



TECHNICAL SPECIFICATION

UNIVERSITY OF MISSOURI
RESEARCH REACTOR FACILITY

Number 3.8

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Date

SUBJECT: Reactor Fuel

Applicability

This specification applies to fuel elements used in the reactor core.

Objective

The objective of this specification is to assure that the reactor fuel is operated within acceptable design considerations thus maintaining fuel integrity.

Specification

- a. The peak burnup for UAl_x intermetallic fuel shall not exceed a calculated 2.3×10^{21} fissions per cubic centimeter.]
- b. The reactor will not be operated using fuel in which anomalies have been detected or in which dimensional changes of any coolant channel between fuel plates exceed ten (10) mils.]
- c. The reactor core shall consist of eight fuel assemblies for which the associated power peaking results in a greater than or equal maximum allowable power than that given in figures 2.0, 2.1, 2.2 of specification 2.1 for the various combinations of core flow rate, reactor inlet temperature and pressurizer pressure.]
Exception: The reactor may be operated to 100 watts above shutdown power on less than eight assemblies or with greater power peaking for purpose of reactor calibration or multiplication studies.]
- d. All fuel elements or fueled devices outside the reactor core shall be stored in a geometry such that the calculated K_{eff} is less than 0.9 under all conditions of moderation.]



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SUBJECT: Reactor Fuel (continued)

- e. Irradiated fuel elements shall be stored in an array which will permit sufficient natural convection cooling such that the fuel element temperature will not exceed design values.

Bases

- a. The fuel burnup limit restricts the peak fissions per cm^3 burnup to values correlated to result in less than a 10% swelling of the fuel plates. It has been found that fuel plate swelling of less than 10% has no detrimental effect on fuel plate performance. (Ref. License R-103 Change No. 4 dated August 12, 1968, Change No. 6 dated November 25, 1970, and Application dated September 12, 1986 with supplements).]
- b. Specification 3.8.b assures that fuel elements which have been inspected and found to be defective are no longer used for reactor operation.
- c. To assure the validity of the safety limit curves (specification 2.1) and other safety analysis, specification 3.8.c limits the core to eight fuel elements and their maximum power peaking for operation at any significant power level.]
- d. The limits imposed by specifications 3.8.d and 3.8.e are conservative and assure safe fuel storage.

- a. Each reactor fuel element shall contain 24 fuel-bearing plates with nominal active length of 24 inches and plate thickness of 0.05 inches. The nominal distance between plates shall be 0.080 inches. Plate nominal cladding thickness shall be 0.015 inches.
- b. The fuel meat shall be fully enriched U235-aluminide, UAl_x .
- c. Each of the reactor fuel elements shall be either of two types; one with a maximum U235 loading of 1270 grams (Extended Life Aluminide Fuel) and a second one with a maximum U235 loading of 775 grams. The reactor shall operate with any possible combination of these two fuel element types. The fuel meat of the Extended Life Aluminide Fuel (ELAF) may also contain boron carbide (B_4C) as burnable poison. The boron content shall not exceed 1.08 grams of natural boron per element.



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SUBJECT: Reactor Fuel

Bases

a. and b.

The fuel elements for the University of Missouri Research Reactor (MURR) are one of a configuration (aluminide UAl_x plate type) successfully and extensively used for many years in test and research reactors. The specifications 4.1.a and 4.1.b require fuel content and dimensions of the fuel elements to be in accordance with the design basis criteria for proper heat transfer and, hence, can be safely used to the burnup limits of Technical Specification 3.8.

- c. The ELAF fuel elements have the same physical dimensions as the 775 gram elements. The only changes will be in the U235 loading per plate and the addition of burnable poison. Extensive neutronic and thermal hydraulic analyses indicate that the performance of the ELAF fuel elements are satisfactory and that the University of Missouri Research Reactor can operate safely at 10 MW steady state power level with ELAF fuel elements or with any mixed combination of 775 gram and 1270 gram fuel elements without violating the current safety limits (Technical Specification 2.1).

References

- 1) Hazards Summary Report, July 1965, Section 4.2
- 2) Hazards Summary Report, July 1965, Section 5.5
- 3) Letter, September 12, 1986, University of Missouri to Nuclear Regulatory Commission (NRC) requesting amendment to R-103 operating license.
- 4) Letter, September 11, 1987, University of Missouri to NRC as a response to NRC request for additional information--dated May 7, 1987.
- 5) Letter, March 11, 1988, University of Missouri to NRC as a response to NRC request for additional information--dated January 11, 1988



TECHNICAL SPECIFICATION

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Number 5.5
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SUBJECT: Fuel Elements

Applicability

This specification shall apply to the surveillance of the reactor fuel elements.

Objective

The objective of this specification is to reasonably assure proper performance of the reactor fuel.

Specification

One fuel element from each consecutively numbered series of eight elements]
will be randomly selected and the fuel plates inspected for anomalies after a]
peak fuel element burnup corresponding to greater than 90 percent of the peak]
burnup limit (specification 3.8.a). If all of a series of eight elements are removed]
from use before they reach 90 percent of the peak burnup limit, then one of the]
four fuel elements with the higher average power histories will be inspected.]

Bases

The specified inspections of fuel elements provide for the detection of anomalies resulting from reactor operation and therefore reduce the possibility that fission products could be released to the reactor coolant.