PG&E **Pacific Gas and Electric Company**

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DEPARTMENT OF NUCLEAR PLANT OPERATIONS
DIABLO CANYON POWER PLANT UNIT NO(S) 1 & 2
EMERGENCY PROCEDURE

TITLE: RELEASE OF AIRBORNE RADIOACTIVE MATERIALS

APPROVED: R C Thornberry 10/15/81
PLANT MANAGER DATE

SCOPE

This procedure describes the steps to be taken to evaluate and recover from the consequences of an airborne release that results in an Unusual Event, Alert, Site Area, or General Emergency. It does not describe the operation of the plant equipment necessary to terminate or minimize the release. This latter subject is covered in the appropriate OP series Emergency Procedure for the particular release mechanism.

SYMPTOMS

1. The following symptoms indicate that an airborne release may be occurring in the Controlled Area:

   a. There is actual or suspected leakage of water, steam, or noncondensible gases from any vessel or piping system containing primary coolant, liquid radwaste, or gaseous radwaste.

   b. Damage occurs to a submerged, irradiated fuel assembly with the resultant release of significant quantities of noncondensible gases.

   c. Alarms occur on CAMs.

   d. A fire occurs in radioactive materials.

   e. G-M type survey instruments in the area begin to show an increasing background count rate.

      NOTE: The external dose rate produced by airborne levels near MPC is very low and may not be noticed on a Rad Owl. However, it produces a noticeable increase on a G-M survey instrument.

   f. A major radioactive material spill occurs.

2. There are numerous indications available in the control room to identify and diagnose a possible airborne release.

   These vary depending upon the mechanism of the release, and are covered in detail in the OP series Emergency Procedures and EP G-1, "Accident Classification and Emergency Plan Activation." However, the most likely symptom(s) will involve alarms on at least one of the area and/or process radiation monitors.

IMMEDIATE ACTIONS

1. Personnel in the Area

   a. Unless qualified and equipped with appropriate monitoring and/or respiratory equipment, evacuate the area and proceed to access control.

   b. Notify the control room.

2. The Shift Foreman (interim Site Emergency Coordinator) shall:

   a. Clear the affected area.

      This can be done most efficiently by sounding the emergency signal. The emergency signal shall be sounded for the following circumstances:

      1) Airborne contamination is widespread. Refer to EP R-4, "High External Radiation (In-Plant)."

      2) Major damage occurs to plant equipment. Refer to appropriate OP procedure or EP G-1, "Accident Classification and Emergency Plan Activation."

      3) Site evacuation is necessary. Refer to EP G-5, "Evacuation of Nonessential Site Personnel."

      4) Mobilization of personnel is necessary. Refer to EP G-2, "Establishment of the Onsite Emergency Organization" and EP G-4, "Personnel Assembly and Accountability,"

      5) The Shift Foreman deems it necessary.

   b. Establish an appropriate interim onsite emergency organization in accordance with EP G-1, "Accident Classification and Emergency Plan Activation."

      1) Assign the Emergency Liaison Coordinator and the Liaison Assistant to begin notification of offsite agencies and plant staff.

      2) Assign operators to isolate the release using appropriate OP series emergency procedures.

      3) Have the Emergency Evaluations and Recovery Coordinator (normally the Shift Engineer) begin preliminary evaluation and classification of the actual or potential severity of the release. Instructions for performing this evaluation are contained in the Subsequent Actions section of this procedure.

c. Treat any injured personnel in accordance with EP R-1, "Personnel Injury (Radiological Related and/or Overexposure."

SUBSEQUENT ACTIONS

1. Subsequent Actions Common to All Events

   a. Establish an appropriate long-term onsite emergency organization in accordance with EP G-2, "Establishment of Onsite Emergency Organization." As a minimum, notify the following personnel:

      1) Plant Manager (Long-Term Emergency Coordinator)

      2) Plant Superintendent

      3) Supervisor of Chemistry and Radiation Protection

   b. Alert offsite groups in accordance with EP G-3, "Notification of Offsite Organizations."

      1) Prompt notification of County and other offsite authorities should occur within about 15 minutes for the Unusual Event class and sooner (consistent with the need for other emergency actions) for other classes. Use Form 18-9221, Emergency Notification Record.

         NOTE: As a minimum, notify the NRC Operations Center within one hour via the "hot line." This notification is required pursuant to 10CFR50.72 as an event requiring initiation of the licensee's emergency plan or any section of that plan.

      2) Periodic updates on the status of the emergency shall be provided to the County and other offsite authorities, at least every 15 minutes. Use Form 18-10262, Emergency Status Form, giving as much information as is known at the time.

2. Classify the Emergency

   a. General

      1) To a large extent, subsequent actions are based upon the potential severity of the occurrence, as identified by the emergency classification. Therefore, the Emergency Evaluations and Recovery Coordinator (EERC) shall inform the Site Emergency Coordinator at the earlies possible time whether the emergency is classified as an Unusual Event, Alert, Site Area or General Emergency using EP G-1, "Accident Classification and Emergency Plan Activation."

NOTE: If core damage is a possibility, the Shift Engineer should be directing his attention towards its assessment and the task of classifying the accident should be assigned to someone else, such as a Senior Control Operator.

2) The EERC shall keep the Site Emergency Coordinator apprised of any escalation or reduction of the emergency classification.

b. How to Make Initial Classification of the Emergency

There are four general methods for initially classifying an emergency:

1) accident scenario,

2) estimate release rate,

3) Use accident summary sheets, or

4) perform offsite monitoring.

Each is discussed below.

1) Classify Emergency Based Upon Emergency Scenario

The preferred method for initially classifying the emergency is to diagnose the most likely cause (LOCA, steam line break, gas decay tank rupture, etc.) and base the classification on this information.

a) Go to the appropriate OP series procedure and use the guidance contained therein to classify the accident.

b) If the emergency does not fit any OP series procedure, or if the guidance in the OP series procedure is unclear, go to EP G-1.

EP G-1 gives examples of typical emergency scenarios which fall into each accident classification. Classify the emergency at a level consistent with the scenario which most closely approximates the actual situation.

c) If multiple emergency situations are occurring simultaneously, such that the probability of a release of radioactive materials is increased over what it would be for a single occurrence, classify the emergency one level higher that it would otherwise have been based on the most severe single occurrence.

2) Classify Emergency Based On Release Rate

a) General

The second best way to classify the emergency is to estimate the magnitude of the release rate. However, using release rate information to classify the emergency is subject to the following limitation:

(1) If the classification based upon the emergency scenario is more severe than would be warranted by release data, use the conservative (emergency scenario) classification. The reason for this is that EP G-1 specifies a classification for many events based upon the potential for a release. This conservative classification must be used even if the actual release does not materialize.

(2) If the release rate data indicates a classification more severe than the classification based upon the scenario, use the conservative classification based on release data, if the release data is considered to be reliable.

(3) Both whole body and thyroid exposure must be considered when making a classification based upon release data. Classify the emergency based upon the most conservative of these two values.

b) Dose and Release Rate Criteria for Classifying Emergency

The criteria for classifying an emergency based on dose and release data are summarized in Appendix 1.

c) Instructions

Regardless of the particular instruments used, the basic technique is as follows:

(1) Determine the classification criteria using Appendix 1. Use real meteorological data if possible, or default values is necessary.

(2) Estimate the noble gas and iodine release rates in curies/second. There are numerous possible techniques for doing this. Appendix 2 gives detailed instructions for the following common methods:

(a) Use of plant vent noble gas monitors RE-14 or RE-29.

(b) Use of plant vent iodine monitor RE-24.

(c) Use of containment air sample results if leak is via containment purge or other path out of containment.

(d) Use of RCS coolant sample results during S/G tube rupture.

(3) Compare the estimated release rate data with the criteria values.

3) Classify Emergency Using Accident Summary Sheets

Appendix 6 contains summary sheets for each accident analyzed in the FSAR. They can be used to estimate the severity of an accident.

4) Classify Emergency Based On Field Monitoring Data

a) General

As discussed in Appendix 1, the accident classification definitions are based upon dose rates at the site boundary. In theory, therefore, field data taken at the site boundary should provide a direct method of classifying the accident. In practice, this is only the third best technique because there is the possibility that you will miss the plume, and also because it takes considerable time to deploy monitoring teams.

b) Instructions

Appendix 6 summarizes the basic formulas related to environmental monitoring that are useful in classifying accidents and in projecting doses.

NOTE: At this point, the emergency is classified. Go to Steps 3, 4, 5, or 6 for Unusual Event, Alert, Site Area Emergency, or General Emergency respectively.

3. Subsequent Actions for an Unusual Event

a. Evaluate the internal exposure received by affected personnel using the instructions given in Emergency Procedure R-1, "Personnel Injury (Radiological Related) and/or Overexposure."

b. Make the best possible quantification of the extent of any offsite release using the results of air samples, effluent monitors, envorinmental monitoring, or other techniques.

c. Conduct appropriate cleanup and reentry operations.

NOTE: General guidelines for cleanup and reentry are contained in Attachment 1.

d. Close-out the event with a verbal summary to offsite agencies and complete the following written reports:

1) Plant Problem Report (see Nuclear Plant Administrative Procedure C-12).

2) Written summary to NRC within 24 hours.

4. Subsequent Actions for an Alert

a. Activate the Technical Support Center, the Emergency Operations Facility, and the Operational Support Center in accordance with EP's, EF-1, EF-3 and EF-2, respectively.

b. If the release has the potential for necessitating onsite protective measures (i.e., if it is more than about 10 times the threshold levels for an Alert), make a check of downwind onsite assembly areas to determine if any protective measures are needed for onsite personnel.

c. If the results of the initial assessment indicate that site personnel are receiving significant exposures, and that evacuation can measurably reduce it, the Site Emergency Coordinator shall order their evacuation either offsite (preferred) or to an upwind site location (if the duration of the release is expected to be very short).

d. Provide periodic meteorological assessments to offsite authorities and, if any releases are occurring, dose projections for actual releases.

1) Activation of EARS is the preferred method for transmitting dose projections offsite.

2) If EARS is not available in either the automatic (EARAUT) or manual (EARMAN) mode, perform appropriate hand calculations using Appendices 2 - 7 of this procedure.

e. Perform Comprehensive Follow-up Surveys Onsite

1) Personnel Assembly Areas

Although a preliminary assessment should have been made at personnel assembly areas, if the release was substantially in

excess of limits, it is wise to check or recheck these locations as time and conditions permit, with the following objectives:

a) To verify that long-term evacuation is not required if personnel were not previously evacuated based upon the initial assessment.

b) To obtain iodine and particulate samples if these were not obtained earlier (assuming that significant quantities of iodine and particulate matter were released, and that the cloud has not long since passed),

c) To run smear surveys to see whether decontamination is required. If significant activity is found, the smear pads should be counted on the MCA to assist in determining the isotopes to which persons might have been exposed. (If significant personnel exposure is suspected, the persons should also be whole body counted in accordance with Emergency Procedure R-1).

2) Remainder of Site

Downwind areas which may have been contaminated should be checked for contamination to provide data for determining the necessity and extent of cleanup operations. Smear samples should be retained for subsequent isotopic analysis if required.

f. Perform Offsite Monitoring as Warranted

If the estimate of curie release and/or onsite monitoring indicates that offsite effects are negligible (as they would be for most Alert conditions), offsite monitoring may not be necessary. However, if there is a realistic possibility that offsite locations may have become contaminated, local government agencies should be alerted and on offsite monitoring program should be instituted for the following purposes:

1) Determine the need for long-term decontamination or impoundment of foodstuffs, even if offsite personnel evacuation is not required.

NOTE: These decisions are the responsibility of local government agencies. However, current governmental recommendations are summarized in EP RB-10.

2) Allay any public concern.

3) Obtain background data for reports to regulatory agencies.

g. Conduct appropriate post-accident cleanup and reentry operations.

h. Close-out the event with a verbal summary to offsite agencies and complete the following written reports:

1) Plant Problem Report (see Nuclear Plant Administrative Procedure C-1Z).

2) Written summary to NRC within 8 hours.

5. Subsequent Actions for a Site Area Emergency

a. Activate the Technical Support Center, the offsite Emergency Operations Facility and the onsite Operational Support Center in accordance with EP's, EF-1, EF-3, and EF-3, respectively.

b. Consider evacuation of nonessential site personnel.

If it is likely that a release is occurring, or will occur which exceeds the threshold for a Site Area Emergency (i.e., 17mR WB or 85 mrem thyroid at site boundary), evacuation of site personnel either offsite (preferred) or to an upwind site location (if the duration of the release is expected to be very short).

c. Provide periodic meteorological assessments to offsite authorities and, if any releases are occurring, dose projections for actual releases.

1) Activation of EARS is the preferred method for transmitting dose projections offsite.

2) If EARS is not available in either the automatic (EARAUT) or manual (EARMAN) mode, perform appropriate hand calculations using Appendices 2 - 7 of this procedure.

d. Perform Offsite Monitoring

A Site Area Emergency release is of sufficient magnitude such that some offsite protective measures, such as evacuation of persons in portions of the LPZ, or long-term impoundment of foodstuffs, may be required near the site boundary. Therefore, an offsite monitoring program should be established for the following purposes:

1) Initially the program should be directed toward identifying those areas where personnel evacuation may be necessary to prevent persons from exceeding the recommended evacuation criteria doses of 500 mrem whole body and/or 5 rem thyroid.

2) Once any immediate evacuation is accomplished, the program should be set up to determine the need for long-term decontamination or impoundment of foodstuffs, which may be desirable even in areas where prompt personnel evacuation was not required.

NOTE: These decisions are the responsibility of local government agencies. However, current government recommendations are summarized in EP RB-10.

3) The program should provide background data for any necessary reports to regulatory agencies.

4) The program should provide the data to answer questions of public concern.

e. Take Protective Measures for Members of the Public (if required)

Table 1 summarizes recommended protective actions for exposure to a passing plume. The area where action is taken must include the entire area in which the dose criteria have been exceeded. A somewhat larger area than this should be considered.

If evacuation is required, determine which area is to be evacuated. On a map, draw an arrow pointing in the downwind direction. Mark a 22.5° sector on both sides of this downwind sector. Evacuate everyone within this 67.5° sector out to the limit of the LPZ.

NOTE: The decision to evacuate and which area is to be evacuated are the responsibility of local government agencies.

f. Conduct appropriate post-accident cleanup and reentry operations.

g. Close-out the event with a verbal summary to offsite agencies and complete the following written reports:

1) Plant Problem Report (see Nuclear Plant Administrative Procedure C-12).

2) Written summary to NRC within 8 hours.

6. Subsequent Actions for a General Emergency

a. Activate the Technical Support Center, the Emergency Operations Facility and the onsite Operational Support Center in accordance with EP's, EF-1, EF-3, and EF-2, respectively.

b. Evacuate Site Personnel

1) As soon as the accident has been classified as a General Emergency, evacuate all nonessential site personnel in accordance with instructions given in EP G-5.

2) Evacuate site personnel engaged in recovery actions if it appears that they will exceed the emergency dose criteria given in EP RB-2.

c. Evacuate Members of the Public from the Downwind LPZ

As soon as the accident has been classified as a General Emergency, notify the Sheriff and recommend immediate evacuation of the LPZ in the downwind direction with the remainder of the ingestion pathway LPZ being placed on standby alert[1]. If it is anticipated that conditions will escalate to a General Emergency, it is not necessary to delay evacuation of the LPZ until confirmed offsite monitoring results are obtained.

If evacuation is required, determine the area which should be evacuated first. On a map, draw an arrow pointing in the downwind direction. Mark a 22.5° sector on either side of this downwind sector. Evacuate everyone within this 67.5° sector out to the limit of the LPZ.

d. Provide periodic meteorological assessments to offsite authorities and, if any releases are occurring, dose projections for actual releases.

1) Activation of EARS is the preferred method for transmitting dose projections offsite.

2) If EARS is not available in either the automatic (EARAUT) or manual (EARMAN) mode, perform appropriate hand calculations using Appendices 2 - 7 of this procedure.

e. Perform Offsite Monitoring

1) General

A General Emergency release is of sufficient magnitude such that some offsite protective measures beyong the LPZ, such as evacuation or long-term impoundment of foodstuff , may be required. Therefore, an offsite monitoring program should be established for the following purposes:

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[1]This can be done by sounding the Early Warning System.

a) Initially, the program should be directed toward identifying those areas located beyond the LPZ where personnel evacuation may be necessary to prevent persons from exceeding the recommended evacuation criteria doses of 500 mrem whole body and/or 5 rem thyroid.

b) Once any immediate evacuation is accomplished, the program shall be set up to determine the need for long-term decontamination or impoundment of foodstuffs, which might be desirable even in areas where prompt personnel evacuation was not required.

NOTE: These decisions are the responsibility of local government agencies. However, current government recommendations are summarized in EP RB-10.

c) The program should provide background data for any necessary reports to regulatory agencies.

d) The program should provide the data to answer questions of public concern.

f. Take Protective Measures for Members of the Public

Table 1 summarizes recommended protective actions for exposure to a passing plume. The area where action is taken must include the entire area in which the dose criteria are exceeded. A somewhat larger area than this should be considered.

NOTE: Evacuate at least a 67.5° sector (22.5° on both sides of the downwind sector).

g. Conduct appropriate post-accident cleanup and reentry operations.

h. Close-out the event with verbal summary to offsite agencies and complete the following written reports:

1) Plant Problem Report (see Nuclear Platn Administrative Procedure C-12).

2) Written summary to NRC within 8 hours.

APPENDICES

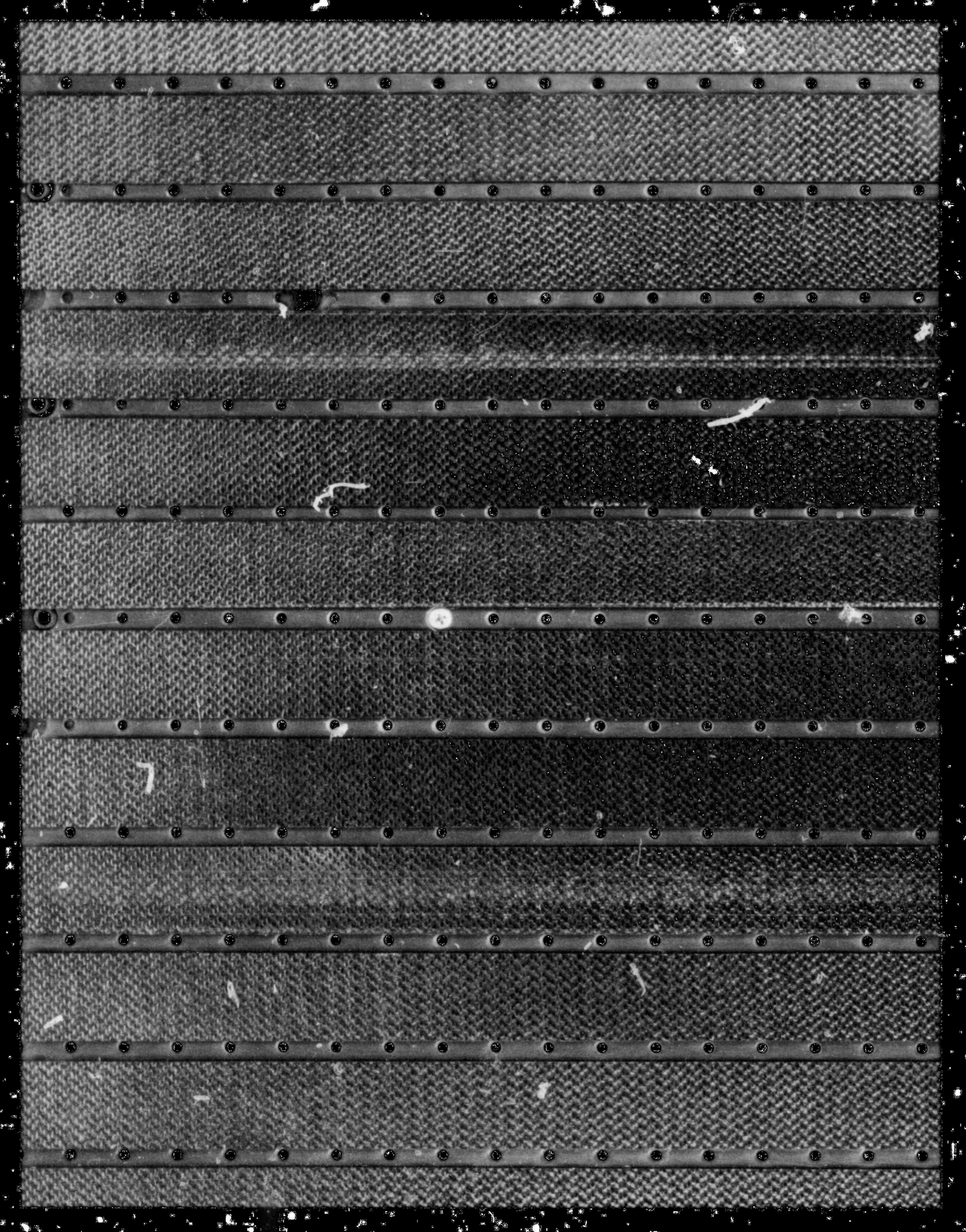
1. Summary of Criteria for Classifying Emergency Based Upon Dose and Release Data

2. Instructions for Estimating Noble Gas Release Rate Using Plant Vent Monitor RE-14 or RE-29

3. Instructions for Estimating Iodine Release Rate Using Plant Vent Monitor RE-24
4. Use of Containment Air Sample Data to Estimate Release Rate
5. Use of RCS Coolant Sample Results During S/G Tube Rupture Accident
6. Accident Summary Sheets
7. Summary of Field Monitoring Formulae that are Useful in Classifying Accidents

ATTACHMENTS

1. Form 18-10262, "Emergency Status Form"
2. Form 18-9221, "Emergency Notification Record"



...ACTIVE MATERIALS

...REDUCE WHOLE BODY AND THYROID DOSE

...POSURE TO A GASEOUS PLUME

	Recommended Actions (a)	Comments
less than 0.5 (b) Thyroid - less than 5	No planned protective actions (c). Offsite authorities may issue an advisory to seek shelter and await further instructions. Monitor environmental radiation levels.	Previously recommended protective actions may be reconsidered or terminated.
Whole Body - 0.5 to 5 Thyroid - 5 to 25	Seek shelter as a minimum. Consider evacuation/unless constraints make it impractical. Monitor environmental radiation levels. Control access to affected areas.	If constraints exist to prevent full-scale evacuation, special consideration should be given for evacuation of children and pregnant women.
Whole body - 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 to affected areas.	Sheltering is an alternative if evacuation can not be promptly accomplished.

a) These actions are recommended for planning purposes. Protective action decisions at the time of the incident must take existing conditions into consideration (e.g., weather, plume arrival time).

The value of 0.5 rem whole body is based upon guidance from the state of California (see reference 3).

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 (ALARA).

APPENDIX 1

SUMMARY OF CRITERIA FOR CLASSIFYING EMERGENCY BASED UPON DOSE AND RELEASE DATA

NOTE 1: For each classification, the actual definition is given from EP G-1. If the necessary information is available, this is the best criteria to use. In addition, however, a set of Derived Criteria are also provided. These are calculated criteria, which are slightly less accurate because of the necessity to make calculational assumptions, but which may be more useful depending on what information is readily available.

NOTE 2: In general, derived criteria are expressed in terms of the site boundary atmosphere dilution factor, $(X/Q)_{800}$. This can be obtained from the meteorological computer. However, if this information is not readily available, default values of the criteria are given using the FSAR design basis $(X/Q)_{800} = 5.3X10^{-4}$ sec/m^3.

NOTE 3: The definitions of terms used in the quations are:

$\dot{Q}_{NG}$ = noble gas release rate (Ci/sec)

$\dot{Q}_I$ = iodine release rate (Ci/sec)

Q_{NG} = total curies of noble gas released (Ci)

Q_I = total curies of iodine released (Ci)

X_I = iodine concentration (μCi/CC or Ci/m^3)

$(X/Q)_{800}$ = centerline atmospheric dilution factor @ 800 m (sec/m^3)

A. UNUSUAL EVENT

1. Definition

Radiological effluent technical specification limits exceeded.

The technical specification limits correspond to site boundary (800 m or 0.5 miles dose rates of:

a. Whole body ≥ 0.057 mR/hr.
b. Thyroid ≥ 0.170 mrem/hr.

APPENDIX 1 (Continued)

2. Derived Criteria

a. Noble Gas Release Rate

$$\dot{Q}_{NG} \geq \frac{6.3 \times 10^{-7}}{(X/\dot{Q})_{800}}$$

Default Value: $\dot{Q}_{NG} \geq$ 0.0012 Ci/sec

b. Iodine Release Rate

$$\dot{Q}_{I} \geq \frac{9.2 \times 10^{-11}}{(X/\dot{Q})_{800}}$$ (Assumed to be I-131)

Default Value: $\dot{Q}_{I} \geq 1.7 \times 10^{-7}$ Ci/sec

c. Centerline Iodine Concentration @ 800 m

$$X_{I} \geq 9.2 \times 10^{-11}$$ (Assumed to be I-131)

B. ALERT

1. Definition

Radiological effluents greater than 10 times technical specification limits exceeded.

This corresponds to the following dose rates at the site boundary (800 m or 0.5 miles):

a. Whole body $\geq$ 0.57 mR/hr.

b. Thyroid $\geq$ 1.70 mrem/hr.

2. Derived Criteria

a. Noble Gas Release Rate

$$\dot{Q}_{NG} \geq \frac{6.3 \times 10^{-6}}{(X/\dot{Q})_{800}}$$

Default Value: $\dot{Q}_{NG} \geq$ 0.012 Ci/sec

APPENDIX 1 (Continued)

b. Iodine Release Rate

$$\dot{Q}_I \geq \frac{9.2 \times 10^{-10}}{(X/\dot{Q})_{800}}$$ (Assumed to be I-131)

Default Value: $\dot{Q}_I \geq 1.7 \times 10^{-6}$ Ci/sec

c. Centerline Iodine Concentration at 800 m

$X_I \geq 9.2 \times 10^{-10}$ (Assumed to be I-131)

C. SITE AREA EMERGENCY

1. Definition

Radiological effluents correspond to greater than 50 mR/hr for 1/2 hour or greater than 500 mR/hr for 2 minutes to the whole body (or five times these levels to the thyroid) at the site boundary (800 m).

This can also be interpreted to mean an accident which produces a total dose at the site boundary of ≥ 17 mR (whole body) or ≥ 85 mrem (thyroid).

2. Derived Criteria

a. Peak Noble Gas Release Rate (≥ 2 minutes duration)

$$\dot{Q}_{NG} \geq \frac{5.6 \times 10^{-3}}{(X/\dot{Q})_{800}}$$

Default Value: $\dot{Q}_{NG} \geq 10.5$ Ci/sec

b. Average Noble Gas Release Rate (≥ 30 minutes duration)

$$\dot{Q}_{NG} \geq \frac{5.6 \times 10^{-4}}{(X/\dot{Q})_{800}}$$

Default Value: $\dot{Q}_{NG} \geq 1.0$ Ci/sec

c. Total Noble Gas Release

$$Q_{NG} \geq \frac{0.68}{(X/\dot{Q})_{800}}$$

Default Value: $Q_{NG} \geq 1280$ Curies

APPENDIX 1 (Continued)

d. Peak Iodine Release Rate ($\geq$2 minutes duration)

$$\dot{Q}_I \geq \frac{1.35\times10^{-6}}{(X/\dot{Q})_{800}}$$ (Assumed to be I-131)

Default Value: $\dot{Q}_I \geq 2.5\times10^{-3}$ Ci/sec

e. Average Iodine Release Rate ($\geq$ 30 minutes duration)

$$\dot{Q}_I \geq \frac{1.35\times10^{-7}}{(X/\dot{Q})_{800}}$$ (Assumed to be I-131)

Default Value: $\dot{Q}_I \geq 2.5\times10^{-4}$ Ci/sec

f. Total Iodine Release

$$Q_I \geq \frac{1.65\times10^{-4}}{(X/\dot{Q})_{800}}$$

Default Value: $Q_I \geq 0.3$ Curies

D. GENERAL EMERGENCY

1. Definition

Radiological effluents correspond to 1 R/hr whole body or 5 rem/hr thyroid at the site boundary.

2. Derived Criteria

a. Noble Gas Release Rate

$$\dot{Q}_{NG} \geq \frac{0.011}{(X/\dot{Q})_{800}}$$

Default Value: $\dot{Q}_{NG} \geq 21$ Ci/sec

b. Iodine Release Rate

$$\dot{Q}_I \geq \frac{2.7\times10^{-6}}{(X/\dot{Q})_{800}}$$ (Assumed to be I-131)

Default Value: $\dot{Q}_I \geq 0.005$ Ci/sec

APPENDIX 2
INSTRUCTIONS FOR ESTIMATING NOBLE GAS RELEASE RATE USING PLANT VENT MONITORS RE-14 OR RE-29

APPLICABILITY

First choice if noble gas release is going out of plant vent.

INSTRUCTIONS

1. Determine Plant Vent Flow Rate (in cfm) on Affected Unit

   a. Check FR-12 on Unit 2 RMS board in control room. If operable, read flow rate directly off of chart.

   F_{vent} = _____ cfm

   b. If FR-12 is inoperable, determine the flow rate using the number of ventilation fans in operation and the following fan capacities:

   _____ FHB exhaust fans @ 35750 cfm/fan = _____ cfm
   _____ Aux. bldg. exhaust fans @ 73500 cfm/fan = _____ cfm
   _____ Cont. purge exhaust fans @55000 cfm/fan = _____ cfm
   _____ Cont H_2 purge fan @300 cfm/fan = _____ cfm

   =

   Sum F_{vent} = _____ cfm

2. Read RE-14 (in control room) if it is on scale. Otherwise read RE-29 in the package boiler room. Convert the readings to plant vent concentration using Figure 1 (for RE-14) or Figure 2 (for RE-29). Summarize the data in spaces provided.

   NOTE: On Figure 1, assume effective age $\leq$ 1000 hours for all accidents except a fuel handling accident where the fuel has been out of the core for at least a month.

RE-14			RE-24		
Time	cpm	µCi/cc	Time	mR/hr.	µCi/cc

APPENDIX 2 (Continued)

3. Calculate Noble Gas Release Rate

Regardless of the instrument used, the formula for calculating the noble gas release rate is:

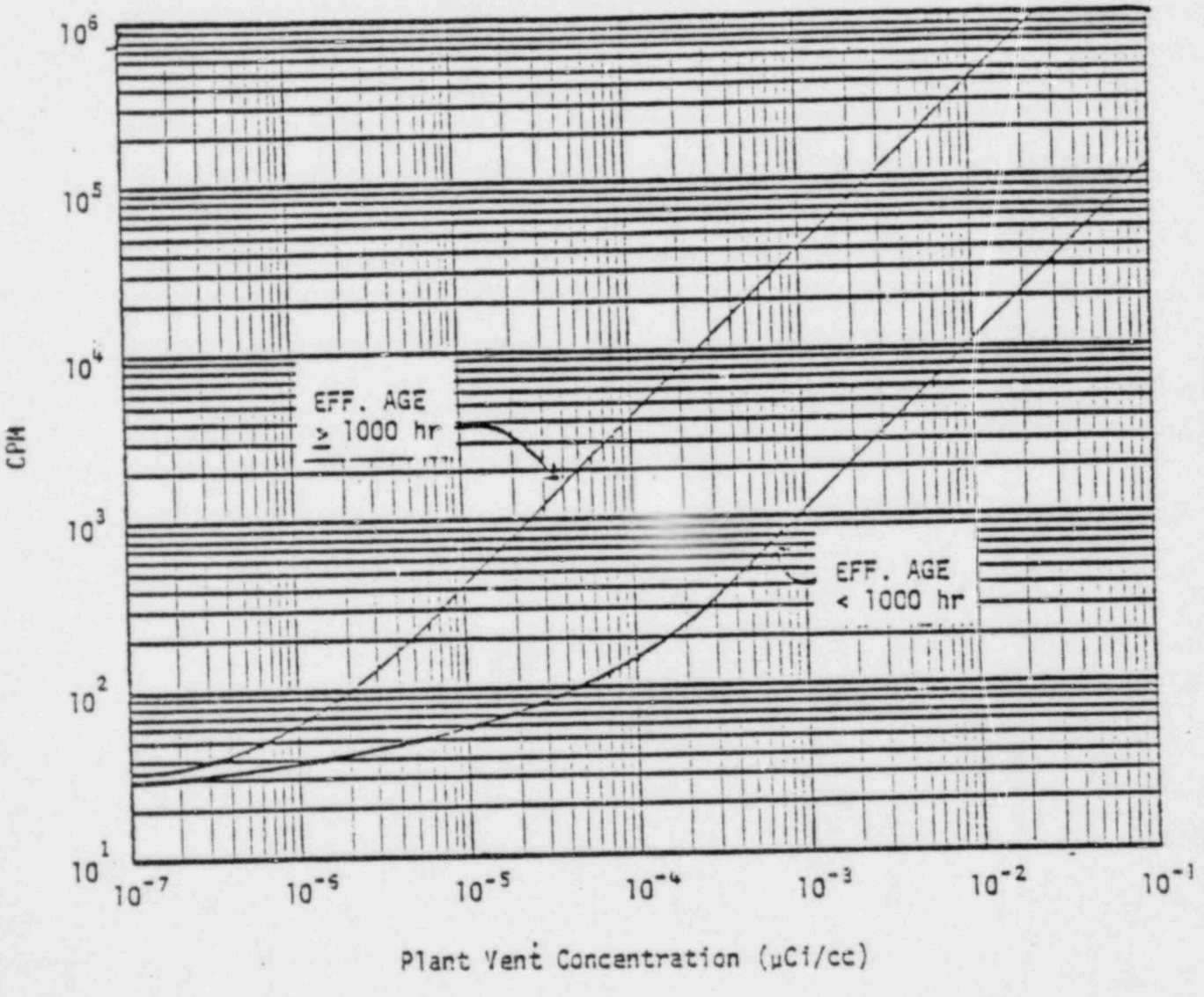
$$\dot{Q}_{NG}(\text{Ci/sec}) = (\mu\text{Ci/cc Vent} \times F_{vent}\ (\text{cfm}) \times 4.72 \times 10^{-4}$$

INSTR.	TIME	(µCi/cc)	x	(F_{vent})	x	(4.72×10^{-4})	=	$\dot{Q}_{NG}$ (Ci/sec)
RE-___	___	___	x	___	x	4.72×10^{-4}	=	___
RE-___	___	___	x	___	x	4.72×10^{-4}	=	___
RE-___	___	___	x	___	x	4.72×10^{-4}	=	___
RE-___	___	___	x	___	x	4.72×10^{-4}	=	___
RE-___	___	___	x	___	x	4.72×10^{-4}	=	___
RE-___	___	___	x	___	x	4.72×10^{-4}	=	___
RE-___	___	___	x	___	x	4.72×10^{-4}	=	___
RE-___	___	___	x	___	x	4.72×10^{-4}	=	___
RE-___	___	___	x	___	x	4.72×10^{-4}	=	___

Date ____________________ By ____________________

APPENDIX 2 (Continued)

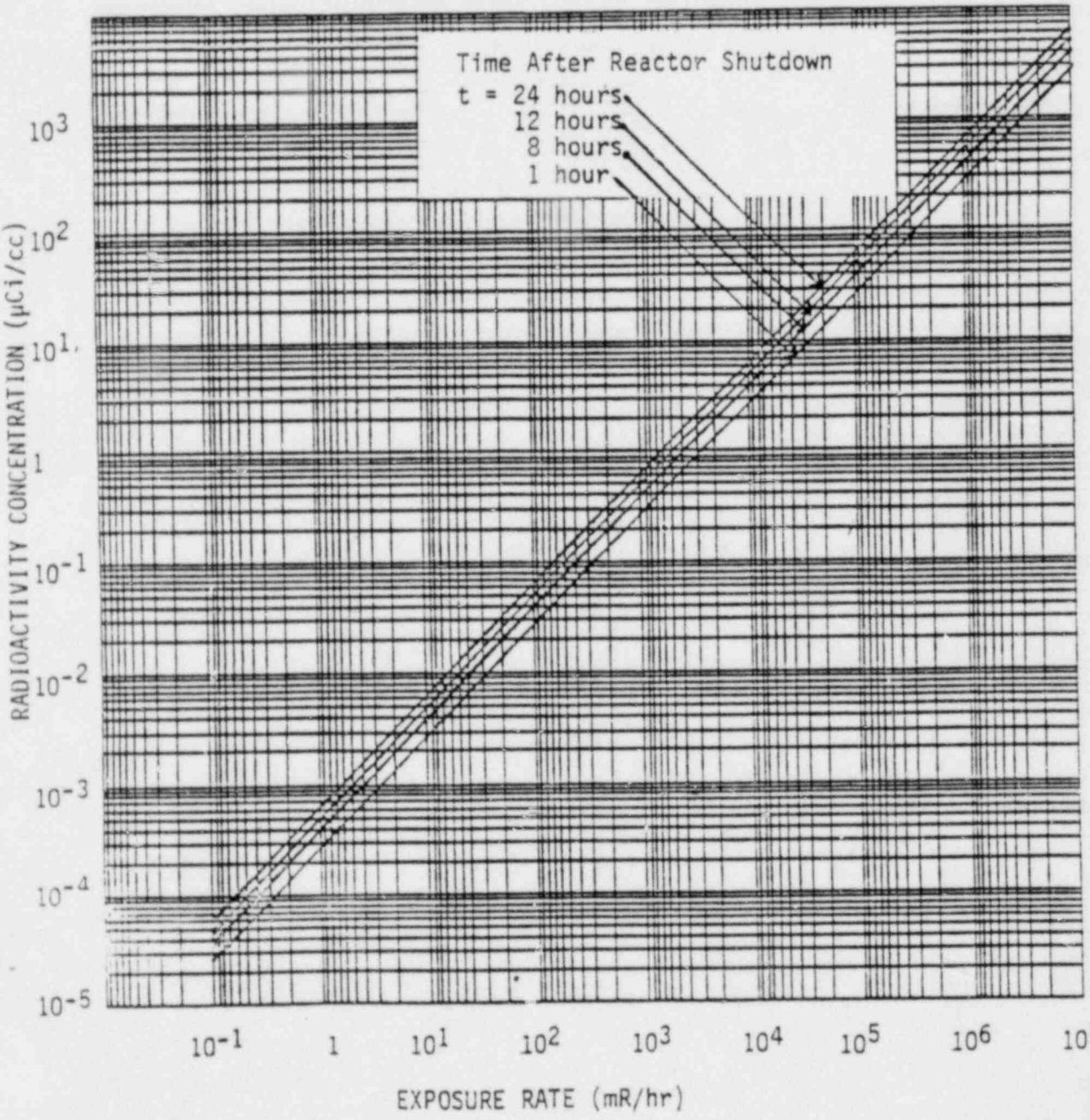
FIGURE 1
RESPONSE OF PLANT VENT RADIOGAS MONITOR (RE-14)



APPENDIX 2 (Continued)

FIGURE 2

RESPONSE OF INTERIM PLANT VENT RADIOGAS MONITOR (RE-29)



APPENDIX 3

INSTRUCTIONS FOR ESTIMATING IODINE RELEASE RATE USING PLANT VENT MONITOR RE-24

APPLICABILITY

RE-24 first choice for estimating iodine release rate for minor accidents, where release path is the plant vent. RE-24 will go off scale for any release classed as Site Area Emergency or above, and dose rates may make instrument inaccessible. Under such circumstances, it is best to estimate the release rate by some other method, although a technique is given for estimating high release rates using this instrument.

INSTRUCTIONS

1. Determine Ratio of Plant Vent Flow Rate to Sampler Flow Rate

   a. Sampler Flow Rate

      Read at instrument. Otherwise assume the normal setting of 1 cfm.

      F_{samp} = [cfm]

   b. Plant Vent Flow Rate

      1) Check FR-12 on Unit 2 [illegible] in control room. If operable, read flow rate di[illegible] of chart.

         F_{vent} = [cfm]

      2) If FR-21 is inoperable, determine the flow rate using the number of ventilation fans in operation and the following fan capacities:

         _____ FHB exhaust fans @35750 cfm/fan = _____ cfm
         _____ Aux. bldg. exhaust fans @73500 cfm/fan = _____ cfm
         _____ Cont. purge exhaust fans @55000 cfm/fan = _____ cfm
         _____ Cont. H2 purge fan @ 300 cfm/fan = _____ cfm

         Sum F_{vent} = [cfm]

   c. Calculate Flow Rate Ratio

      FRR = $F_{vent} \div F_{samp}$ = _____ ÷ _____ = [ ]

APPENDIX 3 (Continued)

2. Obtain Reading On Instrument and Calculate Release Rate

   a. Turn the toggle switch on the front of the instrument to the uCi/sec($x10^{-11}$) position.

   b. Turn the SCALE FACTOR switch to the "1000" position. This switch is located inside the door on the lower front part of the instrument. Record the scale factor in the blank in paragraph 2.d. below.

   c. To allow for instrument response time wait at least one (1) minute and then read the chart. Enter this reading in the blank in paragraph 2.d. below. The chart reading is a number between 1 and 1000. <u>If the instrument does not read on scale, I-131 is not a significant contribution to the accident</u>.

   d. Calculate the release rate using the formula $\dot{Q}_I$ (Ci/sec)=(Chart Reading)x (Scale Factor)x (FRR)x 10^{-17}.

TIME	(Chart Reading)	x (Scale Factor)	x (FRR)	x (10^{-17})	= $\dot{Q}_I$ (Ci/sec)
____	________	________	____	10^{-17}	________
____	________	________	____	10^{-17}	________
____	________	________	____	10^{-17}	________
____	________	________	____	10^{-17}	________
____	________	________	____	10^{-17}	________
____	________	________	____	10^{-17}	________
____	________	________	____	10^{-17}	________
____	________	________	____	10^{-17}	________

3. Calculating Release Rate If Cartridge Is Analyzed In the Lab

   Sometimes it is desirable to take the cartridge to the counting room. If so, have the technician report the total µCi of I or I-131 contained on the cartridge.

   a) Activity on Cartridge (A_{cart}) = __________ µCi (circle I or I-131)

   b) Estimate the time over which the release has persisted (in seconds).

   $\Delta t_{RELEASE}$ = ________ (SEC)

APPENDIX 3 (Continued)

c) Calculate the average release rate using the equation:

$$\dot{Q}_I \text{ (Ci/sec)} = \frac{[A_{cart} \text{ } (\mu Ci)] \times (FRR) \times 10^{-6}}{[\Delta t_{RELEASE} \text{ (Sec)}]}$$

$$= \frac{(\quad) \times (\quad) \times 10^{-6}}{(\quad)} = \boxed{\qquad\qquad \text{Ci/sec}}$$

4. Calculating Release Rate If RE-24 is Inaccessible

NOTE: This method is very approximate and is an interim technique only.

a. Take a Radowl or other γ dose rate measuring instrument and approach RE-24 as close as possible, being careful not to exceed personnel exposure limits.

b. Get as close to RE-24 as you can and take a Radowl reading (in R/hr.) and also estimate the distance (in meters) you are from RE-24.

Dose Rate (DR) = _____ R/hr.
Distance to RE-24 (d) = _____ m

c. Estimate the time over which the release has persisted (in seconds).
$\Delta t_{RELEASE}$ = sec.

d. Calculate the release rate from the equation.

$$\dot{Q}_I \text{ (Ci/sec)} = \frac{60 \times (DR) \times (d)^2 \times (FRR)}{(\Delta t_{RELEASE})}$$

$$= \frac{(60) \times (\quad) \times (\quad)^2 \times (\quad)}{(\quad)}$$

$$= \boxed{\qquad\qquad \text{Ci/sec}}$$

5. Calculating Release Rate If RE-24 is Accessible, But Dose Rates Are Too High To Permit Cartridge To Be Collected

a. Proceed as in paragraph 4 above, with the following exceptions:

1) Open Cartridge holder door and take dose reading on exposed cartridge. Again, estimate distance in meters.

DR = _____ R/hr
d = _____ m

APPENDIX 3 (Continued)

b. Calculate the release rate from the equation:

$$\dot{Q}_I \text{ (Ci/sec)} = \frac{1.3 \times (DR) \times (d)^2 \times (FRR)}{(\Delta t_{RELEASE})}$$

$$= \frac{1.3 \times (\quad) \times (\quad)^2 \times (\quad)}{(\quad)}$$

$$= \boxed{\qquad\qquad \text{Ci/sec}}$$

NOTE: The reason the equations are different is because there is less shielding when the cartridge is exposed.

APPENDIX 4

USE OF CONTAINMENT AIR SAMPLE DATA TO ESTIMATE RELEASE RATE

APPLICABILITY

Many postulated accidents first result in a release to containment. From there the activity may go to the environment via the containment purge (if it is not isolated), or via some unspecified leak path. If a containment air sample is obtained and the leakage flow rate is known, or can be estimated, the release rate is easily determined.

INSTRUCTIONS

1. Obtain air sample and analyze for noble gas and/or iodine. The results will be given as concentration , C(in μCi/cc), in the containment atmosphere.

TIME AT WHICH SAMPLE WAS TAKEN	$C_{NOBLE\ GAS}$ (μCi/cc)	C_{IODINE} (μCi/cc)

2. Estimate flow rate from containment, F_{cont} (in cfm).

   NOTE: If there is no obvious leak path, assume containment leaks at design value of 0.1%/day, which translates to F_{cont} = 1.8 cfm.

   F_{cont} = _____ cfm

3. Calculate Release Rate

   The expression is as follows:

   $\dot{Q}$ (Ci/sec) = C (μCi/cc) x F_{cont} (cfm) x (4.72×10^{-4})

APPENDIX 4 (Continued)

TIME	(C_{IODINE})	x	(F_{CONT})	x	(4.72×10^{-4})	=	Q_{IODINE} (Ci/sec)
					4.72×10^{-4}		
					4.72×10^{-4}		
					4.72×10^{-4}		
					4.72×10^{-4}		
					4.72×10^{-4}		

TIME	$(C_{NOB\ GAS})$	x	(F_{CONT})	x	(4.72×10^{-4})	$Q_{NOB\ GAS}$ (Ci/sec)
					4.72×10^{-4}	
					4.72×10^{-4}	
					4.72×10^{-4}	
					4.72×10^{-4}	
					4.72×10^{-4}	

APPENDIX 5

USE OF RCS COOLANT SAMPLE RESULTS DURING S/G TUBE RUPTURE ACCIDENT

APPLICABILITY

The most difficult accident to estimate the release rate for is a S/G tube rupture because of uncertainties in primary to secondary leak rate and in steam leak rate to atmosphere. However, if the activity level in the RCS is known, it is possible to make some assumptions about leak rates and make some very rough approximations of the release rate.

INSTRUCTIONS

1. Determine Primary System Activity

   Measurement will be activity concentration, C, in μCi/cc.

   RCS Concentrations (μCi/cc)

TIME	C_{IODINE}	$C_{NOB\ GAS}$

2. Estimate Flow Rate To Atmosphere

   The best estimate of the release rate that can be made is that the flow rate of reactor coolant to the atmosphere is equal to the primary to secondary tube rupture flow during the period when steam is being dumped.

   Estimate the primary to secondary leakage using a mass balance, or guess at it based upon the assumption that the complete severance of one tube produces a primary to secondary leakage of 600 gpm.

   $F_{PRI,sec}$ = _____ gpm

3. Estimate The Release Rate

   The appropriate equation is:

   $\dot{Q}$ (Ci/sec) = C(μCi/cc) x $F_{PRI,sec}$ (gpm) x PF x 6.3×10^{-5}

   Where: PF = iodine partition factor, to account for retention of iodine in water. Use PF = 1 for noble gases, PF = 0.1 for iodine if S/G is empty, and PF = 0.01 for iodine is S.G is partly full of water.

APPENDIX 5 (Continued)

TIME	C_{IODINE}	x	$F_{PRI, SEC}$	x	PF	x	6.3×10^{-5}	=	$\dot{Q}$ IODINE (Ci/sec)

TIME	($C_{NOB\ GAS}$)	x	($F_{PRI,SEC}$)	x	(PF)	(6.3×10^{-5})	=	$\dot{Q}$ NOB GAS (Ci/sec)
		x		x	1.0			
		x		x	1.0			
		x		x	1.0			
		x		x	1.0			
		x		x	1.0			

APPENDIX 6
ACCIDENT SUMMARY SHEETS

This attachment contains summary sheets for the various postulated accidents which have been analyzed in the FSAR. These sheets contain both the "design basis" and "expected" case variables which were assumed in the FSAR analyses. The sheets can be used to compare actual measurements with assumed numbers from the FSAR, in order to help evaluate how things are going in relation to predictions, or they can be used as a source of data to supply unavailable numbers in calculations which are performed at the time of the accident.

Two sets of data are included. The "design basis" case is expected to be highly conservative, where every variable is at a worst-case condition. The "expected" case is the best estimated prediction of what might actually occur. When FSAR values are used to make calculations or predictions at the time of the accident, the "design basis" values can be used to provide a quick upper limit result, but as soon as data becomes available which tends to confirm one case or the other, the one which best agrees with the data should be used.

The accident classifications identified in this attachment are based on the activity releases. Other emergency procedures may have different classifications which are based on the initiating event.

The summary sheets provided are:

A. 10A MAJOR LOCA
B. 10B MAJOR STEAM LINE BREAK
C. 10C MAJOR FEEDWATER LINE BREAK
D. 10D BLACKOUT (OR PLANT COOLDOWN WITH ATMOSPHERIC DUMP)
E. 10E SMALL LOCA
F. 10F TUBE RUPTURE
G. 10G LOCKED ROTOR
H. 10H FUEL HANDLING ACCIDENT IN FUEL HANDLING BUILDING
I. 10I FUEL HANDLING ACCIDENT IN CONTAINMENT
J. 10J ROD EJECTION ACCIDENT
K. 10K GAS DECAY TANK RUPTURE
L. 10L LIQUID HOLDUP TANK RUPTURE
M. 10M VCT RUPTURE

SUMMARY SHEET 1A
MAJOR LOCA

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1. Total Release to Containment Free Volume, Ci			
a. Xe-133	2.03×10^8	1.36×10^6	
b. Other Noble Gases	5.73×10^8	4.27×10^5	
c. I-131	2.21×10^7	1.82×10^5	
d. Other Iodine	1.90×10^8	2.73×10^5	
e. Effective Age of Mixture (hr)	0	20	
f. Release Assumption	100% of core N.G., 25% of core iodines	100% of gap N.G., 25% of gap iodines	
2. Containment Spray Effectiveness			
a. Removal half-life (hrs)	0.022	0.0075	
b. Number of operable spray pumps	1	2	
3. Containment Leak Rate (%/day)	0.1 for 1st day 0.05 after 1st day	0.05 for 1st day 0.025 after 1st day	
4. Total Release to Environs, First 2 Hours, Ci			
a. Xe-133	16,840	56	
b. Other Noble Gases	25,930	21	
c. I-131	191	0.05	
d. Other Iodine	1,325	0.08	
e. Effective Age of Mixture	1	40	
f. Release Mechanism	Containment Leakage	Containment Leakage	

SUMMARY SHEET 1A (continued)

	PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
5.	$(\chi/\dot{Q})$ CL (sec/m^3)			
	a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
	b. 10000m (6 mi. LPZ)	2.20×10^{-5}	2.20×10^{-6}	
6.	Whole Body Dose Results			
	a. Total 800m dose for 1st two hours (mR)	5,600	0.365	
	b. Total 10000m dose for 30 days (mR)	567	0.06	
7.	Thyroid Dose Results			
	a. Total 800m dose for 1st two hours (mR)	95,900	1.25	
8.	Accident Classification	General Emergency	Alert	
9.	Miscellaneous			
	a. Containment-free volume (cc)		7.36×10^{10}	
	b. RCS Coolant Mass (gm)		2.4×10^{8}	

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SUMMARY SHEET 1B
MAJOR STEAM LINE BREAK

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1. Initial Conditions and Assumptions			
a. Primary Coolant Activity (μCi/gm)			
1) Xe-133	270	67.2	
2) I-131	2.6	0.65	
3) Other Iodine	7.9	2.0	
b. Secondary Water Activity (μCi/gm)			
1) I-131	0.015	0.44×10^{-4}	
2) Other Iodines	0.037	0.90×10^{-4}	
c. Assumed Fuel Defects (%)	1	0.2	
d. Primary to Secondary Leakage (gpm)	1	0.014	
e. Steam Release, 1st Two Hours (lbs)			
1) Failed generator	97,000		
2) Other generator (atmospheric dump)	520,000		
f. Total Steam Release During 8-Hour Cooldown (lbs)	1,600,000		
g. Liquid Release Fraction for Iodine			
1) Failed generator	0.1		
2) Other generators	0.01		

SUMMARY SHEET 1B (Continued)

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
2. Activity Release to Environs, First 2 Hours (Ci)			
a. Xe-133	56.8	0.172	
b. Other Noble Gases	5.2	0.016	
c. I-131	0.157	0.00045	
d. Other Iodines	0.047	0.0013	
e. Effective Age of Mixture (hrs)	65	65	
3. $(\chi/\dot{Q})$ CL (sec/m^3)			
a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
b. 10000m (6 mi. LPZ)	2.20×10^{-5}	2.20×10^{-6}	
4. Whole Body Dose Results			
a. Total 800m dose for 1st two Hours (mR)	1.8	0.0006	
b. Total 10000m dose for 30 days (mR)	0.03	0.0010	
5. Thyroid Dose Results			
a. Total 800m dose for 1st two hours (mR)	65	0.012	
b. Total 10000m dose for 30 days (mR)	66	0.012	
6. Accident Classification	Alert	Alert	

SUMMARY SHEET 1B (Continued)

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
7. Miscellaneous			
a. Fluid Mass/Stm Gen (lbs)			
1) Water		95,100	
2) Steam		6,620	
b. Safety Valve and Steam Dump Valve Capacities (lb/hr/valve)			
1) S.G. safety valve		800,000	
2) 10% atmospheric dump		380,000	
3) 35% atmospheric dump		597,000	

SUMMARY SHEET 1C
MAJOR FEEDWATER LINE BREAK

The release from this accident comes from release of steam by safety valves and/or atmospheric steam dump of steam generator water during cooldown if the condenser is not available. The steam generator water is contaminated if there is tube leakage. The feedwater itself which is released has very little activity in it and is ignored. This accident is basically the same as a steam-line break and summary sheet 9B can be used. Note, however, that the steam release will be through relief valves and so the iodine liquid release fraction should be 0.01 for the entire release. This will reduce the thyroid dose somewhat from the steam-line break case.

SUMMARY SHEET 1D
BLACKOUT (PLANT COOLDOWN WITH ATMOSPHERIC DUMP)

The release from this accident comes from release of steam by safety valves and/or atmospheric steam dump of steam generator water is contaminated if there is tube leakage. This accident is basically the same as a steam-line break and summary sheet 9B can be used. Note, however, that the steam release will be through relief valves and so the iodine liquid release fraction should be 0.01 for the entire release. This will reduce the thyroid dose somewhat from the steam-line break case.

SUMMARY SHEET 1E
SMALL LOCA (RELEASE OF COOLANT TO CONTAINMENT)

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1. Initial Coolant Activity (μCi/gm)			
a. Xe-133	270	45.7	
b. Other Noble Gases	30	5.6	
c. I-131	2.62	0.45	
d. Other Iodine	7.88	1.35	
e. Effective Age of Mixture (hr)	60	60	
f. Fuel Defects (%)	1	0.2	
2. Initial Release to Containment (Ci)			
a. Xe-133	65,430	16,280	
b. Other Noble Gases	7,950	1,980	
c. I-131	63	16	
d. Other Iodine	193	48	
e. Assumption	100% of coolant N.G. activity +10% of coolant iodines	100% of coolant N.G. activity +10% of coolant iodines	
3. Containment Spray Effectiveness			
a. Removal Half-life (hrs)	0.022	0.0075	
b. Number of operable spray pumps	1	2	
c. Containment Leak Rate (%/day)	0.1 for 1st day 0.05 after 1st day	0.05 for 1st day 0.025 after 1st day	

SUMMARY SHEET 1E (Continued)

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
4. Containment Leak Rate (%/day)	0.1	0.05	
5. $(\chi/\dot{Q})$ CL (sec/m^3)			
a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
b. 10000m (6 mi. LPZ)	2.20×10^{-5}	2.20×10^{-6}	
6. Whole Body Dose Results			
a. Total 800m dose for 1st two hours (mR)	0.18	0.004	
b. Total 10000m dose for 30 days (mR)	0.05	0.001	
7. Thyroid Dose Results			
a. Total 800m dose for 1st two hours (mR)	0.2	0.0009	
b. Total 10000m dose for 30 days (mR)	0.03	0.0001	
8. Accident Classification	Alert	Alert	
9. Miscellaneous			
a. Containment-Free Volume (cc)	7.36×10^{10}		
b. RCS Coolant Mass (gm)	$2.4 \times 10^{}$		
c. Liquid Release Fraction for Iodine	0.1		

SUMMARY SHEET 1F
TUBE RUPTURE

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1. Initial Conditions and Assumptions			
a. Primary Coolant Activity (μCi/gm)			
1) Xe-133	270	67.2	
2) I-131	2.6	0.65	
3) Other Iodine	7.9	2.0	
b. Secondary Water Activity (μCi/gm)			
1) I-131	0.015	0.44×10^{-4}	
2) Other Iodines	0.037	0.90×10^{-4}	
c. Assumed Fuel Defects (%)	1	0.2	
d. Primary to Secondary Leakage (gpm)	1	0.014	
e. Steam Release, 1st Two Hours (lbs)			
1) Failed generator	31,000		
2) Other generators (atmospheric dump)	380,000		
f. Total Steam Release During 8-Hour Cooldown (lbs)	1,600,000		
g. Liquid Release Fraction for Iodine			
1) Failed generator	0.01		
2) Other generators	0.01		
2. Total Release to Environs, First 2 hours (Ci)			
a. Xe-133	10,980	2,383	
b. Other Noble Gases	1,067	234	
c. I-131	0.75	0.14	

SUMMARY SHEET 1F (Continued)

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
d. Other Iodines	3.1	0.62	
e. Effective Age of Mixture (hrs)	65	65	
3. $(\chi/\dot{Q})$ CL (sec/m^3)			
a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
b. 10000m (6 mi. LPZ)	2.20×10^{-5}	2.20×10^{-6}	
4. Whole Body Dose Results			
a. Total 800m dose for 1st two hours (mR)	360	7.7	
b. Total 10000m dose for 30 days (mR)	15	0.3	
5. Thyroid Dose Results			
a. Total 800m dose for 1st two hours (mR)	340	4.3	
b. Total 10000m dose for 30 days (mR)	15	0.2	
6. Accident Classification	Alert	Alert	
7. Miscellaneous			
a. Fluid Mass/Stem Gen. (lbs)			
1) Water	95,100		
2) Steam	6,620		
b. Safety Valve and Steam Dump Valve Capacities (lbs/hr/valve)			
1) S.G. safety valve	800,000		
2) 10% atmospheric dump	380,000		
3) 35% atmospheric dump	597,000		

SUMMARY SHEET 1G
LOCKED ROTOR ACCIDENT

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1. Total Release to Environs, 1st Two Hours (Ci)			
a. Xe-133	97	0.73	
b. Other Noble GAses	19.6	0.21	
c. I-131	0.24	0.003	
d. Other Iodines	0.36	0.003	
e. Effective Age of Mixture	50	50	
f. Assumptions			
1) Coolant Activity	1% fuel defects +3% of gap activity	0.2% fuel defects +3% of gap activity	
2) Primary to Secondary Leakage (gpm)	1	0.014	
3) Secondary Steam Release, 1st Two Hours (lbs)	617,000	617,000	
4) Total Steam Release During 8 Hour Cooldown (lbs)	1,600,000	1,600,000	
2. $(\chi/\dot{Q})$ CL (sec/m^3)			
a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
b. 10000m (6 mi. LPZ)	2.20×10^{-5}	2.20×10^{-6}	

SUMMARY SHEET 1G (Continued)

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
3. Whole Body Dose Results			
a. Total 800m dose for 1st two hours (mR)	4.4	0.004	
b. Total 10000m dose for 30 days (mR)	0.5	0.0004	
4. Thyroid Dose Results			
a. Total 800m dose for 1st two hours (mR)	82	0.06	
b. Total 10000m dose for 30 days (mR)	27	0.02	
5. Accident Classification	Alert	Alert	
6. Miscellaneous			
a. Fluid Mass/Stm Gen. (lbs)			
1) Water		95,100	
2) Steam		6,620	
b. Safety Valve and Steam Dump Valve Capacity (lbs/hr/valve)			
1) S.G. safety valve		800,000	
2) 10% atmospheric dump		380,000	
3) 35% atmospheric dump		597,000	
c. Liquid Release Fraction for Iodines	0.01		

SUMMARY SHEET 1H
FUEL HANDLING ACCIDENT IN FUEL HANDLING BLDG

	PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1.	Initial Conditions			
	a. Radial Peaking Factor of Damaged Assembly	1.65	1.26	
	b. Elapsed Time Since Reactor Shutdown (hrs)	100	100	
	c. Type of Release to Pool	100% of assembly gap activity	100% of assembly gap activity	
	d. Bundle Submergence (ft)	26	26	
	e. Pool Decontamination Factor for Iodine	100	760	
	f. Total Assembly Gap Activity at Time of Accident			
	1) Xe-133	100,000	8,137	
	2) Other Noble Gases	4,500	1,500	
	3) I-131	52,670	5,282	
	4) Other Iodines	7,000	220	
	5) Effective Age of Mixture (hr)	600	600	
2.	$(\chi/\dot{Q})$ CL (sec/m^3)			
	a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
	b. 10000m (6 mi. LPZ)	2.20×10^{-5}	2.20×10^{-6}	

SUMMARY SHEET 1H (Continued
FUEL HANDLING ACCIDENT IN FUEL HANDLING BLDG

	PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
3.	Total Release to Environs, 1st Two Hours (Ci)			
	a. Xe-133	100,400	523	
	b. Other Noble Gases	4,100	101	
	c. I-131	80	0.005	
	d. Other Iodines	10	0.0002	
	e. Effective Age of Mixture (hrs)	600	600	
4.	Whole Body Dose Results			
	a. Total 800m dose for 1st two hours (mR)	2,450	1.5	
	b. Total 10000m dose for 30 days (mR)	102	0.06	
5.	Thyroid Dose Results			
	a. Total 800m dose for 1st two hours (mR)	22,200	0.08	
	b. Total 10000m dose for 30 days (mR)	923	0.003	
6.	Accident Classification	Site Emergency	Alert	
7.	Miscellaneous			
	a. Fuel Handling Building Volume (ft^3)	435,000		
	b. Fuel Handling Building Exhaust Rate (cfm)	35,700	35,700	
	c. Filter Cleanup Factor	0.10	0.01	

SUMMARY SHEET 1I
FUEL HANDLING ACCIDENT IN CONTAINMENT

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1. Initial Conditions			
a. Radial Peaking Factor of Damaged Assembly	1.65	1.26	
b. Elapsed Time Since Reactor Shutdown (hrs)	100	100	
c. Type of Release to Pool	100% of assembly gap activity	100% of assembly gap activity	
d. Bundle Submergence (ft)	26	26	
e. Pool Decontamination Factor for Iodine	100	760	
f. Total Assembly Gap Activity at Time of Accident (Ci)			
1) Xe133	100,000	8,137	
2) Other Noble Gases	4,500	1,500	
3) I-131	52,670	5,282	
4) Other Iodines	7,000	220	
5) Effective Age of Mixture (hrs)	600	600	
2. $(\chi/\dot{Q})$CL (sec/m^3)			
a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
b. 10000m (6 mi LPZ)	2.20×10^{-5}	2.20×10^{-6}	

SUMMARY SHEET 1I (Continued)
FUEL HANDLING ACCIDENT IN CONTAINMENT

	PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
3.	Total Release to Environs, 1st Two Hours (Ci)			
	a. Xe-133	12,460	38	
	b. Other Noble Gases	557	7	
	c. I-131	65	0.033	
	d. Other Iodines	8.7	0.0013	
	e. Effective Age of Mixture (hrs)	600	600	
4.	Whole Body Dose Results			
	a. Total 800m dose for 1st two hours (mR)	0.31	0.0001	
	b. Total 10000m dose for 30 days (mR)	0.013	4×10^{-6}	
5.	Thyroid Dose Results			
	a. Total 800 m dose for 1st two hours (mR)	18.4	6×10^{-4}	
	b. Total 10000m dose for 30 days (mR)	0.76	3×10^{-5}	
6.	Accident Classification	Site Emergency	Alert	
7.	Miscellaneous Activity Release Mechanism	Activity released from cavity to containment atmosphere is confined directly above the cavity water level. It is picked up by the fan coolers and sent out through the containment purge.		

SUMMARY SHEET 1J
ROD EJECTION ACCIDENT

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1. Total Release to Containment Free Volume (Ci)			
a. Xe-133	2.01×10^5	1.52×10^5	
b. Other Noble Gases	6.82×10^4	6.22×10^4	
c. I-131	7.32×10^3	7.28×10^3	
d. Other Iodine	1.11×10^4	1.09×10^4	
e. Effective Age of Mixture (hrs)	40	40	
f. Release Assumption	Coolant activity (1% defects) plus 10% of core gap activity times a liquid release fraction of either 0.1 (for I) or 1.0 (for N.G.)	Coolant activity (0.2% defects) plus 10% of core gap activity times a liquid release fraction of either 0.1 (for I) or 1.0 (for N.G.)	
2. Containment Spray Effectiveness			
a. Removal half-life (hrs)	0.022	0.0075	
b. Number of operable spray pumps	1	2	
3. Containment Leak Rate (%/day)	0.1	0.05	
4. $(\chi/\dot{Q})$CL (sec/m^3)			
a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
b. 10000m (6 mi LPZ)	2.20×10^{-5}	2.20×10^{-6}	

SUMMARY SHEET 1J (Continued)
ROD EJECTION ACCIDENT

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
5. Total Release to Environs, 1st 2 Hours (Ci)			
a. Xe-133	11.2	5.6	
b. Other Noble Gases	4.1	2.0	
c. I-131	0.0098	0.002	
d. Other Iodine	0.015	0.002	
e. Effective Age of Mixture (hrs)	40	40	
f. Release Mechanism	Containment Leakage	Containment Leakage	
6. Whole Body Dose Results			
a. Total 800m dose for 1st two hours (mR)	0.73	0.04	
b. Total 1000m dose for 30 Days (mR)	0.13	0.006	
7. Thyroid Dose Results			
a. Total 800m dose for 1st two hours (mR)	3.3	0.04	
b. Total 10000m dose for 30 days (mR)	0.14	0.002	
8. Accident Classification	Alert	Alert	
9. Miscellaneous			
a. Containment free volume (cc)	7.36×10^{10}		
b. RCS Coolant Mass (gm)	2.4×10^{8}		

SUMMARY SHEET 1K
GAS DECAY TANK RUPTURE

	PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1.	Total Release to Environs, 1st Two Hours (Ci)			
	a. Xe-133	65,400	16,300	
	b. Other Noble Gases	7,300	2,140	
2.	$(\chi/\dot{Q})$CL (sec/m^3)			
	a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
	b. 10000m (6 mi LPZ)	2.20×10^{-5}	2.20×10^{-6}	
3.	Whole Body Dose Results			
	a. Total 800m dose for 1st two hours (mR)	2,010	44	
	b. Total 10000m dose for 30 days (mR)	84	2	
4.	Accident Classification	Site Emergency	Alert	
5.	Miscellaneous			
	a. Tank Volume (cc)	2.18×10^{-7}		
	b. Tank Press	100 psi		
	c. Volume Released (cc)	1.48×10^{8}cc		

SUMMARY SHEET 1L
LIQUID HOLDUP TANK RUPTURE

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1. Activity in Holdup Tank (Ci)			
a. Xe-133	51,000	10,200	
b. Other Noble Gases	4,710	930	
c. I-131	492	98.3	
d. Other Iodines	1,086	217	
e. Effective Age of Mixture (hrs)	60	60	
2. Cleanup Parameters			
a. Liquid Release Fraction for Iodines from Tank to Auxiliary Building Atmosphere	10^{-4}	10^{-4}	
b. Charcoal Filter Cleanup Factor	0.1	0.01	
c. Release Duration (hrs)	2	2	
3. Activity Release to Environs, 1st Two Hours (Ci)			
a. Xe-133	51,000	10,200	
b. Other Noble Gases	4,710	930	
c. I-131	0.00492	0.0098	
d. Other Iodines	0.01086	0.00217	
4. $(\chi/\dot{Q})$CL (sec/m^3)			
a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
b. 10000m (6 mi LPZ)	2.20×10^{-5}	2.20×10^{-6}	

SUMMARY SHEET 1L (Continued)
LIQUID HOLDUP TANK RUPTURE

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
5. Whole Body Dose Results			
a. Total 800m dose for 1st two hours (mR)	1,440	37	
b. Total 10000m dose for 30 days (mR)	60	1.6	
6. Thyroid Dose Results			
a. Total 800m dose for 1st two hours (mR)	1.93	0.003	
b. Total 10000m dose for 30 days (mR)	0.08	0.0001	
7. Accident Classification	Site Emergency	Alert	
8. Miscellaneous			
a. Tank Volume (cc)		3.03×10^8	

SUMMARY SHEET 1M
VOLUME CONTROL TANK RUPTURE

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
1. Activity in VCT (Ci)			
a. Xe-133	3,330	828	
b. Other Noble Gases	198	42	
c. I-131	12.1	3.0	
d. Other Iodines	35	8.7	
e. Effective Age of Mixture (hrs)	60	60	
2. Cleanup Parameters			
a. Liquid Release Fraction for Iodines from Tank to Auxiliary Building Atmosphere	10^{-4}	10^{-4}	
b. Charcoal Filter Cleanup Factor	0.1	0.01	
c. Release Duration (hrs)	2	2	
3. Activity Release to Environs, 1st Two Hours (Ci)			
a. Xe-133	3,330	828	
b. Other Noble Gases	198	42	
c. I-131	0.00012	0.000003	
d. Other Iodines	0.00035	0.00009	
4. $(\chi/\dot{Q})$CL (sec/m^3)			
a. 800m (site boundary)	5.29×10^{-4}	5.29×10^{-5}	
b. 10000m (6 mi LPZ)	2.20×10^{-5}	2.20×10^{-6}	

SUMMARY SHEET 1M (Continued)
VOLUME CONTROL TANK RUPTURE

PARAMETER	FSAR DBA	FSAR EXPECTED	ACTUAL
5. Whole Body Dose Results			
a. Total 800m dose for 1st two hours (mR)	465	9.3	
b. Total 10000m dose for 30 days (mR)	19	0.4	
6. Thyroid Dose Results			
a. Total 800m dose for 1st two hours (mR)	0.03	0.00004	
b. Total 10000m dose for 30 days (mR)	0.001	0.000001	
7. Accident Classification	Site Emergency	Alert	
8. Miscellaneous			
a. Tank Volume (cc)	1.1×10^7		

APPENDIX 7

SUMMARY OF FIELD MONITORING FORMULAE THAT ARE USEFUL IN CLASSIFYING ACCIDENTS

1. Relationship Between Whole Body Dose Rate and Noble Gas Release Rate

   If a whole body dose rate measurement is taken in the environment, it can be related to the release rate using the equation:

   $$DR_{WB,L} = 9 \times 10^5 \times \bar{E}_\gamma \times \dot{Q}\,NG \times (X/\dot{Q})_L$$

   Where: $DR_{WB,L}$ = Whole body dose rate at location L (mR/hr.)

   $\bar{E}_\gamma$ = average gamma energy (mev) (default value - 0.1 mev)

   $\dot{Q}_{NG}$ = noble gas release rate (Ci/sec)

   $(X/\dot{Q})_L$ = dilution factor at downwind location L

   NOTE: This equation can also be used to calculate downwind dose rate if the release rate is know.

2. Relationship Between Thyroid Dose Rate and Iodine Concentration

   Assuming all iodine is I-131:

   $$DR_{THY,L} = 1.85 \times 10^6 \left[X_{131}\right]_L$$

   Where: $DR_{THY,L}$ = Thyroid dose rate at location L (Rem/hr).

   $\left[X_{131}\right]_L$ = I-131 Concentration at location L ($\mu Ci/cc$ or Ci/m^3)

3. Relationship Between Thyroid Dose Rate and Iodine Release Rate

   Assuming all iodine is I-131:

   $$DR_{THY,L} = (1.85 \times 10^6)\ (\dot{Q}_I)\ (X/\dot{Q})_L$$

   Where: $DR_{THY,L}$ = Thyroid dose rate at location L (Rem/hr).

   $\dot{Q}_I$ = iodine release rate (Ci/sec)

   $(X/\dot{Q})_L$ = dilution factor at location L (sec/m^3)

APPENDIX 7 (Continued)

4. Extrapolation of Dose Rates, Doses or Concentrations to Other Locations

If a dose or dose rate value is available at one location in the environment, it may be extrpolated to another location if the respective $(X/\dot{Q})$ values are know.

$$(DR)_A = \frac{(X/\dot{Q})_A \, (DR)_B}{(X/\dot{Q})_B}$$

or

$$(D)_A = \frac{(X/\dot{Q})_A \, (D)B}{(X/\dot{Q})_B}$$

or $$X_A = \frac{(X/\dot{Q})_A \, X_B}{(X/\dot{Q})_B}$$

Where:

DR = dose rate (μR/hr, mR/hr, R/hr)

D = dose (μR, mR, R)

X = concentration (μCi/cc or Ci/m^3)

A,B = locations A and B

Pacific Gas and Electric Company
Department of Nuclear Plant Operations
Diablo Canyon Power Plant Unit Nos. 1 and 2

Part A: Radiological Emergency Status Form

Provide as much information as is available at the time of notification or update. That indicated by a * should be given for initial notification at a minimum.

Date: ___/___/___ Time: ___a.m. ___p.m. Person Authorizing Report: _____ (DCPP only)

1. Notification Type: ☐ Initial ☐ Update

2. *Emergency Classification: ☐ Unusual Event ☐ Alert ☐ Site Area Emergency ☐ General Emergency

3. *Description of Incident: Date ___/___/___ Time Incident Began: ___a.m. ___p.m.

   a. Site Emergency Signal Sounded: ☐ Yes ☐ No

   b. What Happened: _____

4. Radiological Release Information:

   a. Time Data Collected: ___a.m. ___p.m.

   b. *Release: ☐ Occurring ☐ Anticipated--When: ___a.m. ___p.m.

5. *Location of Release: ☐ Plant vent ☐ Steam ☐ Surface ☐ Liquid Discharge

6. *Estimated Duration of Release: _____ Hours

Form and Quantities of Release Materials:

7. *Release Monitored: ☐ Yes ☐ No Describe: _____

8. *Physical Form: ☐ Liquid ☐ Gas ☐ Particulate

9. *Iodine: ☐ Quantity ☐ Release Rate_____Ci(Ci/sec)

10. *Particulates: ☐ Quantity ☐ Release Rate_____Ci(Ci/sec)

11. *Noble Gases: ☐ Quantity ☐ Release Rate_____Ci(Ci/sec)

12. Estimate of Surface Contamination: _____dpm/100cm^2 Where: _____

13. Unusual Radiation Levels in Plant: Where: _____mR/hr: _____

14. *Meteorological Date (Use 10m elevation on primary met tower or_____)

15. *Wind Velocity: _____m/secx2.2_____ = mph Direction (from): _____deg

16. *Weather Conditions: ☐ Rain ☐ Clear ☐ Fog ☐ Cloudy

Stability: Class:_____ Sigma A (deg):_____ ΔT:_____ ^{o}C/m (10 m to 76m)

18.

Center Line Dose Projections	Plume Arrival Time	Dose Rate	Integrated Dose	Affected Sectors
Site Boundary				
2 Miles				
5 Miles				
10 Miles				

19. *Recommended Emergency Actions/Protective Measures (who is to do what -- provide standard message to county/states using EP G-3): _____

20. Emergency Response Actions Underway by PGandE:_____

21. *Prognosis for Escalation or Termination of Accident:_____

Data Transmitted By:_____

This Data Sheet Filled Out By:_____

Date:___/___/___ Time:_____a.m. _____p.m.

cc DJBaxter/Public Information Recovery Manager
WHFujimoto/Engineering & Logistics Recovery Manager
WBKaefer/Advisor to the County Emergency Organization
RFLocke/Corporate Law Department Coordinator
SMSkidmore/DPSerpa/Radiological Emergency Recovery Manager
JDTownsend/Operations and Analytical Recovery Manager
EOF Status File
EOF Emergency Status Board
UDAC
JDShiffer/Recovery Manager

Pacific Gas and Electric Company
Department of Nuclear Plant Operations
Diablo Canyon Power Plant Unit Nos. 1 and 2

Part A: Miscellaneous Emergency Information Form

Provide as much information as is available at the time of notification of update.

Date:___/___/___ Time:___a.m. ___p.m. Person Authorizing Report:_____ (DCPP only)

1. Notification Type: ☐ Initial ☐ Update Time Data Collected: ___a.m. ___p.m.

2. Personnel Injuries: How Many? _____

   a. Type:_____ _____ Contamination: ☐ Yes ☐ No

   b. Injured Person Location: ☐ Plant ☐ Ambulance ☐ Hospital

3. Fires:

   a. Location:_____ Time Reported:___a.m. ___p.m.

   b. Type: ☐ Electrical ☐ Fuel_____

   c. Contamination Present: ☐ Yes ☐ No

   d. Fire Assistance Requested: ☐ Yes ☐ No

   e. Fire Assistance Onsite: ☐ Yes ☐ No

4. Security/Safeguards:

   a. Bomb Threat: Search Conducted: ☐ Yes ☐ No

      Search Results:_____

      Site Evacuated: ☐ Yes ☐ No

   b. Intrusion: Insider:_____ Outsider:_____

      Point of Intrusion:_____ Extent of Intrusion:_____

      Apparent Purpose:_____

   c. Strike/Demonstrations: Size of Group:_____

      Purpose:_____

   d. Sabotage: Radiological: ☐ Yes ☐ No Arson: ☐ Yes ☐ No

      Equipment/Property:_____

   e. Extortion: Source (phone, letter, etc.):_____

      Location of Letter:_____

      Demands:_____

f. General: Firearms Involved: ☐ Yes ☐ No Violence: ☐ Yes ☐ No

Control of Facility Compromised or Threatened: ☐ Yes ☐ No

Stolen/Missing Material: _____

Agencies Notified (FBI, State Police, Local Police, etc.): _____

_____

5. Press Information:

Location of Press Release: ☐ San Francisco ☐ San Luis Obispo ☐ Other: _____

Time of Press Release: ____a.m. ____p.m.

News Media Interest: ☐ Yes ☐ No Local/National: _____

Data Transmitted By: _____

This Data Sheet Filled Out By: _____

Date: ___/___/___ Time: _____a.m. _____p.m.

DJBaxter/Public Information Recovery Manager
WHFujimoto/Engineering & Logistics Recovery Manager
WBKaefer/Advisor to the County Emergency Organization
RFLocke/Corporate Law Department Coordinator
SMSkidmore/DPSerpa/Radiological Emergency Recovery Manager
JDTownsend/Operations and Analytical Recovery Manager
EOF Status File
EOF Emergency Status Board
UDAC
JDShiffer/Recovery Manager

18-9221 7/80 (100)

DEPARTMENT OF NUCLEAR PLANT OPERATIONS
DIABLO CANYON POWER PLANT

EMERGENCY NOTIFICATION RECORD

EMERGENCY IDENTIFICATION _____ DATE _____ SHEET _____

PERSON CALLED	AFFILIATION	TIME	REACHED	BY	MESSAGE GIVEN	RESPONSE