PUBLIC MEETING DISCUSSION TOPICS

RELATED TO TOPICAL REPORT

"Uranium Oxycarbide (UCO) Tristructural

Isotropic (TRISO) Coated Particle Fuel Performance"

The following questions cover areas that may involve requests for information regarding topical report "Uranium Oxycarbide (UCO) Tristructural Isotropic (TRISO) Coated Particle Fuel Performance, Topical Report EPRI-AR-1" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19155A173).

At this stage, these questions are not formal requests for information. However, staff expects the regulatory basis for future RAIs based on these questions to be related to 10 CFR 50. 34(a)(1)(ii)(C), which requires an applicant describe the extent to which the reactor incorporates unique, unusual or enhanced safety features having a significant bearing on the probability or consequences of accidental release of radioactive materials, and General Design Criterion (GDC) 10, "Reactor design". Although the GDC do not directly apply to non-light water reactor designs, all applicants for a nuclear power reactor must provide principal design criteria (see 10 CFR 50.34(a)(3)(i), 10 CFR 52.47(a)(3)(i), or 10 CFR 52.79(a)(4)(i)), and for designs utilizing TRISO fuel referencing the topical report, staff expects the radionuclide retention function of the fuel to be a key element in justifying acceptably low calculated dose.

1. Conclusion 1 of the TR states that "testing of UCO TRISO-coated fuel particles in AGR-1 and AGR-2 constitutes a performance demonstration of these particle designs over a range of normal operating and off-normal accident conditions." Discussions under the conclusion reference a compact-averaged burnup of 7.3-19.6% fissions per initial metal atom (FIMA) and time averaged maximum temperatures of 1069-1360 C. Are there other relevant performance parameters that bound the data set, such as those referenced in Figure 4-6 (packing fraction, fluence, power density)? Based on the discussion in the report, it appears some of these parameters could influence particle performance, but these values are not provided as bounds for the "range of normal operating and off-normal accident conditions". Provide context for what constitutes a "range of normal operating and off-normal accident conditions" (e.g. reference a table), or provide a justification for why burnup and time averaged temperature are sufficient.

2. Conclusion 2 of the TR states "UCO TRISO-coated fuel particles that satisfy the parameter envelope defined by these measured particle layer properties in Table 5-5 can be relied on to provide satisfactory performance." While Table 5-5 provides a list of physical parameters for fuel specifications, it does not appear to directly cover all of the parameters that govern the specifications that constitute the parameter envelope applicable to the tested AGR fuel. Some elements in particular that the report highlights as important but that are not directly referred to in Table 5-5 include kernel-to-buffer ratio for the fuel particle (and potentially its associated size), columnar grain structure of the SiC, and carbon content of the UCO. It is not clear to the staff how these limits are applicable to the conclusions in the report. Provide a justification for how these parameters are implicitly captured in Table 5-5, supplement the report to include these

parameters as limits for TR applicability, or provide justification for why these elements are not important.

Further, the report references the importance of an uninterrupted coating process in the manufacture of the fuel. Do the parameters in Table 5-5 adequately restrict fuel particle specifications such that this process does not need to be explicitly required? If not, provide a justification, consider restricting the applicability of the TR to fuel manufactured using a similar process, or add a proxy measurable parameter to Table 5-5 that does provide assurance that an uninterrupted coating process has been followed.

3. The TR states that "fuel particles tested in AGR-1 and AGR-2 exhibited property variations…with remarkably similar excellent irradiation and accident safety performance results. The ranges of those variations in key characteristics of the kernels and coatings are reflected in measured particle layer properties provided in Table 5-5 from AGR-1 and AGR-2." Table 5-5 provides a set of characteristics for both tested fuel and specified ranges for "acceptable" fuel, both for mean values and extremes. The specification range is large than the tested fuel range, sometimes substantially. Based on the provided data, there is a clear basis for use of the measured values in Table 5-5, but the basis for the specified range and especially the Maximum Allowable Fraction Beyond the Critical Limit(s) is not clear. Additionally, the table references the AGR-1 and -2 dataset separately in some cases. Provide a table with a clear requested range for each property for approval to be referenced in the conclusions. Further, provide a basis for useage of the values in this table for ranges beyond the tested ranges, paying particular attention to Maximum Allowable Fraction Beyond the Critical Limit(s), where the allowed particles may be substantially "worse" than those tested.

4. TR conclusion 3 states "fission product release data and fuel failure fractions, as summarized in this report, can be used for licensing of reactors employing UCO TRISO-coated fuel particles that satisfy the parameter envelope defined by measured particle layer properties in Table 5-5." The phrases "as summarized in this report" and "can be used for licensing of reactors" lack specificity, though the subsequent discussion is relatively clear.

   (a) Consider revising to more specifically reference the data presented, and narrow the scope of the request "can be used for licensing of reactors" to something more appropriate for the TR.

   (b) Conclusion number 3 further states that the aggregate AGR-1 and AGR-2 fission product release data and fuel failure fractions can be used for licensing of reactors employing UCO TRISO-coated fuel particles that satisfy the parameter envelope detailed in the topical report. The staff notes that while the topical report supports fission gas release rates for most isotopes, it does not cover short-lived isotopes which decayed away before the particles discussed in EPRI-AR-1(NP) could be characterized. Therefore, the data set does not cover all of the fission gas release data necessary for licensing. Provide justification to support the statements in conclusion number 3 or limit the conclusion to the isotopes covered by the topical report.

5. The staff assessment of “Next Generation Nuclear Plant Quality Assurance Program Description,” dated September 12, 2012 (ADAMS Accession No. ML12241A157), found that the QAPD was acceptable for use during the technology development and high level design phase of the NGNP project. As such, the staff is seeking clarification on the scope of the activities performed by Idaho National Laboratory to obtain and submit the data used by EPRI in their topical report titled “Uranium Oxycarbide (UCO) Tristructural Isotropic (TRISO) Coated Particle Fuel Performance: Topical Report EPRI-AR-I(NP)”.