

8506140077 850125  
PDR FOIA  
DETJEN84-897 PDR

# NARRATIVE REPORT

TMI-1

LER 81-13

## I. Current Activities

TMI-1 is shutdown by NRC order dated August 9, 1979.

## II. Leading Circumstances

Following secondary chemistry analyses results indicating presence of primary-to-secondary leakage, a bubble leakage test was applied to the Once Through Steam Generator tubing with nitrogen pressure applied to the secondary side.

## III. Description of the Occurrence

OTSG Tube leakage was initially suspected when OTSG-B sample results showed decreasing pH and increasing activity. These symptoms appeared following Reactor Coolant System pressurization to about 45 psig for functional testing. The functional testing program was then aborted and the Reactor Coolant System depressurized and partially drained in preparation for bubble leak testing to locate the tube or tubes which were leaking. Primary-to-secondary leakage with the RC System pressurized to about 45 psig amounted to about 0.2 to 0.3 gpm.

Initial bubble testing indicated about 27 leaking tubes in the "B" OTSG, the steam generator whose secondary chemistry indicated primary-to-secondary leakage when the Reactor Coolant System was pressurized to about 45 psig. A later bubble test on 11/28/81 identified eleven additional leaking tubes in the "B" OTSG.

Subsequent bubble tests in the "A" OTSG identified 88 tube leaks in that OTSG.

The event was considered reportable per Technical Specification 6.9.2.A(3).

## IV. Any Significant Events Which Happened as a Result of the Original Occurrence

None

## V. Previous Events

No previous OTSG leaks.

## VI. Root Cause of the Occurrence

Detailed investigations into root cause are now in progress and are presently inconclusive.

## VII. Immediate Corrective Action

Since the unit is in a cold shutdown condition, immediate corrective action was to depressurize the Reactor Coolant System and clean the contaminated secondary fluid.

## VIII. Long Term Corrective Action

Present investigations are continuing to identify the root cause for the tube leaks which presently seem to be concentrated in the Upper Tube Sheet region of the steam generator tubing. Preparations are being made to remove a sample of the affected tubes for metallurgical analyses. Eddy

Long Term Corrective Action Cont'd

Current testing has begun on OTSG-E and will shortly commence on OTSG-A. Additional bubble testing is also planned.

The results of these investigations and the appropriate corrective actions required to restore the integrity of the steam generator primary coolant pressure boundary will be reported in a followup report to NRC by February 1, 1982.

**Memorandum**

Subject: IODINE SPIKE AND STEAM LINE  
RADIATION MONITORS

Date: September 21, 1983  
NF 3455

From: T. Y. Byoun

Location: CHB - 3

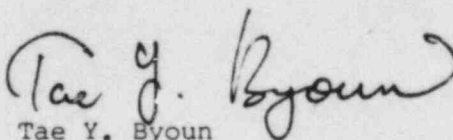
To: M. J. Graham - TMI Licensing Engineer

References : (1) TDR 432, "TMI-1 RMS Set Points for the Site Emergency Conditions", dated 6/21/83;  
(2) Calculation No. N1779-5412-003, dated 9/20/83.

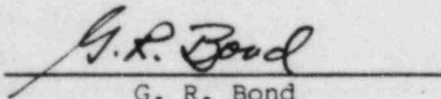
You have requested that we provide you with the offsite radiological impacts when the plant suffers an iodine spike followed by a large tube leak in the OTSG.

According to Ref. 1, the detector reading of 3500 cpm on the steam line radiation monitors (RM-G26/G27) would result in the 250 mr/hr offsite thyroid dose assuming no iodine spike occurred. With the unrealistic assumption that all the count rate is due to an iodine spike, the 3500 cpm of the RM-G26/G27 reading would correspond to approximately 1.3 rem/hr thyroid dose at the exclusion boundary. The key assumptions used in this scoping analysis are : (1) 30 lbs./sec. steam release through the Atmospheric Dump Value (ACV); (2) X/Q-value of  $6.8 \times 10^{-4}$  sec./M; and (3) 100% iodine activities in the steam line (Ref. 2).

If you have any questions on this , please call me at Ext. 2232.

  
Tae Y. Byoun

Approved :

  
G. R. Bond

Nuclear Analysis & Fuels Director

TYB lsp

CC: J. R. Sipp - Manager, Chemical Engineering  
J. Wetmore - Manager PWR Licensing  
J. D. Luoma - Manager, TMI Fuel Projects  
T. G. Broughton - Director of Systems Engineering  
N. G. Trikourcs - Manager, Safety Analysis & Plant Control  
M. Mahgerefteh - Engineer  
ED&CC



Three Mile Island Nuclear Station  
Procedure Change Request

PCR No. 1-MD-93-0075

NOTE: Instructions and guidelines in AP1001A must be followed when completing this form.

1. Procedure EP1004.7 REG OFFSITE/ONSITE DOSE PROJECTIONS  
No Present Revision No Title

2. Recommended Change: (Include page numbers, paragraph numbers, and exact wording of recommended change. Attach additional sheets if necessary and provide the generic nature of the change on this sheet.)

SEE ATTACHED DIRECTION SHEET

3. Reason for Change: (Is this change part of the Biennial Procedure Review? Yes ☒ No ☐ Include I&E Bulletins, TSCR #, T.S. Amendment #, Modification #, etc.)

TO INCORPORATE ACTION ITEMS RESULTING FROM DRILLS  
AND AN INPD AUDIT.

4. (a) Does Revision replace a TCN? ☐ yes ☒ no  
(b) If "yes" indicate the TCN Number

5. Is procedure "Important to Safety"? ☒ yes ☐ no  
If "Yes" a Safety Evaluation is required (side 2).

6. Is procedure "Environmental Impact Related"? ☐ yes ☒ no  
If "Yes" an Environmental Impact Evaluation is required (side 2).

## Review Signatures:

7. Change Recommended by RF Eberts JW Date 8/8/83  
8. Procedure Owner Concurrence: RF Eberts RF Eberts Date 8/8/83  
9. Responsible Technical Reviewer Concurrence RF Eberts JW Date 8/8/83

10. Approval Signature(s): (Per AP1001A)

(ISR) JAC Brady 8/26/83  
Signature Date

NOTE: Procedure coordinator's signature signifies all required reviews per AP1001A have occurred.

Signature

Date

Procedure Coordinator

Date

11. Change Entered

Date

Rev No

# "EVALUATION"

## Three Mile Island Nuclear Station Safety/Environmental Impact Evaluation

5. ☐ ☐ - ☐ - ☐ - ☐ - ☐ - ☐  
New Procedure  
☐ ☐ - ☐ - ☐ - ☐ - ☐ - ☐  
STP  
☒ ☒ - 70 - 83 - 0075  
PCR 75

1. Doc. ID EP. P 1004-7 OFFSITE / ONSITE DOSE PROTECTIONS  
Number or Title

### 2. Safety Evaluation

Does this procedure:

- \* (a) increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety? yes ☐ no ☒
- \* (b) create the possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report? yes ☐ no ☒
- \* (c) reduce the margin of safety as defined in the basis for any technical specification? yes ☐ no ☒

Details of Evaluation (Explain why answers to above questions are "no" Attach additional pages if required.)

CHANGES ENHANCE THE ACCURACY OF THE DOSE  
ASSESSMENT PROCESS

Evaluation By RF Eberts Date 8/8/83

\*If any of these questions are answered "YES" the change must be reviewed and approved by the NRC prior to implementation

### 3. Environmental Impact Evaluation

Does this procedure:

- (a) possibly involve a significant environmental impact? yes ☐ no ☐  
(if 3(a) is "yes", answer questions (b) and (c) and fill in "Details of Evaluation" below. If no, state why by filing in the "Details of Evaluation" below.)
- \* (b) have a significant adverse effect on the environment? yes ☐ no ☐
- \* (c) involve a significant environmental matter or question not previously reviewed and evaluated by the NRC? yes ☐ no ☐

Details of Evaluation (Attach additional pages if required)

Evaluation By \_\_\_\_\_ Date \_\_\_\_\_

\*If any of these questions are answered "YES" the change must be reviewed and approved by the NRC prior to implementation.

### 4. Approval(s) (Per AP 1001A)

(SR) A. Brady 8/26/83  
Signature Date  
\_\_\_\_\_  
Signature Date

## DIRECTIONS

REPLACE THE FOLLOWING ATTACHMENTS WITH THE MATERIAL PROVIDED:

ATTACHMENT VIII - COMPUTERIZED DOSE CALCS

ATTACHMENT VII - AIRBORNE IODINE SAMPLE  
NOMOGRAPH

ATTACHMENT VI - PROTECTIVE ACTION GUIDES

ATTACHMENT IV - CONTINGENCY SOURCE TERM  
CALCULATION

ADD THE FOLLOWING ATTACHMENTS:

ATTACHMENT X - DOSE CONVERSION FACTOR  
CALCULATION

ATTACHMENT XI - HYDROGEN PULSE CALCULATION

ATTACHMENT XII - THUMB RULES

MODIFY THE FOLLOWING ATTACHMENTS WITH THE MATERIAL PROVIDED:

ATTACHMENT IF - HIGH RANGE REMS DOSE  
CALCS

MODIFY PAGES 1.0 AND 2.0 AS SHOWN ON THE MATERIAL PROVIDED.

~~ATTACHMENT II~~  
~~ATTACHMENT III~~  
ATTACHMENT III  
COMPUTERIZED DOSE CALCULATIONS

1. Ensure computer components are connected as pictured in Attachment 1A.
2. Energize the system components in the following order:

- a. Quick Printer II
- b. Video Display
- c. Keyboard Terminal
- d. Expansion Interface

3. Computer will respond with the following message:

MEMORY SIZE -

Strike the 'ENTER' key

4. Computer will respond with:

RADIO SHACK LEVEL II BASIC

READY

>

-----  
: NOTE: For loading Unit II programs goto step 7 :  
-----

5. For airborne release:

Place cassette labeled 'Program "D" Airborne Dose Calculations' in recorder and ensure cassette is rewound. Depress the PLAY button, set volume level to '4'.

6. For liquid release:

Place cassette labeled 'Program "L" Liquid Release Calculations' in recorder and ensure cassette is rewound. Depress the PLAY button, set volume level to '4'.

7. For Unit II airborne release with RMS system in-service and on-scale:

Place cassette labeled 21. ~~EMERG2~~ "EMERG2" UNIT II Emergency Dose Calculations" in recorder and ensure cassette is rewound. Depress the PLAY button, set volume level to '4'.



8. For Unit ~~II~~ airborne release with RMS system out of service and/or off-scale:

Place cassette labeled "Emergency Contingency Calculations" in recorder and ensure cassette is rewound. Depress the PLAY button, set volume level to '4'.

ATTACHMENT VIII (cont'd)

CLOAD "EMERG2" For Unit II Emergency  
Dose Calculations; CLOAD "CONT2"  
For Unit II Emergency Contingency  
Calculations

9. Enter the following command from the keyboard:

CLOAD "D" for <sup>unit I</sup>airborne; CLOAD "L" for <sup>unit I</sup>liquid; and strike the 'ENTER' key.

At this time the cassette will begin loading the program into the computer memory. Program loading will take approximately 2 1/2 or 3 minutes. One steady and one blinking star will appear in the upper right corner of the video display to signify program loading is in progress.

NOTE: If both stars appear, with neither blinking; i.e. both steady replace cassette with new copy and start over at step 5.

10. When program loading is completed, the computer will respond with:

READY

>\_

Depress stop button, rewind the cassette and remove it from the recorder.

11. To begin program execution, enter the following command from the keyboard:

RUN

and strike the 'ENTER' key.

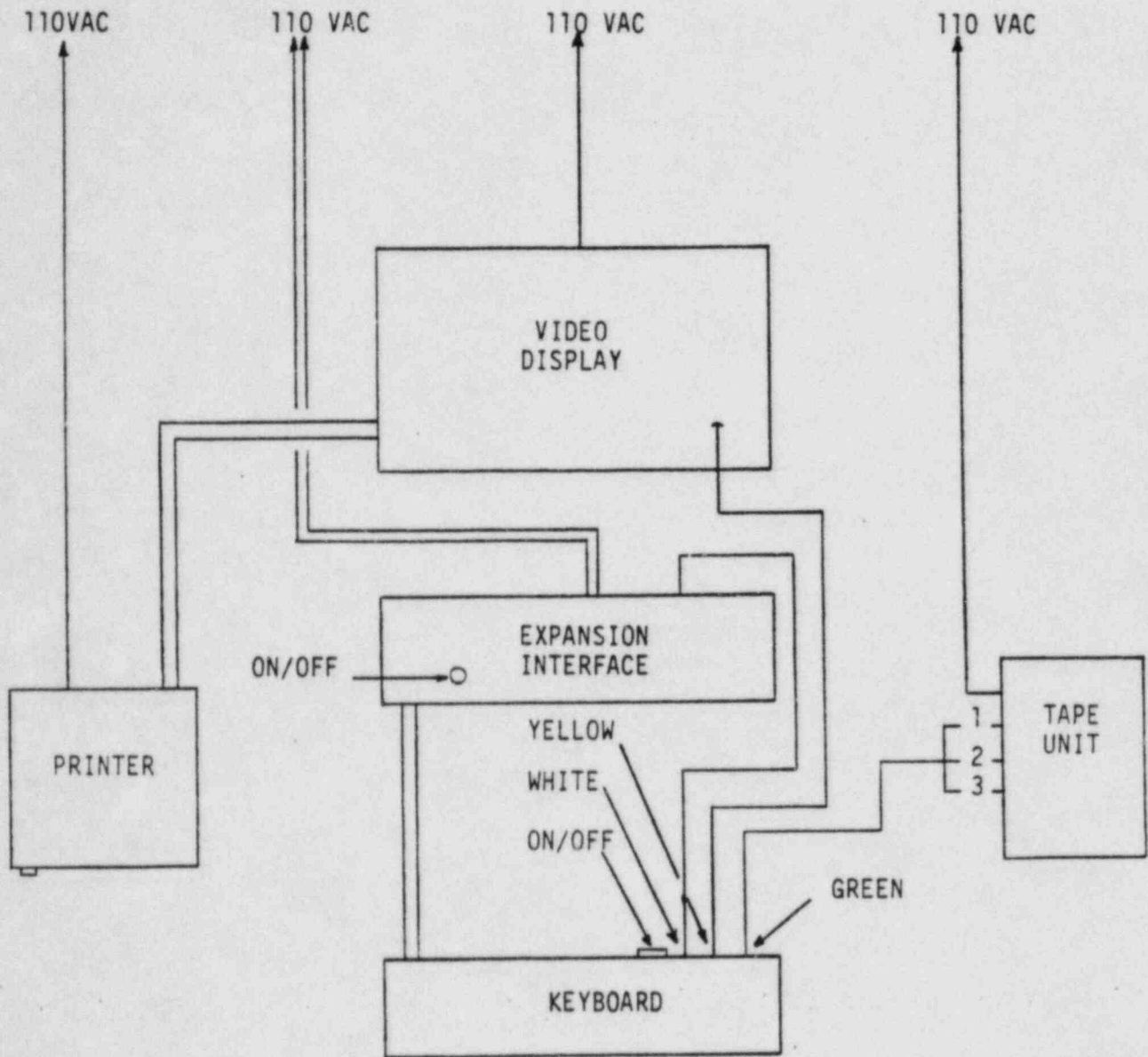
12. General notes on program operation:

- a. All responses must be followed by striking the 'ENTER' key.
- b. Numbers in scientific notation should be entered using the following formats:  
 $9.2 \times 10^3 = 9.2E3$   
 $4.0 \times 10^{-4} = 4E-4$
- c. All responses requiring a yes or no, are to be answered with a Y or N.

# ATTACHMENT VIII

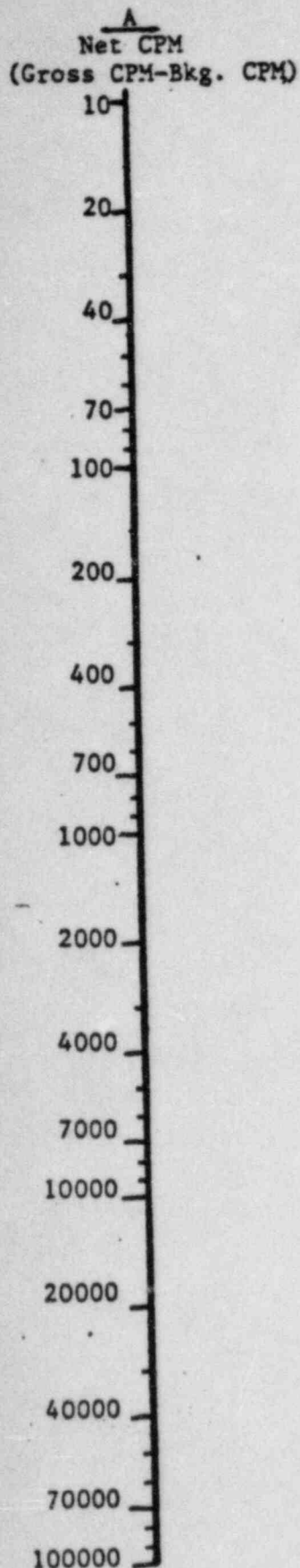
## COMPUTER CONNECTIONS

### AND COLOR CODES



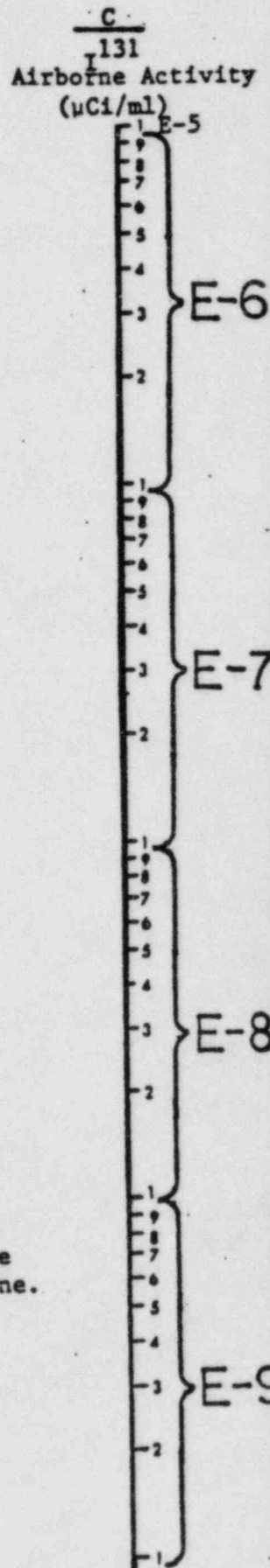
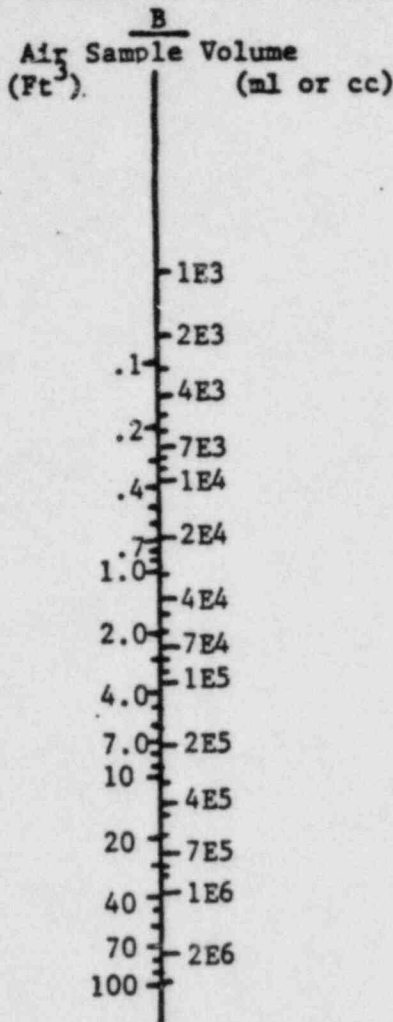
#### TAPE UNIT

1. Black Plug - Ear
2. Lg. Grey Plug - Au
3. Sm. Grey Plug - Mi



# AIRBORNE IODINE SAMPLE NOMOGRAPH

Note: This nomograph is to be used for Iodine 131 air samples counted with a SAM II. This nomograph assumes an ave. counter factor of 16000 for SAM II's.



Instructions: Draw a line through Net CPM (A) and Air Sample Volume (B) using a straight edge and read I<sup>131</sup> Airborne Activity (C) on the line.

IODINE NOMOGRAPH



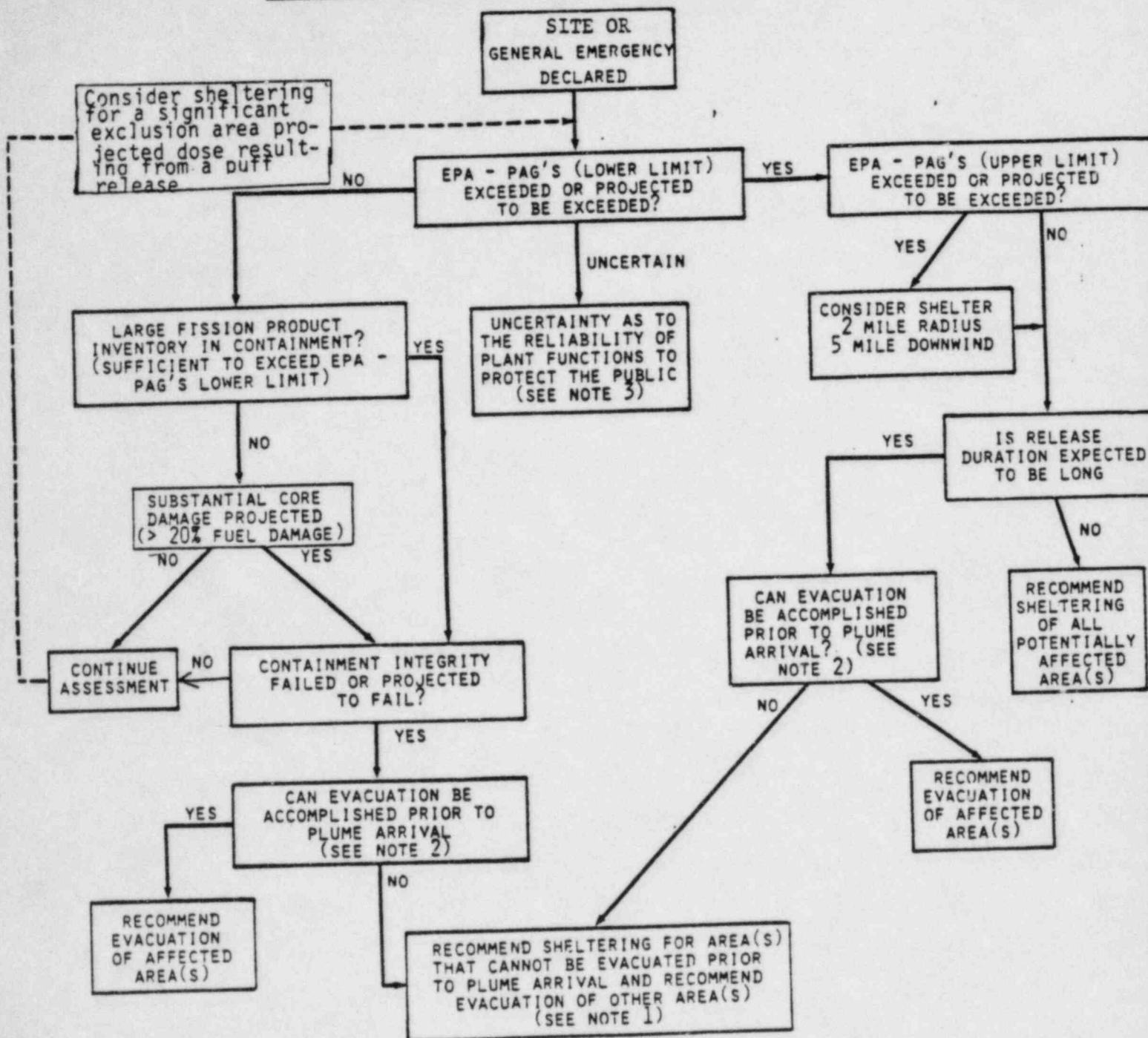
## ATTACHMENT VI

Protective Action Guides / PROTECTIVE ACTION RECOMMENDATIONS

Emergency Action Level (EAL)	Actual or Projected Exclusion Area Dose (mrem)	
	Whole Body	Thyroid
1. Unusual Event	$\leq 10$	$< 50$
2. Alert	$\geq 10$ $< 50$	$\geq 50$ $< 250$
3. Site Emergency	$\geq 50$ $< 1000$	$\geq 250$ $< 5000$
4. General Emergency	$\geq 1000$	$\geq 5000$

Protective Action Guide (PAG'S)	Actual or Projected Exclusion Area Dose (rem)	
	Whole Body	Thyroid
Lower Limit (PAG)	1	5
Upper Limit (PAG)	5	25

# LOGIC DIAGRAM DEVELOPMENT OF PROTECTIVE ACTION RECOMMENDATIONS (PAR)



**NOTE 1:** CONSIDERATION SHOULD BE GIVEN TO THE PROJECTED EXPOSURE TO BE RECEIVED TO A PERSON IF HE SHELTERS VICE EVACUATES. IN SO DOING, YOU MUST FACTOR RELEASE DURATION, RELEASE MAGNITUDE AND ASSUME A PROTECTION FACTOR OF 2 FOR UP TO THE FIRST 2 HOURS OF RELEASE DURATION AND A PF OF 1 FOR > 2 HOURS RELEASE DURATION. THE PATHWAY OF LEAST EXPOSURE SHOULD BE CHOSEN.

**NOTE 2:**

## TMI EVACUATION TIME ESTIMATES

	LOWER (HOURS)	UPPER (HOURS)
BEST ESTIMATE (NIGHT)	5.25	8.50
TYPICAL WEEKDAY (NORMAL)	5.75	8.50
ADVERSE WEATHER	8.00	11.50

LOWER - GOOD STATE OF EMERGENCY READINESS (SLOW SCENARIO)  
UPPER - LACK OF ADEQUATE PREPARATION TIME (FAST SCENARIO)

**NOTE 3:** IN EXERCISING THE JUDGMENT AS TO THE NEED FOR PROTECTIVE ACTION RECOMMENDATIONS, ANY UNCERTAINTY CONCERNING THE STATUS OF PLANT FUNCTIONS NEEDED FOR PROTECTION OF THE PUBLIC, THE LENGTH OF TIME THE UNCERTAINTY EXISTS, THE PROSPECTS FOR EARLY RESOLUTION OF AMBIGUITIES, AND THE POTENTIAL DEGRADATION OF THE PLANT FUNCTIONS NEEDED FOR PROTECTION OF PUBLIC SHOULD BE CONSIDERED; I.E., SIGNIFICANT UNCERTAINTY AS TO THE RELIABILITY OF PLANT FUNCTIONS TO PROTECT THE PUBLIC EXTENDING BEYOND A REASONABLE TIME PERIOD IS A SUFFICIENT BASIS FOR MAKING A PROTECTIVE ACTION RECOMMENDATION TO SHELTER

10  
ATTACHMENT ~~III~~ CONTINGENCY SOURCE TERM CALCULATION

----- Instructions for Using Attachment ~~Three~~

**FOUR**

1. Select a release pathway from the posted menu:

A. Case I Secondary Side Release

Includes: OTSG tube rupture  
Loss of electric load  
Loss of power  
Direct steam release

-- GO TO CASE I --

B. Case II Reactor Building Release

Includes: Loss of coolant accident (LOCA)  
Maximum hypothetical accident (MHA)  
Rod ejection accident  
Spent fuel accident in the RB

-- GO TO CASE II --

C. Case III Auxiliary and Fuel Handling Building Release

Includes: Spent fuel handling accident in the FHB  
Fuel cask drop during transfer Op  
waste decay tank rupture

-- GO TO CASE III --

2. For the selected release pathway follow the logic diagram and calculate the noble gas and radiiodine source terms (S1 and S2 respectively).

3. Enter the following items on the dose assessment worksheet (Attachment ~~VI~~ <sup>VI</sup>)

S1 = Noble gas source term (CI/sec)

S2 = Radiiodine source term (CI/sec)

S3 = whole body DCF (MREM/HR/UCI/CC)

S4 = Thyroid DCF (MREM/HR/UCI/CC)

Attach to the dose assessment worksheet (Attachment ~~III~~ <sup>I</sup>) a completed worksheet A.

## CASE I. SECONDARY SIDE RELEASE

SECTION A - DETERMINE THE REACTOR COOLANT ACTIVITY  
BY FOLLOWING THE FLOW DIAGRAM STARTING IN THE  
UPPER LEFT HAND CORNER THEN CONTINUE TO SECTION B.

SECTION B - DETERMINE THE OTSG TUBE RUPTURE  
LEAK RATE BY FOLLOWING THE FLOW DIAGRAM  
STARTING IN THE UPPER LEFT HAND CORNER THEN CONTINUE TO  
SECTION C.

SECTION C - DETERMINE THE TRANSPORT FRACTIONS  
BY FOLLOWING THE FLOW DIAGRAM STARTING IN  
THE UPPER LEFT-HAND CORNER THEN CONTINUE TO SECTION D.

SECTION D - TO DO THE DOSE ASSESSMENT CALCULATION  
USE THE ANSWERS FROM SECTIONS A, B & C. FILL  
IN THE APPROPRIATE BLANKS AND CALCULATE C1 & C2.  
THEN PROCEED TO SECTION E.

SECTION E - FOLLOW DIRECTIONS AS INDICATED AT  
END OF PAGE.



# CASE I: SECONDARY SIDE RELEASE

## A. Reactor Coolant Activity

Is the  
RML (RC Letdown Monitor)  
High Channel Reading in cpm  
available? (Y/N)

-- YES --

Enter the RML High Reading = A1 = \_\_\_\_ CPM

Calculate the RCS Activity

In  $\frac{UC}{ml} = (\frac{A1}{22}) = \frac{D1}{}$  (Enter Item D1 in Section D)

*CHECK*

Fill in the blank and ~~circle~~ the appropriate item in Section E

C1 = "RML High Channel Reading of \_\_\_\_ CPM indicating \_\_\_\_"

----- GO TO SECTION B -----

Is the  
RML (RC Letdown Monitor)  
Low Channel Reading in cpm  
available? (Y/N)

-- YES --

Enter the RML Low Reading = A1 = \_\_\_\_ CPM

Calculate the RCS Activity

In  $\frac{UC}{ml} = (\frac{A1}{1220}) = \frac{D1}{}$  (Enter Item D1 in Section D)

*CHECK*

Fill in the blank and ~~circle~~ the appropriate item in Section E

C1 = "RML Low Channel Reading of \_\_\_\_ CPM indicating \_\_\_\_"

----- GO TO SECTION B -----

Is the  
most Recent RCS Sample Gross  
Beta Gamma Activity in uc/ml  
available? (Y/N)

- YES -

RCS Activity in  $\frac{uc}{ml} = \frac{D1}{}$  (Enter Item D1 in Section D)

C1 = "Most Recent RCS Sample of \_\_\_\_  $\frac{uc}{ml}$ "

*CHECK*

Fill in the blank and ~~circle~~ the appropriate item in Section E

----- GO TO SECTION B -----

RCS Activity

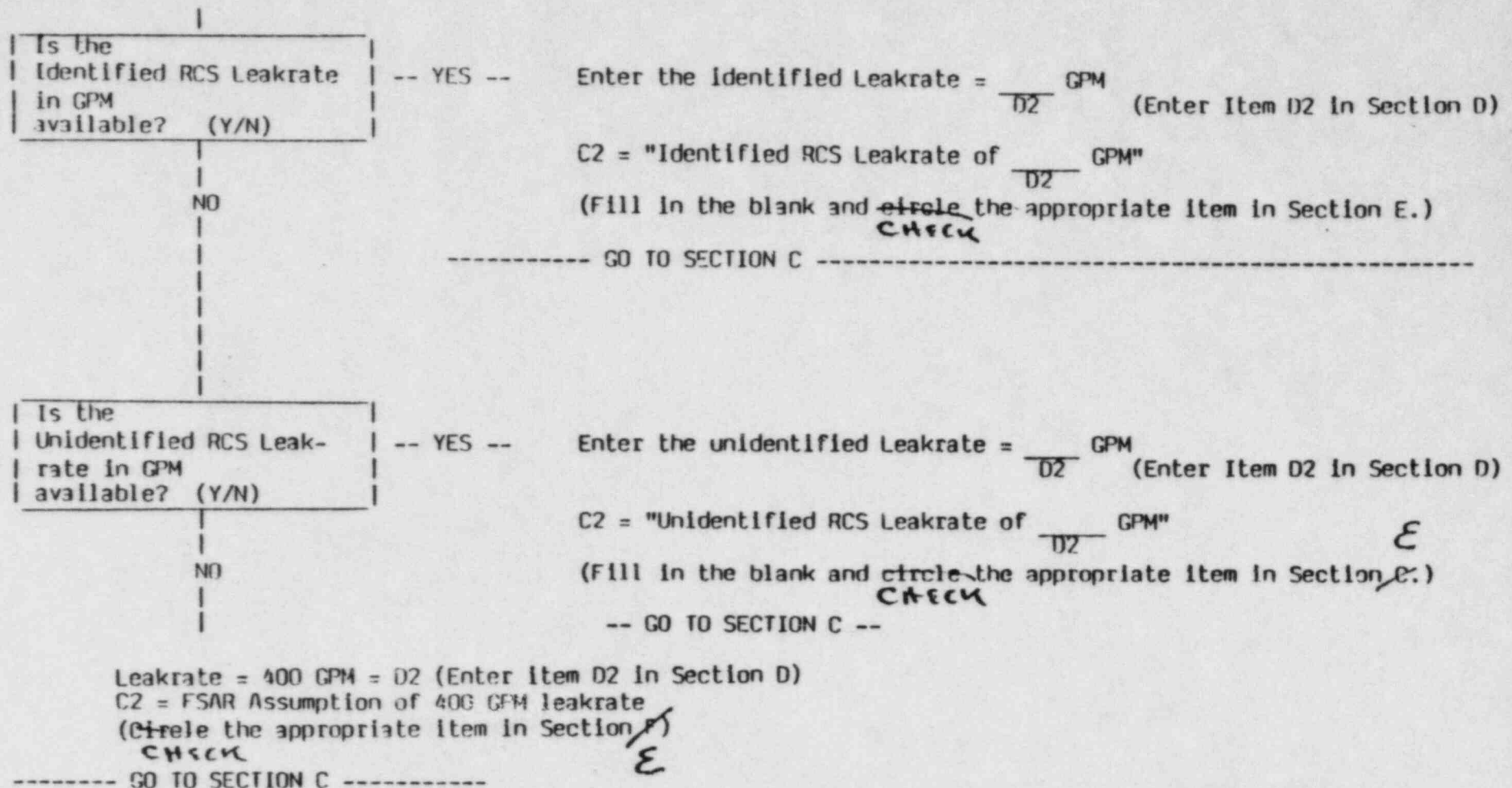
In  $\frac{uc}{ml} = \frac{360}{D1} = D1$  (Enter Item D1 in Section *D*)

C1 = FSAR Assumption of 1% FF and 360  $\frac{uc}{ml}$  Gross Beta Gamma activity. (Fill in the blank and ~~circle~~ the appropriate item in Section E.)

GO TO SECTION B

CASE 1: SECONDARY SIDE RELEASE

B. DTSG Tube Rupture Leakrate



# CASE I: SECONDARY SIDE RELEASE

## C. Transport Fractions

Is there a direct release of steam to the atmosphere (Y/N)

- NO - Radioiodine Transport Fraction = ~~.0001~~ <sup>.0075</sup> = D3  
(Enter Item D3 in Section D)

C3 = Condenser Off-Gas Release

(Circle the appropriate item in Section E)

CHECK

----- GO TO SECTION D -----

YES

Is A fraction of total steam flow through the condenser hotwells? (Y/N)

- NO - Radioiodine Transport Fraction = 1 = D3  
(Enter Item D3 in Section D)

C3 = Direct Release of Steam to the Atmosphere

(Circle the appropriate item in Section E)

CHECK

----- GO TO SECTION D -----

YES

Enter the fraction of steam flow directed to the condenser hotwell as (A)

(SEE TABLE 1 "STEAM DISCHARGE FLOWRATES" ATTACHMENT IX)  
.0075

Radioiodine Transport Fraction =  $\left( \frac{(A)}{(A)} * \text{.0001} \right) + \left[ \left( 1 - \frac{(A)}{(A)} \right) * 1 \right] = \text{---} + \text{---}$

=  $\text{---} = \text{D3}$  (Enter Item D3 in Section D)

C3 = Combined Release of Steam to the Condenser and Directly to Atmosphere (Circle the appropriate item in Section E)

CHECK

-- GO TO SECTION D --

CASE I: SECONDARY SIDE RELEASE

----- WORKSHEET A -----

D. Dose Assessment Calculation

D1 = Reactor Coolant Activity in (uc/ml) from Section A

D2 = Primary to Secondary Leakrate in (GPM) from Section B

D3 = Radioiodine Transport Fraction from Section C

Noble Gas  
Source Term

$$\text{in } \left( \frac{\text{CI}}{\text{sec}} \right) = \frac{\text{D1}}{\text{D1}} \cdot \frac{\text{D2}}{\text{D2}} \cdot 5\text{E-5}$$

$$= \frac{\text{S1}}{\text{S1}}$$

Radioiodine  
Source Term

$$\text{in } \left( \frac{\text{CI}}{\text{sec}} \right) = \frac{\text{D1}}{\text{D1}} \cdot \frac{\text{D2}}{\text{D2}} \cdot \frac{\text{D3}}{\text{D3}} \cdot 2.5\text{E-6}$$

$$= \frac{\text{S2}}{\text{S2}}$$

-- GO TO SECTION E --

$$\text{S3} = 4\text{E5} \quad \frac{\text{MREM}}{\text{HR}} \cdot \frac{\text{UCI}}{\text{CC}}$$

$$\text{S4} = 1.6\text{E9} \quad \frac{\text{MREM}}{\text{HR}} \cdot \frac{\text{UCI}}{\text{CC}}$$

ENTER S1, S2, S3 AND S4  
ONTO THE DOSE ASSESSMENT  
SHEET, ATTACHMENT 1,



C1 =    "RML High Channel Reading of CPM indicating UC  
A1 D1 m1"

☐ "RML" Low Channel Reading of CPM indicating  $\frac{UC}{m}$ "  
A1
D1

☐ "Most Recent RCS Sample of" UC  
m1"  
D1

FSAR Assumption of 1% FF and 360  $\frac{UC}{m}$

$$C2 = \frac{\square \text{ "Identified RCS Leakrate of GPM" }}{D2}$$

☐ "Unidentified RCS Leakrate of \_\_\_\_\_ GPM"

C2 = FSAR Assumption of 400 GPM Leakrate

C3 = D C3 = Condenser Off-Gas Release

17 C3 = Direct Release of Steam to the Atmosphere

C3 = Combined Release of Steam to the Condenser and  
Directly to Atmosphere

## CASE II. REACTOR BUILDING RELEASE

SECTION A - DETERMINE ACCIDENT SELECTION BY FOLLOWING FLOW DIAGRAM STARTING AT THE UPPER LEFT HAND CORNER. THEN CONTINUE TO SECTION B.

SECTION B - DETERMINE THE REACTOR COOLANT ACTIVITY BY FOLLOWING THE FLOW DIAGRAM STARTING IN THE UPPER LEFT HAND CORNER (2 PAGES). THEN CONTINUE TO SECTION C.

SECTION C - TO MAKE THE CALCULATION OF REACTOR BUILDING RADIONUCLIDE CONCENTRATIONS, ANSWER THE QUESTIONS IN THE BOX THEN DO THE NECESSARY CALCULATION, THEN PROCEED TO SECTION D.

SECTION D - TO DO THE CALCULATION OF REACTOR BUILDING LEAKAGE FOLLOW THE FLOW DIAGRAM STARTING IN THE UPPER LEFT HAND CORNER. THEN CONTINUE TO SECTION E.

SECTION E - TO DO THE CALCULATION OF REACTOR BUILDING EXPOSURE. THEN USE THE RESULTS FROM SECTIONS A, C & D THEN CONTINUE TO SECTION F.

SECTION F - FOLLOW DIFFERENTIAL EQUATIONS IN SECTION F.

# CASE II: REACTOR BUILDING RELEASE

## A. Accident Selection

Is the release associated with a spent fuel handling accident? (Y/N)

-- NO ----- Go to Section B

YES

C1 = Spent Fuel Handling Accident in the RB (~~Circle~~ **CHECK** the appropriate item in Section F)

is the number of damaged fuel rods available? (Y/N)

-- NO ----- C2 = Number of damaged fuel rods is FSAR postulated 208

**CHECK**  
(~~Circle~~ the appropriate item in Section F)

Noble Gas Concentration

**ITEM E1**

$$\left(\frac{uci}{cc}\right) = 1.7 = E1 \text{ (Enter in Section E)}$$

Radioiodine Concentration

**ITEM E2**

$$\left(\frac{uci}{cc}\right) = 1.5E-3 = E2 \text{ (Enter in Section E)}$$

-- GO TO SECTION D --

Enter the number of damaged fuel rods = A1 = \_\_\_\_\_

C2 = Actual number of damaged fuel rods  
(~~Circle~~ the appropriate item in Section F)

Reactor Building

$$\text{Noble gas concentration } \left(\frac{uci}{cc}\right) = (1.7 \cdot \frac{A1}{C2}) \div 208$$

$$= \frac{uci}{cc} = E1 \text{ (Enter in Section E)}$$

Reactor Building

$$\text{Radioiodine Concentration } \left(\frac{uci}{cc}\right) = (1.5E-3 \cdot \frac{A1}{C2}) \div 208$$

$$= \frac{uci}{cc} = E2 \text{ (Enter in Section E) -- GO TO SECTION D --}$$

MOVE THIS DOWN

YES

EXTEND THIS LINE

THIS ITEM SHOULD BE BELOW

# CASE II: REACTOR BUILDING RELEASE

## B. Reactor Coolant Activity

Is the RML1 (RC Letdown Monitor) High Channel Reading in cpm Available? (Y/N)	-- YES --
--	-----------

NO

Is the RML1 (RC Letdown Monitor) Low Channel Reading in cpm Available? (Y/N)	-- YES --
---	-----------

NO

Enter the RML1 high reading = A1 = \_\_\_\_\_ CPM

Calculate the RCS Activity

$\ln \frac{UC}{mI} = ( \frac{A1}{22} ) = \text{_____} = A2$  (Enter item A2 as as in Section

C1 = "RML1 High Channel Reading of \_\_\_\_\_ CPM"

CHECK  
(Circle appropriate item in Section F)

-- GO TO SECTION C --

Enter the RML1 low reading = A1 = \_\_\_\_\_ CPM

Calculate the RCS Activity

$\ln \frac{UC}{mI} = ( \frac{A1}{1220} ) = \text{_____} = A2$  (Enter item A2 in Secti

C1 = "RML1 Low Channel Reading of \_\_\_\_\_ CPM"

CHECK  
(Circle appropriate item in Section F)

-- GO TO SECTION C --



# B. Reactor Coolant Activity

## CASE II: REACTOR BUILDING RELEASE

Based upon in-core instrumentation does the ED suspect fuel melting?

-- YES --

Reactor Building noble gas concentration

$$\left(\frac{UC}{CC}\right) = 5.7 \times 10^{-3} \left(\frac{UCI}{CC}\right) = E1 \text{ (Enter item E1 in Section E)}$$

Reactor Building radiolodine concentration

$$\left(\frac{UC}{CC}\right) = 5.7 \times 10^{-2} \left(\frac{UCI}{CC}\right) = E2 \text{ (Enter item E2 in Section E)}$$

CI = Fuel melting as indicated by in-core instrumentation  
(Circle appropriate item in Section F)

CHECK

-- GO TO SECTION D --

Based upon in-core instrumentation does the ED suspect fuel cladding damage?

-- YES --

Reactor Building noble gas concentration

$$\left(\frac{UCI}{CC}\right) = 160 \left(\frac{UCI}{CC}\right) = E1$$

Reactor Building radiolodine concentration

$$\left(\frac{UCI}{CC}\right) = 13 \left(\frac{UCI}{CC}\right) = E2$$

CI = Fuel cladding damage as indicated by in-core instrumentation  
(Circle appropriate item in Section F)

-- GO TO SECTION D --

Most Recent RCS Sample Gross Beta Gamma Activity in uc/ml

-- YES --

Enter RCS Activity in  $\frac{UC}{ml} = \underline{\hspace{2cm}} = A2$  (Enter item A2 in Section C)

CI = "Most Recent RCS Sample"  
(Circle appropriate item in Section F)

-- GO TO SECTION C --

NO

Reactor Building noble gas concentration

$$\left(\frac{UC}{ml}\right) = 160 = E1 \text{ (Enter item E1 in Section E)}$$

Radiolodine concentration

$$\left(\frac{UC}{ml}\right) = 13 = E2 \text{ (Enter item E2 in Section E)}$$

CI = "FSAR assumed fuel cladding damage"  
(Circle appropriate item in Section F)

CHECK

-- GO TO SECTION D --

# CASE II: REACTOR BUILDING RELEASE

## C. Calculation of Reactor Building Radionuclide Concentrations

<p>Is the total number of gallons of RCS leakage into the Reactor Building available? (Y/N)</p>	-- NO --
<p>YES</p>	

C1 - FSAR assumed fuel cladding damage

~~CHECK~~  
(~~Circle~~ the appropriate item in Section F)

Reactor Building noble gas concentration

$$\left(\frac{\text{uci}}{\text{cc}}\right) = 160 = \text{E1} \quad (\text{Enter item E1 in Section E})$$

Radiiodine concentration

$$\left(\frac{\text{uci}}{\text{cc}}\right) = 13 = \text{E2} \quad (\text{Enter item E2 in Section E})$$

-- GO TO SECTION ~~D~~ --

Enter the total number of gallons = \_\_\_\_\_ = A3 (Enter item A3 below)

C2 = Actual number of gallons of RCS leakage into the

Reactor Building (~~Circle~~ the appropriate item in Section F)  
~~CHECK~~

Calculate the Reactor Building Noble Gas Concentration  $\left(\frac{\text{uci}}{\text{cc}}\right) =$

$$\left(\frac{\text{A2}}{\text{A3}} \cdot \frac{\text{A3}}{\text{A3}} \cdot 2950\right) \div 5.6\text{E10} = \text{_____} = \text{E1} \quad (\text{Enter item E1 in Section E})$$

Reactor Building Radiiodine Concentration  $\left(\frac{\text{uci}}{\text{cc}}\right) =$

$$\left(\frac{\text{A2}}{\text{A3}} \cdot \frac{\text{A3}}{\text{A3}} \cdot 56\right) \div 5.6\text{E10} = \text{_____} = \text{E2} \quad (\text{Enter item E2 in Section E})$$

-- GO TO SECTION D --

# CASE II: REACTOR BUILDING RELEASE

## D. Calculation of Reactor Building Leakrate

Is the actual Reactor Building Internal pressure indicated on PT-291? (Y/N) -- NO --

YES

Enter the actual pressure = \_\_\_\_\_ = A4

C3 = Actual RB Internal pressure ~~A4~~ = 50.6

(Circle the appropriate item in Section F)

CHECK

A4 = 50.6 psig

C3 = FSAR postulated RB pressure of 50.6 psig

CHECK  
(Circle the appropriate item in Section F)

Enter item A4 below and perform the calculation

Calculate the actual RB leakrate ( $\frac{CC}{sec}$ )

$$= \frac{656}{50.6} \cdot \left( \frac{A4}{50.6} \right)^{\frac{1}{2}} \cdot \frac{1}{\left( \frac{A4 + 14.7}{14.7} \right)^{\frac{1}{2}}} = \text{_____} \left( \frac{CC}{sec} \right) = E3 \text{ (Enter item E3 in Section E)}$$

-- GO TO SECTION E --

----- WORKSHEET A -----

CASE II: REACTOR BUILDING RELEASE

E. Calculation of Reactor Building Source Terms

Noble gas source term ( $\frac{CI}{sec}$ )

$$= \left( \frac{E1}{E1} \cdot \frac{E3}{E3} \right) \div 1E6 = \frac{SI}{SI}$$

Radioiodine source term ( $\frac{CI}{sec}$ )

$$= \left( \frac{E2}{E2} \cdot \frac{E3}{E3} \right) \div 1E6 = \frac{S2}{S2}$$

$$S3 = 4E5 \quad \frac{MREM}{HR} \frac{UCI}{CC}$$

$$S4 = 1.6E9 \quad \frac{MREM}{HR} \frac{UCI}{CC}$$

ENTER ITEMS  
S1, S2, S3, AND S4  
ONTO THE DOSE  
ASSESSMENT SHEET,  
ATTACHMENT 1.

**CHECK THE BOX**

F. Dose Assessment Assumptions (Strike and fill in the blank items if applicable)

- ☐ C1 = Spent fuel handling accident in the Reactor Building
- ☒ C2 = Number of damaged fuel rods is FSAR assumed 208
- ☐ C2 = Actual number of damaged fuel rods is AI
- ☐ C1 = RML1 high channel reading of AI CPM
- ☐ C1 = RML1 low channel reading of AI CPM
- ☐ C1 = Fuel melting as indicated by in-core instrumentation
- ☐ C1 = Fuel cladding damage as indicated by in-core instrumentation
- ☐ C1 = Most recent RCS sample
- ☐ C1 = FSAR assumed fuel cladding damage
- ☐ C2 = Actual number of gallons of RCS leakage into the Reactor Building
- ☐ C3 = FSAR postulated RB pressure of 50.6 psig
- ☐ C3 = Actual RB pressure of AI psig



CASE III. AUXILIARY AND FUEL HANDLING BUILDING RELEASE

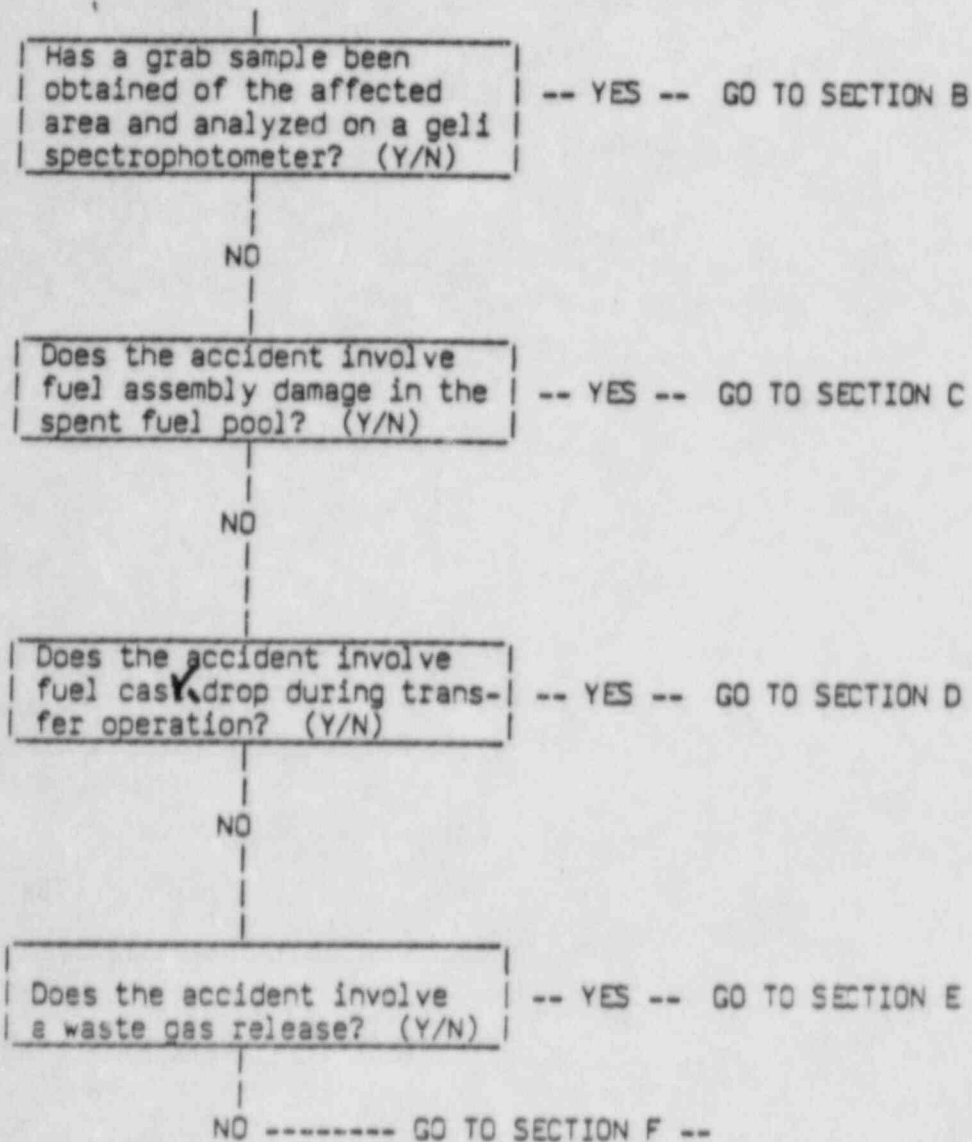
SECTION A - FOLLOW THE ACCIDENT SELECTION  
FLOW DIAGRAM AND THEN CONTINUE TO THE  
SECTION INDICATED BY THE ANSWER (YES OR NO)

FOR SECTIONS B, C, D & E - IN THESE SECTIONS DO  
THE NECESSARY CALCULATIONS TO GET THE  
ANSWERS S1 & S2 & C1, THEN CONTINUE TO  
SECTION F.

SECTION F. - FILL OUT SHEET COMPLETELY.

CASE III: AUXILIARY AND FUEL HANDLING BUILDING RELEASE

A. Accident Selection



CASE III: AUXILIARY AND FUEL HANDLING BUILDING RELEASE

B. Source Term Generation Based Upon a Grab Sample

Calculate the noble gas source term in ( $\frac{CI}{sec}$ ) where

B1 = total  $\frac{UC}{cc}$  of noble gas isotopes as indicated in sample

B2 = ventilation flowrate from affected building in CFM

$$\text{Noble gas source term} = \frac{\quad}{B1} \times \frac{\quad}{B2} \times 4.7E-4 = \frac{\quad}{S1} \frac{CI}{sec}$$

Calculate the radioiodine source term in ( $\frac{CI}{sec}$ ) where

B3 = total  $\frac{UC}{cc}$  of radioiodine isotopes as indicated in sample

B2 = ventilation flowrate from affected building in CFM

$$\text{Radioiodine source term} = \frac{\quad}{B3} \times \frac{\quad}{B2} \times 4.7E-4 = \frac{\quad}{S2} \left(\frac{CI}{sec}\right)$$

B2,

Enter S1 and S2 in Section F

Enter the Time/Date of the sample in the blank below

C1 - Grab sample analyzed on a gel spectrophotometer at                       
Time/Date

**CHECK**

(~~Circle~~ the appropriate item in Section F **AND FILL IN THE BLANKS**)

-- GO TO SECTION F --

CASE III: AUXILIARY AND FUEL HANDLING BUILDING RELEASE

C. Fuel Assembly Damage in the Spent Fuel Pool

Noble gas source term  $\left(\frac{CI}{\text{sec}}\right) = \frac{4.2}{S1}$  (Enter S1 and S2 in Section F)

Radioiodine source term  $\left(\frac{CI}{\text{sec}}\right) = \frac{7.5E-4}{S2}$

CI = FSAR postulated fuel assembly damage in the spent fuel pool

~~CIRCLE~~ <sup>CHECK</sup> the appropriate item in Section F)

-- GO TO SECTION F --

D. Fuel Cask Drop During Transfer Operation (Enter S1 and S2 in Section F)

Noble gas source term  $\left(\frac{CI}{\text{sec}}\right) = \frac{1.2E-3}{S1}$

Radioiodine source term  $\left(\frac{CI}{\text{sec}}\right) = \frac{4.5E-4}{S2}$

CI = FSAR postulated fuel cask drop during transfer operation

~~CIRCLE~~ <sup>CHECK</sup> the appropriate item in Section F)

-- GO TO SECTION F --



CASE III: AUXILIARY AND FUEL HANDLING BUILDING RELEASE

E. Waste Gas Decay Tank Rupture

Noble gas source term ( $\frac{CI}{\text{sec}}$ ) =  $\frac{26}{S1}$  (Enter S1 and S2 in Section F)

Radioiodine source term ( $\frac{CI}{\text{sec}}$ ) =  $\frac{.004}{S2}$

CI = FSAR postulated waste gas decay tank rupture

(~~Circle~~ appropriate item in Section F)

~~CHECK~~

-- GO TO SECTION F --

CASE III: AUXILIARY AND FUEL HANDLING BUILDING RELEASE

F. Dose assessment assumptions

**CHECK THE BOX**

(~~Circle~~ and fill in applicable items)

☒ C1 = Grab sample analyzed on a gel spectrophotometer at \_\_\_\_\_  
Time/Date

☒ C2 = Ventilation flowrate of \_\_\_\_\_ CFM  
B2

☐ C1 = FSAR postulated fuel assembly damage in the spent fuel pool

☐ C1 = FSAR postulated fuel cask drop during transfer operation

☐ C1 = FSAR postulated waste gas decay tank rupture

S1 = \_\_\_\_\_ (CI/sec)

S2 = \_\_\_\_\_ (CI/sec)

S3 = 4E5 (MREM/HR/uci/cc)

S4 = 1.6E9 (MREM/HR/uci/cc)

**ENTER ITEMS S1, S2, S3, AND S4 ONTO THE  
DOSE ASSESSMENT SHEET, ATTACHMENT I.**

ATTACHMENT X. DOSE CONVERSION FACTOR CALCULATION

----- Instructions for Using Attachment X -----

1. Select a DCF calculation from the posted menu:
  - A. Whole body DCF calculation based upon gamma spectrum analysis.  
-- GO TO SECTION A --
  - B. Thyroid DCF calculation based upon a gamma spectrum analysis.  
-- GO TO SECTION B --
  - C. Whole body DCF decay correction (assumes 1 hr elapsed time from original sample analysis).  
-- GO TO SECTION C --
  - D. Thyroid DCF decay correction (assumes 1 hr elapsed time from original sample analysis).  
-- GO TO SECTION D --
  - E. Default DCF (DPCF) calculations  
-- GO TO SECTION E --
2. For the selected DCF calculation determine the whole body or thyroid DCF, S3 and S4 respectively.
3. Enter the following items on the dose assessment worksheet (Attachment I Section 4.0).  
S3 = Whole body DCF (MREM/HR/uci/cc)  
S4 = Radioiodine DCF (MREM/HR/uci/cc)
4. Attach to the dose assessment worksheet (Attachment I) a completed Worksheet B.

A. WHOLE BODY DOSE CONVERSION FACTOR (WBDCF) CALCULATION

----- Utilizing the Attached Worksheet -----

1. Enter the Date/Time of the sample analysis.
2. Enter the Concentrations in ( $\frac{UC}{CC}$ ) for the listed nuclides in column 2.
3. Multiply the concentration of the listed nuclides (column 2) by the photon energy (column 3) to obtain the photon contribution (column 4). Enter the Photon Contribution in column 4.
4. Determine the total concentration of the listed nuclides by adding items a.-m. of column 2. Enter the Total Concentration as item A1.
5. Determine the total photon contribution of the listed nuclides by adding items a.-m. of column 4. Enter the Total Photon Contribution as item A2.
6. Enter items A1 and A2 in equation A-1. Calculate the WBDCF on the worksheet as item



----- WORKSHEET B -----

WBDCF Calculation,

Sample \_\_\_\_\_  
Date/Time \_\_\_\_\_

COL 1	COL 2	COL 3	COL 4
Nuclide	Concentration	Photon Energy	Photon Contribution
a.) KR 85M	<del>0.9</del>	X .18	= <del>0.162</del>
b.) KR 85		X .0022	= <del>2.4</del>
c.) KR 87	<del>3.1</del>	X .79	= <del>2.45</del>
d.) KR 88	<del>1.6</del>	X 2.2	= <del>3.52</del>
e.) XE 133M	<del>0.3</del>	X .02	= <del>.006</del>
f.) XE 133	<del>24</del>	X .03	= <del>0.72</del>
g.) XE 135M		X .53	=
h.) XE 135	<del>3.0</del>	X .26	= <del>0.99</del>
i.) I 131		X .39	=
j.) I 132		X 2.2	=
k.) I 133		X .6	=
l.) I 134		X 2.6	=
m.) I 135		X 1.5	=

Total Conc. = ~~3.7~~  
A1

Total Photon Cont. = ~~7.05~~  
A2

Equation A-1 WBDCF Calculation:

WBDCF in  $\frac{\text{MREM}}{\text{HR}} \cdot \frac{\text{uci}}{\text{cc}}$

Sample Date/Time \_\_\_\_\_

$$= \left( \frac{A2}{A1} \right) \cdot 9E5 = \frac{2.1 \times 10^5}{53}$$

B. THYROID DOSE CONVERSION FACTOR (TDCF) CALCULATION

----- Utilizing the Attached Worksheet -----

1. Enter the Date/Time of the sample analysis.
2. Enter the Sample Concentrations <sup>IN  $\mu\text{Ci/cc}$</sup>  for the listed nuclides in column 2.
3. Multiply the nuclide concentrations in column 2 by the isotope DCF in column 3 to obtain the isotope contributions (column 4). Enter the Isotope Contributions in column 4.
4. Determine the total concentration for the listed nuclides by adding items a.-e. of column 2. Enter the Total Concentration as item A1.
5. Determine the total isotope contribution for the listed nuclides by adding items a.-e. of column 4. Enter the Total Isotope Contribution as item A2.
6. Enter items A1 and A2 in equation B-1.
7. Calculate the TDCF utilizing equation B-1. Enter the TDCF as item S4 on the worksheet

----- WORKSHEET B -----

Thyroid DCF Calculation

Sample \_\_\_\_\_  
Date/Time \_\_\_\_\_

COL 1	COL 2	COL 3	COL 4
Nuclides	Concentration	Isotope DCF	Isotope Contributions
a. I 131		1.6E9	
b. I 132		7.9E7	
c. I 133		5.4E8	
d. I 134		4E7	
e. I 135		1.6E8	

Total Concentration = \_\_\_\_\_  
A1

Total Isotope Contributions = \_\_\_\_\_  
A2

Equation B-1 TDCF Calculation:

TDCF in  $\frac{\text{MREM}}{\text{HR}} \cdot \frac{\text{UCI}}{\text{CC}}$

$$= \left( \frac{A2}{A1} \right) \cdot = \frac{S4}{S4}$$

C. WHOLE BODY DOSE CONVERSION FACTOR (WBDCF) DECAY CORRECTION

----- Utilizing the Attached Worksheet -----

1. Enter the Date/Time of the original sample.
2. Enter the Original Concentrations <sup>IN  $\mu\text{Ci/g}$</sup>  for the listed nuclides in column 2.
3. Multiply the original nuclide concentrations (column 2) by the remaining fraction (column 3) to obtain the present concentration (column 4). Enter the Present Concentrations in column 4. Factors in column 3 account for 1 hour decay.
4. Multiply the Present Concentration (column 4) by the photon energy (column 5) for the listed nuclides to obtain the photon contribution (column 6). Enter the Photon Contributions in column 6.
5. Determine the total concentrations for the listed nuclides by adding items a.-m. of column 4. Enter the Total Present Concentration as item A1.
6. Determine the total photon contribution for the listed nuclides by adding items a.-m. of column 6. Enter the Total Photon Contribution as item A2.
7. Enter items A1 and A2 in equation C-1.
8. Calculate the WBDCF utilizing equation C-1. Enter the WBDCF on the worksheet as item S3.
9. The elapsed time between the original concentrations and calculated WBDCF is 60 minutes. Determine the date/time of the calculated WBDCF by adding 60 minutes to the original sample time. Enter the date/time on the worksheet.

WORKSHEET B

(WBDCF Decay Correction)

Original Concentration \_\_\_\_\_

Date/Time \_\_\_\_\_

COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6
Nuclides	Original Concentrations	Remaining Fraction	Present Concentrations	Photon Energy	Photon Contributions
a. KR 85M	<del>0.9</del>	0.86		.18	
b. KR 85		1.00		.0022	
c. KR 87		0.58		.79	
d. KR 88		0.75		2.2	
e. XE 133M		0.987		.02	
f. XE 133		0.995		.03	
g. XE 135M		0.08		.53	
h. XE 135		0.93		.26	
i. I 131		0.996		.39	
j. I 132		0.74		2.2	
k. I 133		0.97		.6	
l. I 134		0.45		2.6	
m. I 135		0.90		1.5	

Total Present Concentration = \_\_\_\_\_

A1

Total Photon Contribution = \_\_\_\_\_

A2

Equation C-1 WBDCF Calculation:

WBDCF in  $\frac{\text{MREM}}{\text{HR}} \cdot \frac{\text{UCI}}{\text{CC}}$

Date/Time \_\_\_\_\_  
of decay corrected DCF

$$= \left( \frac{A2}{A1} \div \frac{A1}{A1} \right) \cdot 9E5 = \frac{S3}{S3}$$



D. THYROID DOSE CONVERSION FACTOR (TDCF) DECAY CORRECTION

----- Utilizing the Attached Worksheet -----

1. Enter the Date/Time of the original concentrations.
2. Enter the Original Concentrations <sup>in uci/cc</sup> for the listed nuclides in column 2.
3. Multiply the original nuclide concentrations (column 2) by the remaining fraction (column 3) to obtain the present concentration (column 4). Enter the Present Concentrations in column 4. Factors in column 3 account for 1 hour decay.
4. Multiply the present concentration (column 4) by the isotope DCF (column 5) for the listed nuclides to obtain the isotope contributions (column 6). Enter the Isotope Contributions in column 6.
5. Determine the total concentrations for the listed nuclides by adding items a.-e. of column 4. Enter the total concentration as item A1.
6. Determine the total isotope contribution for the listed nuclides by adding items a.-e. of column 6. Enter the total isotope contribution as item A2.
7. Enter items A1 and A2 in equation D-1.
8. Calculate the TDCF utilizing equation D-1. Enter the TDCF as item S4 on the worksheet.
9. The elapsed time between the original concentrations and calculated TDCF is 60 minutes. Determine the date/time of the calculated TDCF by adding 60 minutes to the time of the original sample. Enter the date/time on the worksheet.

THYROID DCF DECAY CORRECTION

Original Concentration \_\_\_\_\_  
Date/Time \_\_\_\_\_

COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6
Nuclides	Original Concentrations	Remaining Fraction	Present Concentrations	Isotope TDCF	Isotope Contributions
a. I 131		0.996		1.6E9	
b. I 132		0.74		7.9E7	
c. I 133		0.97		5.4EB	
d. I 134		0.45		4E7	
e. I 135		0.90		1.6EB	

Total  
Concentration = \_\_\_\_\_  
A1

Total Isotope  
Contribution = \_\_\_\_\_  
A2

Equation D-1 TDCF Calculation:

TDCF in  $\frac{\text{MREM}}{\text{HR}} \frac{\text{uci}}{\text{cc}}$

$$= \left( \frac{A2}{A1} \div \frac{uci}{cc} \right) \times \frac{3600}{24} = \frac{S4}{}$$

\_\_\_\_\_  
Date/Time

E. DEFAULT DOSE CONVERSION FACTOR (DDCF) CALCULATION

----- Utilizing the Attached Worksheet -----

1. Enter the Date/Time of reactor shutdown.
2. Enter the Date/Time of the requested (DDCF) calculation.
3. Determine the time since reactor shutdown by subtracting the time (Item 2) from the time (Item 1).
4. Select the proper accident classification from column 1. Circle this item.
5. Select the proper "time after Rx S/D" from column 2-10. Circle this item.
6. Enter the whole body dose conversion factor (WBDCF) and thyroid dose conversion factor (TDCF) as items S3 and S4 on the worksheet.

----- WORKSHEET B -----

DDCF Calculation ,

1. Reactor shutdown                      Date \_\_\_\_\_ Time \_\_\_\_\_
2. DDCF calculation                      Date \_\_\_\_\_ Time \_\_\_\_\_
3. Time (hrs.) from Rx SD                      \_\_\_\_\_ Hrs.

Column 1 Accident Classification	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10
	TIME FROM REACTOR SHUT DOWN IN HOURS								
	0	1	2	4	6	8	10	12	24
<u>OTSG Tube Rupture</u>									
WBDCF	2.1E5	1.8E5	1.5E5	1.0E5	8.0E4	6.4E4	5.5E4	4.8E4	3.3E4
TDCF	5.8E8	6.1E8	6.4E8	7.1E8	7.7E8	8.4E8	9.1E8	9.8E8	1.3E9
Fuel Handling (RB)									
WBDCF	2.7E4	2.7E4	2.7E4	2.7E4	2.7E4	2.7E4	2.7E4	2.7E4	2.7E4
TDCF	1.2E9	1.3E9	1.3E9	1.4E9	1.4E9	1.4E9	1.4E9	1.4E9	1.5E9
Fuel Handling (FHB)									
WBDCF	2.4E4	2.4E4	2.4E4	2.4E4	2.4E4	2.4E4	2.4E4	2.4E4	2.4E4
TDCF	1.6E9	1.6E9	1.6E9	1.6E9	1.6E9	1.6E9	1.6E9	1.6E9	1.6E9
<u>Rod Ejection</u>									
WBDCF	1.4E5	1.2E5	1.1E5	9.9E4	9.0E4	8.5E4	8.1E4	7.8E4	7.2E4
TDCF	1.2E9	1.2E9	1.3E9	1.3E9	1.4E9	1.4E9	1.4E9	1.4E9	1.5E9
Waste Gas									
WBDCF	5.5E4	4.9E4	4.5E4	3.9E4	3.5E4	3.2E4	3.1E4	2.9E4	2.7E4
TDCF	5.4E8	6.1E8	6.6E8	7.7E8	8.5E8	9.2E8	9.7E8	1.0E9	1.2E9
Others									
WBDCF	8.2E5	7.0E5	6.0E5	4.6E5	3.7E5	3.0E5	2.6E5	2.2E5	1.3E5
TDCF	3.8E8	4.6E8	5.3E8	6.2E8	6.9E8	7.4E8	7.9E8	8.3E8	1.0E9

WBDCF = 3 = \_\_\_\_\_  
 TDCF = 4 = \_\_\_\_\_

~~SECRET~~  
ATTACHMENT ~~II~~ XI HYDROGEN PURGE CALCULATION

The RAC shall complete this attachment should the Emergency Director (ED) decide that a hydrogen purge of the reactor building (RB) is necessary in compliance with EPIP 1004.4 Item 3.1.2.b. The purpose of this procedure is to provide the (ED) with guidelines for the reactor building ventillation flowrate.

1. Date \_\_\_\_\_ Time \_\_\_\_\_

2. Obtain and analyze a reactor building post-accident sample in accordance with EPIP 1004.31 Item 4.8. Determine the noble gas and radioiodine airborne concentrations in accordance with EPIP 1004-7 Attachment IX Item 2.1. List the noble gas airborne concentration (Item A1) and the radioiodine airborne concentration (Item A2) below.

\_\_\_\_\_ Noble gas airborne concentration  
(A1)  $\left(\frac{\text{uCi}}{\text{cc}}\right)$

\_\_\_\_\_ Radioiodine airborne concentration  
(A2)  $\left(\frac{\text{uCi}}{\text{cc}}\right)$

3. Determine the dispersion factor (X/Q) at the exclusion area (EA) in accordance with Attachment II. List the (EA) dispersion factor (as Item A3) below.

\_\_\_\_\_ Exclusion area (EA) dispersion factor  
A3  $\left(\frac{\text{sec}}{\text{meter}^3}\right)$

4. Determine the whole body and thyroid dose conversion factors (DCF) in accordance with Attachment X. List the whole body DCF (WBDCF) as item A4 below. List the thyroid DCF (TDCF) as item A5 below.

\_\_\_\_\_ Whole body DCF  $\frac{\text{MREM}}{\text{HR} \cdot \frac{\text{uCi}}{\text{cc}}}$   
(A4)

\_\_\_\_\_ Thyroid DCF  $\frac{\text{MREM}}{\text{HR} \cdot \frac{\text{uCi}}{\text{cc}}}$   
(A5)

5. Calculate the (RB) ventillation flowrate that corresponds to 1000  $\frac{\text{MREM}}{\text{HR}}$  whole body dose rate as shown below.

$$2.2 \times 10^6 \div \left( \frac{\text{_____}}{(A1)} \times \frac{\text{_____}}{(A3)} \times \frac{\text{_____}}{(A4)} \right) = \frac{\text{_____}}{(A6)} \text{CFM}$$

6. Calculate the (RB) ventillation flowrate that corresponds to 5000  $\frac{\text{MREM}}{\text{Hr}}$  thyroid dose committment as shown below.

$$1.1 \times 10^7 \div \left( \frac{\text{_____}}{(A2)} \times \frac{\text{_____}}{(A3)} \times \frac{\text{_____}}{(A5)} \right) = \frac{\text{_____}}{(A7)} \text{CFM}$$

7. Compare calculated (RB) ventillation flowrates (items A6 and A7). Choose the most limiting of items A6 and A7. Explain to the ED that this flowrate would yield exclusion area dose rates consistent with EPIP 1004.4 criteria. Also, that continuation of the purge for one hour would yield dose rates consistent with the EPA lower limit PAG's.



## ----- Instructions for Utilizing Annex I -----

1. Identify the release pathway. Select an effluent monitor.
2. Select the appropriate thumbrule from Table 1 or 2.
3. Complete the worksheet by calculating the ratio of actual to assumed conditions for the listed parameters. As an example;

RM-A5 is reading 1E5 CPM (Enter in Col. B)

Condenser off-gas flowrate is 10 SCFM (Enter in Col. C)

The dispersion factor at the exclusion area is 1E-5  $\frac{\text{sec}}{\text{M}^3}$  (Enter in Col. D)

Thumbrule #1 from Table 1 should be utilized. The worksheet should be completed as follows:

Affected Monitor	Ratio Col. B	Ratio Col. C	Ratio D	Correction Factor	Uncorrected Dose Rate	Corrected Dose Rate
RM-A5	$\frac{1E5}{1E6} = .1$	$\frac{10}{20} = .5$	$\frac{1E-5}{1E-4} = .1$	$.1 \times .5 \times .1 = .005$	.01 $\frac{\text{MR}}{\text{HR}}$	$.01 \times .005 = 5E-5 \frac{\text{MR}}{\text{HR}}$

The correction factor is the product of the individual parameter ratios. The corrected dose rate is the product of the correction factor and the uncorrected dose rate.

4. Enter the corrected dose rate on the dose assessment worksheet (Attachment VI). Attach to the dose assessment worksheet a completed Worksheet D. Enter "thumbrule" in items S1, S2, S3, S4 and S5.

# ATTACHMENT ~~XII~~

## ANNEX 1 - TABLE 1

### Low Range RMS Thumbrules for Dose Protection

G = Gaseous Channel

RI = Radioiodine Channel

Column A	Column B	Column C	Column D	Column E
Monitor	Reading	Ventilation Flowrate	Dispersion Factor	Dose Rate
	CPM	CFM	sec/M3	MREM/HR WB
1. RM-A5G	1E6	20	1E-4	.01
2. RM-A8G	1E6	1E5	1E-4	50
3. RM-A8RI	1E4 *	1E5	1E-4	100 **
4. RM-A9G	1E6	5E4	1E-4	25
5. RM-A9RI	1E4 *	5E4	1E-4	50 **

\*  $\frac{\text{CPM}}{\text{MIN}}$

\*\*  $\frac{\text{MREM}}{\text{HR}}$  Thyroid Dose Commitment

### ----- WORKSHEET D -----

Affected Monitor	Ratio Col. B	Ratio Col. C	Ratio Col. D	Correction Factor	Uncorrected Dose Rate	Corrected Dose Rate

# ATTACHMENT XII - TABLE 2

## High Range RMS Thumbrules for Dose Protection G = Gaseous Channel

Column A	Column B	Column C	Column D	Column E
Monitor	Reading (CPM)	Ventilation Flowrate (CFM)	Dispersion Factor ( $\frac{\text{sec}}{\text{M}^3}$ )	Dose Rate MREM/HR (WB)
1. RM-A5 High (G)	1E6	20	1E-4	25
2. RM-G25 (G)	3E3 *	20	1E-4	1
3. RM-G26 & 27 ***	1E3	5.6E6 **	1E-4	5
4. RM-A8 High (G)	1E2	1E5	1E-4	450
5. RM-A9 High (G)	1E3	1E4	1E-4	20
6. RM-G24 (G)	1E2 *	1E4	1E-4	10

\*  $\frac{\text{MR}}{\text{HR}}$

\*\*  $\frac{\text{lb}}{\text{hr}}$

\*\*\* Release via the condenser off-gas

WORKSHEET D

Affected Monitor	Ratio Col. B	Ratio Col. C	Ratio Col. D	Correction Factor	Uncorrected Dose Rate	Corrected Dose Rate

## ATTACHMENT IX

## HIGH RANGE RMS DOSE CALCULATIONS

## Section A - System Description

The High Range RMS is categorized into three distinct subsystems (See Schematic):

1. Radioiodine Processor Stations
2. Containment Air Sampling
3. High Range Noble Gas Channels

## Subsystem (1):

## Radioiodine Processor Stations

Three stations allow samples to be obtained independent of radiation monitors RM-A5, A8 and A9. The stations are controlled by solenoid valves which actuate flow through one or more of the (3) parallel filter cartridges per station. The sampling times for each filter cartridge are adjustable on each local control panel. The filter cartridges must be manually removed for analysis.

## Subsystem (2):

## Containment Air Sampling

The post accident RB atmospheric sampling station is located at the 322' level of the intermediate building, one floor above radiation monitor RM-A2. Three-way ball valves are installed in the RM-A2 sampling lines downstream of containment isolation valves. The sampling lines are connected downstream of CM-V1, CM-V2, CM-V3 and CM-V4 at P-108.



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## ATTACHMENT IX

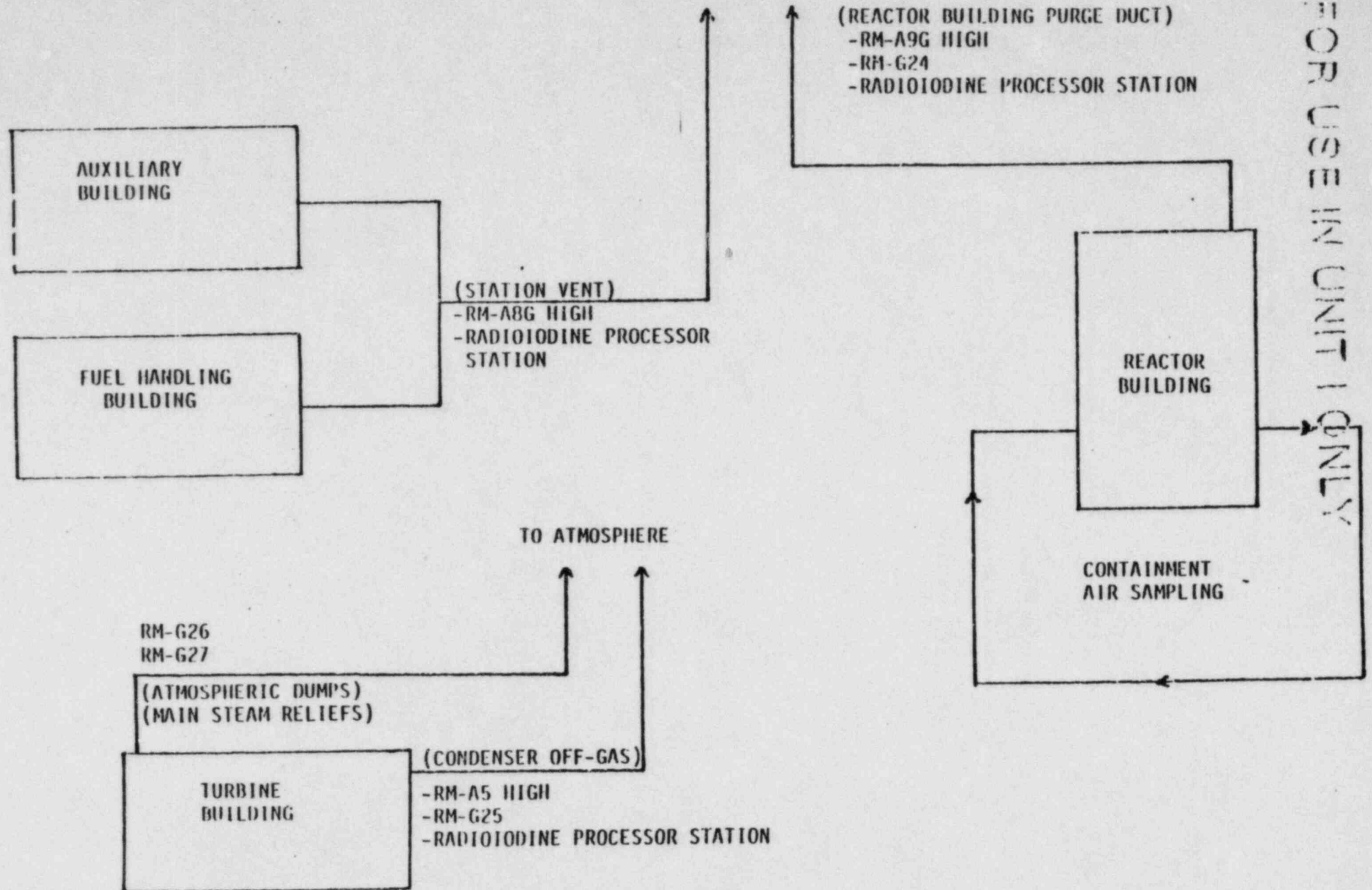
### HIGH RANGE RMS DOSE CALCULATIONS

#### SUBSYSTEM 3: HIGH RANGE NOBLE GAS CHANNELS

MONITOR DESIGNATION	: EFFLUENT PATHWAY	: DETECTOR TYPE	: RANGE : $\mu\text{Ci/cc}$	: CONVERSION : FACTOR CPM/ $\mu\text{Ci/cc}$	: FLOWRATE CFM RECORDED
RM-A8G High	: Aux and FHB	: GM Tube	: 1E-2/1E-3	: 1E3	: FR-151
RM-A9G High	: RB Purge	: GM Tube	: 1E-3/1E2	: 2.6E3	: FR-148
RM-G24	: RB Purge	: Ion Chamber	: 1E1-1E5	: *	: FR-148
RM-A5 High	: Condenser Off-Gas	: GM Tube	: 1E-3/1E2	: 5E3	: See Table 1
RM-G25	: Condenser Off-Gas	: Ion Chamber	: 1E1/1E5	: 1.5	: See Table 1
RM-G26	: A, B Main Steam Lines	: Scintillation	: 1E-2/1E3	: 1020	: See Table 1
RM-G27	: C, D Main Steam Lines	: Scintillation	: 1E-2/1E3	: 1056	: See Table 1

MR/HR/ $\mu\text{Ci/cc}$





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## ATTACHMENT IX

### HIGH RANGE RMS DOSE CALCULATIONS

#### Section B - Source Term Calculations

1.0 Calculation of the Radioiodine Source Term utilizing the Radioiodine Processor Station.

1.1 Enter the radioiodine concentration in microcuries/cc as determined per EPIP 1004.31 from the silver zeolite cartridge:

I131	_____	μci/cc
I132	_____	μci/cc
I133	_____	μci/cc
I134	_____	μci/cc
I135	_____	μci/cc
Total	_____	μci/cc
	(A)	

1.3 Enter the release flowrate in cubic feet per minute (CFM) as determined from the Table below:

: Release Pathway	: Release Flowrate (CFM)	:
: Station Vent	: FR-151	:
: RB Purge Duct	: FR-148	:
: Condenser Off-Gas	: See Table 1	:

Release Flowrate \_\_\_\_\_ (CFM)  
(B)

1.4 Calculate the Radioiodine Release Source Term utilizing the following equation:

~~Filter Total~~ Radioiodine concentration \_\_\_\_\_ (A) (μCi/cc) x Release Flowrate \_\_\_\_\_ (B) (CFM)

x Curie Conversion Factor  $1E-6 \frac{CI}{\mu CI}$  x Flowrate Conversion Factor  $472 \frac{cc}{sec CFM}$  = Radioiodine Source Term \_\_\_\_\_  $\frac{CI}{sec}$

1.5 Go to Attachment 1, Section 4.0 "Dose Assessment Sheet"

TABLE 1

Steam Discharge Flow Rates

(1)

Steam Generator "A", "B"

<u>Valve Tag No.</u>	<u>Steam Flow #/hr.</u>	<u>Press. PSIG</u>
MS-V17A, MS-V17B, C and D	792,610	1050
MS-V18A, MS-V18B, C and D	799,990	1060
MS-V19A, MS-V19B, C and D	814,955	1080
MS-V20A, MS-V20B, C and D	824,265	1092
MS-V21A, MS-V21B	194,900	1040
MS-V22A	70,212	200
MS-V22B	76,793	200

(2) Steam discharged from, steam Generator B similar for Valve MS-V17C, D MS-V18C, D MS-V19C, D, MS-V20C, D, MS-V21B. (MS-V22B is 76,793 #/hr at 200 PSIG)

(3) Steam Dump to Atmosphere MS-V4A and B

<u>% Valve opening demand</u>	<u>Steam flow #/hr.</u>
20	$1.77 \times 10^5$
40	$3.6 \times 10^5$
60	$5.09 \times 10^5$
80	$5.61 \times 10^5$
100	$5.767 \times 10^5$

(4) Condenser Vacuum Pump Discharge Path

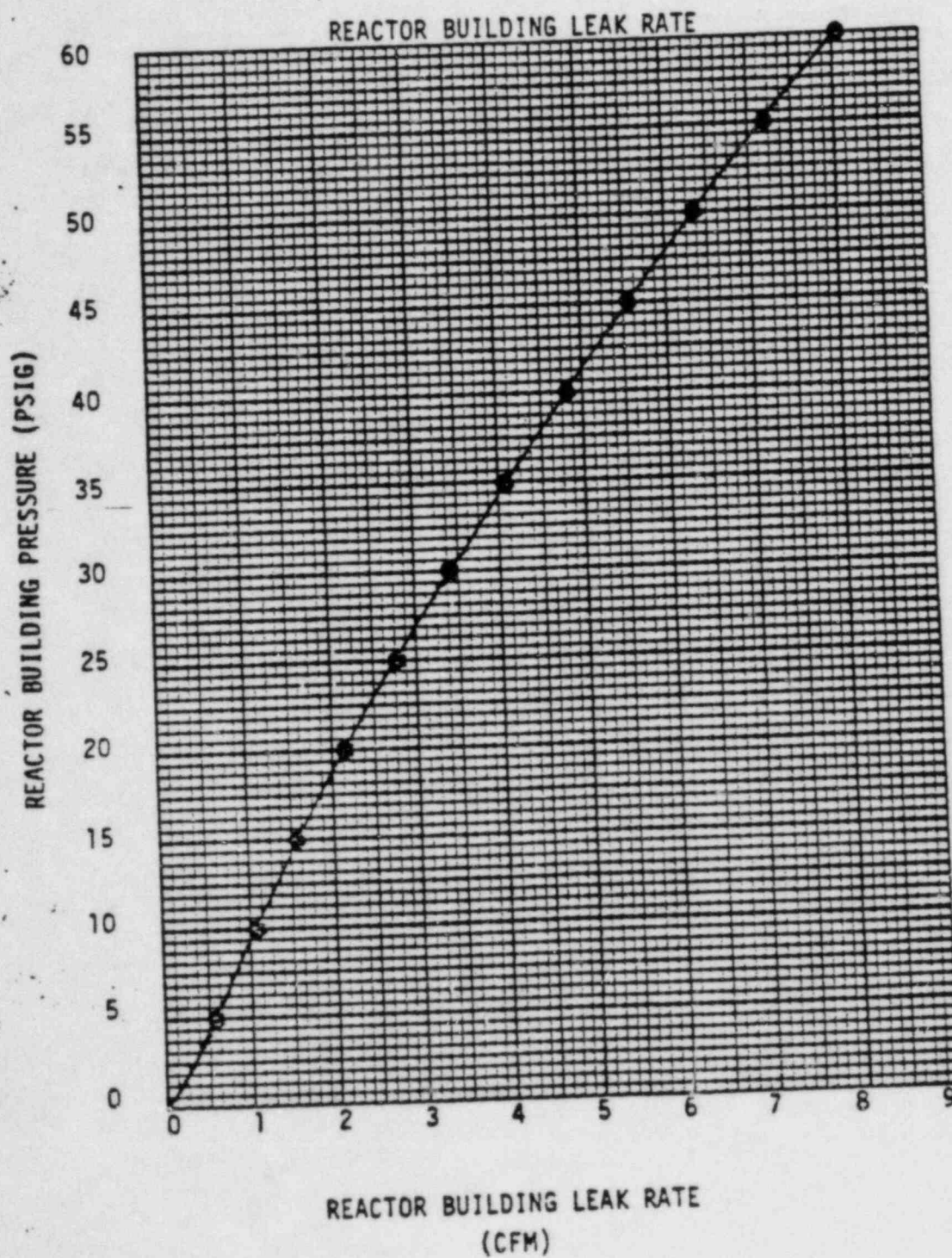
To be read from flowmeter on the pumps, or if unknown, use 20 SCFM.

(5) In the event of a direct release of steam to the atmosphere utilizing RMG-26 or RMG-27 to monitor the source term; the following term shall be included with the release flowrate:

<u>Total Steam Flowrate</u>	RMG-26 or RMG-27
Steam Flow Past	



TABLE 2



## ATTACHMENT IX (Cont'd)

2.0 Calculation of the Radioiodine and Noble Gas Source Terms utilizing the Containment Air Sampling Station.

2.1 Enter the Containment Air Sampling Bomb Radionuclide Concentrations in microcuries per cubic centimeter ( $\mu\text{Ci/cc}$ ) as determined per EPIP 1004.31:

Noble Gas Nuclides		Radioiodine Nuclides	
KR85	_____ $\mu\text{Ci/cc}$	I131	_____ $\mu\text{Ci/cc}$
KR85m	_____ $\mu\text{Ci/cc}$	I132	_____ $\mu\text{Ci/cc}$
KR87	_____ $\mu\text{Ci/cc}$	I133	_____ $\mu\text{Ci/cc}$
KR88	_____ $\mu\text{Ci/cc}$	I134	_____ $\mu\text{Ci/cc}$
XE133	_____ $\mu\text{Ci/cc}$	I135	_____ $\mu\text{Ci/cc}$
XE133m	_____ $\mu\text{Ci/cc}$	Total Radioiodine	_____ $\mu\text{Ci/cc}$
XE135	_____ $\mu\text{Ci/cc}$		(A <sub>2</sub> )
XE135m	_____ $\mu\text{Ci/cc}$		
Total Noble Gas	_____ $\mu\text{Ci/cc}$		
	(A <sub>1</sub> )		

2.2 Enter the Reactor Building release flowrate as determined from the Table below: Release Flowrate \_\_\_\_\_ CFM  
(B)

: Purge Valves Open	FR-148	:
:		:
: Purge Valves Closed	See Table 2	:

2.3 Calculate the Noble Gas Release Source Term utilizing the following equation:

$$\text{Total Noble Gas Concentration} \frac{(A_1)}{\mu\text{Ci/cc}} \times \text{Release Flow Rate} \frac{(B)}{\text{CFM}} \times \text{Flowrate Conversion Factor} \frac{472}{\frac{\text{cc}}{\text{sec CFM}}}$$

$$\text{Curie Conversion} \times \text{Factor} \frac{1\text{E-6}}{\mu\text{Ci}} = \text{Noble Gas Source Term} \frac{\text{Ci}}{\text{Sec}}$$



2.4 Calculate the Radioiodine Release Source Term utilizing the following equation: Revision 6

$$\text{Total Radioiodine Concentration} \frac{\mu\text{Ci}}{\text{cc}} \times \text{Release Flow Rate} \frac{\text{CFM}}{(\text{B})} \times \text{Flowrate Conversion Factor} \frac{472 \frac{\text{cc}}{\text{Sec}}}{\text{CFM}}$$

$$\text{Curie Conversion x Factor} \frac{1\text{E-6}}{\text{Ci}} = \text{Radioiodine Source Term} \frac{\text{Ci}}{\text{Sec}}$$

2.5 Go to Attachment 1, Section 4.0 "Dose Assessment Sheet"

3.0 Calculation of the Noble Gas and Radioiodine Source Terms utilizing the High Range Noble Gas Channels.

3.1 Enter the Noble Gas Channel reading in CPM:  $\frac{\text{CPM}}{(\text{A})}$

3.2 Enter the meter conversion factor as identified in Section A:

$$\frac{\text{CPM or MR}}{(\text{B}) \text{ HR}}$$

$$\frac{\mu\text{Ci}}{\text{cc}}$$

Enter the postulated mixture conversion factor as identified in Table 3:

$$\frac{\mu\text{Ci}}{\text{cc}} \text{ Pos. Mix} \quad \frac{\mu\text{Ci}}{\text{cc}} \text{ Cal. Isotope}$$

Enter the nuclide class fraction as identified in Table 4:

$$\frac{\mu\text{Ci}}{\text{cc}} \text{ Noble Gas} \quad \frac{\mu\text{Ci}}{\text{cc}} \text{ Pos. Mix}$$

3.3 Enter the Release Flowrate in CFM as identified in Section A:

$$\frac{\text{CFM}}{(\text{C})}$$

3.4 Calculate the Noble Gas Source Term in curies per second (CI/SEC) utilizing the equation below:

$$\text{Noble Gas Channel Reading} \frac{(\text{CPM})}{(\text{A})} \times \text{Meter Conversion Factor} \frac{\text{CPM or MR}}{(\text{B}) \text{ HR}} \times \frac{\mu\text{Ci}}{\text{cc}} \text{ Pos. Mix} \quad \frac{\mu\text{Ci}}{\text{cc}} \text{ Cal. Isotope}$$

$$\times \frac{\mu\text{Ci}}{\text{cc}} \text{ Noble Gas} \quad \frac{\mu\text{Ci}}{\text{cc}} \text{ Pos. Mix}$$

$$\times \text{Release Flow Rate} \frac{\text{CFM}}{(\text{C})} \times \text{Release Flowrate Conversion} \frac{472 \frac{\text{cc}}{\text{sec}}}{\text{CFM}}$$

$$\times \text{Curie Conversion} \frac{1\text{E-6}}{\text{Ci}} \frac{\text{Ci}}{\mu\text{C}}$$

$$\text{Noble Gas Source Term} \frac{\text{Ci}}{\text{sec}} \quad (\text{D})$$

3.5 CALCULATE THE RADIOIODINE SOURCE TERM IN CURIES PER SECOND (CI/SEC) AS FOLLOWS:

3.5.1 ENTER THE NOBLE GAS SOURCE TERM AS CALCULATED IN STEP 3.4:  $\frac{\text{CI}}{\text{SEC}}$   
(D)

3.5.2 ENTER THE FRACTION OF RADIOIODINE AS DETERMINED FROM TABLE 4:  $\frac{\text{RADIOIODINE FRACTION}}{\text{(E)}}$

3.5.3 ENTER THE FRACTION OF NOBLE GAS AS DETERMINED FROM TABLE 4:  $\frac{\text{NOBLE GAS FRACTION}}{\text{(F)}}$

3.5.3 DETERMINE THE RADIOIODINE SOURCE TERM UTILIZING THE EQUATION BELOW:

$$\left( \frac{\text{CI NOBLE GAS}}{\text{(D) SEC}} \right) \times \left( \frac{\text{RADIOIODINE FRACTION}}{\text{(E)}} \div \frac{\text{NOBLE GAS FRACTION}}{\text{(F)}} \right)$$

= RADIOIODINE SOURCE TERM  $\frac{\text{CI}}{\text{SEC}}$   
(G)

3.6 GO TO ATTACHMENT 1, SECTION 4.0 "DOSE ASSESSMENT SHEET"

TABLE 3

POSTULATED MIXTURE CONVERSION FACTOR  
( $\frac{U_{Si}}{C_{Si}}$  CALIBRATION ISOTOPE TO  $\frac{U_{Si}}{C_{Si}}$  POS MIXTURE)

MONITOR DESIGNATION	EFFLUENT PATHWAY	CALIBRATION ISOTOPE	CONVERSION FACTOR
RM-A 86 HIGH	AJ4 AND FMB	XE 133	0.7
RM-A 96 HIGH	R3 PURGE	XE 133	0.7
RM-G 24	R3 PURGE	KR 85	0.01
RM-A 5 HIGH	CONDENSER OFF-01B	XE 133	0.6
RM-G 25	CONDENSER OFF-6A2	XE 133	0.6
RM-G 26	A, B MAIN	KR 85	0.007
	STEAM LINES		* 0.005
RM-G 27	C, D MAIN	KR 85	0.007
	STEAM LINES		* 0.005

\* IODINE SPIKE ASSUMPTION BASED UPON PLANT TRANSIENT

TABLE 4

NUCLIDE CLASS FRACTION OF POSTULATED MIXTURE

( $\frac{UCI}{CC}$  POST. MIXTURE TO  $\frac{UCI}{CC}$  NUCLIDE CLASS)

MONITOR DESIGNATION	NOBLE GAS FRACTION	RADIOIODINE FRACTION
Rm - A8 G HIGH	0.94	0.07
Rm - A9 G HIGH	0.94	0.07
Rm - G24	0.94	0.07
Rm - A5 HIGH	1.00	0.0008
Rm - G25	1.00	0.0008
Rm - G26	0.80	0.06
	* 0.67	* 0.24
Rm - G27	0.80	0.06
	* 0.67	* 0.24

\* IODINE SPIKE ASSUMPTION BASED UPON PLANT TRANSIENT



THREE MILE ISLAND NUCLEAR STATION  
UNIT NO. 1 EMERGENCY PLAN IMPLEMENTING PROCEDURE 1004.7  
OFFSITE/ONSITE DOSE PROJECTIONS1.0 PURPOSE

The purpose of the procedure is to provide:

- a. Techniques and methods for calculating projected doses (whole body, and thyroid dose equivalent which might result from monitored releases of radioactive materials from TMI Unit 1.
- b. Techniques and methods for predicting the downstream concentrations of radioactive liquids resulting from a major accidental release of radioactive liquids to the Susquehanna Valley.
- c. Contingency methods for estimating projected doses if monitors are out of service or off-scale high.

The Radiological Assessment Coordinator is responsible for implementing this procedure.

2.0 ATTACHMENTS

- |     |                 |  |
|-----|-----------------|--|
| 2.1 | Attachment I    | Dose Assessment Sheet  |
| 2.2 | Attachment II   | Meteorological Data  |
| 2.3 | Attachment III  | Calculation of the Source Term and Onsite/Offsite Dose Projections |
| 2.4 | Attachment IV   | Contingency Calculations   |
| 2.5 | Attachment V    | Liquid Release Calculation   |
| 2.6 | Attachment VI   | Protective Action Guides   |
| 2.7 | Attachment VII  | Field Monitoring Nomograph   |
| 2.8 | Attachment VIII | <del>Computerized Dose Calculations</del> IGNORE                   |
| 2.9 | Attachment IX   | High Range RMS Dose Calculations                                   |

2.10 ~~3.0~~ ATTACHMENT X DOSE CONVERSION FACTOR CALCULATION

2.11 ATTACHMENT XI HYDROGEN PURGE CALCULATION

2.12 ATTACHMENT XII THUMB RULES



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## 3.0 EMERGENCY ACTION LEVELS

- 3.1 As required by an Emergency Plan Implementing Procedure.
- 3.2 As directed by the Emergency Director or his designee.

## 4.0 EMERGENCY ACTIONS

### INITIALS

-----  
: NOTE: The TRS-80 minicomputer may be used in lieu of :  
: written hand calculations to determine dose projec- :  
: tions. Utilize Attachment VIII "Computerized Dose :  
: Calculations" to operate the minicomputer. :  
-----

-----  
: NOTE: Perform steps in order: :  
: If the release is radioactive materials to the :  
: atmosphere, perform Steps 4.1 - 4.5. :  
: If release is of radioactive liquids to the :  
: Susquehanna River perform Steps 4.6 - 4.8. :  
-----

-----  
: NOTE: Refer to EPIP 1004.6, Additional Assistance and :  
: Notification, Attachment III (pg. 10.0) for :  
: back-up sources of meteorological information. :  
-----

- \_\_\_\_ 4.1 Complete the Meteorological section of the Dose Assessment Sheet by completing Attachment II.
- \_\_\_\_ 4.2 Complete the Release section, Source Term and Dose Projection section of the Dose Assessment Sheet by completing forms on Attachment III. If High Range RMS is to be utilized then refer to Attachment IX. **USE ATTACHMENT I IF A DCF IS TO BE CHARGED.**
- \_\_\_\_ 4.3 Utilize Attachments VI and VII to evaluate Field Monitoring data and recommend Protective Action.
- \_\_\_\_ 4.4 Utilize Attachment IV to project dose based upon contingency calculations.
- \_\_\_\_ 4.5 Always report dose rate, dose, time used, and basis for the time estimate to the Emergency Director, or his designee.

**USE ATTACHMENT XI FOR A HYDROGEN PULSE CALCULATION.**  
**USE ATTACHMENT XII FOR A 2.0 THUMB RULE CALCULATION**

~~John~~ Harley

I talked to Jack Wetmore. He told me GPU is considering conducting another cooldown to get higher tube-to-shell  $\Delta T$ s. The decision will probably come about the end of the week. The cooldown, if done, will probably fall early next week. It would be followed by a heatup, soak and a final cooldown about Oct 10-11. These dates are all tentative. GPU has not decided how it would do this special cooldown.

Jim



GPU Nuclear Corporation  
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717 944-7621  
TELEX 84-2366  
Writer's Direct Dial Number

September 30, 1983  
5211-83-279

Office of Nuclear Reactor Regulation  
Attn: J. F. Stolz, Chief  
Operating Reactors Branch #4  
Division of Licensing  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555


Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)  
Operating License No. DPR-50  
Docket No. 50-289  
Comments on NRC SER Concerning TMI-1  
Steam Generators Repair

This letter is intended to convey GPUN's response to your August 25 safety evaluation on TMI-1 return to service with repaired steam generators. Attachment 1 to this letter documents GPUN actions on confirmatory items in your SER. Attachment 2 is a list of GPUN comments on the Staff SER.

We hope these items will support preparing the scheduled supplement to your SER.

Sincerely,

  
H. D. Hockill  
Vice President - TMI-1

cc: H. Silver



GPUN Actions on Confirmatory Items

<u>Section</u>	<u>Page, Paragraph</u>	<u>Item/Response</u>
4.3.1	39(2nd)	<p>Item: "...an updated TDR 406 confirming the modifications discussed above and containing acceptable documentation of the analytical justifications for these modifications is submitted prior to restart."</p> <p>Response: TDR 406, Rev. 2 is enclosed. Supporting references and procedures have been made available to members of your staff.</p>
4.3.2	42(item 5)	<p>Item: Reactor Coolant Pump NPSH for Emergency Operations, "The licensee should insure that the copy for Control Room use is clear and legible".</p> <p>Response: The Controlled Copy of the approved and formally issued 1202-5 has clear and legible copies of the NPSH curves. A copy of the procedure has been made available for review by members of your staff.</p>
4.3.2	43(item 7)	<p>Item: S/G Isolation/Steaming Criteria, "...the licensee will make a change for SG isolation from a dose to dose rate criteria."</p> <p>Response: The Controlled Copy of the approved and formally issued 1202-5 has dose rate rather than dose isolation criteria. A copy of the procedure has been made available for review by members of your staff.</p>
4.3.2	43-44(item 8)	<p>Item: Pressure Control of Isolated SGs - "The licensee states that instructions for controlling pressure in an isolated SG are planned for inclusion in EP 1202-5".</p> <p>Response: Although the subject of this quote is feeding an isolated OTSG for pressure control, the SEP mistakenly refers to "steaming" an isolated SG in the sentence before the quote.</p>



<u>Section</u>	<u>Page, Paragraph</u>	<u>Item/Comment</u>
2	2(bottom) -3 (top)	<p>Item: 22" expansion.</p> <p>Comment: This paragraph gives the impression that a 22" expansion was performed in each tube. As discussed in TR-008, a 22" expansion was used for tubes where the lowest defect was too low to be repaired by a 17" expansion.</p>
3.1	8 (top)	<p>Item: "The thiosulfate tanks have also been physically removed."</p> <p>Comment: The thiosulfate tank has been physically removed from communication with the reactor coolant system by cutting the connecting lines and sealing them with blind flanges, but the tank has not been physically removed from the plant.</p>
3.2	9 (2nd)	<p>Item: "The extent of corrosion was quantified and all corrosion affected sections in the waste gas system have been replaced."</p> <p>Comment: As discussed in our June 6 update on LER 82-02, all unacceptable corrosion affected sections of the waste gas system have been replaced. Minor indications were placed on an augmented inspection list. In addition, some surface corrosion and/or corrosion products may still be present.</p>
3.2	13 (top)	<p>Item: "...the PORV and safety relief valves, which exhibited pitting corrosion, were replaced".</p> <p>Comment: As discussed in our June 6 update to LERs 82-11 and 83-03, the PORV internals and safety relief valves were replaced. The PORV body was cleaned and inspected, then returned to service. The PORV internals were made of a number of materials some of which exhibited general corrosion and IGSCC as well as pitting corrosion.</p> <p>In addition the safety valves were replaced due to new ring settings not due to corrosion.</p> <p>Item: "The waste gas system was found to be affected, and all corroded portions of this system were replaced."</p> <p>Comment: See comment for p. 9, section 3.2.</p>

TDR 406, Rev. 2 no longer recommends feeding an isolated OTSG for pressure control (see last item of Summary of Change, page 9 of 74 TDR 406, Rev. 2). It should be noted, however, that due to an editing error a reference to this form of OTSG pressure control still exists in section 3.2.4 page 30 of 74. This error will be corrected with the next revision to TDR 406. EP 1202-5 reflects the revised TDR 406, Rev. 2.

4.3.2      44(item 9)      Item:      SG Shell to Tube Differential Temperature Limit.  
"The licensee will be required to clarify procedural action for Delta T's in excess of 100°F."

Response:      The Delta T limit in the procedure is 70°F. If this limit is approached the guidance in 1202-5 does require that the cooldown rate be reduced or secured so as not to exceed 70°F. The guidance for a 100°F Delta T has been removed from TDR 406, Rev. 2 (see abstract and section 3.2.2.3 of TDR 406, Rev. 2). It should be noted, however, that due to an editing error, section 5.2.9 still contains the confusing second reference to a 100°F limit. This error will be corrected with the next revision to TDR 406. EP 1202-5 reflects the revised guidance in TDR 406, Rev. 2.

<u>Section</u>	<u>Page, Paragraph</u>	<u>Item/Comment</u>
3.3	15(table)	<p>Item: Table 3.3-1.</p> <p>Comment: The numbers of tubes listed in the last two columns are approximations only. In some cases more were done in the baseline and will be repeated after 90 days. In some cases fewer were done because the population of tubes in that category was less than shown in the table due to plugging of adjacent tubes or the tubes location in the periphery.</p>
3.3	16 (top)	<p>Item: "As early as feasible in post critical operation, the licensee shall confirm the baseline primary-to-secondary leakage rate, and establish the minimum increase in such leakage rate which can reliably be measured (expected to be about .1gpm) . If leakage exceeds the baseline leakage rate by that minimum increase, the plant shall be shut down and leak tested".</p> <p>Comment: As discussed in TR-008, GPUN has established .1 gpm as an administrative limit on leakage above baseline. This leakage rate is detectable.</p>
3.4.1.b	16(bottom)	<p>Item: Planned testing.</p> <p>Comment: The second phase of testing is complete and results have been reported in TR-008, Rev. 3. Assessment of the joint for the full 35 year design life will be performed when data on actual steam generator performance is available to supplement the results of the 5 year and 15 year test programs. No additional testing is planned prior to the startup after the first refueling outage.</p>
3.4.1.c	17 (top)	<p>Item: "This objective assures that compressive loads during operation and vibrational characteristics of the tube will remain unchanged."</p> <p>Comment: As stated in TR-008, only the maintenance of vibrational characteristics is an objective. It is also a goal that the tubes not be in compression when cold.</p>



Section	Page, Paragraph	Item/Comment														
3.4.2.d	20(3rd)	<p>Item: "...the 1025 pounds necessary to cause tube bowing."</p> <p>Comment: As discussed in TR-008 and our letter of August 3, tube bowing begins at approximately 800 lbs, but loads must reach 1025 lbs before the lateral displacement of the tube exceeds the nominal size of the space between tubes.</p>														
3.4.2.d	21(4th)	<p>Item: "...1.0 ksi in<sup>1/2</sup>."</p> <p>Comment: Calculations were done at 4.0 ksi in<sup>1/2</sup>.</p>														
3.4.2.d	21(bottom)	<p>Item: Stable cracks.</p> <p>Comment: This paragraph may need revision based on TR-008, Rev. 3.</p>														
3.4.2	23(bottom)	<p>Item: "The Staff will condition the license to require submittal of the extended life cycle program qualification test results by Startup after the first regularly scheduled refueling after restart."</p> <p>Comment: See comments for p. 16, section 3.4.1.b.</p>														
3.5	28-29	<p>Item: Cleanup of Contaminant</p> <p>Comment: Some parameters throughout in this section may need to be updated to reflect actual chemical cleaning as discussed in TR-008, Rev. 3.</p> <table border="0"> <tr> <td>Boron (boric acid)</td> <td>1800-2300 ppm</td> </tr> <tr> <td>pH (ambient temperature)</td> <td>8.0-8.5</td> </tr> <tr> <td>H<sub>2</sub>O<sub>2</sub> concentration</td> <td>15-25 ppm</td> </tr> <tr> <td>Temperature</td> <td>130°F ± 5°F</td> </tr> <tr> <td>Cover Gas</td> <td>N<sub>2</sub> (pzi)</td> </tr> <tr> <td>Lithium ion concentration</td> <td>1.8-2.2</td> </tr> <tr> <td>Duration of Treatment</td> <td>400 hrs.</td> </tr> </table> <p>Testing using samples prior to beginning cleaning monitored performance through 500 hrs.</p>	Boron (boric acid)	1800-2300 ppm	pH (ambient temperature)	8.0-8.5	H <sub>2</sub> O <sub>2</sub> concentration	15-25 ppm	Temperature	130°F ± 5°F	Cover Gas	N <sub>2</sub> (pzi)	Lithium ion concentration	1.8-2.2	Duration of Treatment	400 hrs.
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Lithium ion concentration	1.8-2.2															
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3.6	30(item 2)	<p>Item: "All RCS piping..were flushed..."</p> <p>Comment: All RCS piping with a diameter greater than 1" was flushed.</p>														



<u>Section</u>	<u>Page, Paragraph</u>	<u>Item/Comment</u>												
3.6	30(item 4)	<p>Item: "The coolant will be...monitored continuously for pH and conductivity."</p> <p>Comment: Per TR-008, as recorded in your Table 3.6-1, these parameters will be monitored five times per week.</p>												
3.6	31(table)	<p>Item: Table 3.6-1.</p> <p>Comment: There are several differences in Table 3.6-1 from our plans as outlined in TR-008.</p> <table> <tr> <th><u>Parameter</u></th><th><u>Old Limit</u></th><th><u>New Limit</u></th></tr> <tr> <td>Lithium</td><td>0.2-2.0(ppm)</td><td>1.0-2.0(ppm)</td></tr> <tr> <td>Chlorides</td><td>0.15(ppm)</td><td>0.10(ppm)</td></tr> <tr> <td>Sodium</td><td>None</td><td>0.1 (ppm)</td></tr> </table>	<u>Parameter</u>	<u>Old Limit</u>	<u>New Limit</u>	Lithium	0.2-2.0(ppm)	1.0-2.0(ppm)	Chlorides	0.15(ppm)	0.10(ppm)	Sodium	None	0.1 (ppm)
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Chlorides	0.15(ppm)	0.10(ppm)												
Sodium	None	0.1 (ppm)												
3.8	33-35	<p>Item: Occupational Dose Assessement.</p> <p>Comment: Final man-rem exposures and final numbers of tubes plugged are recorded in TR-008, Rev. 3.</p>												
4.3.1	39(2nd)	<p>Item: "This dose corresponds to levels prescribed in 10CFR, Part 20..."</p> <p>Comment: This dose corresponds to emergency plan action levels.</p>												
4.3.2	41(item 1)	<p>Item: "...a 50-gpm leak rate criterion...corresponds to the complete separation of one tube."</p> <p>Comment: A 50-gpm leak rate is approximately 10% of the leakage from a complete separation (double ended tube rupture) of one tube. The criterion corresponds to emergency plan action levels.</p>												
5.2	46	<p>Item: License Conditions 4 and 5.</p> <p>Comment: See comments for page 16, section 3.3. and page 16, section 3.4.1.b.</p>												