The composition of the fuel for the ATRIUM 11 in the TN-B1 can be broadly put into two categories: BLEU material and Non-BLEU material.

Non-BLEU material

All ATRIUM 11 fuel, with the exception of BLEU (down-blended low enrichment fuel), is made from UF_6 which meets ASTM C996-15 "Standard Specification for Uranium Hexafluoride Enriched to Less Than 5% ^{235}U" requirements. ASTM C996-15 allows for the use of reprocessed UF_6.

The term "reprocessed uranium" used in the SAR, FS1-0014159 "Framatome TN-B1 Docket No. 71-9372 Safety Analysis Report" is derived from the term "reprocessed UF_6" as defined in ASTM C996-15. The ASTM definition is shown below:

> "3.1.3 *Reprocessed UF_6* – any UF_6 made from uranium that has been exposed in a neutron irradiation facility and subsequently chemically separated from the fission productions and transuranic isotopes so generated".

Section 5.1 of ASTM C996-15 states that:

> "5.1 Both Enriched Commercial Grade UF6 and Enriched Reprocessed UF_6 must meet the specification criteria except as differentiated in 4.4, 4.5, 5.4, and 5.5. For certain isotopes, including artificially created radioactive species, two groups of limits are set. Limits for Enriched Commercial Grade UF_6 are set so as to have no special impact on the use of this material in existing facilities. For Enriched Reprocessed UF_6, higher limits are indicated to correspond with Specification C787, and lower limits may be agreed upon by the buyer and seller according to the composition of the feed material presented for enrichment."

As shown in ASTM C996-15, ^{236}U is used as an indicator for other actions to take. Specifically section 5.4 of the ASTM reads as follows:

> "5.4 Enriched Commercial Grade UF_6 shall comply with the limits given in 5.5. For evaluating Enriched Commercial Grade UF_6, the measured concentration of ^{236}U will be used as an indicator for contamination with reprocessed uranium, on the assumption that there is no opportunity for contamination with irradiated uranium that has not been processed to remove the majority of fission products. Uranium isotopic concentrations shall be determined and reported for ^{234}U, ^{235}U, and ^{236}U."

As shown in 5.5 of the ASTM C995-15, ASTM C996-15 and ASTM C787-15 "Standard Specification for Uranium Hexafluoride for Enrichment" are then used to determine the acceptable limits for ^{234}U, ^{235}U and ^{236}U. ASTM C996-15, section 4.4 and 4.5, and ASTM C787-15, sections 4.4 and 4.5 are then used to establish gamma and alpha activity limits for the fission products not removed by the chemical separation process.

As a result Framatome can state that all incoming UF_6 meets the requirements of ASTM C996-15, although some of the UF_6 will not meet the definition of "commercial grade UF_6" as defined in the ASTM (e.g. "reprocessed UF_6"). Since pellets are made from the incoming UF_6, and Framatome has no ability to further irradiate or concentrate isotopes, the isotopic requirements of ASTM C996-15 and ASTM C787-15 bound the isotopic values of the isotopes of interest. Additionally the gamma and alpha activity can be similarly bounded.

BLEU material

Regarding BLEU material, BLEU is not supplied to Framatome as UF_6. It is supplied to Framatome based upon an "Interagency Agreement-TVA-DOE-Material Specification". The isotopic content is detailed in Attachment 2 "SRS Low Enriched Uranyl Nitrate Solution Specifications" of that material specification. The uranyl nitrate is converted to UO_2 powder prior to arrival in Richland. The specification also provides a "Fission Product Gamma Activity".

Since pellets are made from the incoming BLEU material, and Framatome has no ability to further irradiate or concentrate isotopes, the isotopic values shown in the "Interagency Agreement-TVA-DOE-Material Specification" bound the isotopic values of the isotopes of interest. Additionally the gamma activity can be similarly bounded.

Summary

The content of the package, in particular the isotopic composition, is shown in Table "1-3 Type B Quantity of Radioactive Material" and Table 1-4 "Isotopes and A2 Fractions" of the SAR. The tables show the limiting isotopes between the BLEU material and material made from UF_6.

References

1. ASTM C996-15 "Standard Specification for Uranium Hexafluoride Enriched to Less Than 5% 235U"
2. FS1-0014159 "Framatome TN-B1 Docket No. 71-9372 Safety Analysis Report"
3. ASTM C787-15 "Standard Specification for Uranium Hexafluoride for Enrichment"
4. Interagency Agreement DE-SA09-01 SR18976/TVA NO. P-01 NSA-249655-001 Between The Department Of Energy (DOE) And The Tennessee Valley Authority (TVA) For The Off-Specification Fuel Project.