TRIP REPORT

Quadripartite Working Group on New Nuclear Reactor Designs
Paris, France
October 8 – 10, 2008

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Representatives from Germany, France, Japan, and the U.S. met to discuss new nuclear reactor designs and safety reviews associated with the designs, with an emphasis on the European Pressurized Water Reactor (EPR) being built at the Flamanville, France site. The Agenda for the meeting is attached (Attachment 1).

The following sections summarize activities and discussions that took place during the 3-Day Working Group Meeting.

October 8, 2008 – Visit to Flamanville Unit 3 reactor construction site.

Member Stetkar and Staff Scientist Widmayer travelled with other members of the Working Group to the construction site of the Flamanville Unit 3 EPR reactor in France. Representatives of Électricité de France (EDF) provided the Working Group members with two slide and two video presentations on the process for deciding on the Flamanville site for construction of the EPR and on progress of construction since its initiation. Site work in preparation for construction began in August of 2006 and continued until December 2007, at which time construction commenced and was approximately 15% complete at the time of the Working Group visit. Full operation of the reactor is planned for 2012.

Main construction activities at the time of the visit included: installation of the reactor building steel liner; construction of the steel and concrete supports for the turbines; construction of the double exterior concrete walls for the fuel handling building; concrete construction of the inlets for the pumping station, and concrete work on the basemat of the Operations Building (offices and laboratories).

Due to the proximity of the Unit 3 EPR construction site to Flamanville Units 1 and 2, several protective measures have been taken to prevent damage to those operating units in the event of a construction mishap. For example, the main construction crane tower closest to Units 1 and 2 has been surrounded by a concrete caisson, which would prevent the crane assembly from toppling onto any vital areas of Unit 2.

One notable characteristic of the Flamanville Site is a cliff face formed by the removal of material to construct the three reactor units. The cliff face runs the entire north – south length of the site, is approximately 150 meters tall, and is only about 50 meters west of the fuel handling building of the new reactor.

Another notable characteristic of the Flamanville Site is that the three reactors, including the new EPR Unit 3, will all use the same canal as the source of water for their pumping stations. The three reactors all pump cooled water from the secondary loop of the reactors back into the sea under this canal to discharge outlets offshore. In the case of the new Unit 3, the discharge pipe had to be routed underneath an old offshore iron mine that was in operation at the Flamanville Site in the late 1800s and early 1900s. The routing of the discharge under the mine has added considerable challenges to the construction of that part of the plant.

October 9, 2008 – Day 1 of Quadripartite Working Group Meeting

Vice-Chairman Bonaca, Members Powers and Stetkar, and Staff Scientist Widmayer attended the first day of the Quadripartite Working Group Meeting held at the offices of the French Nuclear Safety Authority (ASN) in Paris, France.

Vice-Chairman Bonaca provided a presentation and led a discussion in the morning session on the ACRS Role in Design Certification. Member Powers provided a presentation and led a discussion in the afternoon session on Fire Risk in Nuclear Power Plants. Notable discussions provided by other Working Group Meeting attendees are presented in the next paragraphs.

Phillippe Dupuy of ASN provided a presentation on the EPR Licensing Process. The process began with establishment of the Safety Objectives for the next generation of pressurized water reactors, which was accomplished by a cooperative team from the ASN and the German Reactor Safety Commission (RSK) in 1993. The safety approach and requirements were synthesized over the next several years and the technical guidelines that a new reactor needed to meet were published in 2000. Following this, a licensing process involving adoption of the safety options for the EPR that included public meetings and a process similar to the final safety analysis report review and issuance of a Safety Evaluation Report in the US was completed. The government of France issued the “safety decree” for the Flamanville Unit 3 in 2007 allowing construction to begin. Authorization for fuel loading is now scheduled for sometime in 2012.

Jean-Marie Mattei of the Groupe Permanent “Reacteurs” (GPR) of France provided a presentation and led a discussion on Internal and External Hazards for new reactor designs in France. He introduced the most notable change to the Safety Objectives for the new generation of pressurized water reactors, which is that the global core melt frequency must be reduced to less than 10^{-5} per plant operating year, uncertainties and all failures and hazards being taken into account. The previous safety objective was 10^{-4}.

Frank Otremba of the RSK provided a presentation and led a discussion on the German Concept of Break Exclusion. The RSK has evolved their requirements in the “Basis Safety Concept,” to provide the pressure-retaining boundary with a safety basis that precludes any disastrous failure of a plant component as a result of manufacturing defects. The safety basis is assured through materials selection, component design, manufacturing and quality assurance, and continuous and recurrent monitoring and testing of components. Research work at MPA Universität Stuttgart was presented verifying the use of the break exclusion concept through full scale tests of components. Results of the full scale tests are utilized in stress and fracture analysis to determine the

maximum allowable loads on components, and knowledge of manufacturing and service life of components coupled with ongoing and recurrent monitoring of stresses ensures the maximum loads never occur.

October 10, 2008 – Day 2 of Quadripartite Working Group Meeting

Vice-Chairman Bonaca, Members Powers and Stetkar, and Staff Scientist Widmayer attended the second day of the Quadripartite Working Group Meeting held at the ASN Offices in Paris, France.

Member Powers chaired the morning session of Day 2 of the Working Group Meeting. Member Stetkar provided a presentation and led a discussion in the morning session on the Use of probabilistic safety analysis (PSA) for Design Certification and Combined License Application. Member Powers provided a presentation and led a discussion, also in the morning session, on Accident Analysis. Notable discussions provided by other Working Group Meeting attendees are presented in the next paragraphs.

Cornelia Spitzer of the RSK provided a presentation and led a discussion on the Probabilistic Safety Assessment in Germany. The use of PSA has been extended in Germany to include an analysis for low-power and shutdown operations (LPS). The result of this extension of the PSA was development of improved procedures for LPS to avoid precursor conditions.

Jean-Marie Lanore of the GPR provided a presentation and led a discussion on the Use of PSA for the EPR in France. The technical guidelines do not provide quantitative probabilistic targets as requirements, “orientation” values were used for the evaluation of total core melt frequency (all Initiating Events) of 10^{-5} per plant operating year and core melt frequency for internal IE of 10^{-6} per plant operating year. The use of these orientation values in the PSA led to several design improvements in the EPR, including the implementation of two additional diesel generators (in addition to the four main diesel generators), the diversification of the cooling of the two low pressure injection pumps, and the diversification of the level signal in the main loops.

At the conclusion of the technical presentations, a discussion summarizing the two-day Working Group Meeting was held. All attendees said that valuable information had been shared between the groups that would assist them in further work evaluating the safety of new reactor designs. The group focused on the different applications of PSA between the countries, emphasizing there were more similarities to the approaches than differences. The working group attendees then discussed briefly, what should be discussed at the next Quadripartite Working Group Meeting currently scheduled for next fall in Tokyo, Japan. It was agreed that the following subjects would be considered and discussed further to develop the agenda for next year’s meeting: Digital I&C, Seismic Safety (with an emphasis on lessons learned in Japan from the Chuetsu-Oki earthquake on July 16, 2007), and New Reactors (with an emphasis on advanced analysis methods being used in safety reviews).