West Valley Demonstration Project

Doc. Number TR-IRTS-11

Revision Number 0

Revision Date 09-25-91
Engineering Release #2192

TITLE: Fissile Material Mass Balance Across the LWTS Evaporator

PREPARED BY _____ J. J. Prowse Date 8/14/91
Cognizant Engineer

APPROVED BY _____ D. C. Meess Date 8-14-91
Cognizant System Design Manager

APPROVED BY _____ R. A. Humphrey Date 8/14/91
Radiation & Safety Committee
Chairman

APPROVED BY _____ D. L. Shugars Date 8/14/91
Quality Assurance

APPROVED BY P. J. Valenti /jcc P. J. Valenti Date 8-14-91
Facilities Manager

APPROVED BY _____ D. J. Harward Date 8/14/91
Radiation & Safety Department
Manager

West Valley Nuclear Services Co., Inc.

P.O. Box 191

West Valley, NY 14171-0191

DMS0878:WP3RM

WV-1816, Rev. 1

DOE Approved DW:91:0682
Dated: August 26, 1991

RECORD OF REVISION

PROCEDURE

If there are changes to the procedure, the revision number increases by one. These changes are indicated in the left margin of the body by an arrow (>) at the beginning of the paragraph that contains a change.

Example:

> The arrow in the margin indicates a change.

Rev. No.	Description of	Revision On Page(s)	Dated
0	Original Issue	All	09/25/91

RECORD OF REVISION (CONTINUATION SHEET)

Rev. No.	Description of Changes	Revision On Page(s)	Dated

TECHNICAL REQUIREMENT IRTS-11

TITLE: Fissile Material Mass Balance Across the LWTS Evaporator

CRITERIA: Maintain the mass of fissile plutonium deposited in the LWTS evaporator to less than 450 g.

Maintain the mass of fissile uranium deposited in the LWTS evaporator to less than 1.5 kg.

UNACCEPTABLE EVENTS: Deposition of fissile material in the evaporator in excess of criteria.

REPORTING REQUIREMENTS: For Technical Requirement (TR) violations, WV-987, "Initial Investigation, Oral Reporting, and Written Critique of Occurrences at WVNS," shall be followed.

Technical Requirement IRTS-11
Fissile Material Mass Balance Across the LWTS Evaporator Page No.

IMPLEMENTING PROCEDURES:

TBD

TECHNICAL REQUIREMENT

Fissile Material Mass Balance Across the LWTS Evaporator

APPLICABILITY

This Technical Requirement (TR) applies to the accumulation of fissile plutonium and fissile uranium in the Liquid Waste Treatment System (LWTS) between the evaporator feed tank and the concentrates tank (specifically, the accumulation of fissile plutonium and fissile uranium in the evaporator).

OBJECTIVE

To maintain a mass inventory for fissile plutonium and fissile uranium in the LWTS between the evaporator feed tank and the concentrates tank and, specifically, to limit the accumulated mass, as a deposit of fissile plutonium to less than 450 g and fissile uranium to less than 1.5 kg in the evaporator.

DEFINITIONS

Alpha Plutonium - Pu-238 plus Pu-239 plus Pu-240 plus Pu-242
Fissile Plutonium - Pu-239 plus Pu-241
Fissile Uranium - U-233 plus U-235
Deposit - a solid form of salt which cannot be easily rinsed or flushed from a vessel
Total Uranium - all isotopes of uranium
Weekly - at least once every 7 days (168 hours), but not to exceed once every 8 days (192 hours)

LIMITING CONDITIONS FOR OPERATION (LCOs)

For the evaporator to process radioactive waste, the accumulated fissile plutonium and fissile uranium masses, as deposits in the evaporator (31017), must be less than 450 g and 1.5 kg, respectively.

SURVEILLANCE REQUIREMENTS (SRs)

(Reference LCO) During processing of each batch, at least one representative sample of liquid from the evaporator feed tank (e.g., 5D-15B or 35104) and the concentrates tank (e.g., 5D-15A1 or 5D-15A2), as appropriate, shall be taken and analyzed for alpha plutonium and total uranium. A fissile mass balance shall be calculated and documented based on these samples and the volume

processed. A cumulative fissile plutonium and fissile uranium mass inventory for the LWTS between the evaporator feed tank and the concentrates tank shall also be maintained.

RECOVERY ACTIONS

(Reference LCO) An independent evaluation shall be performed and documented to assess the mass inventory. Proposed corrective actions shall be approved by the Radiation and Safety Committee and the actions documented prior to resumption of radioactive waste processing activities.

BASIS

This TR implements the controls needed to limit the accumulated fissile mass, as a deposit, in the evaporator. By limiting the accumulated masses of fissile plutonium and fissile uranium to less than 450 g and 1.5 kg, respectively, between the evaporator feed tank and the concentrates tank, the accumulation in the evaporator is also limited to this amount.

During trending analysis of process data from the IRTS in early November, 1990, it was observed that the concentration of dissolved plutonium and uranium in Tank 8D-2 had increased. On November 14, 1990, the observation was categorized as an Unusual Occurrence per DOE Order 5000.3A, "Occurrence Reporting and Processing of Operation Information". An Occurrence Report was issued (WVNS-90-0026, LWTS-90-0001), and the IRTS was placed in standby pending the completion of an investigation. The investigation was completed and it was estimated that 359±100 g total plutonium and 1,886 g (upper bound) total uranium had resulted in a salt deposit on the surfaces of the evaporator (Mahoney, 1991). Acid washing the evaporator removed Pu and U and established a lower initial inventory of fissile material prior to resumption of radioactive waste processing.

Criticality analyses of the evaporator were completed and indicated that the evaporator was in a highly subcritical state with 460 g fissile plutonium and 1,886 g of fissile uranium present (Caldwell, 1991; Yuan, 1991). The expected maximum liquid concentration of fissile plutonium and fissile uranium will add less than 20 g of fissile material at the maximum working volume of the evaporator during sludge wash solution processing. The limits in the LCO of 450 g of fissile plutonium and 1.5 kg of fissile uranium can be considered a

"safe mass" as defined in DOE Order 5480.5, "Safety of Nuclear Facilities," and as demonstrated by the criticality analyses which have been performed.

REFERENCES

Caldwell, J. T., Letter Report, "Keff Calculations for WVNS," dated March 11, 1991, ZW:91:0031.

DOE Order 5000.3A, "Occurrence Reporting and Processing of Operations Information," May 30, 1990.

DOE Order 5480.5, "Safety of Nuclear Facilities," September 23, 1986.

Mahoney, J. L., Memo to P. J. Valenti, "Best Estimate and Uncertainty of Pu in the LWTS Evaporator," dated May 28, 1991, CJ:91:0047.

Memo from Y. Yuan to C. J. Roberts, "Criticality Evaluation IRTS Evaporator, Final Report," dated April 11, 1991, FB:91:0081.

UOR WVNS-90-0026, LWTS-90-0001, "Significant Curtailment of Operations by WVNS to Perform an Investigation of Processing."