TITLE: CORE DAMAGE EVALUATION

ISSUANCE AUTHORIZED BY	Milt McBride for Don Warembourg		
PORC REVIEW	PORC 571 MAY 30 1984		EFFECTIVE DATE 6-1-84

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GENERAL

This procedure provides guidance for estimating core damage (failed fuel fraction) following a LOFC accident. The procedure utilizes the results of a PCRV volume calculation and radiochemical analyses of primary coolant. The following assumptions are made:

1.) The PCRV is depressurized to 5 PSIG within 7 hours after a LOFC event, and there is no failed fuel during this time period;

2.) Previous reactor power history is used to establish the quantities of radionuclides available for release from the fuel;

3.) The expected R/B values for noble gases in primary coolant are in the range of 1E-6; therefore the initial PCRV inventory of noble gases during reactor depressurization is ignored;

4.) The purification system is not operating during the LOFC condition; and

5.) The release fraction of noble gases is directly proportional to the failed fuel fraction.

1.0 Criteria for Implementation

This procedure is intended to be used following a LOFC accident; however the basic methodology may be applied in other cases where fuel failure is suspected. Other cases of this sort will be handled on a case by case basis.

2.0 Procedure

Worksheet 1 is utilized to calculate the failed fuel fraction. The failed fuel fraction is simply the ratio of the observed (circulating) activity of 133Xe to the total (available for release from the fuel) activity of 133Xe.

2.1 In order to perform a core damage evaluation, primary coolant analyses must be obtained in units of μCi/scc. The PCRV volume must also be calculated. Using this information, the circulating activity of 133Xe is obtained.

2.2 The total quantity of 133Xe present in the fuel prior to shutdown, including the 133I precursor, is calculated.

2.3 Utilizing the results of steps 2.1 and 2.2, Worksheet 1 is completed.

3.0 Responsibilities

3.1 Health Physics Supervisor or Designee

The Health Physics Supervisor or his designee is responsible for ensuring that primary coolant samples are collected as required for analysis.

3.2 Radiochemistry Supervisor or Designee

The Radiochemistry Supervisor or his designee is responsible for ensuring that primary coolant samples are analyzed in accordance with procedures. The Radiochemistry Supervisor or his designee is also responsible for calculating PCRV volume.

3.3 Radiological Assessment Coordinator

The Radiological Assessment Coordinator is responsible for completing Worksheet 1 and reporting the results of the failed fuel evaluation to the Corporate Emergency Director and, as directed, to the TSC Director.

4.0 References

4.1 HPP-14, Analytical Instrumentation Room

4.2 RCP-22, Primary Coolant Radioactivity Surveillance for Technical Specification SR 5.2.11W

4.3 R. D. Burnette, "Measurement of Fuel Failed in FSV During LOFC"

4.4 "VOLUME" Computer Program

WORKSHEET 1

FAILED FUEL EVALUATION

1. Primary Coolant 133Xe inventory (curies) _____ (Xe_1)

2. Reactor Power at shutdown, MW(th) _____

3. Time since Reactor shutdown, hours _____

4. Failed Fraction =

$$\frac{Xe_1}{I_o\left(e^{-\lambda_1 t} - e^{-\lambda_2 t}\right)\frac{\lambda_1}{\lambda_2-\lambda_1} + Xe_o\left(e^{-\lambda_2 t}\right)}$$

where

Xe_1 = total curies of 133Xe in helium (PCRV) at sample isolation time (1 above)

I_o = total curies of 133I at shutdown (fuel)
MW(th) * FY_{133I} * 3.15E16 f/s/MW * 1/3.7E10 dps/Ci

λ_1 = decay constant for 133I, 3.41E-02 hr^{-1}

λ_2 = decay constant for 133Xe, 5.46E-03 hr^{-1}

t = time since reactor shutdown, hours (3 above)

Xe_o = total curies of 133Xe at shutdown, (fuel)
MW(th) * FY_{133Xe} * 3.15E16 f/s/MW * 1/3.7E10 dps/Ci

MW(th) = reactor power at shutdown, MW(th) (2 above)

FY_{133I} = 6.69E-02

FY_{133Xe} = 6.69E-02

FAILED FRACTION = _____

Work/Datasheet/Checklist Control List

NOTE: Extra attachments as listed are found in the working copy of this procedure in the Forward Command Post and the Technical Support Center.

Worksheet No.	Title	Number of Copies
1	Failed Fuel Evaluation	10

Datasheet No.		
None	N/A	N/A

Checklist No.		
None	N/A	N/A

Attachment No.		
None	N/A	N/A

FORMS USE REPORTING SHEET

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