

RECORDS MANAGEMENT DEPARTMENT

TO: C. GLENN
FROM: D.L. HORTON

NRC HEADQUARTERS

AOC-21 TEL: 716 942-4300

DATE: 12/06/2002
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CONTROLLED COPY#	PROC ID	REV#	FC#	ISSUE DATE	PROCEDURE TITLE
006	PSR-1	2		12/06/2002	REQUIREMENTS FOR LIQUID TRANSFERS OF FISSILE MATERIAL

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PROCESS SAFETY REQUIREMENTS
WVDP-218
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PSR-18	0		COLLECTION, PROCESSING, AND STORAGE REQUIREMENTS FOR FISSILE-BEARING DEBRIS	ACTIVE	06/12/2002	COVERT, B.C.
PSR-18	0	1	COLLECTION, PROCESSING, AND STORAGE REQUIREMENTS FOR FISSILE-BEARING DEBRIS	ACTIVE	11/14/2002	COVERT, B.C.


West Valley Demonstration Project

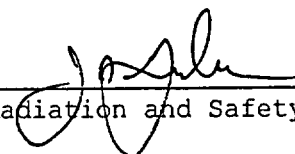
Doc. ID Number PSR-1

Revision Number 2

Revision Date 12/06/2002

PROCESS SAFETY REQUIREMENTS REQUIREMENTS FOR LIQUID TRANSFERS OF FISSILE MATERIAL

APPROVED BY:  Date 11/22/02
Cognizant Manager

APPROVED BY:  Date 11/22/02
Radiation and Safety Committee Chairman

APPROVED BY:  Date 12-2-02
Site Services Manager

WVNSCO
West Valley Nuclear Services Company
10282 Rock Springs Road
West Valley, New York USA 14171-9799

PROCESS SAFETY REQUIREMENT - 1

TITLE: Requirements for Liquid Transfers of Fissile Material

CRITERIA: Prevention of inadvertent criticality due to liquid transfers.
(PSR Criterion 3.a.)

UNACCEPTABLE EVENTS: Combination of process streams resulting in an inadvertent criticality.

Process Safety Requirement - 1

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PROCESS SAFETY REQUIREMENT

REQUIREMENTS FOR LIQUID TRANSFERS OF FISSILE MATERIALS

APPLICABILITY

This Process Safety Requirement (PSR) applies to tank-to-tank transfers of liquids containing greater than 1 gram total uranium or 0.06 Ci (Pu-239 + Pu-240).

This PSR does not apply to transfers of liquids between tanks 7D-2 and 3D-2 for the purpose of sampling tank 7D-2. This PSR does not apply to transfers of liquids within or between any of the following tanks or components within the Integrated Radwaste Treatment System (IRTS): 8D-1, 8D-2, 50D-001, STS Ion Exchange Columns, 8D-3, 5D-15B, 31017 (LWTS evaporator), 5D-15A1, 5D-15A2, the Distillate Surge Tank (71-D-005), and the Waste Dispensing Vessel (70-D-001). This PSR does not apply to transfers of liquids within or between any of the following tanks or components within the Waste Tank Farm and Vitrification Facility (VF): 8D-1, 8D-2, 8D-3, 8D-4, Concentrator Feed Makeup Tank, Melter Feed Hold Tank, Slurry Fed Ceramic Melter, Submerged Bed Scrubber, Neutralizing Tank, and the Decontamination Tank.

OBJECTIVE

The objective of this PSR is to ensure that all liquid transfers of FISSILE URANIUM and FISSILE PLUTONIUM are conducted in a manner such that a subcritical condition exists at all times.

SPECIFICATIONS

1. LIMITING CONDITION FOR OPERATION

The FISSILE URANIUM and FISSILE PLUTONIUM concentrations in liquids in both the "sending tank" and "receiving tank" involved in a liquid transfer shall be in compliance with the limits listed in Table 1.

ACTION

If sample analysis or documented process knowledge indicates that the FISSILE URANIUM and FISSILE PLUTONIUM concentrations of either the sending tank or receiving tank are not in compliance with the limits specified in Table 1, the transfer shall not proceed, the tank(s) shall be left in its as discovered state, and the Radiation and Safety Committee Chairman shall be notified.

Disposition of the tank contents shall be in accordance with a written plan that is approved by the Radiation and Safety Committee.

SURVEILLANCE REQUIREMENT

Before initiating tank-to-tank transfers of liquids containing FISSILE URANIUM and FISSILE PLUTONIUM, the FISSILE URANIUM and FISSILE PLUTONIUM concentrations in both the sending tank and the receiving tank shall be determined in accordance with the requirements of an approved IMPLEMENTING PROCEDURE.

2. LIMITING CONDITION FOR OPERATION

FISSILE URANIUM and FISSILE PLUTONIUM in solution shall not be precipitated.

ACTION

If it is determined that conditions exist such that the precipitation of FISSILE URANIUM and FISSILE PLUTONIUM is possible, the transfer shall not proceed and the Radiation and Safety Committee Chairman shall be notified. Disposition of the tank contents shall be in accordance with a written plan that is approved by the Radiation and Safety Committee.

SURVEILLANCE REQUIREMENT

Before initiating tank-to-tank transfers of liquids containing FISSILE URANIUM and FISSILE PLUTONIUM and before neutralization of solutions containing FISSILE URANIUM and FISSILE PLUTONIUM, analyses shall be performed to ensure that FISSILE URANIUM and FISSILE PLUTONIUM will not precipitate.

BASES

Basis of Applicability

This PSR has been prepared to control the transfer of liquids containing FISSILE URANIUM and FISSILE PLUTONIUM between tanks in facilities at the WVDP. Due to the nature of activities at the WVDP, many waste streams, including streams meeting environmental discharge requirements, contain some quantity of FISSILE URANIUM and FISSILE PLUTONIUM. The thresholds specified in the Applicability of this PSR (i.e.,

1 gram TOTAL URANIUM, or 0.06 Ci Pu-239 + (Pu-240) have been selected to exclude waste streams containing very low masses of FISSILE URANIUM and FISSILE PLUTONIUM. This threshold is consistent with DOE Order 420.1, DOE G 421.1-1, ANSI/ANS-8.1-1983, and ANSI/ANS-8.10-1983. DOE G 421.1-1 specifically addresses the concept of "Exempt quantities of fissionable materials" in section 5.6.2.12. This concept allows for each facility to document the quantities of fissionable materials that do not require Nuclear Criticality Safety Evaluations and do not require criticality safety controls. Based upon process knowledge and sampling history, the tanks to which this PSR applies are not expected to contain quantities of FISSILE URANIUM and FISSILE PLUTONIUM such that the exempt quantity would result in a meaningful increase in the K_{eff} of any of the tanks. Further, this practice is also applied at Savannah River and Hanford.

The analysis documented in Reference 1 has determined that the tanks to which this PSR applies (i.e.; Tanks 13D-8, 7D-2, 3D-2 [except when sampling 7D-2], 7D-8, 7D-14, 4D-10, 7D-1, 4D-2) are critically safe when the limits of Table 1 are met. The criticality safety of operations within the IRTS and Vitrification Facility are documented in References 2 and 3. These systems process waste streams with inherently safe FISSILE URANIUM and FISSILE PLUTONIUM concentrations. Therefore, liquid transfers of FISSILE URANIUM and FISSILE PLUTONIUM in the IRTS and Vitrification Facility need not be addressed in this PSR.

Bases of Limiting Conditions for Operation

1. Reference 1 calculates the safe concentration of Pu-239 corresponding to a given concentration of U-235. The analysis in Reference 1 assumed a moderated, unreflected system containing only U-235 and Pu-239. Other fissile nuclides at the WVDP include U-233 and Pu-241. Although the analysis in Reference 1 considered these nuclides, it concluded that these nuclides would not contribute significantly to the reactivity of systems in which they are present due to the relatively small fraction (less than 5%) of the total fissile mass that these nuclides represent. Table 1 of this PSR has been adapted, and independently reviewed, from Table 5.3 of Reference 1 to present limits in units provided by Analytical and Process Chemistry.
2. The analysis of Reference 1 assumes that the FISSILE URANIUM and FISSILE

PLUTONIUM is homogeneously distributed within the solution. Precipitation of FISSILE URANIUM and FISSILE PLUTONIUM in a plant tank could result in an unanalyzed condition. Standard criticality safety references such as Reference 4 indicate that heterogenous moderated systems are more reactive than similar homogeneous systems. It is therefore necessary to identify and evaluate conditions that could result in the precipitation of FISSILE URANIUM and FISSILE PLUTONIUM:

ATTACHMENT

Table 1 - Criteria for Determining the Allowable FISSILE URANIUM and FISSILE PLUTONIUM Concentrations for Liquid Transfers

REFERENCES

- 1) FB:85:0150, *Allowable Fissile Material Solution Concentration for Liquid Transfers*, Revision 1, K. A. O'Ahoofe memo to C.J. Roberts dated July 2, 1985.
- 2) WVNS-SAR-001, *Safety Analysis Report for Waste Processing and Support Activities*.
- 3) Paxton, H. C., and N. L. Pruvost. July, 1987. *Critical Dimensions of Systems Containing ²³⁵U, ²³⁹Pu, and ²³³U (1986 Revision)*. Los Alamos National Laboratory. Report No. LA-10860-MS.
- 4) DOE Order 420.1. "Facility Safety."
- 5) DOE G 421.1-1. "DOE Good Practices Guide: Criticality Safety Good Practices Program Guide for DOE Nonreactor Nuclear Facilities."
- 6) ANSI/ANS-8.1-1983. "Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors." 1983.
- 7) ANSI/ANS-8.10-1983. "Criteria for Nuclear Criticality Safety Controls in Operations with Shielding and Confinement." 1983.

TABLE 1

CRITERIA FOR DETERMINING THE ALLOWABLE FISSILE URANIUM and FISSILE PLUTONIUM CONCENTRATIONS FOR LIQUID TRANSFERS ¹

Column 1		Column 2
Concentration of Total Uranium ²		Corresponding Maximum Plutonium Concentration (Pu-239 + Pu-240)
µg/mL		µCi/mL
Greater Than or Equal to	But Less Than	
		Greater than 190 ³
0.	50	190 ³
50	500	170
500	1,000	140
1,000	2,000	94
2,000	2,500	71
2,500	3,000	46
3,000	3,500	20
3,500 ³		

1. Column 1 is the concentration of total FISSILE URANIUM and Column 2 is the corresponding allowable concentration of FISSILE PLUTONIUM. For a sample containing total uranium in the range shown in Column 1, the corresponding value in Column 2 provides the concentration limit for Pu-239 plus Pu-240.
2. The total uranium limits in Table 1 correspond to 100 weight percent (w/o) U-233 + U-235 enriched solutions. Although such streams do not exist at the WVDP, laboratory analyses for specific uranium isotopes are typically not provided. However, if isotopic data are available, the values for U-233 + U-235 may be compared to the values of Table 1.
3. Written authorization of the Radiation and Safety Committee is required for processing liquids at these concentrations.

WVNS RECORD OF REVISION

<u>Rev. No.</u>	<u>Description of Changes</u>	<u>Revision On Page(s)</u>	<u>Dated</u>
2	<p>This revision of the PSR has been prepared to clarify the applicability of the PSR and to limit its applicability to transfers of liquids containing greater than 1 gram of total FISSILE URANIUM and FISSILE PLUTONIUM. The revision also introduces a new Limiting Condition for Operation to address FISSILE URANIUM and FISSILE PLUTONIUM precipitation. Table 1 has been modified to present the limits in terms of units received from the analytical laboratory. PSO and the A&PC Lab. are affected by these changes.</p> <p>DOE approval contained in Letter DW:2000:0026, dated January 14, 2000.</p>	All	12/06/02