



PUBLIC SERVICE COMPANY OF COLORADO

FORT ST. VRAIN NUCLEAR GENERATING STATION

RERP-CORE
Issue 1
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TITLE: CORE DAMAGE EVALUATION

ISSUANCE
AUTHORIZED
BY

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PORC
REVIEW

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* ANYTIME A WORKSHEET, DATASHEET, OR CHECKLIST HAS BEEN WRITTEN ON, COMPLETE THE REPORTING SHEET ATTACHED IN THE TABBED WORKSHEET SECTION AND FORWARD IT TO THE NUCLEAR DOCUMENTS SPECIALIST, FORT ST. VRAIN. DO NOT WRITE ON ANY WORKSHEETS, DATASHEETS, CHECKLISTS, OR REPORTING SHEETS IN THE PROCEDURE ITSELF. ALL WORKSHEETS/DATASHEETS/CHECKLISTS ARE TO BE TAKEN FROM THE TABBED SECTION FOLLOWING EACH PROCEDURE.

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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 ^{133}Xe to the total (available for release from the fuel) activity of ^{133}Xe .

- 2.1 In order to perform a core damage evaluation, primary coolant analyses must be obtained in units of $\mu\text{Ci}/\text{scc}$. The PCRV volume must also be calculated. Using this information, the circulating activity of ^{133}Xe is obtained.
- 2.2 The total quantity of ^{133}Xe present in the fuel prior to shutdown, including the ^{133}I 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 ^{133}Xe inventory (curies) _____ (Xe_1)
2. Reactor Power at shutdown, MW(th) _____
3. Time since Reactor shutdown, hours _____
4. Failed Fraction = _____ Xe_1

$$\frac{I_0 (e^{-\lambda_1 t} - e^{-\lambda_2 t})}{\lambda_2 - \lambda_1} + \text{Xe}_0 (e^{-\lambda_2 t})$$

where

Xe_1 = total curies of ^{133}Xe in helium (PCRVR) at sample isolation time (1 above)

I_0 = total curies of ^{133}I at shutdown (fuel)
 $\text{MW(th)} * \text{FY}_{^{133}\text{I}} * 3.15\text{E}16 \text{ f/s/MW} * 1/3.7\text{E}10 \text{ dps/Ci}$

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

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

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

Xe_0 = total curies of ^{133}Xe at shutdown, (fuel)
 $\text{MW(th)} * \text{FY}_{^{133}\text{Xe}} * 3.15\text{E}16 \text{ f/s/MW} * 1/3.7\text{E}10 \text{ dps/Ci}$

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

$\text{FY}_{^{133}\text{I}} = 6.69\text{E-}02$

$\text{FY}_{^{133}\text{Xe}} = 6.69\text{E-}02$

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.

<u>Worksheet No.</u>	<u>Title</u>	<u>Number of Copies</u>
1	Failed Fuel Evaluation	10

<u>Datasheet No.</u>		
None	N/A	N/A

<u>Checklist No.</u>		
None	N/A	N/A

<u>Attachment No.</u>		
None	N/A	N/A

FORMS USE REPORTING SHEET

Nuclear Documents Specialist:

This sheet is being transmitted to report use of forms from a controlled copy of the Radiological Emergency Response Plan Implementing Procedures, BOOK NO. _____, located at _____ . The following forms have been utilized from this copy:

Worksheet NumbersCopies UsedDatasheet NumbersCopies UsedChecklist NumbersCopies Used

The procedure affected by this sheet is shown in the header to this page, unless otherwise noted below in the comments to this reporting form. When this form is received, it will be necessary to replace the noted number of forms, as well as this "Forms Use Reporting Sheet" for the affected procedure in the affected book.



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FORMS USE REPORTING SHEET (Continued)

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