

dose from a LOCA and the dose would remain below regulatory limits.

The pressurized-water reactor (PWR) steam generator tube rupture accident involves direct release of radioactive material from contaminated reactor coolant to the environment. As discussed previously, no change is being requested by Exelon in the licensed technical specifications pertaining to allowed cooling-water activity concentrations. The maximum coolant activity is regulated through technical specifications that are independent of fuel burnup. Therefore, the gap-release fraction does not significantly affect the amount of radionuclides available for release during a steam generator tube rupture. Therefore, there would be no significant increase in the previously calculated dose from a steam generator tube rupture and the calculated dose would remain below regulatory limits.

The scenario postulated to evaluate potential fuel-handling accidents involves a direct release of gap activity to the environment. The assumptions regarding gap activity are based on guidance in Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" and NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants"; the gap activity consists primarily of the noble gases, iodines, and cesiums. The only isotopes that contribute significant fractions of the committed effective dose equivalent and thyroid doses are  $^{131}\text{I}$  and  $^{134}\text{Cs}$ . Similarly, the only isotopes that contribute significant fractions of the deep dose are  $^{132}\text{I}$  and  $^{133}\text{Xe}$ . The inventory of iodine, the primary dose contributor, decreases with increasing burnup. However, gap-release fraction increases as burnup increases; this in turn, would increase the calculated dose from a fuel handling accident involving one of the four assemblies addressed in this exemption. As discussed earlier and outlined in NUREG/CR-6703, additional information is needed to assess the relationship between gap-release fraction and burnup beyond 60,000 MWD/MTU to 75,000 MWD/MTU. However, based on the trend of the gap-release fraction from 33,000 MWD/MTU to 60,000 MWD/MTU, the increase in gap-release fraction as burnup increases from 60,000 MWD/MTU to 69,000 MWD/MTU is expected to be small. Therefore, the staff concludes (1) that the increase in the previously calculated dose resulting from a fuel-handling accident involving one of the assemblies would not be significant and (2) that the dose would remain below regulatory limits.

#### Environmental Impacts of Transportation

The environmental effects of incident-free spent fuel transportation were also evaluated in NUREG/CR-6703. Incident-free transportation refers to transportation activities in which shipments of radioactive material reach their destination without releasing any radioactive cargo to the environment. The vast majority of radioactive shipments are expected to reach their destination without experiencing an accident or incident, or releasing any cargo. The incident-free impacts from these normal, routine shipments arise from the low levels of radiation that are emitted externally from the shipping container. Although Federal regulations in 10 CFR part 71 and 49 CFR Part 173 impose constraints on radioactive material shipments, some radiation is not entirely shielded by the shipping container and exposes nearby persons to low levels of radiation. Based on the analyses presented in NUREG/CR-6703, the staff concludes that doses associated with incident-free transportation of spent fuel with burnup to 75,000 MWD/MTU are bounded by the doses given in 10 CFR 51.52, Table S-4, for all regions of the country if dose rates from the shipping casks are maintained within regulatory limits.

Additionally, the environmental effects of spent fuel transportation accidents were also evaluated in NUREG/CR-6703. Accident risks are the product of the likelihood of an accident involving a spent-fuel shipment and the consequences of a release of radioactive material resulting from the accident. The consequences of such a transportation accident are represented by the population dose from a release of radioactive material, given that an accident occurs that leads to a breach in the shipping cask's containment systems. The consequences are a function of the total amount of radioactive material in the shipment, the fraction that escapes from the shipping cask, the transport of radioactive material to humans, and the characteristics of the exposed population. Considering the uncertainties in the data and computational methods, the overall changes in transportation accident risks due to increasing fuel burnup of the four fuel assemblies are not significant. The calculated doses resulting from a spent fuel transportation accident will remain below regulatory limits, and no significant increase in the environmental effects of spent-fuel transportation accidents are expected.

#### Non-Radiological Impacts

With regard to potential non-radiological impacts, the proposed action does not have a potential to affect any historic sites. It does not affect non-radiological plant effluents and has no other environmental impact. Therefore, there are no significant non-radiological environmental impacts associated with the proposed action.

#### Summary

Based on the staff's independent assessment discussed above, the NRC concludes that there will be no significant environmental impacts associated with (1) using LTA M09E with fuel rods composed of ZIRLO<sup>TM</sup> cladding that has a tin content lower than the currently licensed tin content range for ZIRLO<sup>TM</sup>, and (2) irradiating the four fuel assemblies (M09E, M10E, M11E, and M12E) to a burnup of 69,000 MWD/MTU.

#### *Environmental Impacts of the Alternatives to the Proposed Action*

As an alternative to the proposed action, the staff considered denial of the proposed action (*i.e.*, the "no action" alternative). Denial of the application would result in no change in current environmental impacts. The environmental impacts of the proposed action and the alternative action are similar. However, it would deny to the licensee and the NRC operational data on low-tin content ZIRLO<sup>TM</sup> and the performance of fuel at extended burnup conditions.

#### *Alternative Use of Resources*

The action does not involve the use of any different resources than those previously considered in the Final Environmental Statement for the Byron Station, Unit Nos. 1 and 2, dated April 30, 1982.

#### *Agencies and Persons Consulted*

On July 9, 2003, the staff consulted with the Illinois State official, Frank Niziolek, of the Illinois Department of Nuclear Safety, regarding the environmental impact of the proposed action. The State official had no comments.

#### *Finding of No Significant Impact*

On the basis of the foregoing environmental assessment, the NRC staff concludes that (1) allowing use of an LTA (*i.e.*, LTA M09E) with a limited number of replacement fuel rods with ZIRLO<sup>TM</sup> cladding that has a tin content lower than the currently licensed tin content range for ZIRLO<sup>TM</sup>, and (2) permitting irradiation of four fuel assemblies (M09E, M10E, M11E, and