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PALISADES NUCLEAR PLANT
EMERGENCY IMPLEMENTATION PROCEDURE
Revision and Approval Summary

TITLE: ESTIMATE OF OFFSITE DOSE

1. Prepared

C. J. Dorr — Originator
1-4-83 — Date

2. QA Concurrence

Not required N/A — Date

3. Recommend Approval/Q-List (Yes) No

[signature] — Department Head
1/5/83 — Date

4. PRC Reviewed

R M Krich — PRC 83-04
3/15/83 — Date

5. Approved

[signature] — Plant Manager
3/16/83 — Date

6. Biennial Review

_____ — Date

7. ATMS Incorporated 3/28/83
Date

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TITLE: ESTIMATE OF OFFSITE DOSE

1.0 PURPOSE

To provide a simplified method for estimating wholebody and child thyroid dose rates due to abnormal releases of radioactive materials to the environment. To provide a method to compare the integrated wholebody and child thyroid doses to the EPA Protective Action Guides (PAG's).

2.0 INITIAL CONDITIONS AND/OR REQUIREMENTS

2.1 This procedure is to be used for rapid estimate of offsite doses. Actual environmental monitoring should be done as soon as possible to verify the dose estimate (see Section 3.0 of Attachment 1 of this procedure).

2.2 The duration of the release is assumed to be a two-hour period for this procedure.

2.3 Personnel Responsible:

a. The Chemistry/Health Physics Superintendent or the Plant Health Physicist is responsible for the implementation of this procedure.

b. Members of the Radiation Protection Group will complete parts of this procedure as directed by the Chemistry/Health Physics Superintendent or the Plant Health Physicist.

c. If necessary, it will be the responsibility of the Shift Supervisor in concurrence with the Shift Technical Advisor to notify the Radiation Protection Group to implement this procedure.

3.0 PROCEDURE

3.1 Determine release rate (Ci/sec) using Attachment 1.

NOTE: If a steam generator tube rupture accident occurs, check the high range steam dump monitor in the NE corner of the Technical Support Center near the drinking fountain for a release. If the high range steam dump monitor indicates a release, determine the release rate using Attachment 1, Section 2.3. If the high range steam dump monitor indicates no release, use Attachment 2 to estimate the release rate.

3.2 If desired, a conservative approximation of wholebody and child thyroid dose may now be determined using Attachment 3.

3.3 Determine atmospheric stability class using Attachment 4.

3.3.1 After determining stability class, select appropriate dose contour overlay (isopleth) and place it over appropriate area map.

NOTE: Upper left hand corner of isopleth and map had a date of April 1, 1981 and a set number starting with PAL81 followed by a letter designating

3.6 Data needed for the offsite dose calculation should be reviewed at least every 1/2-hour until the Site Emergency Director requests longer intervals or determines they are no longer needed. The calculation should be updated if the stability class changes, the affected map sectors change, the release rate increases, or the wind speed decreases.

4.0 ATTACHMENTS AND RECORDS

4.1 Attachment 1, "Determination of Release Rates"

4.2 Attachment 2, "Estimated Release Rates Due to Steam Generator Tube Rupture"

4.3 Attachment 3, "Approximation of Offsite Dose"

4.4 Attachment 4, "Determination of Atmospheric Stability Class"

4.5 Attachment 5, "Offsite Dose Data Sheet"

4.6 Attachment 6, "Protective Action Guides"

4.7 Attachment 7, Figure 1, "Stack Monitor Response (0 to 24 Hours)"

4.8 Attachment 8, Figure 2, "Stack Monitor Response (0 to 30 Days)"

4.9 Attachment 9, Figure 3, "Steam Dumps Monitor Response (0 to 24 Hours)"

4.10 Attachment 10, Figure 4, "Steam Dumps Monitor Response (0 to 30 Days)"

4.11 Attachment 11, Figure 5, "Stack Monitor Total Noble Gas"

DETERMINATION OF RELEASE RATES

NOTE: If offsite radiological results are known, complete Step 3.0 of this attachment to calculate release rates.

1.0 Use of Stack Gas Monitor Readings

NOTE: **RIA-2318 is the preferred monitor for determining release rate, use **RIA-2319 only if **RIA-2318 is not available.

1.1 Obtain stack gas flow rate (ft^3/min) from chart recorder **FRC-2318 for the latest two-hour period. Multiply by 0.028 to convert to m^3/min.

1.2 Obtain pre-release readings in cpm from the stack gas monitors **RIA-2318 and **RIA-2319 as indicated on chart recorder **RR-2300.

1.3 Obtain readings in cpm for **RIA-2318 and **RIA-2319 during the release.

1.4 If both stack gas monitors **RIA-2318 and **RIA-2319 have gone offscale, go to Section 2.0 for this attachment.

1.5 Obtain a net reading by subtracting pre-release (Step 1.2 above) from the reading during the release (Step 1.3 above). Record appropriate information in Section B of Attachment 5.

1.6 Obtain noble gas release rate as follows:

for **RIA-2318

$$QN\ (Ci/sec) = (Net\ cpm)\left(\frac{\mu Ci/cc}{cpm}\right)*(m^3/min\ flow)(1/60)$$

NOTE: Obtain $\frac{\mu Ci/cc}{cpm}$ from Figure 5 for the applicable monitor. Use the six (6) hour time for release other than fuel melt for holdup times less than 15 days. Use the appropriate decay time on Figure 5 for holdup times greater than 15 days.

1.7 Estimate Iodine release rate from Step 1.6 (above) as follows:

$$QI\ (Ci/sec) = (QN)(1.0E\text{-}03)$$

1.8 Record release rates on Section B of Attachment 5.

1.9 Repeat readings approximately every 15 minutes until Health Physicist or Site Emergency Director requests longer intervals or determines they are no longer needed.

1.10 Go to Step 5.2 of the main procedure.

DETERMINATION OF RELEASE RATES

2.3.1 Background may be determined following release. Proceed with a conservative estimate including background until the release stops.

1. Use Figure 3 for steam dump releases for 0-24 hours after shutdown.

2. Use Figure 4 for steam dump releases for 0-30 days after shutdown.

2.3.2 Multiply dose rates for steam dump monitor by a Response Factor (RF) of 4.8 to get dose rate. Record information in Section B of Attachment 5.

2.4 Iodine release rate may be estimated by multiplying noble gas release rate (2.2.4 or 2.3 above) by 1.0E-03.

2.5 Record release rate in Section B of Attachment 5.

2.6 Readings should be repeated approximately every 15 minutes until the Health Physicist or Site Emergency Director requests longer intervals or determines they are no longer necessary.

2.7 Go to Step 5.2 of the main procedure.

3.0 Offsite Radiological Monitoring

NOTE: This method more accurately determined the iodine release rate which was estimated previously.

3.1 Determine iodine ground concentration CI ($\mu Ci/cm^3$) using Emergency Implementation Procedure EI-9.

3.2 Calculate the iodine release rate QI (Ci/sec) using the following:

$$QI = \frac{CI}{X/Q}$$

Where: QI = Iodine release rate (Ci/sec)
CI = Iodine ground concentration ($\mu CI/cm^3$)
X/Q = Value from nearest point on isopleth where iodine ground concentration was determined (sec/m^3)

3.3 Record as appropriate in Section B of Attachment 5.

3.4 Go to Step 5.2 of the main procedure.

ESTIMATED RELEASE RATES DUE TO STEAM GENERATOR TUBE RUPTURE ACCIDENT

1.0 Determine Xe-133 Ci release from a steam generator by the following:

$$QN(CI/sec) = \frac{\bar{E} \cdot GA \cdot VC \cdot 3.78 \times 10^{-3}}{t}$$

*$\bar{E}$ = average energy of radioactivity in primary coolant.

*GA = gaseous activity present in primary coolant, $\frac{\mu Ci}{cc}$ = (If $\bar{E}$ and/or A are unknown use $\bar{E} \cdot GA = 100$).

VC = volume of primary coolant (gallons) that has leaked to the secondary system. If unknown use 8.19×10^4 gallons.

t = release period in seconds

* Obtained from Chemistry report forms.

2.0 Determine I-131 Ci released from a steam generator by the following:

$$QI(Ci/sec) = \frac{D \cdot VC \cdot 3.78 \times 10^{-3}}{t}$$

D = dose equivalent I-131 obtained from Chemistry report forms (if unknown, use 40 μCi/cc).

VC = volume of primary coolant (gallons) that has leaked to the secondary system. If unknown, use 8.19×10^4 gallons.

3.0 Record appropriate information in Section B of Attachment 5.

4.0 Go to Step 5.2 of the main procedure.

APPROXIMATION OF OFFSITE DOSE

1.0 Determine the following points on the area map in the Technical Support Center in the direction of the release path:

Site Boundary
5 miles
10 miles
Nearest population point (city, town, etc)

2.0 Determine the X/Q values for the points in Step 1.0 from Table 3.1 (these values are calculated for stability condition E and a wind speed of 2 m/sec).

3.0 Determine wholebody dose (2 hour exposure) for the points in Step 1.0.

$D_{wb} = (X/Q)(QN)(8.6 \times 10^2)$ Rem

Where: D_{wb} = wholebody dose (Rem)

X/Q = atmospheric dispersion factor (sec/m^3)

QN = Noble gas release rate (Ci/sec) (Attachment 1)

$8.6 \times 10^2 = 4.3 \times 10^2 \frac{\text{rem/hr x 2 hours}}{Ci/m^3}$

4.0 Determine child thyroid dose (2 hour exposure) for the points in Step 1.0 above.

$D_{ct} = (X/Q)(QI)(7.4 \times 10^6)$ Rem

Where: D_{ct} = child thyroid dose (Rem)

QI = release rate of radioiodines Ci/sec (Attachment 1)

7.4×10^6 = child thyroid dose conversion factor $\frac{Rem\text{-}m^3}{Ci}$

5.0 Record appropriate information in Section C of Attachment 5.

DETERMINATION OF ATMOSPHERIC STABILITY CLASS

1.0 Using Control Meterological Terminal

1.1 This is the preferred method, if meteorology tower data is unavailable, go to Part 2.0.

1.2 Following the posted instructions in the Control Room, activate the meteorological terminal and obtain a printout. The printout should be in the form of the following example.

?

SITE	PALI	PALI	PALI	PALI	PALI	PALI	PALI	PALI
HEIGHT	10-M	6010	10-M	10-M	10-M	60-M	60-M	60-M
PARAMETER	TEMP	DELT	WS	WD	SGMA	WS	WD	SGMA
UNITS	C	C	MPH	DEG	DEG	MPH	DEG	DEG
AVE ENDING-EST								
02/12/80 15:00	-4.7	-0.49	11.70	249.	14.3	14.11	241.	10.2
STATUS 00	0	0	0	0	0	0	0	0

1.3 Verify the "STATUS 00" to be "0" for the "10-M WS" and "10-M WD" columns (10 meter wind speed and wind direction, respectively) and record readings in Section A of Attachment 5.

NOTE: If status is other than 0, record "60-M WS" and "60-M WD".

1.4 Verify the "STATUS 00" to be "0" for the "6010 DELT" column (60 meter/10 meter temperature differential) and note reading on Attachment 5.

NOTE: If status is other than 0, go to Step 1.6.

1.5 Use Table 4.1 of this attachment in conjunction with Parameter DELT to determine stability class. Record in Section A of Attachment 5.

Return to Step 5.3 of the main procedure

DETERMINATION OF ATMOSPHERIC STABILITY CLASS

NOTE: OFF is to the RIGHT
ON is to the LEFT

2.2 Dial any of the following numbers using the adjacent telephone and place the handset in the telephone coupler at the back of the terminal.

Ann Arbor
Detroit
Chicago

2.2.1 When the green light at the front of the keyboard lights, type two Carriage Returns. Note those items to be entered are in quotes. Do not type quotes.

NOTE: If WSI in unavailable, go to Step 3.0.

2.2.2 When the terminal responds with "TERMINAL=" type "T145" then Carriage Return (cr.).

2.2.3 When the terminal responds with "@" type: "C (space 617133" and two more Carriage Returns.

2.2.4 When requested, type "LOGIN PAL" then (cr).

2.2.5 The password, when requested, is "POWER" then (cr).

2.3 Type "NUKE PALI" (cr)

2.3.1 Use the table labeled "Recent Hourly Obs and Pasquill Stability" for Benton Harbor. Wind direction is read from the column labeled "wind", wind direction is given in tens of degrees from true north and wind speed is in knots. The first two digits are wind direction and the last two digits are wind speed. For example: 2213 would represent a wind direction of 220 degrees and a wind speed of 13 knots.

2.3.2 Convert wind speed to miles per hour as follows:

Speed _____ x 1.15 (mph/knot) = Speed _____ mph

2.4 Type "LOGOUT" (cr) when the session is over and replace telephone. Reconnect the meteorological tower line.

2.5 Return to Step 5.3 of main procedure.

OFFSITE DOSE DATA SHEET

Date_____

A. Meteorology: Time_____ WS_____mph WD_____DEG Stability Class_____ 6010 Delt_____

B. Release Rate:

RIA-2318 /RIA-2319 Monitors

Time	Monitor Reading (cpm) Gross	Bkg	Net	Stack Gas Flow Rate (Cu Ft/min) to Cu Meters/min	QN (Ci/sec)	QI (Ci/sec)	Calculated By:

High Range Effluent Monitor

Time	Monitor Reading (R/hr) Gross	Bkg	Net	RF x Net	Dose rate to release rate ratio R/hr / Ci/sec	QN (Ci/sec)	QI (Ci/sec)	Calculated By:

Offsite Measurements

Time	Instrumentation Used Model#	Serial#	Date	Location	QI (Ci/sec)	Other	Calculated By:

C. Offsite Doses

Time	WHOLEBODY DOSES (REM) (2.89E3)(X/Q)(QN)(2.23/WS) SB	1 mi	2 mi	5 mi	10 mi	Other	CHILD THYROID DOSES (REM) (3.69E6)(X/Q)(QI)(2.23/WS) SB	1 mi	2 mi	5 mi	10 mi	Other	Calculated By:

RECOMMENDED PROTECTIVE ACTIONS TO REDUCE WHOLEBODY AND THYROID DOSE FROM EXPOSURE TO A GASEOUS PLUME

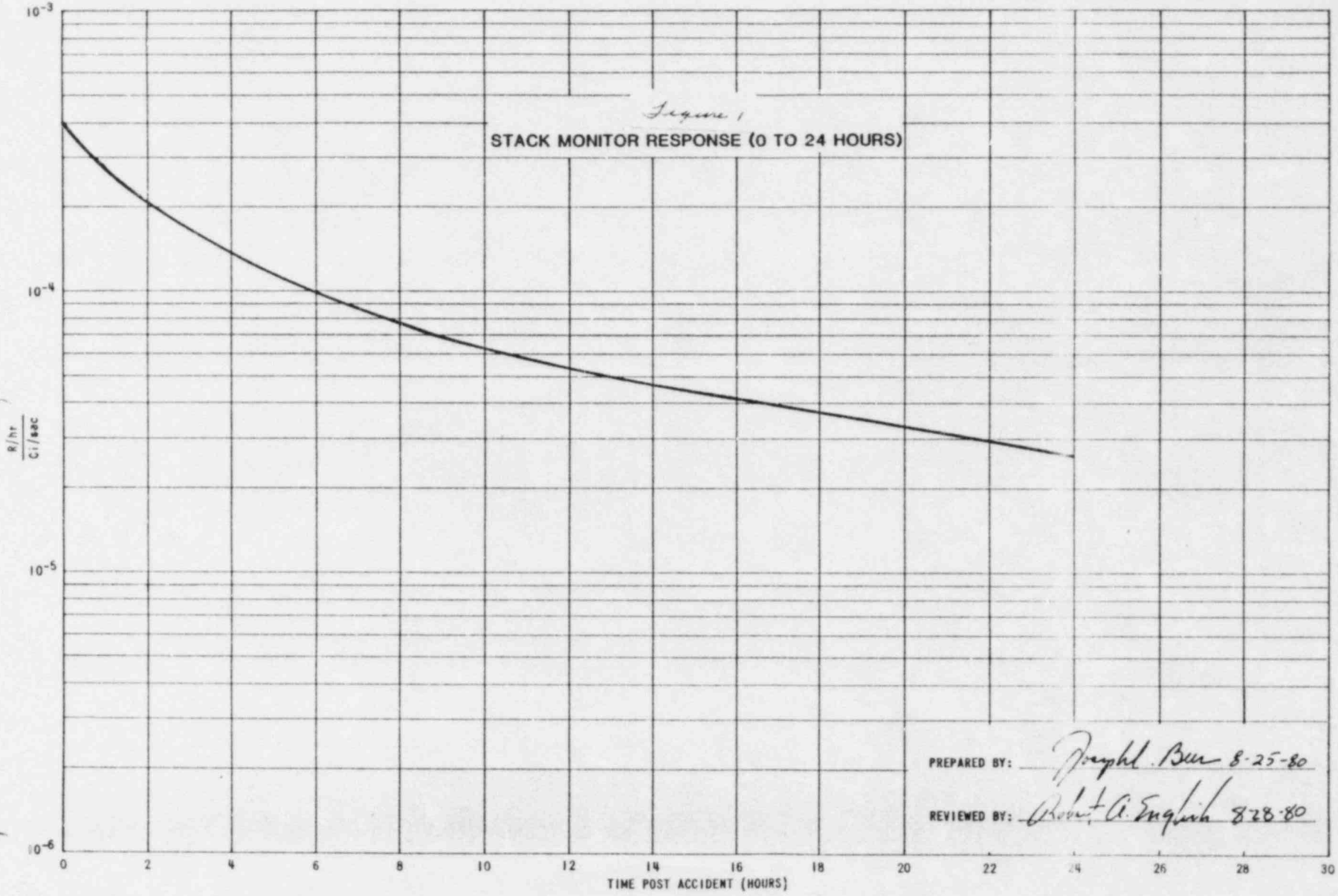
Projected Dose (Rem) to the Population	Recommended Actions[a]	Comments
Wholebody < 1 Thyroid < 5	No planned protective actions[b] State may issue an advisory to seek shelter and await further instructions. Monitor environmental radiation levels.	Previously recommended protective actions may be reconsidered or terminated.
Wholebody 1 to < 5 Thyroid 5 to < 25	Seek shelter as a minimum. Consider evacuation. Evacuate unless constraints make it impractical. Monitor environmental radiation levels. Control access.	If constraints exist, special consideration should be given for evacuation of children and pregnant women.
Wholebody 5 and above Thyroid 25 and above	Conduct mandatory evacuation. Monitor environmental radiation levels and adjust area for mandatory evacuation based on these levels. Control access.	Seeking shelter would be an alternative if evacuation were not immediately possible.
Projected Dose (Rem) to Emergency Team Workers		
Wholebody 25 Thyroid 125	Control exposure of emergency team members to these levels except for lifesaving missions. (Appropriate controls for emergency workers, include time limitations, respirators and stable iodine.)	Although respirators and stable iodine should be used where effective to control dose to emergency team workers, thyroid dose may not be a limiting factor for lifesaving missions.
Wholebody 75	Control exposure of emergency team members performing lifesaving missions to this level. (Control of time of exposure will be most effective).	

[a] These actions are recommended for planning purposes. Protective action decisions at the time of the incident must take existing conditions into consideration.

[b] At the time of the incident, officials may implement low-impact protective actions in keeping with the principle of maintaining radiation exposures as low as reasonably achievable.

Figure 1

STACK MONITOR RESPONSE (0 TO 24 HOURS)

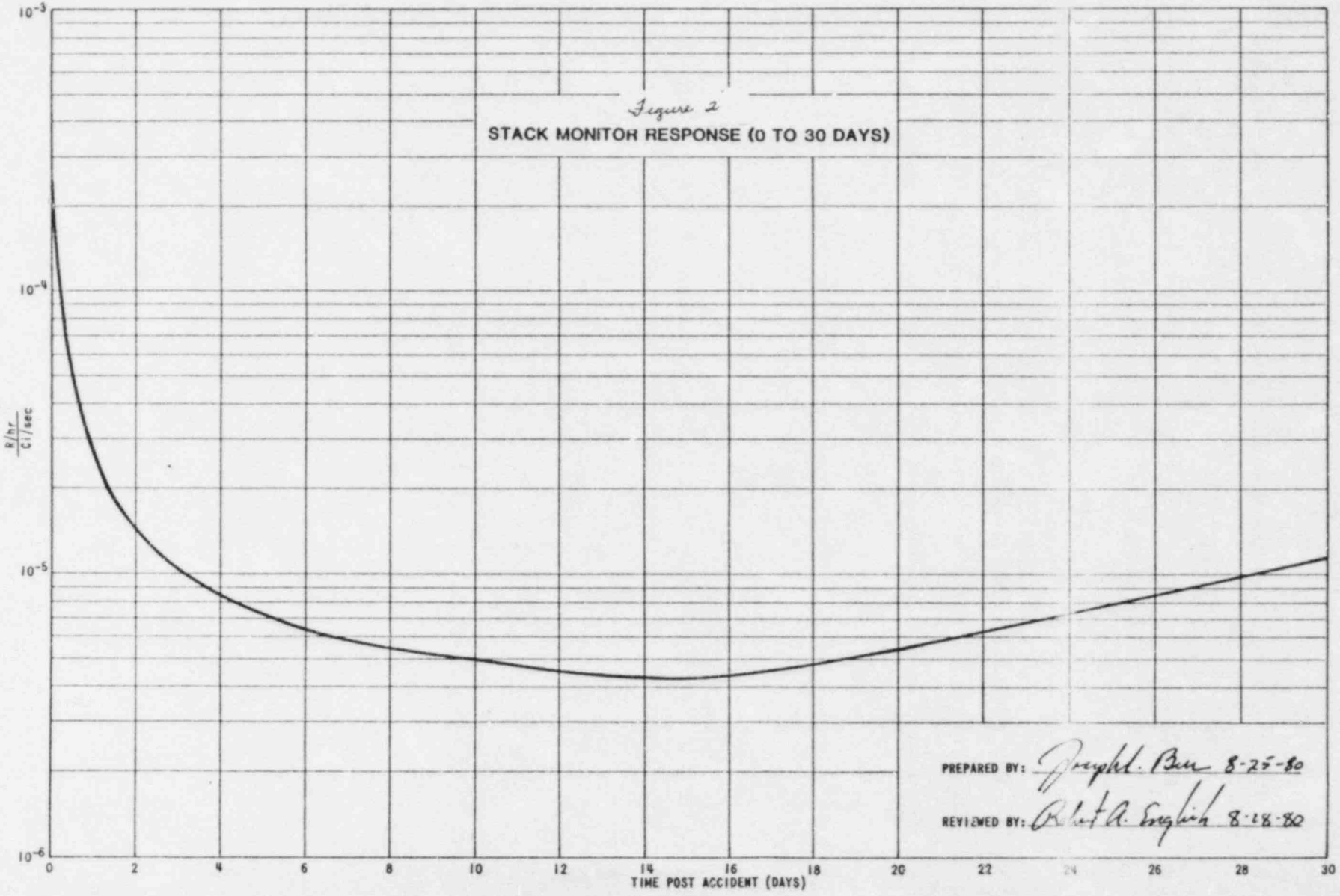


PREPARED BY: Joseph L. Bun 8-25-80

REVIEWED BY: Robert A. English 8-28-80

Figure 2

STACK MONITOR RESPONSE (0 TO 30 DAYS)

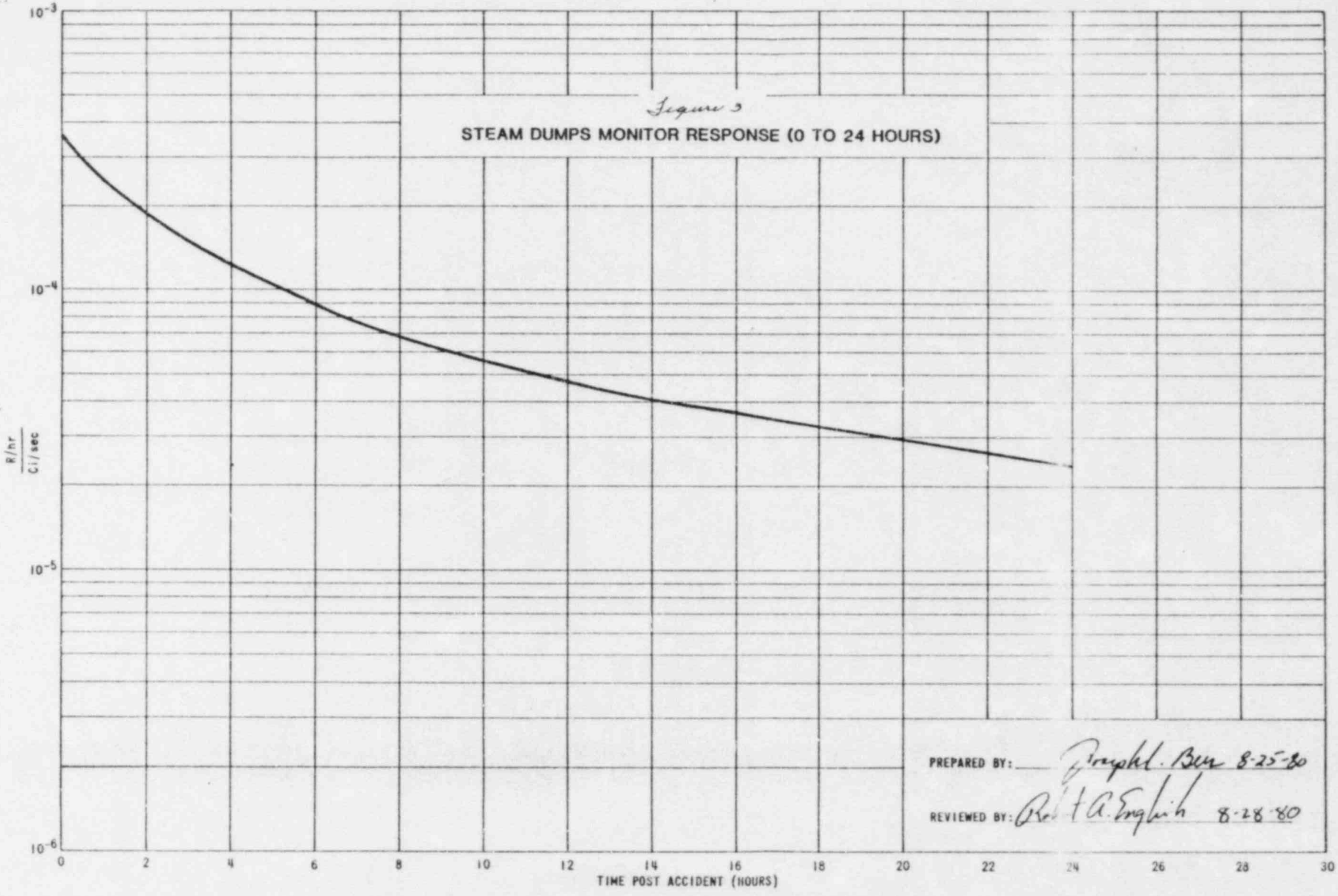


PREPARED BY: Joseph L. Burr 8-25-80

REVIEWED BY: Robert A. English 8-28-80

Figure 3

STEAM DUMPS MONITOR RESPONSE (0 TO 24 HOURS)

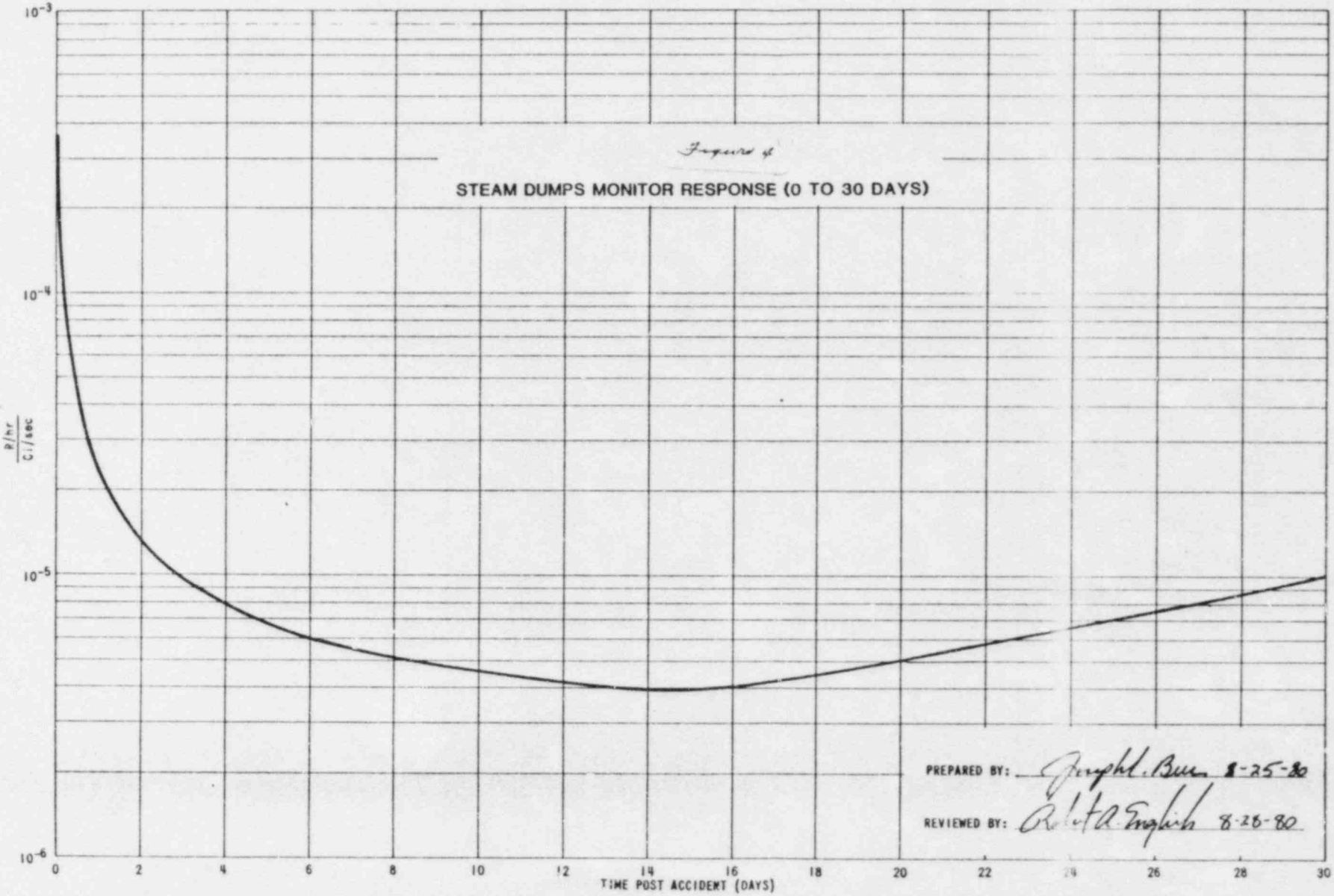


PREPARED BY: Joseph L. Burr 8-25-80

REVIEWED BY: Robert A. English 8-28-80

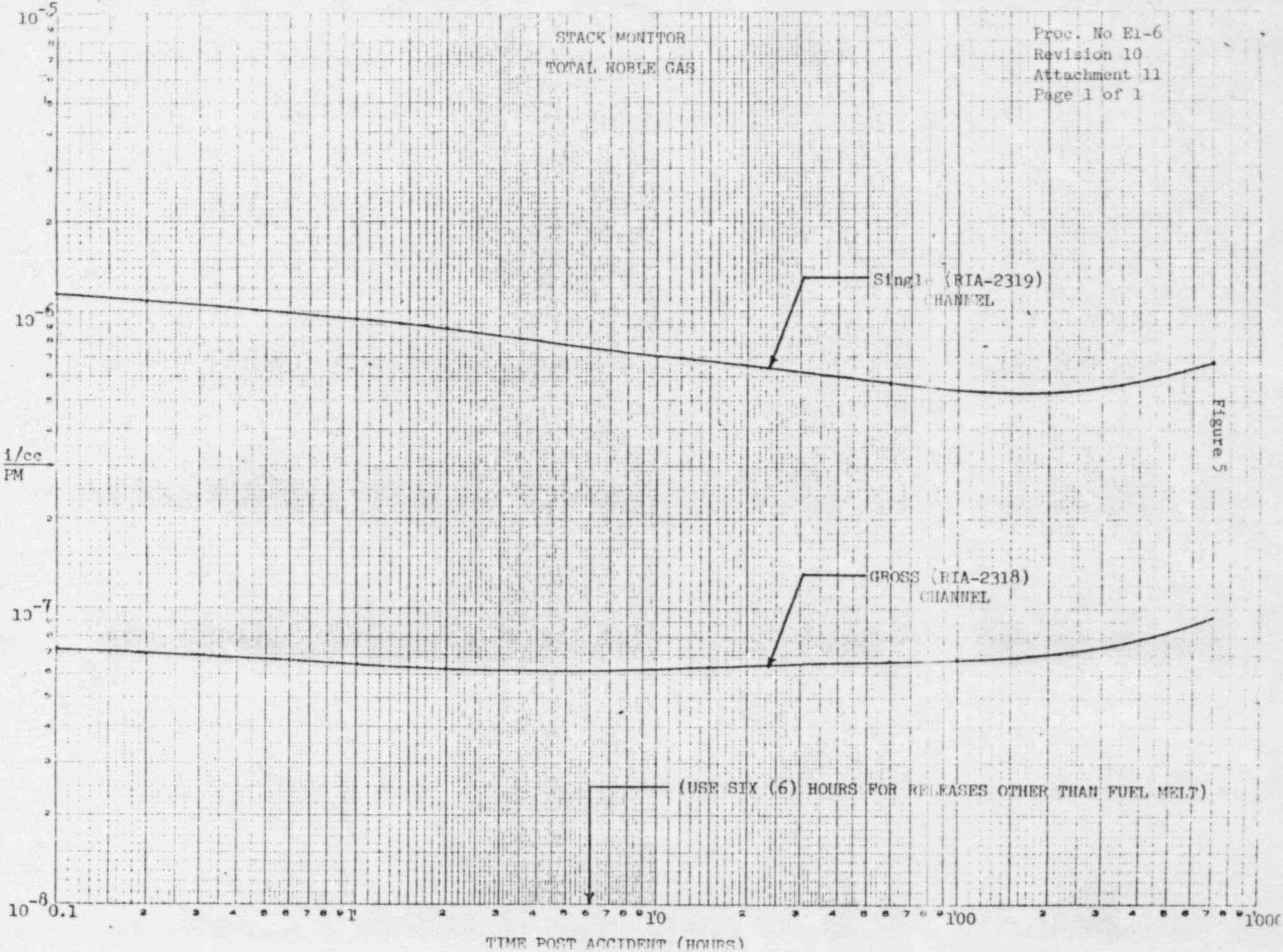
Figure 4

STEAM DUMPS MONITOR RESPONSE (0 TO 30 DAYS)



PREPARED BY: Joseph L. Burn 8-25-80

REVIEWED BY: Robert A. English 8-28-80


STACK MONITOR
TOTAL NOBLE GAS
Proc. No E1-6
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Page 1 of 1
Single (RIA-2319) CHANNEL
GROSS (RIA-2318) CHANNEL
(USE SIX (6) HOURS FOR RELEASES OTHER THAN FUEL MELT)
Figure 5
1/cc
PM
10^{-5}
10^{-6}
10^{-7}
10^{-8}
0.1
1
10
100
1000
TIME POST ACCIDENT (HOURS)