Met-Ed / GPU

Metropolitan Edison Comp
Post Office Box 480
Middletown, Pennsylvania

Writer's Direct Dial Number

December 9, 1981
L1L [illegible]

Office of Inspection and Enforcement
Attn: R. C. Haynes, Director
Region I
U. S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
[redacted]

Attached please find Licensee Event Report 81-013/01T-0 which is a follow-up report concerning the leaks found in the Steam Generators. This event is reportable ~~per~~ Technical Specification 6.9.2.A(3).

Sincerely,

H. D. Hukill
Director, TMI-1

HDH:CJS:vjf

Attachment

cc: L. Barrett
V. Stello
R. Jacobs
J. Stolz
NRC Office of Management Information & Program Control

TMI-1
Distribution
812 742

ject:
81-12

signed to:
DC/Roo
Date: 8/23/82

	C	A
ill-Trl.115		
ill-Trl.184	X	X
ilson-Parsip.		
TMI-2		
lls 1.239	X	X
.144	X	X
.arsip.	X	X
-Trl.67		
.-Parsip.		
anas-Parsip.		
ief-Training		
Parsip.		
son-Admin.	X	X
rman-Parsip.		
ngane-Parsip.		
ison-Trl.145	X	X
thie-Airport		
as-Srv.Bldg.		
nauss-Parsip.	X	X
aur-Parsip.	X	
van-Trl.68	X	X
rpe-Parsip.		
lo-Srv.Bldg.	X	X
lace-Parsip.	X	X
ah-Parsip.		
nsimmer-Parsip.		
Wilson-Admin.		
C-TMI	X	X
C-Cherry Hill	X	X
sight Com.		
nold-Admin.		
rnoff-JCP&L		
rry-Parsip.		
k-Parsip.		
chump-Parsip.		
-Parsip.		
PENE.		
[illegible]	X	X

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T. DATE: 12-21-81

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 indica [illegible] e of primary-to secondary leakage, a bubble leakage test was applied [illegible] he Once Through Steam Generator tubing with nitrogen pressure applied [illegible] the secondary side.

III. Description of the Occurrence

OTSG Tube leakage was initially suspected when OTSG-B [illegible] mple results showed decreasing pH and increasing activity. These [illegible] toms appeared following Reactor Coolant System pressurization to ab [illegible] 5 psig for functional testing. The functional testing program w [illegible] hen aborted and the Reactor Coolant System depressurized and parti [illegible] ly drained in preparation for bubble leak testing to locate the tub [illegible] r 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, imme [illegible] corrective action was to depressurize the Reactor Coolant System and c [illegible] in the contaminated secondary fluid.

VIII. Long Term Corrective Action

Present investigations are continuing to identify th [illegible] t cause for the tube leaks which presently seem to be concentrated i [illegible] e Upper Tube Sheet region of the steam generator tubing. Preparations [illegible] being made to remove a sample of the affected tubes for metallurgica [illegible] alyses. Eddy

Long Term Corrective Action Cont'd

Current testing has begun on OTSG-B 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 reactor coolant pressure boundary will be reported in a followup report to NRC by February 1, 1982.

GPU Nuclear

File : 1119

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 x 10^{-4} sec./M^3; 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
Tae Y. Byoun

Approved : G.R. Bond
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

168

"CHANGE" Side 1

Three Mile Island Nuclear Station
Procedure Change Request

PCR No. 1 - MD - 83 - 0075

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

1. **Procedure** EPIP 1004.7 (No) Rev 6 (Presen. Revision No) OFFSITE/ONSITE DOSE PROJECTIONS (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 INPO 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 Date 8/8/83

9. Responsible Technical Reviewer Concurrence ~~RF Eberts~~ Date 8/24/83 ~~8/8/83~~

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

(ISR) Joe A Brady 8/26/83
Signature Date

Signature Date

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

Procedure Coordinator Date

11. **Change Entered** Date Rev No

8-82 A0001131 A

"EVALUATION"

Three Mile Island Nuclear Station
Safety/Environmental Impact Evaluation

5. ☐ ☐-☐☐-☐☐-☐☐☐☐
New Procedure

☐ ☐-☐☐-☐☐☐☐
STP

☑ 1-m0-83-00[illegible]
PCR
75

1. Doc. ID EP.P 1004.7 OFFSITE/ONSITE DOSE PROJECTIONS
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 N.R.C. 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) Joe 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 III - PROTECTIVE ACTION GUIDES
ATTACHMENT IV - CONTINGENCY SOURCE TERM CALCULATION

ADD THE FOLLOWING ATTACHMENTS:

ATTACHMENT X - DOSE CONVERSION FACTOR CALCULATION
ATTACHMENT XI - HYDROGEN PURGE CALCULATION
ATTACHMENT XII - THUMBRULES

MODIFY THE FOLLOWING ATTACHMENTS WITH THE MATERIAL PROVIDED:

ATTACHMENT IX - HIGH RANG RMS DOSE CALCS

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

ATTACHMENT VIII

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-servic and on-scale:

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

ATTACHMENT VIII (cont'd)

9\. ~~7.~~ Enter the following command from the keyboard: [redacted]

CLOAD "D" for unit I airborne; CLOAD "L" for unit I liquid; CLOAD"EMERG2" for Unit II Emergency Dose Calculations; CLOAD"CONT2" For Unit II Emergency Contingency Calculations 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\. ~~8.~~ When program loading is completed, the computer will respond with:

```
READY

>_
```

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

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

```
RUN
```

and strike the 'ENTER' key.

12\. ~~10.~~ 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:

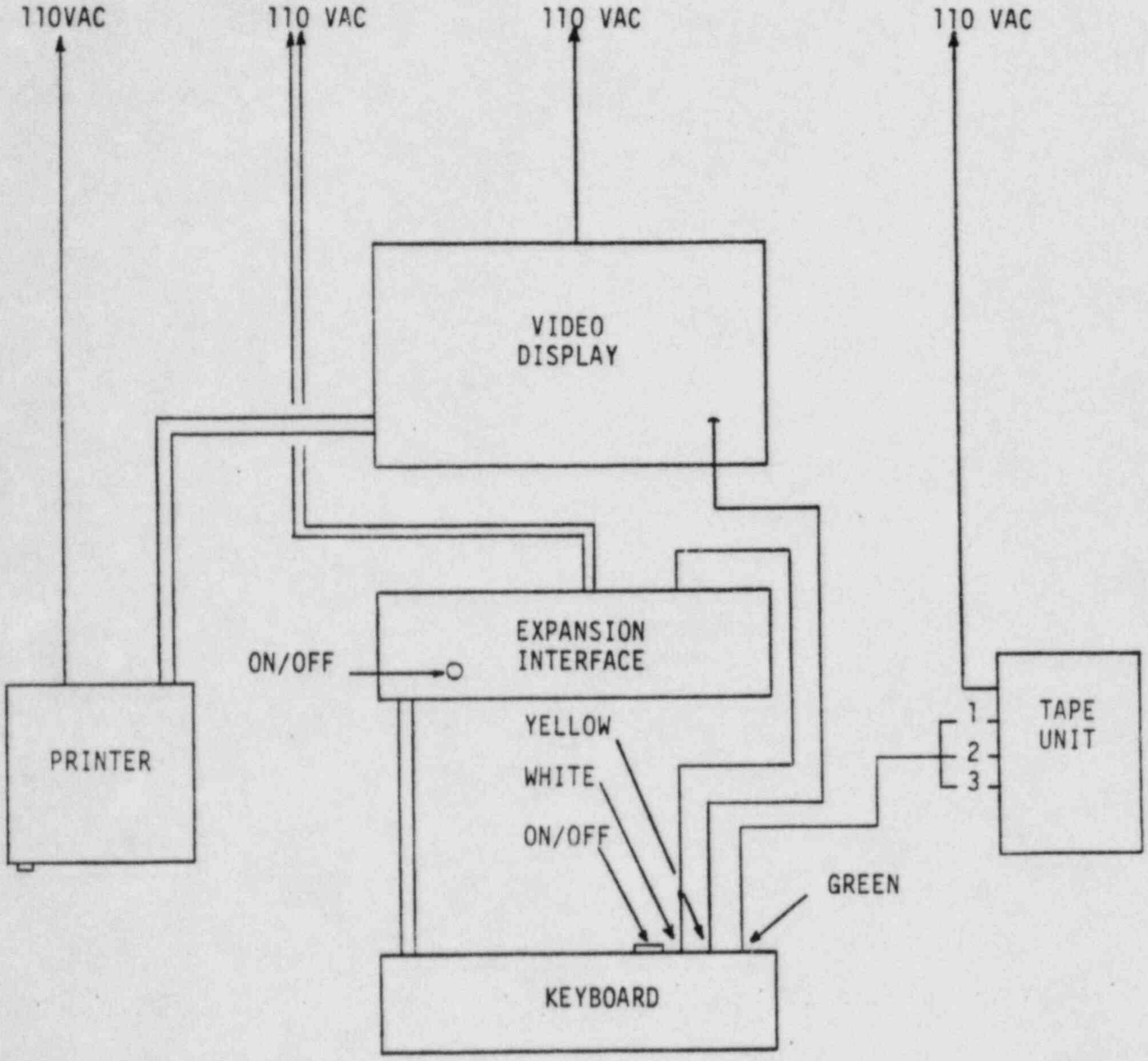
9.2×10^3 = 9.2E3

4.0×10^{-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

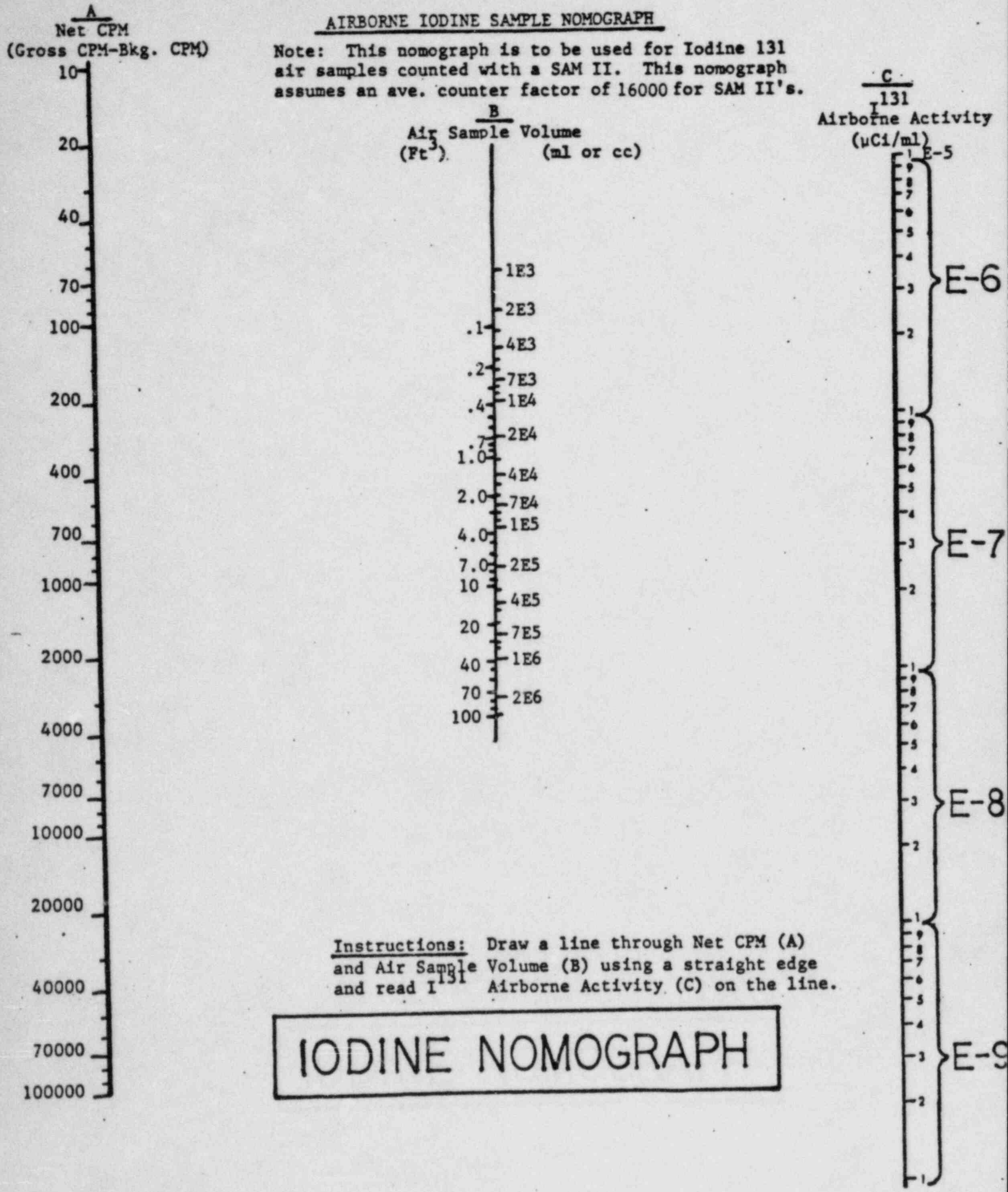


TAPE UNIT

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^{131} Airborne Activity (C) on the line.

IODINE NOMOGRAPH

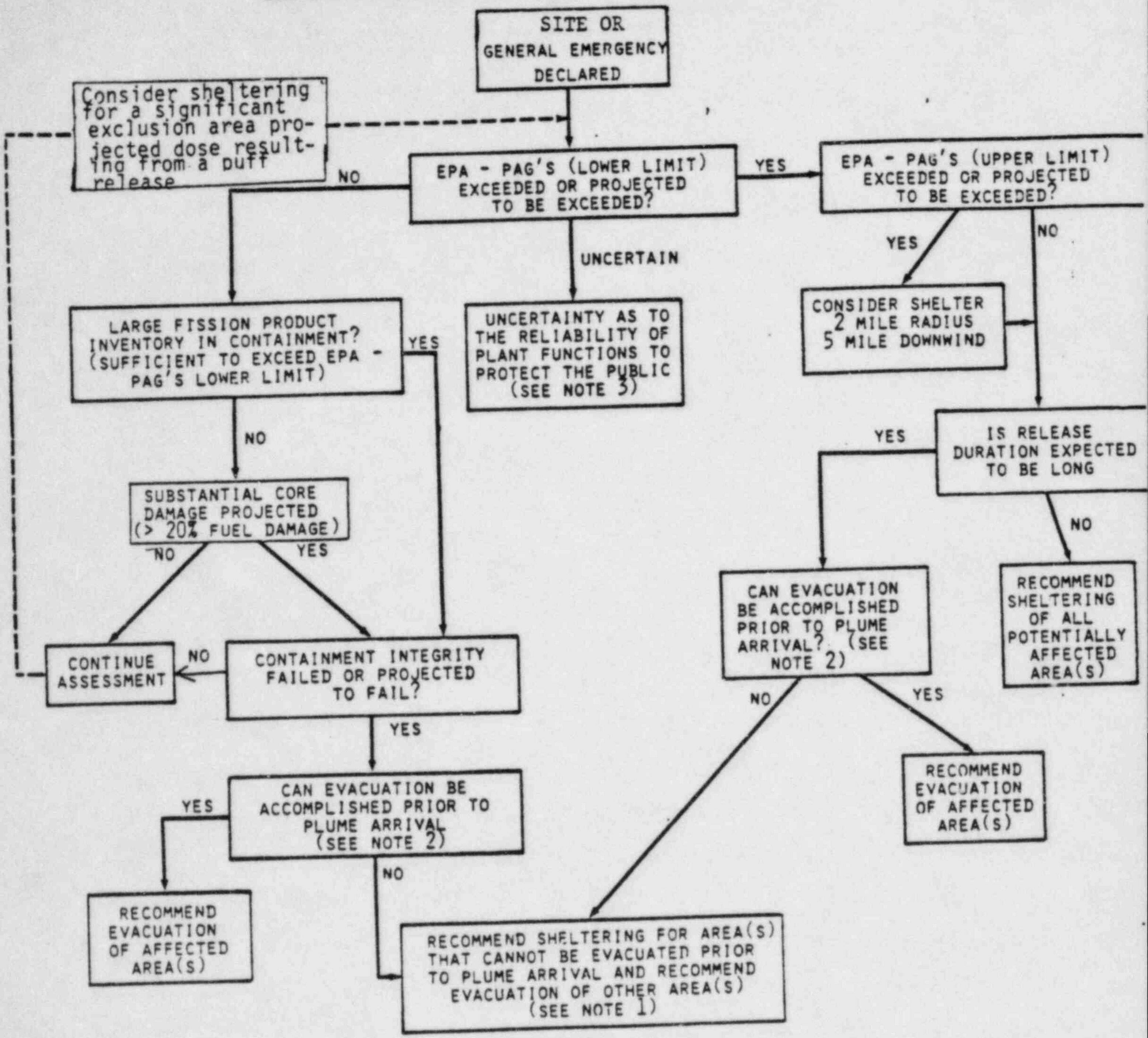
ATTACHMENT VI

Protective Action Guides / PROTECTIVE ACTION RECOMMENDATI

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

ATTACHMENT ~~III.~~ IV 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 radioiodine source terms (S1 and S2 respectively).

3. Enter the following items on the dose assessment worksheet (Attachment ~~VI~~ II

S1 = Noble gas source term (CI/sec)

S2 = Radioiodine source term (CI/sec)

S3 = Whole body DCF (MREM/HR/uci/cc)

S4 = Thyroid DCF (MREM/HR/uci/cc)

4. Attach to the dose assessment worksheet (Attachment ~~III~~ I) 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 CALCULAT USE THE ANSWERS FROM SECTIONS A, B & C. FILL IN THE APPROPRIATE BLANKS AND CALCULATE [illegible] & [illegible]. THEN PROCEED TO SECTION E.

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

CASE I: SECONDARY SIDE RELEASE

A. Reactor Coolant Activity

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

Enter the RML1 High Reading = A1 = ____CPM

Calculate the RCS Activity

in $\frac{uc}{ml} = (\frac{\quad}{A1} \div 22) = \frac{\quad}{D1}$ (Enter Item D1 in Section D)

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

C1 = "RML1 High Channel Reading of $\frac{\quad}{A1}$ CPM indicating $\frac{\quad}{D1}$

NO

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

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

Enter the RML1 Low Reading = A1 = ____CPM

Calculate the RCS Activity

in $\frac{uc}{ml} = (\frac{\quad}{A1} \div 1220) = \frac{\quad}{D1}$ (Enter Item D1 in Section D)

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

C1 = "RML1 Low Channel Reading of $\frac{\quad}{A1}$ CPM indicating $\frac{\quad}{D1}$

NO

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

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

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

C1 = "Most Recent RCS Sample of $\frac{\quad}{D1}$ $\frac{uc}{ml}$"

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

NO

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

RCS Activity

in $\frac{uc}{ml} = \frac{360}{\quad}$ = D1 (Enter Item D1 in Section ~~E~~ D)

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

GO TO SECTION B

CASE I: SECONDARY SIDE RELEASE

B. OTSG Tube Rupture Leakrate

Is the Identified RCS Leakrate in GPM available? (Y/N)

-- YES -- Enter the Identified Leakrate = ____ GPM (Enter Item D2 in Section D)
D2

C2 = "Identified RCS Leakrate of ____ GPM"
D2

(Fill in the blank and ~~circle~~ CHECK the appropriate item in Section E.)

---------- GO TO SECTION C ----------

NO

Is the Unidentified RCS Leakrate in GPM available? (Y/N)

-- YES -- Enter the unidentified Leakrate = ____ GPM (Enter Item D2 in Section D)
D2

C2 = "Unidentified RCS Leakrate of ____ GPM"
D2

(Fill in the blank and ~~circle~~ CHECK the appropriate item in Section ~~C~~ E.)

-- GO TO SECTION C --

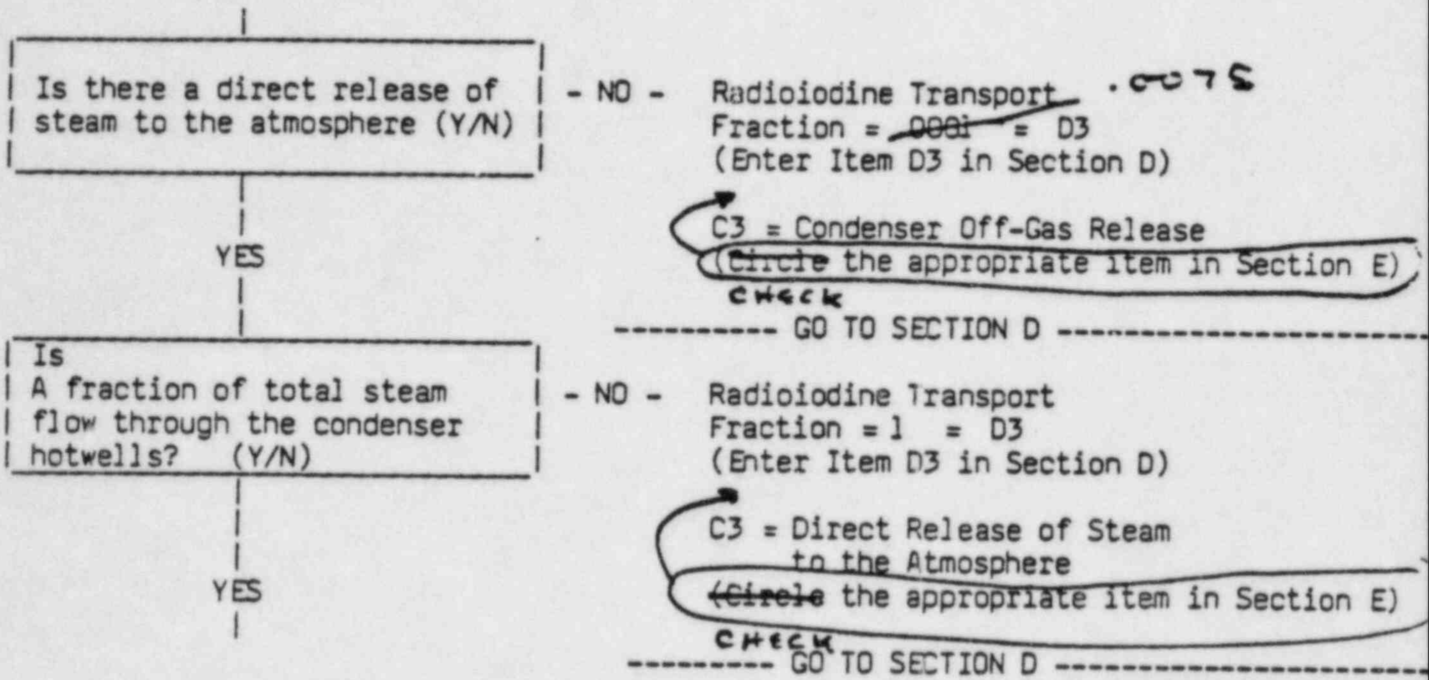
NO

Leakrate = 400 GPM = D2 (Enter item D2 in Section D)
C2 = FSAR Assumption of 400 GPM leakrate
(~~Circle~~ CHECK the appropriate item in Section ~~F~~ E)

-------- GO TO SECTION C ----------

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~~ .0075 = D3
(Enter Item D3 in Section D)

C3 = Condenser Off-Gas Release
(~~Circle~~ CHECK the appropriate item in Section E)

---------- 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~~ CHECK the appropriate item in Section E)

---------- 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

Radioiodine Transport Fraction = ($\frac{\quad}{(A)}$ * ~~.0001~~ .0075) + [(1 — $\frac{\quad}{(A)}$) * 1] = ______ + ______

= ________ = D3 (Enter Item D3 in Section D)

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

-- GO TO SECTION D --

CASE I: <u>SECONDARY SIDE RELEASE</u>

-------------------------------- 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

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

$$= \underset{S1}{\underline{\qquad\qquad}}$$

Radioiodine
Source Term

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

$$= \underset{S2}{\underline{\qquad\qquad}}$$

-- GO TO SECTION E --

$$S3 = 4E5 \; \frac{\frac{MREM}{HR}}{\frac{uci}{cc}}$$

$$S4 = 1.6E9 \; \frac{\frac{MREM}{HR}}{\frac{uci}{cc}}$$

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

WORKSHEET A

E. Dose Assessment Assumptions (~~circle~~ CHECK appropriate entry and fill in the blank)

C1 = ☐ "RML1 High Channel Reading of ______ CPM indicating ______ $\frac{uc}{ml}$"

A1 D1

☐ "RML1 Low Channel Reading of ______ CPM indicating ______ $\frac{uc}{ml}$"

A1 D1

☐ "Most Recent RCS Sample of ______ $\frac{uc}{ml}$"

D1

☐ FSAR Assumption of 1% FF and 360 $\frac{uc}{ml}$

C2 = ☐ "Identified RCS Leakrate of ______ GPM"

D2

☐ "Unidentified RCS Leakrate of ______ GPM"

D2

☐ C2 = FSAR Assumption of 400 GPM Leakrate

C3 = ☐ C3 = Condenser Off-Gas Release

☐ C3 = Direct Release of Steam to the Atmosphere

☐ C3 = Combined Release of Steam to the Condenser OFF-GAS 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 BUILDIN RADIONUCLIDE CONCENTRATIONS, ANSWER THE QUESTION IN THE BOX THEN DO THE NECESSARY CALCULATION, THEN PROCEED TO SECTION D.

SECTION D – TO DO THE CALCULATION OF REACTOR BUILDING LEAKRATE 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 SOURCE TERMS USE THE [illegible] FROM SECTIONS B, C & D THEN CONTINUE TO SECTION F.

SECTION F – FOLLOW DIAGRAM [illegible]

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 (CHECK ~~Circle~~ 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

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

Radioiodine Concentration

ITEM E2

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

-- GO TO SECTION D --

YES

EXTEND THIS LINE

MOVE THIS DOWN

Enter the number of damaged fuel rods = A1 = _____

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

Reactor Building

Noble gas concentration $(\frac{uci}{cc}) = (1.7 \cdot \underline{\quad A1 \quad}) \div 208$

ITEM E1

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

THIS ITEM SHOULD BE BELOW

Reactor Building

Radioiodine Concentration $(\frac{uci}{cc}) = (1.5E-3 \cdot \underline{\quad A1 \quad}) \div 208$

ITEM E2

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

CASE II: REACTOR BUILDING RELEASE

B. Reactor Coolant Activity

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

Enter the RML1 high reading = A1 = ____CPM

A2

Calculate the RCS Activity

in $\frac{uc}{ml}$ = ($\frac{\quad}{A1}$ ÷ 22) = ________ = A2 (Enter item as in Section

C1 = "RML1 High Channel Reading of $\frac{\qquad}{A1}$ CPM"

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

-- GO TO SECTION C --

NO

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

Enter the RML1 low reading = A1 = ____CPM

Calculate the RCS Activity

in $\frac{uc}{ml}$ = ($\frac{\quad}{A1}$ 1220) = ________ = A2 (Enter item A2 in Secti

C1 = "RML1 Low Channel Reading of $\frac{\qquad}{A1}$ CPM"

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

-- GO TO SECTION C --

NO

CASE II: REACTOR BUILDING RELEASE

B. Reactor Coolant Activity

Based upon in-core instrumentation does the ED suspect fuel melting? -- YES -- Reactor Building noble gas concentration

$(\frac{uc}{cc}) = 5.\overset{7}{\cancel{6}}E3\ (\frac{uci}{cc})$ = E1 (Enter item E1 in Section E)

Reactor Building radioiodine concentration

$(\frac{uc}{cc}) = \overset{5E2}{\cancel{5.3E1}}\ (\frac{uci}{cc})$ = E2 (Enter item E2 in Section E)

C1 = Fuel melting as indicated by in-core instrumentation

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

CHECK

-- GO TO SECTION D --

NO

Based upon in-core instrumentation does the ED suspect fuel cladding damage? -- YES ------------ Reactor Building noble gas concentration

$(\frac{uci}{cc}) = 160\ (\frac{uci}{cc})$ = E1

Reactor Building radioiodine concentration

$(\frac{uci}{cc}) = 13\ (\frac{uci}{cc})$ = E2

C1 = Fuel cladding damage as indicated by in-core instrumentation

(~~CIRCLE~~ APPROPRIATE ITEM IN SECTION F)

CHECK

-- GO TO SECTION D --

NO

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

Enter RCS Activity in $\frac{uc}{ml}$ = ______ = A2 (Enter item A2 in Section C)

C1 = "Most Recent RCS Sample"

(Circle appropriate item in Section F)

-- GO TO SECTION C --

NO ---------------------------------- Reactor Building noble gas concentration

$(\frac{uc}{ml})$ = 160 = E1 (Enter item E1 in Section E)

Radioiodine concentration

$(\frac{uc}{ml})$ = 13 = E2 (Enter item E2 in Section E)

C1 = "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

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

C1 - FSAR assumed fuel cladding damage

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

Reactor Building noble gas concentration

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

Radioiodine concentration

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

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

YES

Enter the total number of gallons = _______ = A3 (Enter item A3 bel

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 $(\frac{uci}{cc})$ =

$(\frac{}{A2} \cdot \frac{}{A3} \cdot 2950) \div 5.6E10$ = _______ = E1 (Enter item E1 in Section E)

Reactor Building Radioiodine Concentration $(\frac{uci}{cc})$ =

$(\frac{}{A2} \cdot \frac{}{A3} \cdot 56) \div 5.6E10$ = _______ = E2 (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 --

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

YES

Enter the actual pressure = _____ = A4

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

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

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

$= (\overset{656}{\cancel{588}} * (\overline{\frac{A4}{50.6}})^{\frac{1}{2}}) (\frac{A4+14.7}{14.7}) =$ _______ ($\frac{cc}{sec}$) = E3 (Enter item E3 in Section E)

-- GO TO SECTION E --

WORKSHEET A

CASE II: REACTOR BUILDING RELEASE

E. Calculation of Reactor Building Source Terms

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

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

$= (\underset{E1}{\underline{\hspace{3em}}} \cdot \underset{E3}{\underline{\hspace{3em}}}) \div 1E6 = \underset{S1}{\underline{\hspace{5em}}}$

S3 = 4E5 $\frac{\frac{MREM}{HR}}{\frac{ucI}{cc}}$

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

$= (\underset{E2}{\underline{\hspace{3em}}} \cdot \underset{E3}{\underline{\hspace{3em}}}) \div 1E6 = \underset{S2}{\underline{\hspace{5em}}}$

S4 = 1.6E9 $\frac{\frac{MREM}{HR}}{\frac{ucI}{cc}}$

CHECK THE BOX

F. Dose Assessment Assumptions (~~Circle~~ 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 $\underset{A1}{\underline{\hspace{3em}}}$

☐ C1 = RML1 high channel reading of $\underset{A1}{\underline{\hspace{3em}}}$ CPM

☐ C1 = RML1 low channel reading of $\underset{A1}{\underline{\hspace{3em}}}$ 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 $\underset{A4}{\underline{\hspace{3em}}}$ psig

CASE III. AUXILARY 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

```
                 |
 ______________________________
| Has a grab sample been       |
| obtained of the affected     | -- YES --  GO TO SECTION B
| area and analyzed on a geli  |
|_spectrophotometer?  (Y/N)____|
                 |
                 |
                NO
                 |
                 |
 ______________________________
| Does the accident involve    |
| fuel assembly damage in the  | -- YES --  GO TO SECTION C
|_spent fuel pool?  (Y/N)______|
                 |
                 |
                NO
                 |
                 |
                 |
 ______________________________
| Does the accident involve    |
| fuel cask drop during trans- | -- YES --  GO TO SECTION D
|_fer operation?  (Y/N)________|
                 |
                 |
                NO
                 |
                 |
                 |
 ______________________________
|                              |
| Does the accident involve    | -- YES --  GO TO SECTION E
|_a waste gas release?  (Y/N)__|
                 |
                 |
                NO -------- GO TO SECTION F --
```

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

Noble gas source term = $\underset{B1}{\underline{\hspace{3cm}}} \times \underset{B2}{\underline{\hspace{3cm}}} \times 4.7E\text{-}4 = \underset{S1}{\underline{\hspace{3cm}}} \frac{CI}{sec}$

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

Radioiodine source term = $\underset{B3}{\underline{\hspace{3cm}}} \times \underset{B2}{\underline{\hspace{3cm}}} \times 4.7E\text{-}4 = \underset{S2}{\underline{\hspace{3cm}}} (\frac{CI}{sec})$

Enter B2, S1 and S2 in Section F

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

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

(~~Circle~~ CHECK the appropriate item in Section F AND FILL IN THE BLANK

-- 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 $\left(\frac{CI}{sec}\right) = \frac{4.2}{S1}$ (Enter S1 and S2 in Section F)

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

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

(~~Circle~~ CHECK 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 $\left(\frac{CI}{sec}\right) = \frac{1.2E-3}{S1}$

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

C1 = FSAR postulated fuel cask drop during transfer operation

(~~Circle~~ CHECK 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 $(\frac{CI}{sec})$ = 26 (Enter S1 and S2 in Section F)
S1

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

C1 = FSAR postulated waste gas decay tank rupture

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

-- GO TO SECTION F --

CASE III: AUXILIARY AND FUEL HANDLING BUILDING RELEASE

F. Dose assessment assumptions

CHECK THE BOX

(~~Circ~~le and fill in applicable items)

☐ C1 = Grab sample analyzed on a geli 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 1.

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 (~~DP~~DCF) 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 <u>Worksheet B</u>.

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 Contributi 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. 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	~~0.9~~	X .18	= ~~0.162~~
b.) KR 85		X .0022	= ~~2.4~~
c.) KR 87	~~3.1~~	X .79	= ~~2.45~~
d.) KR 88	~~1.6~~	X 2.2	= ~~3.52~~
e.) XE 133M	~~0.3~~	X .02	= ~~.006~~
f.) XE 133	~~24~~	X .03	= ~~0.72~~
g.) XE 135M		X .53	=
h.) XE 135	~~3.8~~	X .26	= ~~0.99~~
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. = ~~[illegible]~~ A1 Total Photon Cont. = ~~7.05~~ A2

Equation A-1 WBDCF Calculation:

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

____
Sample Date/Time

= (____ A2 ÷ ____ A1) . 9E5 = ~~2.1 x 10^5~~ S3

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 IN μCi/cc 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 Nuclides	COL 2 Concentration	COL 3 Isotope DCF	COL 4 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 $\frac{\frac{MREM}{HR}}{\frac{uci}{cc}}$

$$= \left(\underset{A2}{\underline{\qquad}} \div \underset{A1}{\underline{\qquad}} \right) . = \underset{S4}{\underline{\qquad}}$$

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 IN uCi/cc 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 Nuclides	COL. 2 Original Concentrations	COL. 3 Remaining Fraction	COL. 4 Present Concentrations	COL. 5 Photon Energy	COL. 6 Photon Contributions
a. KR 85M	~~0.9~~	0.86		.18	
b. KR 85		1.00		.0022	
c. KR 87		0.58		.79	
d. KR 88		0.78		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 $\frac{\frac{MREM}{HR}}{\frac{uci}{cc}}$

____
Date/Time
of decay corrected DCF

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

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 in uci/cc 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.

WORKSHEET B

THYROID DCF DECAY CORRECTION

Original Concentration ____________
Date/Time

COL. 1 Nuclides	COL. 2 Original Concentrations	COL. 3 Remaining Fraction	COL. 4 Present Concentrations	COL. 5 Isotope TDCF	COL. 6 Isotope Contributions
a. I 131		0.996		1.6E9	
b. I 132		0.74		7.9E7	
c. I 133		0.97		5.4E8	
d. I 134		0.45		4E7	
e. I 135		0.90		1.6E8	

Total Concentration = ____________ A1

Total Isotope Contribution = ____________ A2

<u>Equation D-1</u> TDCF Calculation:

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

$= \left(\frac{\_\_\_\_}{A2} \div \frac{\_\_\_\_}{A1} \right)$ ~~[illegible]~~ $= \frac{\_\_\_\_}{S4}$

____
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 substracting 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 1
	TIME FROM REACTOR SHUT DOWN IN HOURS								
	0	1	2	4	6	8	10	12	24
OTSG Tube Rupture									
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
Rod Ejection									
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

S
WBDCF = ~~S~~3 = ________
TDCF = ~~S~~4 = ________
S

ATTACHMENT 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.

$\underset{(A1)}{\underline{\qquad\qquad}}$ Noble gas airborne concentration $(\frac{uCi}{cc})$

$\underset{(A2)}{\underline{\qquad\qquad}}$ Radioiodine airborne concentration $(\frac{uCi}{cc})$

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.

$\underset{A3}{\underline{\qquad\qquad}}$ Exclusion area (EA) dispersion factor $(\frac{sec}{meter^3})$

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.

$\underset{(A4)}{\underline{\qquad\qquad}}$ Whole body DCF $\frac{\frac{MREM}{HR}}{\frac{uCi}{cc}}$

$\underset{(A5)}{\underline{\qquad\qquad}}$ Thyroid DCF $\frac{\frac{MREM}{HR}}{\frac{uCi}{cc}}$

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

$$2.2 \times 10^6 \div (\underset{(A1)}{\underline{\qquad}} \times \underset{(A3)}{\underline{\qquad}} \times \underset{(A4)}{\underline{\qquad}}) = \underset{(A6)}{\underline{\qquad}} CFM$$

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

$$1.1 \times 10^7 \div (\underset{(A2)}{\underline{\qquad}} \times \underset{(A3)}{\underline{\qquad}} \times \underset{(A5)}{\underline{\qquad}}) = \underset{(A7)}{\underline{\qquad}} CFM$$

7. Compare calculated (RB) venitllation 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.

ATTACHMENT XII
~~ANNEX I~~ - THUMBRULES ~~BASED UPON GAS SAMPLING~~

---------------------- 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 <u>actual</u> to <u>assumed</u> conditions for the listed parameters. As an example;

   RM-A5 is reading 1E5 CPM (Enter in Col. B)
   Condenser off-gas flowrate is 1[illegible] SCFM (Enter in Col. C)
   The dispersion factor at the exclusion area is 1E-5 $\frac{sec}{M3}$ (Enter in Col. [illegible])

   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	$\frac{1E5}{1E6} = .1$	$\frac{10}{20} = .5$	$\frac{1E-5}{1E-4} = .1$	.1x.5x.1 = .005	.01 $\frac{MR}{HR}$	.01 x .005 = 5E-5 $\frac{MR}{HR}$

   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 <u>Worksheet D</u>. 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 Committment

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 ($\frac{sec}{M3}$)	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

* $\frac{MR}{HR}$

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

*** 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.

FOR USE IN UNIT I ONLY

ATTACHMENT IX

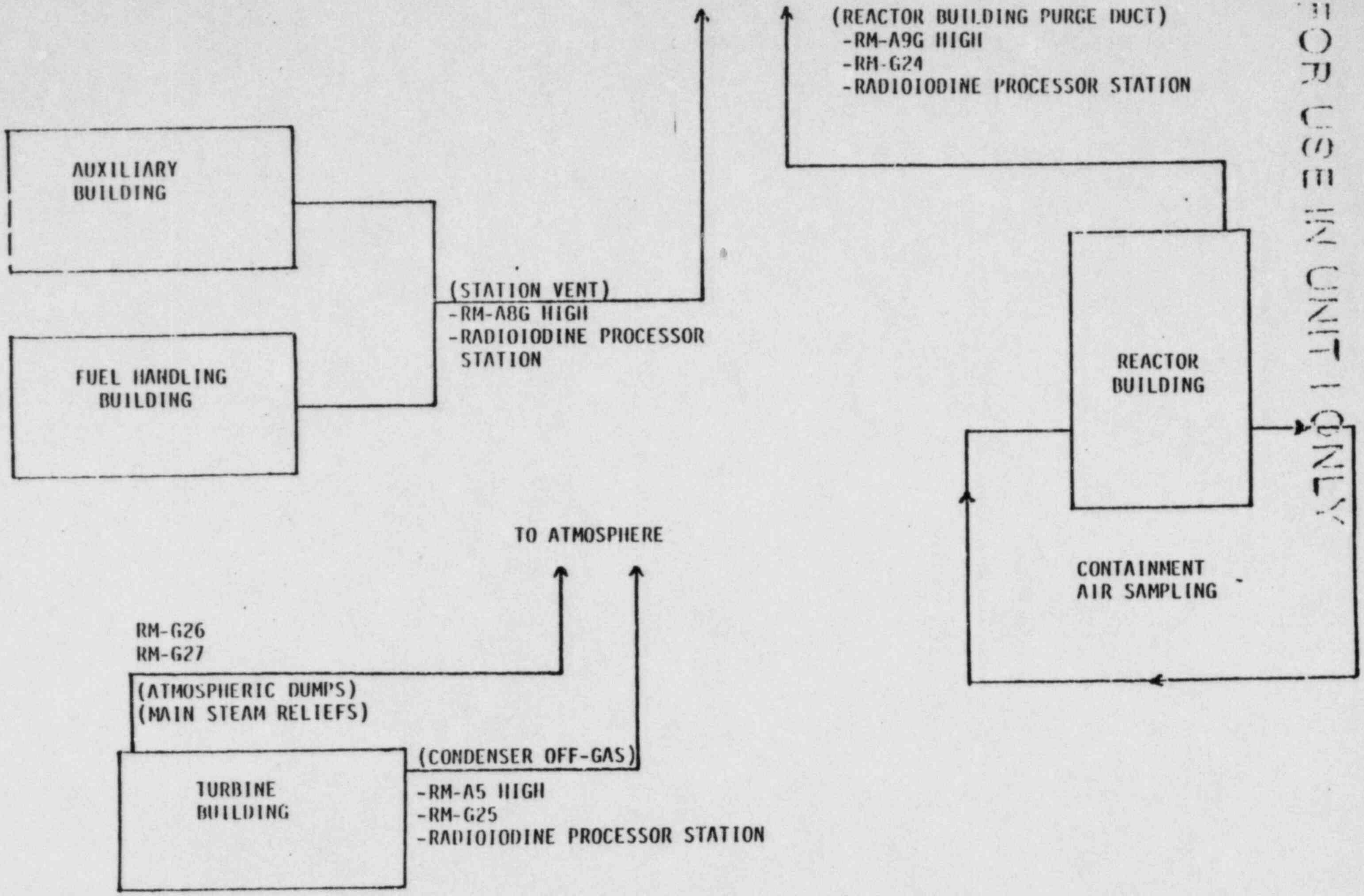
HIGH RANGE RMS DOSE CALCULATIONS

SUBSYSTEM 3: HIGH RANGE NOBLE GAS CHANNELS

MONITOR DESIGNATION	EFFLUENT PATHWAY	DETECTOR TYPE	RANGE µCi/cc	CONVERSION FACTOR CPM/µci/cc	FLOWRATE CFM RECORDE
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	* 9.5	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/µci/cc

HIGH RANG. MS


(REACTOR BUILDING PURGE DUCT)
-RM-A9G HIGH
-RM-G24
-RADIOIODINE PROCESSOR STATION
AUXILIARY BUILDING
(STATION VENT)
-RM-A8G HIGH
-RADIOIODINE PROCESSOR STATION
FUEL HANDLING BUILDING
REACTOR BUILDING
CONTAINMENT AIR SAMPLING
TO ATMOSPHERE
RM-G26
RM-G27
(ATMOSPHERIC DUMPS)
(MAIN STEAM RELIEFS)
TURBINE BUILDING
(CONDENSER OFF-GAS)
-RM-A5 HIGH
-RM-G25
-RADIOIODINE PROCESSOR STATION

FOR USE IN UNIT I ONLY

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"

Valve Tag No.	Steam Flow #/hr.	Press. PSIG
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

% Valve opening demand	Steam flow #/hr.
20	1.77×10^5
40	3.6×10^5
60	5.09×10^5
80	5.61×10^5
100	5.767×10^5

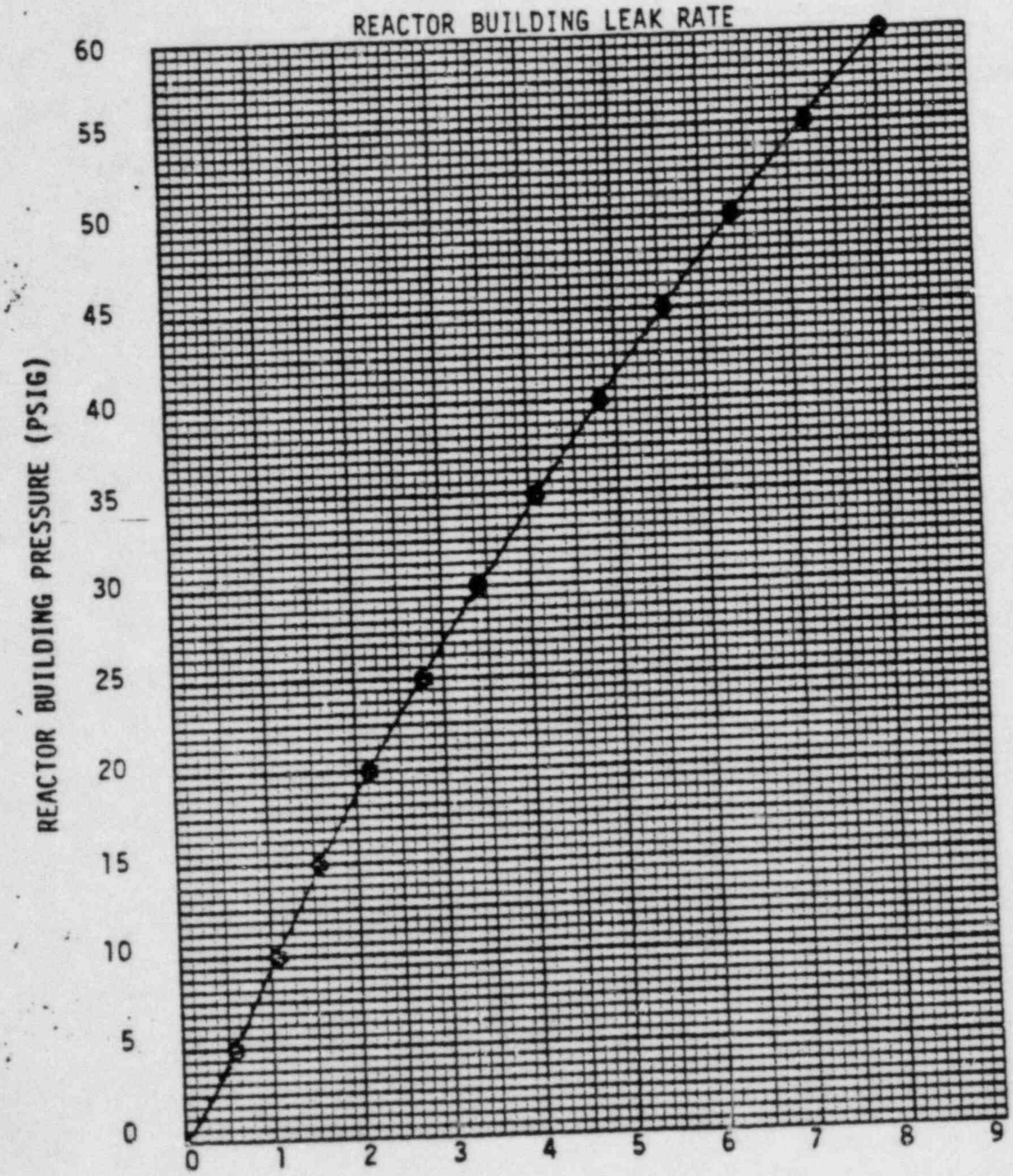
(4) Condenser Vacuum Pump Discharge Path

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:

$$\frac{\text{Total Steam Flowrate}}{\text{Steam Flow Past}} \quad \text{RMG-26 or RMG-27}$$

TABLE 2


REACTOR BUILDING LEAK RATE
REACTOR BUILDING PRESSURE (PSIG)
60
55
50
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
9
REACTOR BUILDING LEAK RATE
(CFM)

FOR USE IN UNIT I ONLY

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 (µci/cc) as determined per EPIP 1004.31:

Noble Gas Nuclides

KR85 __________ µci/cc
KR85m __________ µci/cc
KR87 __________ µci/cc
KR88 __________ µci/cc
XE133 __________ µci/cc
XE133m __________ µci/cc
XE135 __________ µci/cc
XE135m __________ µci/cc
Total Noble Gas __________ µci/cc
(A_1)

Radioiodine Nuclides

I131 __________ µci/cc
I132 __________ µci/cc
I133 __________ µci/cc
I134 __________ µci/cc
I135 __________ µci/cc
Total Radioiodine __________ µci/cc
(A_2)

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:

Total Noble Gas Concentration $\underset{(A1)}{\underline{\quad\quad}}$ $\frac{\mu ci}{cc}$ x Release Flow Rate $\underset{(B)}{\underline{\quad\quad}}$ CFM x Flowrate Conversion Factor $\underline{472}$ $\frac{cc/sec}{CFM}$

Curie Conversion
x Factor $\underline{1E-6}$ $\frac{Ci}{\mu ci}$ = Noble Gas Source Term ______ $\frac{Ci}{Sec}$

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

Total Radioiodine Concentration ____ (A2) $\frac{\mu ci}{cc}$ x Release Flow Rate ____ (B) CFM x Flowrate Conversion Factor 472 $\frac{\frac{cc}{Sec}}{CFM}$

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

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: ____ (A) CPM

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

____ (B) $\frac{CPM \text{ or } \frac{MR}{HR}}{\frac{\mu ci}{cc}}$

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

____ (B1) $\frac{\frac{\mu ci}{cc} \text{ Pos. Mix}}{\frac{\mu ci}{cc} \text{ Cal. Isotope}}$

Enter the nuclide class fraction as identified in Table 4:

____ (B2) $\frac{\frac{\mu ci}{cc} \text{ Noble Gas}}{\frac{\mu ci}{cc} \text{ Pos. Mix}}$

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

____ (C) CFM

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

Noble Gas Channel Reading ____ (A) (CPM) ÷ Meter Conversion Factor ____ (B) $\frac{CPM \text{ or } \frac{MR}{HR}}{\frac{\mu ci}{cc} \text{ Cal. Isotope}}$ x ____ (B1) $\frac{\frac{\mu ci}{cc} \text{ Pos. Mix}}{\frac{\mu ci}{cc} \text{ Cal. Isotope}}$

x ____ (B2) $\frac{\frac{\mu ci}{cc} \text{ Noble Gas}}{\frac{\mu ci}{cc} \text{ Pos. Mix}}$ x Release Flow Rate ____ (C) CFM x Release Flowrate Conversion 472 $\frac{\frac{cc}{sec}}{CFM}$

x Curie Conversion 1E-6 $\frac{CI}{\mu c}$ = Noble Gas Source Term ____ (D) $\frac{CI}{sec}$

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: ______ (D) $\frac{\text{CI}}{\text{SEC}}$

3.5.2 ENTER THE FRACTION OF RADIOIODINE AS DETERMINED FROM TABLE 4: ______ (E) RADIOIODINE FRACTION

3.5.3 ENTER THE FRACTION OF NOBLE GAS AS DETERMINED FROM TABLE 4: ______ (F) NOBLE GAS FRACTION

3.5.3 DETERMINE THE RADIOIODINE SOURCE TERM UTILIZING THE EQUATION BELOW:

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

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

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

TABLE 3

POSTULATED MIXTURE CONVERSION FACTOR
($\frac{\mu Ci}{cc}$ CALIBRATION ISOTOPE TO $\frac{\mu Ci}{cc}$ POS. MIXTURE)

MONITOR DESIGNATION	EFFLUENT PATHWAY	CALIBRATION ISOTOPE	CONVERSION FACTOR
RM-A8G HIGH	AUX AND FHB	XE133	0.7
RM-A9G HIGH	RB PURGE	XE133	0.7
RM-G24	RB PURGE	KR85	0.01
RM-A5 HIGH	CONDENSER OFF-GAS	XE133	0.6
RM-G25	CONDENSER OFF-GAS	XE133	0.6
RM-G26	A, B MAIN	KR85	0.007
–	STEAM LINES		* 0.005
RM-G27	C, D MAIN	KR85	0.007
	STEAM LINES		* 0.005

* IODINE SPIKE ASSUMPTION BASED UPON PLANT TRANSIENT

TABLE 4

NUCLIDE CLASS FRACTION OF POSTULATED MIXTURE
($\frac{\mu Ci}{cc}$ POS. MIXTURE TO $\frac{\mu Ci}{cc}$ 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

FOR USE IN UNIT 1 ONLY

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

1.0 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 ~~HYDROGEN PURGE CALCULATION~~
2.8	Attachment VIII	~~Computerized Dose Calculations~~ 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	THUMBRULES

FOR USE IN UNIT I ONLY

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 projections. 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 X IF A DCF IS TO BE CALCULATED.

____ 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 PURGE CALCULATION.
USE ATTACHMENT XII FOR A THUMBRULE CALCULATION

9/27/85

~~John~~ Harley

I talked to Jack Wetmore. He told me GPU is considering conducting another cooldown to get higher tube-to-shell ΔTs. 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

GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057
717 944-7621
TELEX 84-2386
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. Hukill
Vice President - TMI-1

cc: H. Silver

PDR
8310070076

171

Attachment 1

GPUN Actions on Confirmatory Items

Section	Page, Paragragh		Item/Response
4.3.1	39(2nd)	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."
		Response:	TDR 406, Rev. 2 is enclosed. Supporting references and procedures have been made available to members of your staff.
4.3.2	42(item 5)	Item:	Reactor Coolant Pump NPSH for Emergency Operations, "The licensee should insure that the copy for Control Room use is clear and legible".
		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.
4.3.2	43(item 7)	Item:	S/G Isolation/Steaming Criteria, "...the licensee will make a change for SG isolation from a dose to dose rate criteria."
		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.
4.3.2	43-44(item 8)	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".
		Response:	Although the subject of this quote is feeding an isolated OTSG for pressure control, the SER mistakenly refers to "steaming" an isolated SG in the sentence before the quote.

Attachment 2

GPUN Comments on NRC SER (NUREG-1019)

Section	Page, Paragraph	Item/Comment
2	2(bottom) -3 (top)	Item: 22" expansion.
		Comment: This paragraph gives the impression that a 22" expansion was performec 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.
3.1	8 (top)	Item: "The thiosulfate tanks have also been physically removed."
		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.
3.2	9 (2nd)	Item: "The extent of corrosion was quantified and all corrosion affected sections in the waste gas system have been replaced."
		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.
3.2	13 (top)	Item: "...the PORV and safety relief valves, which exhibited pitting corrosion, were replaced".
		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. In addition the safety valves were replaced due to new ring settings not due to corrosion.
		Item: "The waste gas system was found to be affected, and all corroded portions of this system were replaced."
		Comment: See comment for p. 9, section 3.2.

Section	Page, Paragraph	Item/Response
		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.

Section	Page, Paragraph	Item/Comment	
3.3	15(table)	Item:	Table 3.3-1.
		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.
3.3	16 (top)	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".
		Comment:	As discussed in TR-008, GPUN has established .1 gpm as an administrative limit on leakage above baseline. This leakage rate is detectable.
3.4.1.b	16(bottom)	Item:	Planned testing.
		Comment:	The second phase of testng 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.
3.4.1.c	17 (top)	Item:	"This objective assures that compressive loads during operation and vibrational characteristics of the tube will remain unchanged."
		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.

Section	Page, Paragraph	Item/Comment	
3.4.2.d	20(3rd)	Item:	"...the 1025 pounds necessary to cause tube bowing."
		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.
3.4.2.d	21(4th)	Item:	"...1.0 ksi $in^{1/2}$."
		Comment:	Calculations were done at 4.0 ksi $in^{1/2}$.
3.4.2.d	21(bottom)	Item:	Stable cracks.
		Comment:	This paragraph may need revision based on TR-008,. Rev. 3.
3.4.2	23(bottom)	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."
		Comment:	See comments for p. 16, section 3.4.1.b.
3.5	28-29	Item:	Cleanup of Contaminant
		Comment:	Some parameters throughout in this section may need to be updated to reflect actual chemical cleaning as discussed in TR-008, Rev. 3. Boron (boric acid) 1800-2300 ppm pH (ambient temperature) 8.0-8.5 H_2O_2 concentration 15-25 ppm Temperature 130°F ± 5°F Cover Gas N_2 (pzr) Lithium ion concentration 1.8-2.2 Duration of Treatment 400 hrs. Testing using samples prior to beginning cleaning monitored performance through 500 hrs.
3.6	30(item 2)	Item:	"All RCS piping..were flushed..."
		Comment:	All RCS piping with a diameter greater than 1" was flushed.

Section	Page, Paragraph		Item/Comment
3.6	30(item 4)	Item:	"The coolant will be...monitored continuously for pH and conductivity."
		Comment:	Per TR-008, as recorded in your Table 3.6-1, these parameters will be monitored five times per week.
3.6	31(table)	Item:	Table 3.6-1.
		Comment:	There are several differences in Table 3.6-1 from our plans as outlined in TR-008.

Parameter	Old Limit	New Limit
Lithium	0.2-2.0(ppm)	1.0-2.0(ppm)
Chlorides	0.15(ppm)	0.10(ppm)
Sodium	None	0.1 (ppm)

Section	Page, Paragraph		Item/Comment
3.8	33-35	Item:	Occupational Dose Assessement.
		Comment:	Final man-rem exposures and final numbers of tubes plugged are recorded in TR-008, Rev. 3.
4.3.1	39(2nd)	Item:	"This dose corresponds to levels prescribed in 10CFR, Part 20..."
		Comment:	This dose corresponds to emergency plan action levels.
4.3.2	41(item 1)	Item:	"...a 50-gpm leak rate criterion...corresponds to the complete separation of one tube."
		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.
5.2	46	Item:	License Conditions 4 and 5.
		Comment:	See comments for page 16, section 3.3. and page 16, section 3.4.1.b.