

71-5797
ENCLOSURE 1

**BACKGROUND AND BASIS FOR SAR REV 14 CHANGES FOR THE ADDITION OF
FUEL ELEMENT COMBS, REMOVAL OF TIE DOWN BANDS FROM SARP FIGURES,
AND DELETION OF THE 3-YEAR PERIODIC INSPECTION**

Fuel Element Combs

HFIR fuel element combs are constructed of 6061-T6 aluminum and installed in segments which are spot welded to fuel plates at the ends of each segment, and in the middle of each segment, to form concentric rings on the non-fuel-bearing portion at the top of the fuel plates. Recent HFIR fuel element manufacturing anomalies have resulted in several fuel elements with welding defects or inadequate fuel plate protrusion into the element side plate(s). In an effort to provide additional structural support (end stiffening and proper separation) for the fuel plates, fuel element combs may be installed on fuel elements, as required, or when a cognizant engineer determines they are necessary (as described in more detail below). The fuel combs reduce the frequency of fuel element failures that could cause a flow blockage event due to a combination of these manufacturing anomalies coupled with expected thermal-hydraulic forces in the reactor.

Fuel element combs were used early in the operating history of the HFIR to stabilize the fuel plates but discontinued after a short period, following successful testing of an element in the reactor for a full cycle without combs. At the time, the probability of damaging the element during comb installation, which involved full circumferential welds around the element (rather than spot welds for the new design), was considered to outweigh the risk associated with plate deflections during reactor operation. Following the HFIR fuel degradation event in 2018 (SCO-SO--ORNL-X10HFIR-2018-0005), and subsequent discoveries of isolated deflected fuel plates in spent fuel stored in the HFIR clean pools, a design change modification was processed to install combs on outer fuel elements with identified degraded fuel plate attachment welds or other manufacturing defects which could result in fuel plate deflection under normal reactor operating conditions. Combs have been installed and successfully operated on multiple outer fuel elements since approval of the design change modification. A similar modification to allow the use of combs on inner fuel elements is expected in the near future. All fuel combs thus far have been installed on site at HFIR; however, it is desired to have the option to install these at the fuel manufacturer in the future.

Computerized tomography (CT) scanning is currently performed on fuel elements at Y-12 National Security Complex prior to operation in the reactor to verify adequate fuel plate attachment welds. Combs may be installed on specified elements as determined (or recommended) by a cognizant HFIR engineer for an abnormal element condition, such as inadequate fuel plate attachment welds or excessive coolant channel variations. Additionally, a Condition of Approval (COA) for the HFIR facility safety basis supplement to install fuel element combs on outer fuel elements was provided to ORNL by the DOE Office of Science:

Any outer element with a weld in seam 1 that does not meet CT acceptance criteria shall have fuel combs installed before being flow tested in the reactor.

(Note that weld seam 1 is the top circumferential weld seam between the edge of a fuel plate and the side plate of the fuel element.) It should also be noted that ORNL is in the process of preparing an additional safety basis supplement to install fuel element combs on all fuel elements,

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regardless of identified weld defects, in order to discontinue CT scanning, which is costly and ineffective for the identification of substandard welds on the outer side plate of outer fuel elements.

The fuel element combs do not perform a credited package safety function for the purpose of compliance with the requirements of 10 CFR 71. The installation of combs represents an insignificant additional weight for the overall package (i.e., less than two ounces for both combs on an outer element) and will have a negligible effect on the fuel element shipping container performance during normal conditions of transport (NCT) and hypothetical accident conditions (HAC).

Tie-Down Band

NRC issued Letter Authorization (ML22105A053) to CoC 5797 Rev. 22 on April 15, 2022 to resolve identified nonconformances associated with the tie down band (TDB) shown on drawing M-20978-EL-008E, Rev. C, ORNL drawings M-20978-EL-002E, M-20978-EL-003E, and M-20978-EL-008E (provided in the SAR as Figures 1.3, 1.4, and 1.5, respectively). These drawings have been updated to remove the TDBs. A new ORNL drawing M-20978-EL-008B, *Shipping Container Tie Down Band For Unirradiated Out/In HFIR Element Details*, was added for reference in the text of Chapter 7.1, *Procedures for Loading Packages*, where the TDB (referred to as a removable shoring ring) is discussed. These changes resolve the referenced nonconformances.

Removal of 3-Year Periodic Inspection

Chapters 8 and 9 of the SAR require a three-year periodic inspection of the HFIR containers against their associated design drawings. A full “as-built” inspection of these containers on a periodic basis is not required by the applicable regulations in 10 CFR 71 and is no longer needed. Pre-shipment inspections performed as required by 10 CFR 71.87, *Routine Determinations*, are sufficient to delete this extra-regulatory requirement from the SAR.