NRC for a similar assignment. The international community, particularly in Europe, Japan, and Korea, has developed integrated advanced control rooms and performed more research in the areas of automation of plant operations and advance plant monitoring and diagnosis than has the U.S. Therefore, there will be significant opportunities for international cooperation in this area. We have also begun initial discussions with CNSC and NII regarding the review of the ACR-700.



New

Reactor Licensing Schedule