NextEra Energy Seabrook, LLC
(Seabrook Station, Unit 1)
License Renewal Application

NRC Staff Answer to Motion for Summary Disposition of Contention 4B

ATTACHMENT 4B-B

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1935

State-of-the-Art Reactor Consequence Analyses (SOARCA) Report

Office of Nuclear Regulatory Research

selection process captured the more important internally and externally initiated core damage scenarios.

SOARCA's analyses were performed with two computer codes, MELCOR for accident progression and the MELCOR Accident Consequence Code System, Version 2 (MACCS2) for offsite consequences. The NRC staff's preparations for the analyses included extensive cooperation from the licensees of Peach Bottom and Surry to develop high-fidelity plant systems models, define operator actions including the most recently developed mitigation actions, and develop models for simulation of site-specific and scenario-specific emergency planning and response. Moreover, in addition to input for model development, licensees provided information on accident scenarios from their PRAs. Through tabletop exercises of the selected scenarios with senior reactor operators, PRA analysts, and other licensee staff, licensees provided input on the timing and nature of the operator actions to mitigate the selected scenarios. The licensee input for each scenario was used to develop assumed timelines of operator actions and equipment configurations for implementing available mitigation measures which include mitigation measures beyond those routinely credited in current PRA models. A human reliability analysis, commonly included in PRAs to represent the reliability of operator actions, was not performed for SOARCA, but instead tabletop exercises, plant walkdowns, simulator runs and other inputs from licensee staff were employed to ensure that operator actions and their timings were correctly modeled.

SOARCA modeled mitigation measures, including those in emergency operating procedures (EOPs), severe accident management guidelines (SAMGs), and Title 10 to the *Code of Federal Regulations* (10 CFR) 50.54(hh). The 10 CFR 50.54(hh) mitigation measures refer to additional equipment and strategies required by the NRC following the terrorist attacks of September 11, 2001, to further improve each plant's capability to mitigate events involving a loss of large areas of the plant caused by fire and explosions. To assess the benefits of 10 CFR 50.54(hh) mitigation measures and to provide a basis for comparison to the past analyses of unmitigated severe accident scenarios, the SOARCA project also analyzed each scenario without 10 CFR 50.54 (hh) equipment and procedures. The analysis that credits successful implementation of the 10 CFR 50.54 (hh) equipment and procedures in addition to actions directed by the EOPs and SAMGs is referred to as the mitigated case. The analysis without 10 CFR 50.54(hh) equipment and procedures is referred to as the unmitigated case (SAMGs were considered but not implemented in the unmitigated case). The unmitigated case of the Surry ISLOCA is an exception to this general principle because it was necessary to assume that at least one of the EOP actions failed to occur for the scenario to lead to core damage. Chapter 3 of NUREG/CR-7110, Volume 1, "SOARCA Peach Bottom Integrated Analysis" and Volume 2, "SOARCA Surry Integrated Analysis", details the specific equipment and operator actions credited for each scenario.

For the LTSBO scenarios for both Peach Bottom and Surry (the most likely severe accident scenario for each plant considered in SOARCA) analyzed assuming no mitigation, core damage begins in 9 to 16 hours, and reactor vessel failure begins at about 20 hours. Offsite radiological release due to containment failure begins at about 20 hours for Peach Bottom (BWR) and at 45 hours for Surry (PWR). The SOARCA analyses therefore show that time may be available for operators to take corrective action and get additional assistance from plant technical support centers even if initial efforts are assumed unsuccessful. For the most rapid events (i.e., the

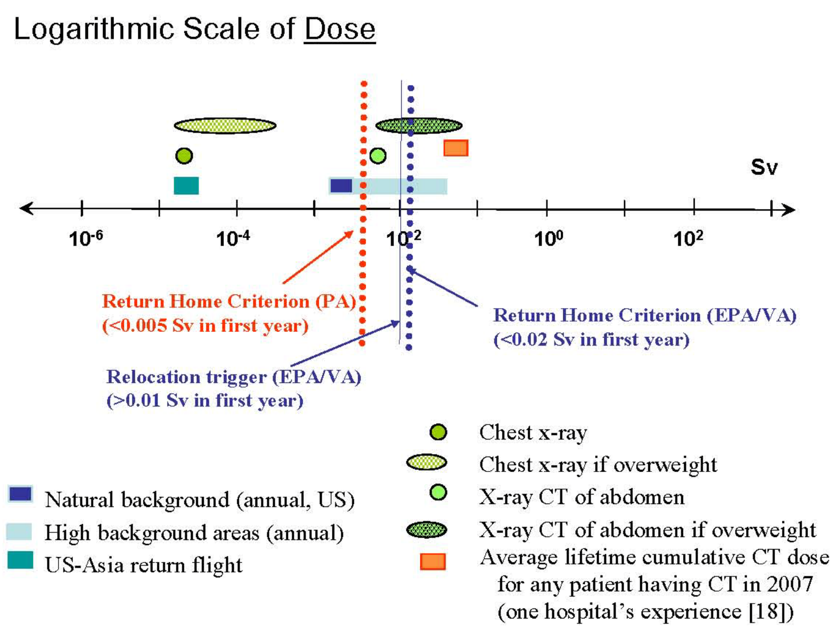

Figure 1. A logarithmic scale of dose showing a range of activities exposing people to ionizing radiation. Shown are annual background dose to residents of the US [14] and to those living in high background regions of the world [15]. Also shown are doses from airline travel and those from radiographic (e.g. chest exam) and CT procedures. [Note that all radiological doses are determined assuming the patient is Reference Man, a thin 70 kg man, 170 cm tall [20]. Since 60% of the population is overweight [21] and since the automatic shut off of the x-ray beam during radiological procedures occurs only when a sufficient number of x-rays has exited the patient, thicker patients require longer irradiation times. For those with only a few cm of extra fat the dose increase is only a factor of 2-5, however since x-ray attenuation increases exponentially with thickness, the dose increase reaches factors of 10 or even more for the very overweight [22]. The average lifetime dose to patients from multiple CT exams [18], shown in orange, is thus an *underestimate*, by an amount that depends on the body fat characteristics (i.e. thickness) of the patients studied.] Vertical lines represent doses used to trigger relocation following an accident at the Surry plant (solid) and those used as return-home criteria (dotted lines).