CURRENT

EMERGENCY PLAN

IMPLEMENTING PROCEDURES

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02/08/84

PG&E Pacific Gas and Electric Company	NUMBER EP G-4
	REVISION 3
DEPARTMENT OF NUCLEAR PLANT OPERATIONS	DATE 12/30/83
DIABLO CANYON POWER PLANT UNIT NO(S) 1 AND 2	PAGE 1 OF 14

TITLE EMERGENCY PROCEDURE
PERSONNEL ACCOUNTABILITY AND ASSEMBLY

APPROVED: R. C. Thornberry (PLANT MANAGER) 1-23-84 (DATE)

SCOPE

This procedure describes the immediate emergency personnel assembly and accountability actions to be taken by all on-site personnel, security officers, contractors, and visitors in the event of a Unit 1 plant emergency while Unit 1 is operational and Unit 2 is still in the construction stage. This procedure and changes thereto require PSRC review.

GENERAL

In the event of an emergency situation at Unit 1, it is imperative that all personnel on-site are notified of the situation, their whereabouts identified for safety and security purposes, and that they respond in a coordinated effort to the emergency.

In certain situations, (e.g., if the emergency is security related), personnel may be directed to respond in a manner other than what is stated in this procedure. In most situations, the primary notification means is the emergency signal which alerts all personnel in the vicinity of the main plant building that an emergency exists.

1. The signal is produced by electronic warblers placed at numerous locations throughout the plant. It has a characteristic sound; a rapid rise in pitch followed by a slower drop. The sound cycle is repeated continuously for as long as the signal remains energized.

2. Flashing red lights have been provided in the containment and other plant areas where the background noise level may not permit audible perception of the electronic warblers.

3. In an emergency situation, the alarm should sound for a minimum of one minute.

Actuation and reset of the signal shall be as follows:

1. Actuation of the plant emergency signal requires specific approval from the Shift Foreman.

2. The signal can be manually actuated from the operator's control console of either unit by manipulating the control switch to the ON position. Actuation can also be performed from the hot shutdown panel of either unit by a control switch similar to the control console switch.

3. The alarm can be reset from the operator's console or the hot shutdown panel by proper operation of the control switch, or from the auxiliary relay panel EACC3 located at the 128 foot elevation on the Unit 1 equipment side.

Each site employee is assigned a designated assembly area (see Figure 1), and each area is assigned a supervisor. The Designated Assembly Area Supervisor (DAAS) notifies the Security Shift Supervisor or General Construction Security who in turn notifies the Security Shift Supervisor, of personnel accountability. The Security Computer roll call is to be used as the primary method of accountability for personnel potentially within the plant area.

Personnel receive instructions on the assembly process as follows:

1. Site area and Unit 2 visitors and common carriers will be logged in and out and provided with instructions at the Avila Gate guard post or plant site guard post, or General Construction Security office.

2. Upon arrival and check-in at the security building, Unit 1 visitors will receive instructions explaining what they are to do and where they are to go in the event of sounding of the Site Emergency Alarm.

INITIATING CONDITIONS

The Shift Foreman declares that the plant is in an Alert, a Site Emergency, or a General Emergency status as defined in Emergency Procedure G-1, "Accident Classification and Emergency Plan Activation," or determines that personnel assembly and accountability is desirable, and activates the emergency signal.

IMMEDIATE ACTIONS

1. PGandE plant personnel engaged in critical operations or emergency recovery actions shall call their assigned assembly areas as soon as practical.

2. Plant security personnel shall respond as follows:

   a. Those assigned to the Central Alarm Station, the Secondary Alarm Station, the perimeter posts, and other fixed posts shall remain at their posts and await further instructions.

   b. Those on routine patrol shall continue their patrol unless otherwise instructed by the Security Shift Supervisor.

   c. All other permanent security force personnel shall call in to the Security Building for instructions.

3. Plant personnel with poten 'al immediate emergency response rolls will report to their assigned in-plant assembly area (Control Room, Access Control, Cold Machine Shop [Operations Support Center], Technical Support Center [TSC]). Operations personnel on shift and at the intake should call the shift foreman. All other personnel at the intake should report directly to their assembly areas. Personnel in the radiologically controlled area of the plant will initially assemble at the Radiological Access Control.

4. All other Unit 1 PGandE personnel not involved in critical operations or emergency recovery shall proceed to the Security Building exit and "badge out" and then proceed to their assembly area. Unit 1 personnel on the Unit 2 side will proceed directly to the assembly area. Figure 2 is a diagram of the Temporary Training Building, showing the designated assembly locations in that area.

   NOTE: It is the responsibility of each supervisor to know the [illegible] of his subordinates at any time.

5. All Unit 1 and Unit 2 PGandE General Construction, construction contract personnel and their visitors will evacuate the plant buildings and proceed to their assigned Assembly Areas via their assigned badge alleys. Badges will be deposited on exit from the project.

6. PGandE DER, California Department of Fish and Game personnel and their visitors, will evacuate from the plant buildings and

adjacent work areas and proceed immediately to their assembly area, the PGandE Biology Lab.

NOTE: Portions of the Station Construction Crew, Line Crew DER Biologists, and others working outside the plant security fence, as well as Camp Residents, will report directly to the appropriate assembly areas.

7. Unit 1 NPO escorted visitors will be escorted to the Security Building and instructed to remain here. Accountability will be maintained by checking off those escorted visitors against the visitor sign-in log maintained at the security office. Escorts themselves will then proceed to their own department or company assembly areas.

8. Unit 1 unescorted visitors "(NPO Contractors, NRC inspectors, consultants, Coast Valley Division or General Office Personnel, not permanently assigned to the plant)" will also report to the Security Building.

9. Unit 2 visitors will be escorted to their visitors assembly area and the escorts will then proceed to their own assembly area. Drivers will park their vehicles and proceed on foot to their assigned area.

SUBSEQUENT ACTIONS - UNIT 1 ONLY

1. The Security Shift Supervisor will insure that the "badge out" counter is manned for persons leaving the Unit 1 protected area.

2. The DAAS for each Unit 1 Assembly Area will use the "BADGE-O-MATIC" computer printout, posted on the wall of each Assembly Area to check off the individuals present at the Assembly Area or prepare a list of personnel present by name and badge rack number. When the head-count is complete:

   a) The DAAS for each Assembly Area inside the protected area (Control Room, TSC, Cold Machine Shop, and Radiological Access Control) shall inform the Security Shift Supervisor (normally uses the emergency conference line ext. 1332) of the total head-count and the names of any individuals not accounted for. When the required information has been passed on to the Security Shift Supervisor, the DAAS should send the "BADGE-O-MATIC" printout or list to the Security Shift Supervisor by runner.

<u>NOTE</u>: The DAAS should maintain contact on the conference line at all times for subsequent instructions or to inform the Security Shift Supervisor of late-comers.

b) The DAAS for each assembly area outside the protected area (Temporary Training Building, Security Training Trailer, and the Access Training Trailer) shall inform the Security Shift Supervisor (normally uses the conference line Ext. 1281) of the total head-count and the names of any individuals not accounted for. When the required information has been passed on to the Security Shift Supervisor, the DAAS should send the markedup copy of the "BADGE-O-MATIC" printout or list to the Security Shift Supervisor by runner.

<u>NOTE</u>: The DAAS should maintain contact on the conference line at all times for subsequent instructions or to inform the Security Shift Supervisor of any late-comers.

3. The Security Shift Supevisor can access the conference lines by dialing: Inside Protected Area --
Outside Protected Area --

4. The names of personnel unaccounted for will be determined by the security shift supervisor by comparing the badge racks against the Security Computer Roll Call, or the assembly area reports. The results will be reported to the Emergency Liaison Coordinator as soon as possible.

5. The Security Shift Supervisor shall notify the Emergency Liaison Coordinator in the TSC (or Control Room if in off-normal hours) of the site personnel accountability, complete the "Summary of Personnel Accountability and Assignments" log sheet (Form 69-10060), and forward the completed forms to the Emergency Liaison Coordinator.

6. If there are any unaccounted for personnel, the following actions will be initiated:

a. The Security Shift Supervisor will attempt to identify the last known location of the unaccounted persons from DAAS Reports and the Security Computer Roll Call, and provide this information to the Emergency Liaison Coordinator.

b. The Site Emergency Coordinator will assign appropriate personnel to perform a plant search. If the situation dictates, the Emergency Radiological Advisor will provide a member of the Chemical and Radiation Protection Department for assistance.

c. The person leading the plant search shall contact the Emergency Liaison Coordinator when contact has been made with the unaccounted for personnel.

7. After persons assigned to other assembly areas have assembled at the Radiological Access Control, have been accounted for, and have been processed through the Contamination Control Point, the DAAS will contact the Emergency Liaison Coordinator and inform him of such. Persons assembled at Access Control will then leave the protected area via the Security Building and proceed to their designated assembly areas.

8. The Site Emergency Coordinator will order any necessary relocations or evacuations of assembly areas as appropriate. The DAAS of each area may relocate personnel if deemed necessary for personnel safety.

9. Personnel required for immediate emergency response will be dispatched from the Operations Support Center (access control and cold machine shop assembly areas). Other personnel assembled may be relocated, on order of the Site Emergency Coordinator, to the Security Building Operational Support Center to await job assignment.

10. Personnel will be granted access to the plant only on the authorization of the Site Emergency Coordinator.

11. Recordkeeping

All records generated by the utlization of this procedure for an exercise or emergency shall be forwarded the next working day to the Assistant Plant Manager/Support Services for review and retention.

1) Records generated from exercises will be categorized as non permanent and retained for a minimum of five years.

2) Records generated from actual emergency events will be categorzied as lifetime and placed into lifetime storage in accordance with procedure "Requirements for Retention and Extended Storage of Operation Phase Activity Records (AP E-1S1)."

SUBSEQUENT ACTIONS - UNIT 2 ONLY

1. Personnel accountability measures must be implemented and are the responsibility of the project superintendent.

   NOTE: It is the responsibility of each supervisor to know the general location of his subordinates at any time.

2. The General Construction Security Department will check off visitors in assembly area D against the visitor sign-in log. A list of personnel within the Unit 2 security fence who did not badge out of the project will be provided the appropriate assembly area supervisor(s). The supervisor will identify the head count and personnel not accounted for by name and last known location.

3. The Project Superintendent or his alternate will appoint a General Construction staff member to contact each group to identify the head count and personnel not accounted for by name and last known work location. The results will be reported to the Project Superintendent or his alternate. This staff member may act as coordinator for the visitors and contractors in assembly areas A, B, and D in the event a security officer is not available. Assistance in this function may be requested from the Site Emergency Coordinator by contacting the Security Shift Supervisor who will relay the request.

4. The status of personnel accountability will be forwarded to the Plant Security Shift Supervisor for relay to the Emergency Liaison Coordinator.

5. If there are any unaccounted for personnel, the following actions will be initiated:

   a. If the person is believed to be outside the plant security fence, the Project Superintendent or his alternate will instruct a security officer to accompany the unaccounted for person's supervisor or designated alternate in a search.

b. If the person is believed to be within the plant security fence, the Site Emergency Coordinator shall assign appropriate personnel to perform a plant search. If the situation dictates, the Emergency Radiological Advisor will provide a member of the Chemical and Radiation Protection Department for assistance.

c. The person leading the search will contact the Project Superintendent or Emergency Liaison Coordinator when contact has been made with the unaccounted for personnel.

6. The Site Emergency Coordinator shall direct the Project Superintendent or his alternate to notify the respective assembled personnel to return to normal activities, remain at their location, move to another on-site location, or evacuate. The DAAS of each area may relocate personnel if deemed necessary for personnel safety.

UNIT 1 ASSEMBLY AREAS

The first available person listed in each group below is designated as the primary DAAS to be responsible for the accountability of personnel at each assembly area. Using the conference lines, (dial 1332, 1281, or normal number 3330) or runner, he shall inform the Security Shift Supervisor of the status of his areas as soon as practicable.

1. Control Room [(Phone)]

   a. Shift Foreman--interim Site Emergency Coordinator
   b. Plant Superintendent
   c. Operators, Control Technicians, Clerk, and others on shift
   d. Resident NRC Inspector (one designated inspector)

2. Technical Support Center [(Phone

   a. Training Manager (Emergency Liaison Coordinator)
   b. Operator Training Instructors (Emergency Liaison Assistants)
   c. Plant Manager--long-term Site Emergency Coordinator
   d. Support Services Manager
   e. Technical Services Manager (Emergency Evaluations and Recovery Coordinator)
   f. Operations Manager (Emergency Operations Advisor)

g. Senior Power Production Engineer (Nuclear)--3
h. Senior Power Production Engineer (Operations)
i. Relief Shift Supervisor
j. Resident NRC Inspector (one designated inspector) and any visiting NRC inspectors
k. QC Supervisor
l. Maintenance Manager (Emergency Maintenance Coordinator)
m. Chemistry and Radiation Protection Manager (Emergency Radiological Advisor)
n. Senior Instrument and Controls Supervisor
o. Communication Technicians--4
p. On-site Safety Review Group Senior Nuclear Engineer
q. G.C. Resident Startup Engineer or his on-shift representative
r. Division of Engineering Research Dosimetry Staff (will report to DAAS by phone from the TSC Lab
s. Chemistry & Radiation Protection Systems Analysts (TSC EARS Operators)

3. Cold Machine Shop (Phone

   a. Fire Marshal
   b. Assistant Fire Captains--2
   c. Maintenance Fire Brigades

4. Access Control (Phone

   a. Senior Chemistry and Radiation Protection Engineer
   b. Chemistry and Radiation Protection Engineers
   c. C&RP Foreman
   d. Chemistry and Radiation Protection Technicians [illegible]

5. Security Building (Phone

   a. Security Shift Supervisor
   b. Security Supervisor
   c. All shift security personnel not on patrol or training status
   d. All nonessential General Office Personnel onsite
   e. All nonessential Coast Valleys Division Personnel onsite
   f. All Unit I Visitors
   g. All Westinghouse and Bechtel Personnel no otherwise assigned

6. Temporary Training Building [(Phone]

The most senior person in each area of the Temporary Training Building shall perform accountability of their area and report results to the DAAS for the Operator Training Office Area for reporting to the Security Shift Supervisor.

a. Operator Training Office Area

1) General Foreman (Mechanical)
2) General Foreman (Electrical)
3) Electrical Maintenance Foreman
4) Training Shift Foreman
5) All other Electrical Maintenance or Operations personnel not designated in areas 1-5 above.

b. West Classroom

1) Maintenance Foreman (Mechanical)
2) All other mechanical maintenance personnel not designated in areas 1-5 above

c. East Classroom

1) I&C Supervisor
2) I&C Foreman
3) All other I&C personnel not designated in areas 1-5 above.

7. Access Training Trailer [(Phone

a. Office Supervisor
b. Assistant Office Supervisor
c. [illegible]
d. Budget Analyst
e. Employee Counselor
f. Personnel and General Services Supervisor
g. All clerical personnel and janitors

8. Security Training Trailer [(Phone]

a. Security Training Supervisor
b. Senior Power Production Engineer (Training)
c. Senior Power Production Engineer (Outage Planning)
d. QA Supervisor and QA Personnel
e. QC Supervisor and QC Personnel
f. ISI Senior Engineer and ISI Personnel
g. All other Technical Personnel not designated in areas 1-6 above

9. Biology Lab (Phone

   a. DER Nuclear Section Supervisor
   b. Biology Lab Staff, Consultants and Visitors.

NOTE: In off normal working hours, the most senior supervisor present will assume the functions of the DAAS.

UNIT 2 PGandE GENERAL CONSTRUCTION AND CONTRACTORS ASSEMBLY AREAS

All Unit 2 construction personnel shall be accounted for by controlling the individual's project I.D. photo badge. Enroute route to their assembly areas, each employee shall deposit their I.D. badge at the proper alley of entry. Each contractor will assign a staff member to report to the badge alley to assist in accounting for their personnel and for resolving any discrepancies. Figure 2 shows the assembly area locations for Unit 2 construction personnel. The assembly area supervisor will be the Senior Representative of each group on site.

Group	Area
Plant Thorpe	A-1
Pullman Power Products	A-2
H.P. Foley and their subcontractors	B
PGandE General Construction	
Engineering Services	C1
Quality Control Group	C1
Mechanical Group	C2
Start-Up Group	C2
[illegible]	
Electrical Group	[illegible]
Civil Group	C3
Administration Group	C4
Station Construction Crew	E
Line Dept./Paint Crews	E
Cal-Poly Foundation	C1
Kaiser/Lockheed/EcoMar/Terra	C1
Telos	C1
Waltek	C2
Bechtel	C2
Thermon	C3
Towill Inc./Ames & Assoc.	C3
Visitors and other personnel not listed above	D

MISCELLANEOUS

If an emergency occurs during the evening or on a weekend or holiday, the same areas used during working hours shall be utilized. However, personnel who are off-site at the time of the emergency and are notified to report to the site to assist in recovery operations should be instructed as to where they should report when notified. If no instructions are given, personnel reporting to the site shall proceed immediately to the Operational Support Center (Security Building Lunch Room).

ATTACHMENTS

1. Form No. 69-10059, Individual Accountability Sheet
2. Form No. 69-10060, Summary of Personnel Accountability and Assignments.
3. DCPP General Construction Personnel Accountability

FIGURES

1. Units 1 & 2 Assembly Area Locations.
2. Assembly Areas -- Temporary Training Building.

SUPPORTING PROCEDURES

G-1, "Accident Classification and Emergency Plan Activation"

G-5, "Evacuation of Non-essential Site Personnel"

FIGURE 1
UNITS 1 & 2 ASSEMBLY AREA LOCATIONS
(OUTSIDE PROTECTED AREA)

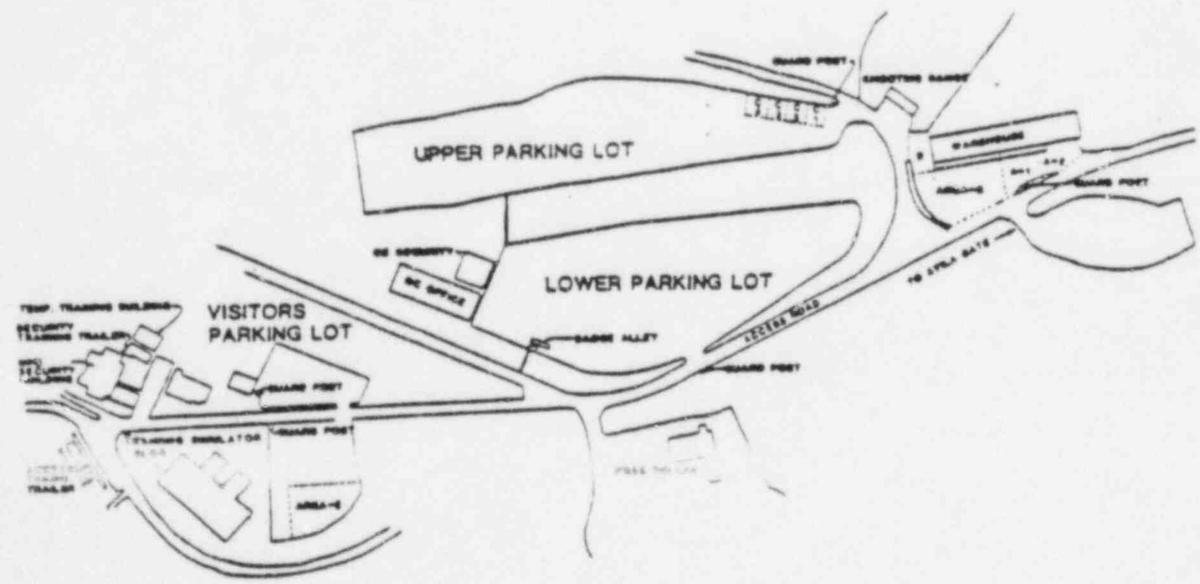
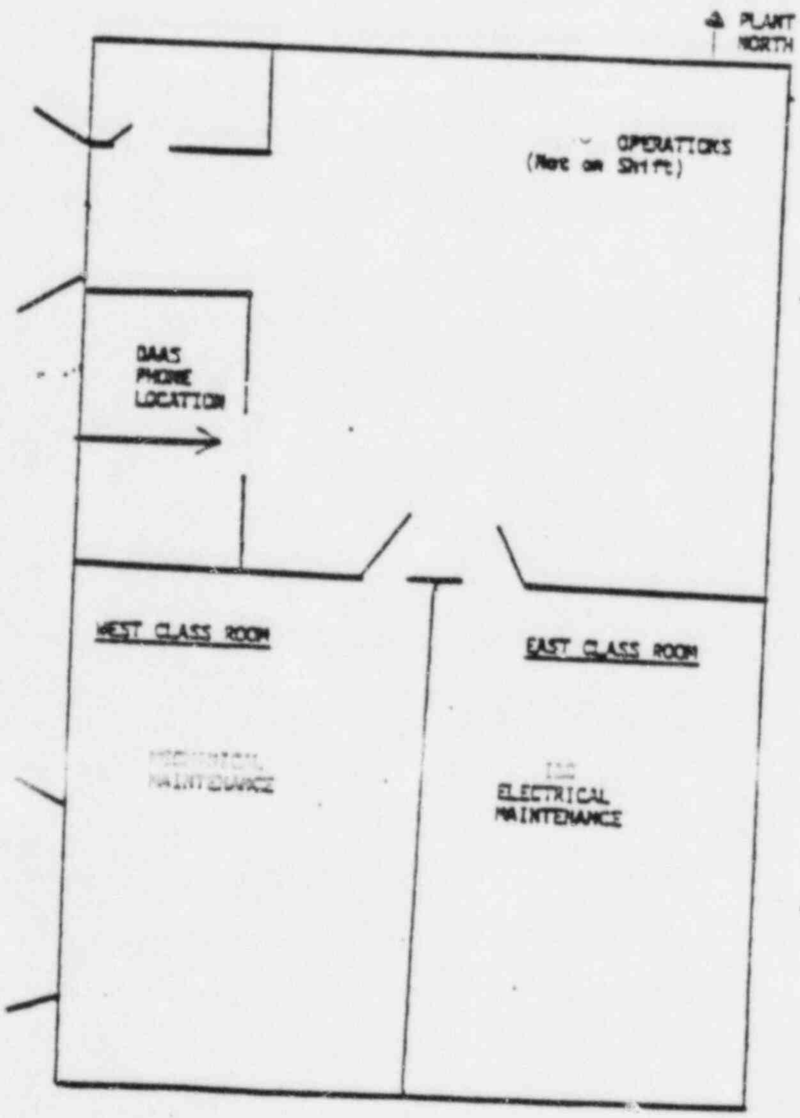


FIGURE 2
ASSEMBLY AREAS TEMPORARY TRAINING BUILDING



PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF NUCLEAR PLANT OPERATIONS
DIABLO CANYON POWER PLANT UNIT NOS. 1 AND 2

INDIVIDUAL ACCOUNTABILITY SHEET

DATE ____________________

AREA ACCOUNTABILITY SUPERVISOR ____________________

NAME	BADGE RACK #	REMARKS (NOTE ANY INJURIES)

DEPARTMENT OF NUCLEAR PLANT OPERATIONS
DIABLO CANYON POWER PLANT UNIT NOS. 1 AND 2

SUMMARY OF PERSONNEL ACCOUNTABILITY AND ASSIGNMENTS

BY ____________ DATE ____________

INITIAL PERSONNEL ACCOUNTABILITY

CONTROL ROOM
In Charge ________ Report In At ________ Hours
No. Of People ________ Accounted For [ ] Yes [ ] No
Missing ________
Injured ________
Remarks ________

TECHNICAL SUPPORT CENTER
In Charge ________ Report In At ________ Hours
No. Of People ________ Accounted For [ ] Yes [ ] No
Missing ________
Injured ________
Remarks ________

COLD MACHINE SHOP
In Charge ________ Report In At ________ Hours
No. Of People ________ Accounted For [ ] Yes [ ] No
Missing ________
Injured ________
Remarks ________

ACCESS
In Charge ________ Report In At ________ Hours
No. Of People ________ Accounted For [ ] Yes [ ] No
Missing ________
Injured ________
Remarks ________

SECURITY TRAINING TRAILER
In Charge ________ Report In At ________ Hours
No. Of People ________ Accounted For [ ] Yes [ ] No
Missing ________
Injured ________
Remarks ________

DEPARTMENT OF NUCLEAR PLANT OPERATIONS
DIABLO CANYON POWER PLANT UNIT NOS. 1 AND 2

SUMMARY OF PERSONNEL ACCOUNTABILITY AND ASSIGNMENTS

BY ______________ DATE ______________

INITIAL PERSONNEL ACCOUNTABILITY

ACCESS TRAINING TRAILER	In Charge ______ Report In At ______ Hours No. Of People ______ Accounted For [ ] Yes [ ] No Missing ______ Injured ______ Remarks ______
SECURITY BUILDING	In Charge ______ Report In At ______ Hours No. Of People ______ Accounted For [ ] Yes [ ] No Missing ______ Injured ______ Remarks ______
TEMPORARY TRAINING BUILDING	In Charge ______ Report In At ______ Hours No. Of People ______ Accounted For [ ] Yes [ ] No Missing ______ Injured ______ Remarks ______
GENERAL CONSTRUCTION	In Charge ______ Report In At ______ Hours No. Of People ______ Accounted For [ ] Yes [ ] No Missing ______ Injured ______ Remarks ______
VISITORS & CONTRACTORS (AREAS A,B,D)	In Charge ______ Report In At ______ Hours No. Of People ______ Accounted For [ ] Yes [ ] No Missing ______ Injured ______ Remarks ______

DEPARTMENT OF NUCLEAR PLANT OPERATIONS
DIABLO CANYON POWER PLANT UNIT NOS. 1 AND 2

SUMMARY OF PERSONNEL ACCOUNTABILITY AND ASSIGNMENTS

BY ____________ DATE ____________

INITIAL PERSONNEL ACCOUNTABILITY

GENERAL CONSTRUCTION (AREA E)
[redacted]

In Charge ________ Report In At ________ Hours
No. Of People ________ Accounted For [ ] Yes [ ] No
Missing ________
Injured ________
Remarks ________

BIOLOGY LAB
[redacted]

In Charge ________ Report In At ________ Hours
No. Of People ________ Accounted for [ ] Yes [ ] No
Missing ________
Injured ________
Remarks ________

PACIFIC GAS AND ELECTRIC COMPANY
STATION CONSTRUCTION DEPARTMENT
DIABLO CANYON PROJECT

UNITS 1 & 2

PERSONNEL ACCOUNTABILITY AND SITE EVACUATION

SCOPE

This procedure describes the plant Emergency Signal and the immediate actions to be taken by General Construction and contractor personnel and their visitors in the event of a plant emergency designated by sounding of the emergency signal.

1. EMERGENCY SIGNAL

A. Identification

1) The signal is produced by electronic warblers placed at numerous locations throughout the plant. It has a characteristic sound which is a rapid rise in pitch followed by a slower drop. The sound cycle is repeated continuously for as long as the signal remains energized.

2) Flashing red lights have been provided in the containment since the background noise level would not permit audible perception of the electronic warblers.

3) Under an emergency situation the alarm should sound for a minimum of one minute.

B. Testing

The emergency signal will be actuated for test purposes every Friday at 12:10 p.m. for a period of approximately ten (10) seconds.

2. RESPONSIBILITIES

A. The General Construction Project Superintendent or his designated alternate will have general responsibility and authority over general construction personnel, contractor and subcontractor personnel, representatives, visitors, and guardforce personnel assigned to construction activities. The Project Superintendent or his designated alternate will keep the Site Emergency Coordinator advised as to the status of accountability of all personnel covered under this procedure via the Shift Security Supervisor.

2. RESPONSIBILITIES - Continued

B. Each Contractor is responsible for the accountability of all employees he has working at the site. An accountability program must be implemented by each Contractor to enable the Project Superintendent to know how many construction personnel are on site at any given time, and their general location on the project.

C. Subcontractors will be responsible for implementing their main Contractor's accountability program. Each Subcontractor will be responsible for the accountability of his employees.

3. PROCEDURE

A. P G and E, Contractors and California Department of Fish and Game

P G and E General Construction personnel, Contractor personnel and California Department of Fish and Game personnel will evacuate from the plant buildings and adjacent work areas and proceed immediately to their assigned assembly areas, via their respective assigned badge alleys. Assigned alleys are those entrances where the site photo badge is kept for each category of worker. A listing of all categories of personnel governed by the procedure and maps showing assigned assembly areas and evacuation routes will be found in Appendix A.

ALL UNIT-I CONSTRUCTION PERSONNEL WILL EVACUATE THROUGH THE PLANT SECURITY BUILDING EXCHANGE THEIR UNIT-I BADGES FOR THEIR SITE PHOTO I.D. BADGES AND PROCEED TO THEIR ASSIGNED ASSEMBLY AREA VIA THEIR ASSIGNED BADGE ALLEY.

All personnel will be accounted for by issuance and control of the individual's site photo I.D. badge. In route to their assembly areas each employee will deposit the I.D. badge at the proper alley of entry. Each contractor will assign a staff member to report to the badge alley to assist in the accounting of their personnel and resolution of any discrepancies.

Upon arrival at their assigned assembly areas, all personnel will have further instructions issued depending on the nature of the emergency. Appendix C outlines the methods to be used in accounting for P G and E personnel. Within one hour of the signal sounding, an accurate tally must be available to the Project Superintendent or his designated alternate indicating missing personnel and their last known location on the project.

B. Ecorted Visitors

Escorted visitors will respond to the signal and will proceed along with their escorts to their specified assembly area. Accountability will be maintained by checking off those escorted visitors at the assembly areas against the visitor sign-in-log maintained at the security office. Escorts themselves will proceed to their own department or company assembly areas after escorting their visitors to the visitor assembly area.

C. Unescorted Visitors

Unescorted visitors will also report to their assigned assembly area. Upon arrival and check in at the project, these persons will be provided with a map and written instructions explaining what they are to do and where they are to go in the event of a site evacuation (refer Appendix D). As in the case of escorted visitors, accountability will be maintained by checking off unescorted visitors at the assembly areas against the visitor sign-in-log maintained at the security office. Persons with vehicles will leave them where parked and proceed on foot to their designated areas.

D. Common Carriers

Common carriers will be handled in the same manner as unescorted visitors with the exception that they will be logged in and out and provided with a map and instructions at the plant site guard post as opposed to the security office. Drivers will leave their vehicles and proceed on foot to their designated area.

E. Pinkerton Guards

Construction Force, Pinkerton Guard personnel will remain on their posts with the exception of mobile and building foot patrols and the Sergeant, all of whom will report to the sergeants trailer which will serve as the G.C. guard command post. The security office will immediately, upon the initiation of the signal, contact the Shift Security Supervisor and relay to him the specific location of the guards remaining on post to determine the necessity of immediate evacuation of these posts. Guards on posts to be included in the evacuation will be notified by radio and ordered to respond to the sergeants trailer for reassignment. Parking lot guards remaining on post will attempt to limit access to personal vehicles until instructions to the contrary are received. Guards will be instructed to take direction only from the Site Emergency Coordinator, the Project Superintendent or his designated alternate, P G and E Security personnel, and their own chain of command. The guard Captain is responsible for the accountability of all guards assigned to construction acitivities and he will report directly to the Project Superintendent or his designate.

4. ASSEMBLY AREA ACCOUNTABILITY

The Project Superintendent or his designate will appoint P G and E General Construction staff to contact all of the various groups by area to determine whether or not all persons covered by this procedure are accounted for, and if not, their last known location on site. This final tally will be relayed to the Site Emergency Coordinator via Shift Security Supervisor. Appendix E shows the forms to be used for making this tally.

4. <u>ASSEMBLY AREA ACCOUNTABILITY</u> - Continued

This procedure or any portion of it may be altered by the Site Emergency Coordinator if a situation arises in which the following of it could cause injury or death to one or more individuals.

CURRENT

EMERGENCY PLAN

IMPLEMENTING PROCEDURES

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IMPORTANT TO SAFETY

TITLE EMERGENCY PROCEDURE
MID AND HIGH RANGE PLANT VENT RADIATION MONITORS

APPROVED R. C. Thornberry 1-9-84
PLANT MANAGER DATE

IMPORTANT TO ENVIRONMENTAL QUALITY

SCOPE

This procedure describes the Midrange and High Range Plant Vent Monitoring Systems, which may be required to assess radioactive effluents in the event of a severe plant emergency. Included in this procedure is a description of the various system components, their interrelationships, detailed operating instructions for each distinct subsystem and basic guidance regarding interpretations and possible significance of information provided by this monitoring system. This procedure and changes thereto requires PSRC review.

SUMMARY

The Midrange and High Range Plant Vent monitoring systems are designed to reliably quantify radioactivity levels of plant effluents that might considerably exceed the maximum capabilities of the normal plant vent monitoring equipment. Also these systems are designed to withstand severe environmental conditions - such as might be encountered during highly abnormal plant conditions. The locations of sampling and monitoring equipment are specified as well as appropriate considerations of personnel access so that sample acquisition, if appropriate, may be made on a timely basis to assist in determining and assessing radioactivity releases to the environment. A methodology is specified for interpretation of equipment response so as to reduce the possibility of mistaking instrument background response for substantial radioactive material releases from the plant.

A detailed systems description (including system drawings, etc.) is included as Appendix 1 to this procedure. In this appendix a brief introduction is included to describe the normal, mid, and high range plant monitoring systems, and how they augment each other to provide overall system integrity.

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PROCEDURE

A. PREREQUISITES

This procedure is intended for use during emergency or abnormal plant conditions. It is recommended that this procedure (which governs operation of the plant vent midrange and high range monitoring systems) be implemented in the event of any of the conditions listed in Table 1 (see page 6). The decision to implement this procedure rests with the senior Chemistry and Radiation Protection Department supervisor on-site (or designee), after consulting with the Shift Engineer on duty at the time the condition(s) is(are) discovered.

TABLE 1
CONDITIONS FOR ACTIVATION OF
NON-ROUTINE PLANT VENT MONITORING SYSTEMS*

CONDITIONS FOR ACTIVATION OF MIDRANGE PLANT VENT MONITORING SYSTEM

1. RE 28 A or B PLANT VENT MON HI RAD**.
2. RE 24 PLANT VENT MON HI RAD**.
3. RE 14 A or B PLANT VENT MON HI RAD**.
4. Failure or off-scale readings on one or more of the following (entire) channels:

   RE 28, RE 24 or RE 14;

5. Declaration of plant emergency condition: Alert, Site Area Emergency, or General Emergency;
6. At the direction of the plant Shift Foreman; or
7. As required to perform routine checks and/or calibration work on system****.

CONDITIONS FOR ACTIVATION OF HIGH RANGE PLANT VENT MONITORING SYSTEM***

1. RE 32 PLANT VENT MIDRANGE IODINE DET HI RAD**.
2. RE 33 PLANT VENT MIDRANGE NOBLE GAS HI RAD**.
3. In-service (which in use) failure of RE 32 or RE 33;
4. Automatic isolation of RE 32/33 sampling line;
5. At the direction of the plant Shift Foreman; or
6. As required to perform routine checks and/or calibration work on system****.

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* The first four conditions for activation of the midrange system actually present an option for activation of this system. If the assessment of cause identifies a non-release cause and monitoring function can be restored forthwith (in accordance with technical specifications requirements), it may not be necessary to activate the midrange system.

** These conditions are associated with annunciation in the Control Room.

*** Beware that although this system is for grab sampling, its operation is <u>not</u> automatic, but rather requires preselection of sampling times and manual start/stop to prevent collection of excessive levels of radioactive materials (see Appendix 3 for guidance).

**** These conditions are not, of themselves, regarded as bringing the monitoring system into actual use in assessing plant vent releases.

B. SYSTEM OPERATION AND INTERPRETATION

1. Normal System

Operation and interpretation of the normal plant vent monitoring system components (e.g., RE 14 A&B, RE 28 A&B and RE 24) is not within the scope of this procedure. Table 2 summarizes the overall sampling/monitoring capabilities (by effluent type) for the normal plant vent monitoring systems. However, under abnormal or emergency plant conditions, sampling media associated with these systems could prove useful in assessing plant vent effluent and release rate conditions. Personnel access to these sampler/monitor units may then be required; therefore, acquisition of sampling media becomes a consideration of this procedure.

a. Location of Normal Plant Vent Monitoring System Components

RE 14A/B, RE 28A/B and RE 24 are located in the Plant Vent Room of the Fuel Handling Building at the 115' elevation. The locations of these components are illustrated in Figure 1 (page 8).

b. Access to System Monitors and Samplers

The components for the Normal Range and Midrange Plant Vent Systems are located adjacent to one another. Under normal conditions of plant operation, personnel access to these systems and sampling media changeout operations should pose no unusual radiological hazards. In the event of highly elevated or off-scale indications of radioactivity levels (as monitored by these systems), special precautions are warranted for personnel entries to sampler equipment locations and for performing operational and maintenance-related work on these or nearby systems. The required special precautions, if any, will be determined by Chemistry and Radiation Protection (in coordination with the Operations Department) on the basis of known or suspected plant conditions. Section 2.b.2 discusses possible precautions and radiological considerations.

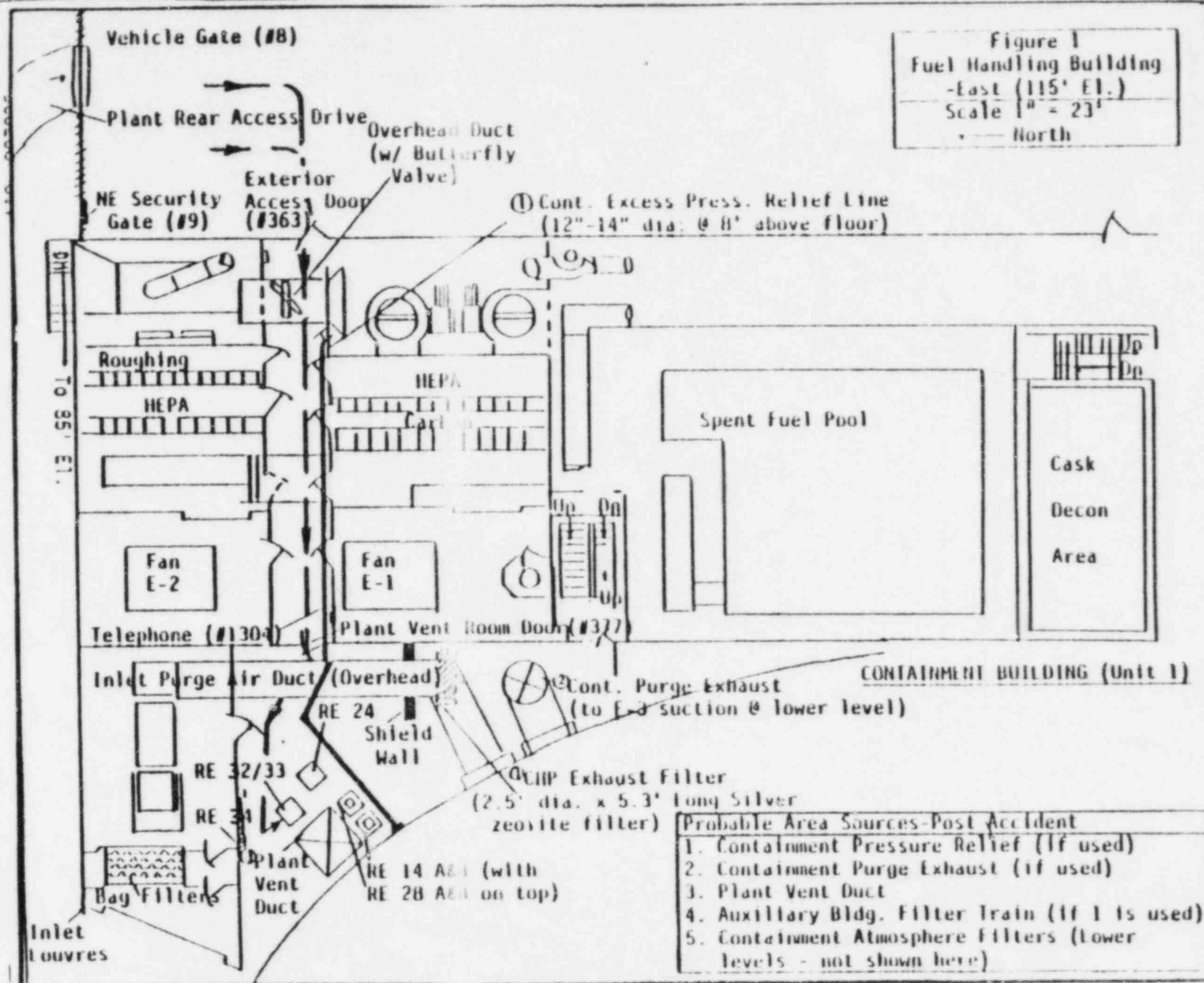


Figure 1
Fuel Handling Building
-East (115' El.)
Scale 1" = 23'
North
Vehicle Gate (#8)
Plant Rear Access Drive
Overhead Duct
(w/ Butterfly
Valve)
Exterior
Access Door
(#363)
NE Security
Gate (#9)
(1) Cont. Excess Press. Relief Line
(12"-14" dia. @ 8' above floor)
To 85' El.
Roughing
HEPA
HEPA
Carbon
Spent Fuel Pool
Cask
Decon
Area
Fan
E-2
Fan
E-1
Up
Dn
Up
Telephone (#1304)
Plant Vent Room Door (#377)
Inlet Purge Air Duct (Overhead)
(2) Cont. Purge Exhaust
(to E-3 suction @ lower level)
CONTAINMENT BUILDING (Unit 1)
RE 24
Shield
Wall
RE 32/33
RE 34
CHP Exhaust Filter
(2.5' dia. x 5.3' long Silver
zeolite filter)
(3) Plant
Vent
Duct
RE 14 A&B (with
RE 28 A&B on top)
Bag Filters
Inlet
Louvres
Probable Area Sources-Post Accident
1. Containment Pressure Relief (if used)
2. Containment Purge Exhaust (if used)
3. Plant Vent Duct
4. Auxiliary Bldg. Filter Train (if 1 is used)
5. Containment Atmosphere Filters (Lower
levels - not shown here)

TABLE 2. PLANT VENT MONITORS: USE ACCORDING TO PLANT STATUS

PLANT STATUS	SYSTEM FEATURE	EFFLUENT TYPE MONITORED OR SAMPLED: NOBLE GASES	RADIOIODINES	PARTICULATES
Normal Operations and Shutdown	Channel Nos.	RE 14 (A & B)	RE 24	RE 28 (A & B)
	Source/Detector Configurations	Fixed Vol./Fixed Det.	Fixed Cart./Fixed Det.	Moving Filter Paper/Fixed Det.
	Useful Range	$1X10^{-7}$ to $1X10^{-4}$ $\frac{\mu Ci}{cc}$	$1X10^{-7}$ to $1X10^{-4}$ $\frac{\mu Ci}{cc}$	$1X10^{-9}$ to $1X10^{-6}$ $\frac{\mu Ci}{cc}$
	System Readout	10 to 10^6 cpm	Est $1X10^{-7}$ to $1X10^0$ µCi/cc (@ Scale Factor - 1000)	10 to 10^6 cpm
	Auxiliary Systems	Remote Mon, Strip Chart, and Alarm	Remote Alarm, Local Readout and Alarm	Remote Mon, Strip Chart, and Alarm
Abnormal Plant Conditions	Channel Nos.	RE 33	RE 32	N/A
	Source/Detector Configurations	Fixed Vol./Fixed Det.	Fixed Cart./Fixed Det.	Grab Sampler Assembly
Mid-Range Systems	Useful Range	$1X10^{-4}$ to $1X10^{1}$ $\frac{\mu Ci}{cc}$	Est $1.3X10^{-7}$ to $.3X10^{-2}$ µCi/cc	Depends on T_{sample} Same as for radioiodines
	System Readout	10 to 10^7 cpm	10 to 10^7 cpm	N/A
	Auxiliary Systems	Remote Mon, Strip Chart and Alarm, ARM (RE 34)	Remote Mon, Strip Chart and Alarm, ARM (RE 34)	None ARM (RE 34)
Hi Range Systems	Channel Nos.	RE 29	RX 40	RX 40
	Source/Detector Configurations	In-line det.	Grab Sampler Assembly	Grab Sampler Assembly
	Useful Range	$1.2X10^{-1}$ to $1.2X10^{5}$ $\frac{\mu Ci}{cc}$ (Xe-133 Equivalent)	Depends on t_{sample}, Est $1X10^{-9}$ to $1X10^{2}$ µCi/cc	Depends on T_{sample} Same as for radioiodine
	System Readout	0.1 to 10^7 mR/hr.	N/A	N/A
	Auxiliary Systems	Remote Mon	ARM (RE 35)	None

2. Midrange System (RE 32, RE 33 and RE 34)

The Midrange Plant Vent Monitoring System consists of a radioiodine sampler/monitor (RE 32), a noble gas monitor (RE 33) and an associated area radiation monitor (RE 34). Also, the system has a particulate grab sampler assembly that may be retrieved for analysis. The overall sampling/monitoring capabilities of this system are summarized in Table 2 for each type of effluent (see page 9).

a. Location of RE 32/33

This system is located in the Plant Vent Room of the Fuel Handling Building at the 115' elevation. The complete monitoring system cabinet assembly is placed adjacent to the Normal Iodine Monitor (RE 24), as shown in Figure 1.

b. Operation of System Components

1) Remote Operations

The Midrange Plant Vent Monitoring System is normally not in operation. In the event one of the routine plant vent monitor channels approaches or exceeds a full-scale reading, the appropriate Midrange Plant Vent Monitor(s) may be activated from the PAM 2 panel in the Control Room. The various channels which comprise this system are RE 32, RE 33 and RE 34. The various remote control elements of this system are as follows:

CONTROL ELEMENT	CHANNEL
Log Ratemeter	RE 32 & 33 (1 each)
Pump & Purge Control	RE 32/33 (common)
Associated ARM Readout	RE 34

The layouts of these control and readout panels are illustrated in Appendix 1 to this procedure.

a) Activation of RE 32/33

When each unit is on and functional, its green "Fail/Reset" pushbutton indicator light should continuously be illuminated. The pushbutton is depressed to clear the unit from an alarm condition.

NOTE: RE 32 should not be allowed to exceed full scale; the sampler should be shut down and new sample medium should be installed if the monitor approaches full scale.

STEPS	REMARKS
1. Turn function switch on both Log Ratemeter panels (RE 32 and RE 33) from "off" to "cal." position. Verify proper indication for each channel after about 15 seconds warm-up.	1. Log Ratemeter panel meter indicator should deflect to "CAL" marker (approx. 6×10^4 cpm-black scale) for each channel. (Note: Alert and High alarm level settings can be checked in this mode by pressing the corresponding alarm light/button.)
2. Turn functional switch from "cal" to "h.v." position (for both channels). Verify proper setting for each channel.	2. Lower scale (red) of panel meters should indicate the following: RE 32 660 volts DC RE 33 1060 volts DC
3. Turn functional switch from "h.v." to "oper." position (for both channels). Note readings. In the event of unusually high readings, refer to 2.b.1)b) "Purging of RE 32 and RE 33 Detector Chambers" (see page 13) for purging the appropriate system as discussed in the accompanying REMARKS. Note results as appropriate.	3. The green indicator light of the Fail/Reset pushbutton should be responding to ambient background (natural sources, detector check source and area sources "through the shield"). Current readings should be compared with recent values to evaluate present operability. Unusually high readings in both channels may be due to residual radioactivity from previous use or high area background levels. Refer to

STEPS	REMARKS
	local ARM (RE 34) response to determine cause. A very high reading in only one channel is unlikely to be caused by elevated background. Purging may reduce (somewhat) the amount of radioactivity present in the detector/sampler chamber.
4. Momentarily depress the "c.s." pushbutton to functionally check the ratemeter (for each channel).	4. Deflection of dial needle upwards (from a nominally low reading) indicates that the detector is functional.
5. Verify that both channel's recorders are operating properly and mark (or set) the time, system background levels, and source check responses on each channel's graph.	5. The readout systems are now in functioning condition. The traveling chart recorder units are located in the PAM 1 panel, each channel being clearly labeled.
6. Turn on the "POWER" switch of the Pump/Purge Control Panel (for RE 32/33).	6. The white (or clear) indicator should light up.
7. Turn the pump switch from "STOP" to "START." Note pump start time and flow rate on each channel's traveling chart. The pumping system flow rate is set at 2.0 scfm, which is not read out in the Control Room.	7. This should light up the red "PUMP ON" indicator and start the pump motor for RE 32 and RE 33. Flow abnormalities (high or low flow alarm conditions) are indicated by the amber "FLOW FAULT" light. The midrange monitoring system is now fully operational. Interpretation of system response is described below in section 2.c.

NOTE: The system is fully operational at this time. It may be necessary to make adjustments to the flow rate of the pumping system if a large change in the plant vent exhaust stream flow causes a departure from isokinetic sampling conditions. These changes should be noted on both the RE

32 and 33 chart recorders, when made. The basis for making flow rate adjustments and limits of departure for isokinetic operation are described fully in Appendix 1, page 65.

b) Purging of RE 32 and RE 33 Detector Chambers

NOTE: Purging will result in a High Flow Fault Alarm.

STEPS	REMARKS
1. Complete steps 6. and 7. of section 2.b.1)a) above or verify that the air pumping system is operating properly.	1. Purging of either detector chamber for RE 32 or RE 33 can be accomplished whether or not their associated detector/ratemeter system is in operation.
2. To purge iodine sampler*, turn "IODINE PURGE" selector switch from "OFF" to "ON" position and allow five minutes for purging.	2. When the channel is in operation, the detector readout may not provide useful data during purge sequences.
3. Upon completion of iodine purge cycle, turn "IODINE PURGE" selector switch from "ON" to "OFF" position.	3. If in operation, the iodine readout will commence or resume (possibly at slightly lower readings) normal operation. Also readings from the gas monitor may momentarily drop immediately after completing an iodine purge cycle.
4. To purge gas sampler*, turn "GAS PURGE" selector switch from "OFF" to "ON" position and allow five minutes for purging.	4. If in operation, the gas monitor readings will indicate near background levels during the purge cycle.

STEPS	REMARKS
5. Upon completion of gas purge cycle, turn "GAS PURGE" selector switch from "ON" to "OFF" position.	5. Readings of the gas monitor will quickly return to normal upon resumption of the normal sampling mode.

*CAUTION: Do not attempt to perform both purges simultaneously. Because valve #4 is open (as required for the iodine purge), sample gas will continue to pass through the sampler, thus limiting the effectiveness of the purge. For additional information, refer to system diagram in Figure 1-3 and purging valve line-up Table 1-4, both in Appendix 1.

c) Activation of Area Radiation Monitor RE 34)

This unit is brought into operation to provide an indication of the radiation exposure rate in the vicinity of the midrange plant vent monitors (RE 32/33) and the plant vent itself at the 115' elevation. When the unit is on and functional, the green "Fail/Reset" indicator should be continuously illuminated. The pushbutton is depressed to clear the unit from an alarm condition.

STEPS	REMARKS
1. Turn range selector switch from "OFF" to "ALL" position and allow about 15 seconds for instrument reading to stabilize after warm-up.	1. Meter readings using top (eight decade) scale corresponds to radiation field of RE 34.
2. Test for continuity among ranges by switching to three decade range (lower scale reading) that corresponds to actual meter reading.	2. Readings on "all" scale and corresponding three decade scales(s) should agree within about ±20%). "ALL" scale readings are the official responses.

STEPS	REMARKS
3. Switch range selector from three decade position to "CS" position.	3. Verify that meter reading is TBS* mR/hr (as read on the eight decade, "all" scale). NOTE: High and alert alarm circuits are disabled during "CS" operation.
4. Switch range selector from "CS" position to desired range for operation.	4. Normally, an on-scale three decade range would be selected. Meter readout corresponds to radiation field of RE 34. Radiation field near RE 32/33 is two (2) times higher.

d) Isolation of RE 32/33

In the event of an alert signal (and computer annunciation) from the gross gamma channel (RE 29), a solenoid valve in the sampling line of this system is energized for closure. The result is that channels RE 32/33 will continue operating but lose their supply of sampled air. The iodine monitor response will immediately level and begin to decay off while the noble gas monitor will rapidly drop to a considerably lower level. The associated pump and purge control panel will show a flow fault condition and should be turned off.

*TBS: To Be Specified.

TBD

2) Local Functions

Operations performed on the midrange plant vent monitoring and sampling equipment itself require personnel access to the Plant Vent Penetration Room (115' El.) via the Fuel Handling Building. When such access is required during a plant emergency, and substantial radioactivity levels may be present in the plant vent, sample lines should be maintained in a thoroughly purged mode while local operations are performed. Assessment of sampling media (e.g., iodine cartridges and particulate filters) retrieved from these systems is discussed below in section 4 of this procedure.

a) <u>Access to Equipment Area</u>

Access from outside the Fuel Handling Building (east side) to the midrange monitors may be made through door #363 via the hallway between Auxiliary Building filter trains at the 115' El. (of the Fuel Handling Building). Figure 1 illustrates the area layout as well as noting potential sources of high radioactivity levels in the area. The following precautions should be taken:

(1) Prior to entry;

(a) Review readings of monitoring equipment in the area, especially ARM RE 34. Dose rates near the RE 32/33 cabinet are approximately two (2) times the reading of RE 34.

<u>NOTE:</u> If the estimated dose rates near RE 32/33 are higher than 25 R/hr, use RX 40 for iodine samples.

(b) If RE 32 shows elevated releases of iodines, calculate the hallway exposure rates by the equation:

$$\dot{D}_H = Dur \times C_I \times 3000 \left(\frac{R\text{-}cc}{hr^2\text{-}\mu Ci}\right)$$

where,

$\dot{D}_H$ = maximum hallway dose rate in R/hr

C_I = concentration of iodines from RE 32, (uCi/cc), (calculated from section 2.c.1)a) "Effluent Concentration and Release Rate Determination" below," page 24)

Dur = Duration of release from Auxiliary Building, (hours)

<u>NOTE</u>: This equation assumes the total release from the plant vent is from the Auxiliary Building, and that the flow from the Auxiliary Building is at its maximum. In addition, it assumes particulates are being released along with the iodine. Hallway dose rates from iodine alone are one-third (1/3) of the combined value. The calculated dose rate has been based on conservative assumptions, thus it should be used only for planning purposes.

(c) Calculate the contact dose rate from the silver zeolite cartridge by the equation:

$$\dot{D}_C = A_I \times 0.4$$

where,

$\dot{D}_C$ = Contact dose rate in mR/hr.

A_I = Total iodine radioactivity (uCi), determined from step 2.c.1)b) "System Limitations", see page 28.

(d) If the calculations in step (c) show a high contact exposure rate, use the oil wrench removal tool (similar to an oil filter removal wrench) and/or tongs (or forceps) to handle the filter and use a shielded "pig" to carry the filter. The extremity dose shall not exceed 75 rem.

(e) Preplan the entry, considering:

- The hallway inside door #363 may be a high radiation area (see step(b) above).
- The area near RE 32/33 may be a high radiation area (see step (a) above).
- The total time needed for filter changeout is about 10 minutes. The total dose to changeout the sampling media and transport cannot exceed 5 rem whole body. Use RX 40 sampling system if the dose calculated above approaches this limit.
- Special equipment may be required, for example: Tongs, wipe rag(s), 160 pound "porta-pig", tape, plastic bags, sampling media, flashlight, pliers, etc. (See steps (c) above and (g) below.)

- Respiratory protection commensurate with the type of release.
- Protective clothing (particularly gloves).
- Portable high range dose rate instrument (preferably a Teletector, or equivalent).

(f) Radiation Protection is responsible for directing Control Room personnel to purge the midrange monitoring system sample chambers, etc., to reduce the potential for airborne radioactivity when systems are opened. Radiation Protection is also responsible for directing Control Room personnel to turn the sample pump off prior to attempting to acquire samples. Purging the pump shutdown should be performed prior to departure to acquire the samples.

g) If the "Sample Net CPM" readings of RE 32 exceeds 10^6 CPM, it is almost certain that the retrieved sample media will require use of the collimation aperture inserts and "handheld" sample pig. The "hand-held" pig is normally kept in the RX HO cabinet and should be obtained on the way back to the TSC after obtaining RE 32 sample media. If RE 32 reading is off scale (over 10^7 CPM), the 160 pound porta-pig should be taken along in case is is required.

(2) During entry to area;

(a) Use protective clothing, equipment and special dosimetry as prescribed by Chemistry and Radiation Protection.

(b) Area entry made by not less than two individuals, one of whom is a one fully qualified member of Chemistry and Radiation Protection.

(c) Make "through the door" dose measurements prior to proceeding into each succeeding room* or area (e.g., hallway, plant vent room) to preclude receiving undue exposures (refer to Figure 1). To perform air sampling in highly contaminated areas, it may prove advantageous to position air sampling probes through opened ventilation pressure relief slide ports installed in the doors of this area, thus minimizing personnel entries into the room(s).

(d) Stand in low dose rate area as much as possible.

(e) Maintain contact (as appropriate) with the Control Room or Technical Support Center during these operations.

b) Initial Actions

STEPS	REMARKS
1. Once in the plant vent penetration room, quickly survey area to determine exposure levels placing emphasis on the equipment cabinet of RE 32/33.	1. The location of RE 32/33 equipment cabinet is depicted in Figure 1. If the general area exposure rates exceed 25 R/hr, or contact exposure rates exceed 450 R/hr, leave the area.
2. Open rear panels of RE 32/33 cabinet and survey sampling lines, sample collection areas, etc.	2. Side towards the near wall is the cabinet rear. (NOTE: Some of the connections may be tight. Changeout tools are kept inside the cabinet to help in this respect.)

STEPS	REMARKS
3. Assure pump motor is off; the photohelic gauge should read zero. If the pump is still on, leave the area and contact Operations and have them purge the lines and shut the pump down.	

c) Changeout of Particulate Filter & Iodine Cartridge

STEPS	REMARKS
1. The particulate filter and iodine cartridge are located in tandem (the particulate filter directly over the iodine cartridge, see Figure 1-4A of Appendix 1, page 75) in the iodine chamber.	
2. Loosen shield plug thumb screws on iodine sampling chamber and slowly slide the shield plug from the port. (The plug weighs about 20 pounds.)	2. May require use of tools to loosen thumb screws. Iodine sampling chamber is accessible from the RE 32/33 cabinet rear and is inside the left-hand shield port near the floor level. (NOTE: Iodine monitor readings displayed in the Control Room will rise considerably if background in plant vent room is relatively high.)
3. Survey the particulate filter and iodine cartridge with a dose rate instrument, then inscrew holder assembly and bag the samples.	3. If sample radioactivity levels are high, use of tongs, etc. may be required for handling.

STEPS	REMARKS
4. After wiping down the holder assembly and sample chamber (if exposure levels permit), place fresh particulate filter and iodine cartridge (silver zeolite) into holder assembly and secure.	4. Make sure cartridge and spacer are properly aligned before tightening fixture.
5. Align iodine chamber shield plug with port and slide into position slowly. (The O-rings will cause the plug to move slowly.) Tighten thumb screws.	5. Be careful not to damage the holder assembly or mash fingers while performing this task. The shield plug weighs about 20 pounds.
6. Close cabinet doors, secure samples and depart area.	6. Notify Control Room of departure so that traveling chart recording of monitor responses during the change-out interval can be noted on the readout and a new sample collection may be started if desired.

(O P T I O N A L)

7. If required by the precautions, and borne out by findings at RE 32/33 area, one of the team members should split off on the return [illegible] the TSC to pick up the "hand-held" pig and push stick.	7. Monitor dose rates along route to ensure keeping doses to a minimum and within applicable limits. The special tools are located in the RX 40 cabinet, which is shown in Figure 3 (page 36).

STEPS	REMARKS
8. Upon arrival at RX 40 area, open cabinet, obtain items of interest, close cabinet and depart immediately.	8. It will probably be possible to catch up with the other individual having the RE 32 sample media in transit to the TSC.
9. Upon arrival outside the TSC, use the tongs (or filter wrench) to transfer the sample media to within the liner "can" built into the "hand-held" pig in the following steps.	9. Monitor dose rates during all operations where highly radioactive sample is manipulated under unshielded conditions. Such samples should <u>not</u> be handled directly.
10. Place the "hand-held" pig on the ground, cavity up, and place the cartridge (particulate side up) within the liner can.	10. Use tongs to handle the cartridge.
11. Place the liner can top on and push down to secure friction fit.	11. Use push rod, if necessary.
12. Bag, seal and place the "hand-held" pig (cavity side down) into the porta-pig.	12. The porta-pig may not be required if exposure levels from the cartridge do not warrant its use.
13. Secure [illegible] down and bag all contaminated items.	13. None.
14. Proceed to TSC lab area with porta-pig containing the sample.	14. Refer to Section 4 below for analysis of sample media.

c. Interpretation of System Readings

1) Radioiodine Monitor (RE 32)

The radioiodine monitor system consists basically of a sampler collection medium (silver zeolite) that is positioned immediately in front of a single channel analyzer/gamma scintillation detector assembly. The detector/SCA system monitors the amount of gamma radiation in the 364 keV energy region that impinges on it from the sample sources (particulate filter and iodine cartridge). When sampling with a fresh iodine cartridge first begins, the detector primarily responds to ambient background radioactivity (attenuated through the sample chamber shielding) noble gas radioactivity, as is being drawn through the iodine detector chamber, and the continuous build-up of radioiodine radioactivity as it is trapped on the particulate filter and the cartridge. After a while, the accumulated radioiodine activity contribution is much greater than the average amount of noble gases being drawn through the chamber. It is this build-up of radioiodines that determines that sampled stream concentration.

a) Effluent Concentration and Release Rate Determinations

Due to the continuous collection of radioiodines on the filter medium, the average concentration of radioiodines in sampled air over a period of time may be specified by the rate of increase of the monitor readout as follows:

$$\bar{C}_{131} = 1.59 \times 10^{-11} \frac{\Delta A / \Delta t}{V' e_s e_c f_I} \quad (\frac{\mu Ci}{cc})$$

where

$\bar{C}_{131}$ = average I-131 concentration during time interval Δt, (μCi/cc)

ΔA = net increase in detector count rate during time interval Δt (net counts/minute)

Δt = time interval with increase of interest, (minutes)

V' = sampler air flow rate, (ft^3/minute)

e_s = sample medium collection efficiency, (dimensionless)

e_c = detection system counting efficiency, (counts/disintegration)

f_I = iodine plateout factor, (dimensionless)

NOTE: Since an increase in radioactivity content of the particulate filter could cause a rise in the detector response, it is possible that the rate of rise value calculated by this equation would predict greater I-131 levels than actually exist. Unless there is a basis for attributing such a detector response to radioisotope(s) other than I-131, it will be necessary to (conservatively) regard the full rate of rise (ΔA-value) as due to I-131 accumulation in the cartridge until it is retrieved and an analysis proving otherwise has been performed.

Typical values for RE 32 are:

V' = 2.0 scfm or 2.0 ft^3/min

e_s = 0.94 (using silver zeolite)

e_c = 2.0% = 0.02

$f_I \cong 1.1$

The total radioiodine concentration (C_I) may then be determined from C_{131} as follows

$$\bar{C}_I = C_{131}/F_{131} \quad (\mu Ci/cc)$$

where

F_{131} is the fraction of I-131 present in a radioiodine mixture of age t_s (taken from Figure 2A on page 27).

From the plant vent effluent radioiodine concentration, the corresponding release rate can be determined. It is given by:

$$RR_I = 4.72 \times 10^{-4} \cdot C_I \cdot F^1$$

where

RR_I = plant vent radioiodine release rate, (Ci/sec)

C_I = (previously specified above)

$\dot{F}^1$ = total plant vent exhaust air flow rate, (ft^3/min)

Possible systems contributing to the plant vent exhaust air flow, hence to the magnitude of F', are discussed in section 1, Appendix 1, Systems Description.

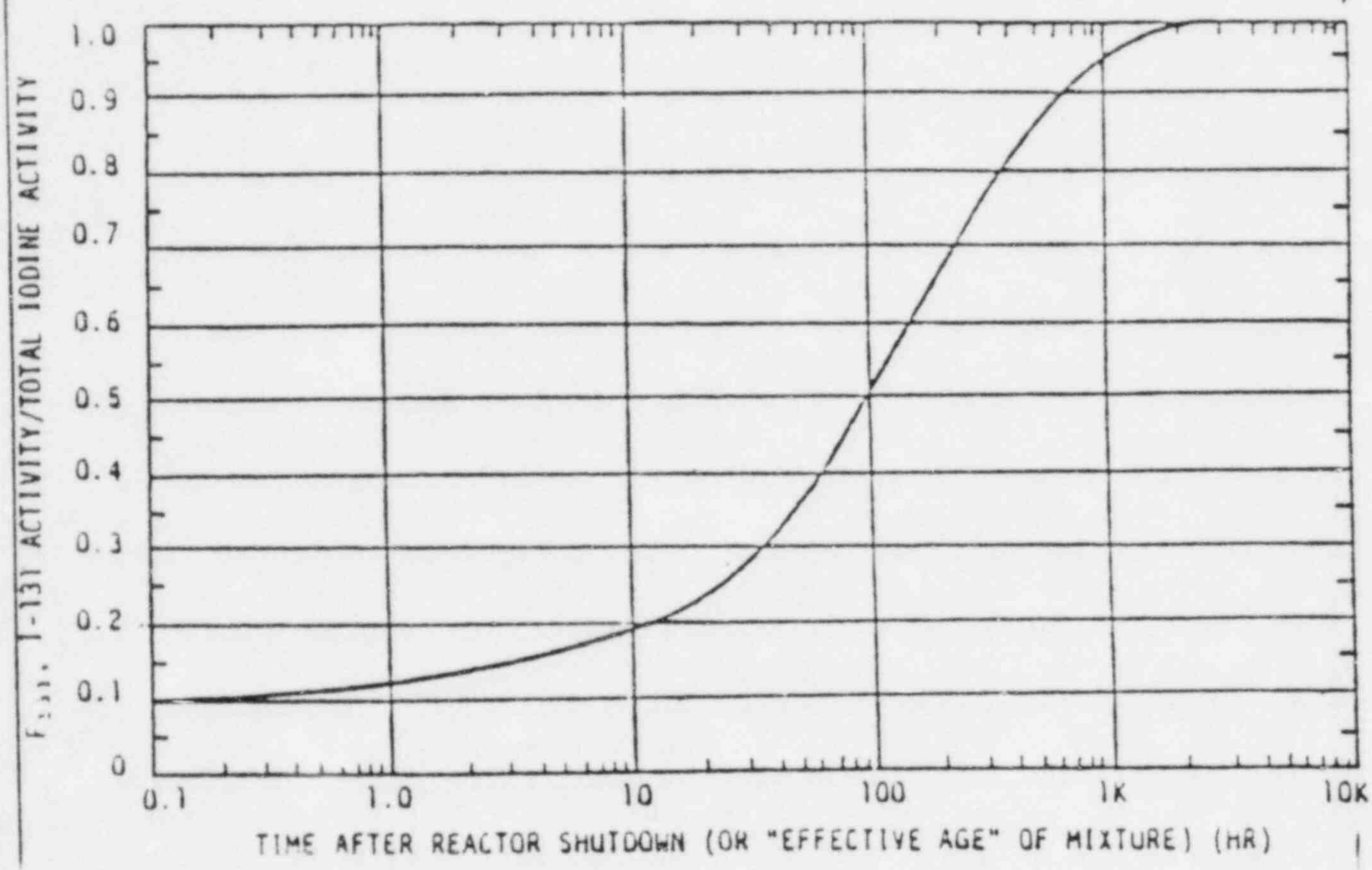


FIGURE 2A

RATIO OF I-131 ACTIVITY TO TOTAL IODINE
ACTIVITY VERSUS "EFFECTIVE AGE" OF MIXTURE

b) System Limitations

Practical limitations to using this equation include high detector background, statistical fluctuations in system response, and possible interferences due to noble gas release spikes. Large fluctuations in readings (up and down) may be due to noble gas spike releases, very large changes in area background levels, or equipment malfunction. The first cause may be overcome or minimized by executing the purge mode. Also, the behavior of RE 33 should indicate this condition clearly. (An extreme case might require an initial purge, taking a baseline reading, sampling for a time, second purge, and taking a final reading.) The second condition may be tested by paying close attention to the associated ARM (RE 34) readout and reviewing its recent behavior as evidenced by the traveling chart recorder. Its response would be expected to correlate closely in time to those of RE 32 and RE 33. The last condition may be reasonably well diagnosed from the Control Room by monitoring the check source function and checking detector high voltage for proper setting.

Another concern in using RE 32 is that of radioiodine build-up on the cartridge to the point of exceeding the detector capability.

$$A_{131}\ (\mu Ci) = \frac{\text{Sample Net CPM}}{e_c \cdot 2.22\times10^6\ \left(\frac{dpm}{\mu Ci}\right)}$$

This may be conservatively estimated at instrument full scale (neglecting background and electronic noise contributions) as:

$$A_{131}^{FS} = \frac{(10^7)}{(0.02)\ (2.22\times10^6)}\ \mu Ci = 225\ \mu Ci \quad \text{(of I-131)}$$

The total radioiodine content of the cartridge may then be conservatively estimated* by using Figure 2 as described above, e.g., $A_I = A_{131}/F_{131}$. Continuing on with this line of reasoning,

$$C_{131}^{max} = \frac{A\ max.}{V'.e_s T_s} = \frac{225\mu Ci}{1.21(Ft^3/min.)28,320\ \frac{(cc)}{Ft^3}.0.94.T_s}$$

$$= \frac{6.99x10^{-3}\ \frac{(\mu Ci\text{-}min)}{cc}}{T_s}$$

where T_s = length of sampling interval, (minutes)

Allowing for a cartridge changeout after 2 hours (or 120 minutes) of continuous sampling,

$C_{131}^{max} = 5.83X10^{-5}\ \mu CI/cc,$

then

$C_I^{max} = C_{131}^{max}/F_{131} = 5.30x10^{-4}\ \frac{\mu Ci}{cc}$, if $F^{131} = 0.11$

(from Figure 2) and the radioiodine release rate remained relatively constant during this time period.

If this same sequence had taken place in 20 minutes, the final result would have been:

$$C_I^{max} = \frac{6.99x10^{-3}}{(20)(0.11)} = 3.18x10^{-3}\ \mu Ci/cc$$

An estimate of the current radioiodine mixture halflife can be obtained by purging RE 32 to remove noble gas radioactivity from the iodine

*When using long collection times this method would tend to overestimate short-lived radioiodine species which could have already reached near equilibrium levels provided recent radioiodine releases had not increased dramatically. This latter circumstance may be determined by inspecting the recent traveling chart recorded data on RE 32 for increasing plateaus.

sampler/detector chamber, followed immediately by shutting the pumping system off. With the pumping system off, the required length of time for the monitor response to decrease by a factor of two (to its most recent plateau) will correspond to the sample half-life. This may be useful in determining if short-lived radioiodines are contributing substantially to the "apparent" I-131 radioactivity in the 364 keV energy region. As indicated by Figure 2, this would not be expected to occur beyond the first two or three days after reactor shutdown. (NOTE: Sample radioactivities accumulated gradually over a long time period would have a built-in bias against short-lived radioiodines due to their reaching near-equilibrium levels. See footnote on previous page.)

2) Noble Gas Monitor (RE 33)

The noble gas monitor is set to detect a fixed volume of sampled air being continuously drawn from the plant vent by the pumping system. Since the effective sample stream is continuously replaced, the monitor output is related to the airborne radioactivity concentration of the sampled air as it passes through the noble gas detector chamber.

a) Effluent Concentrations and Release Rate Determinations

The noble gas concentration of this stream, prefiltered to remove the particulate and radioiodines which may be present, is shown in Figure 2B (see page 32). The curve provides the concentration of noble gases in the plant vent directly from the monitor RE 33 readout.

Background of this system can be determined by purging RE 33 monitor (see section 2.b.1)b), on page 13) or may be conservatively taken as zero.

The actual noble gas effluent concentration may be converted to the Xe-133 equivalent value as follows:

$$C^{133}_{NG} = C_{NG} \cdot CF^{133}$$

where

C^{133}_{NG} = Xe-133 equivalent concentration, $(\frac{\mu Ci}{cc})$

C_{NG} = actual noble gas concentration (determined above)

and

CF^{133} = Xe-133 conversion factor for a particular time after plant shutdown (t_s), as specified in Appendix 3.

From the plant vent (sampled air) noble gas radioactivity concentration, the corresponding release rate can be determined. It is given by:

$$RR_{NG} = 4.72 \times 10^{-4} \cdot C_{NG} \cdot F'$$

where

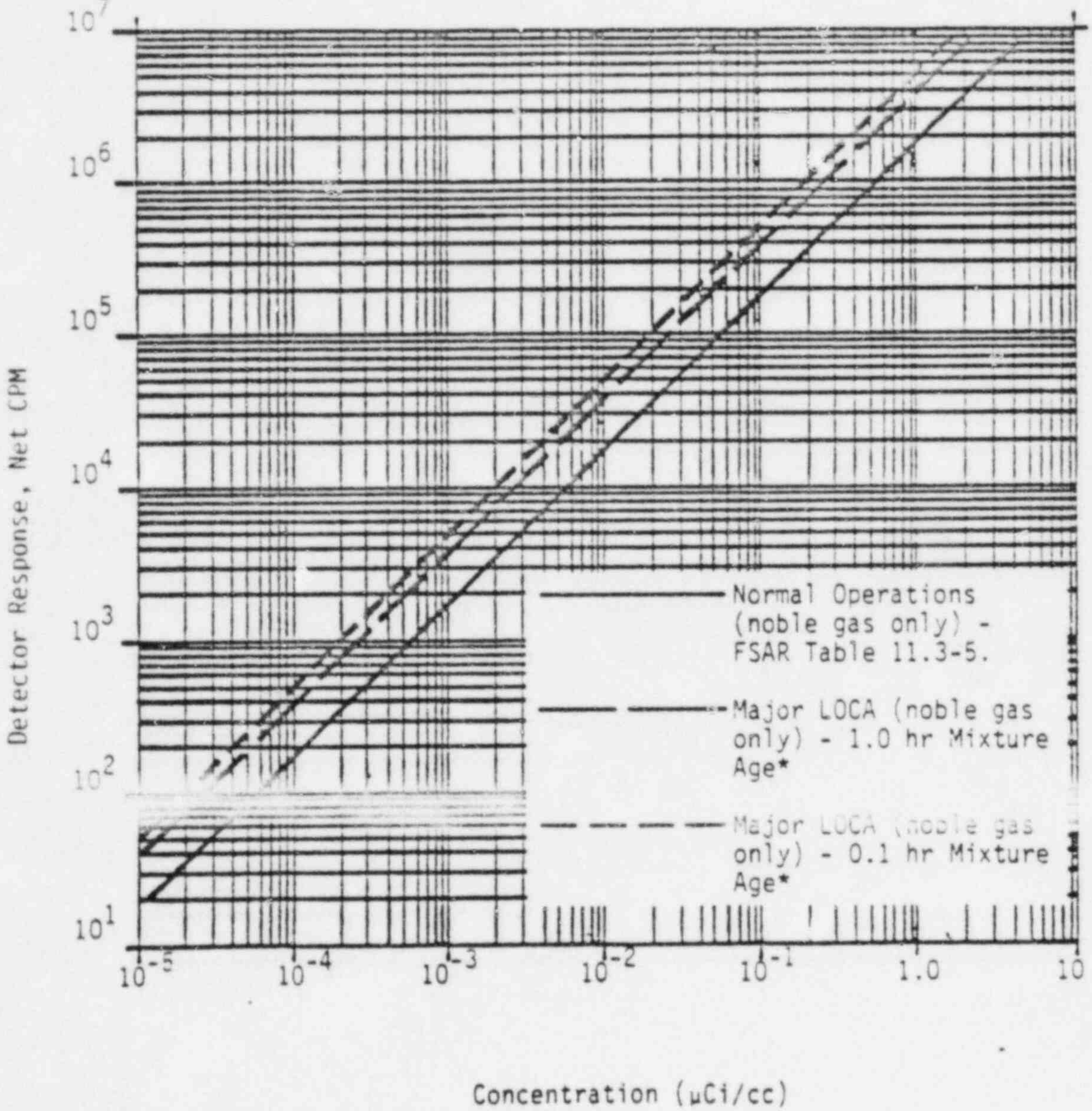
C_{NG} = (previously specified above)

and

F' = total plant vent exhaust air flow rate, (ft^3/min)

Possible systems contributing to the plant vent exhaust air flow, hence to the magnitude of F', are discussed in the systems description (which is included as section 1 of Appendix 1 to this procedure). Similarly, the Xe-133 equivalent release rate, RR^{133}_{NG}, may be determined by substitution of C^{133}_{NG} in place of C_{NG} above.

Figure 2B. Response Curve for RE-33



*Spectrum mixture based on FSAR Table 11.1-4

b) System Limitations

Basically, the use of this system to provide information regarding real-time effluent concentrations (and corresponding release rates) is subject to the physical limitations of detector, electronic, etc. response time, and the effective stay time (or counting time) as the sampled air is drawn before the detector.

Other considerations of using this monitor in conjunction with the iodine detector are discussed above in section 2.c.1)b) (see page 28). Possible contributions to detector background include high ambient area background (discernible by referring to response of area radiation monitor RE 34) and possible build-up of radioactivity due to iodine plateout and settled particulates within the sample/detector chamber. The latter type of contributions can be significant when assessing instrument response at the lower levels of its operational range. System alarm functions and automatic isolation of the sample line described above in section 2.b.1)d), (page 15), for RE 32 apply equally well for RE 33.

An estimate of the gas effluent mixture half-life can be obtained by shutting off the pumping system and noting the required length of time for the net gaseous radioactivity level (gross cpm-background cpm) to decrease by a factor of two. This is useful in assessing mixtures having a substantial portion of short-lived radioactivity. (As an example of this refer to the Fixed Filter CAM trace around 3 A.M. for short half-life response as shown in Appendix 2).

3. High Range System (RE 29, RX 40 and RE 35)

The High Range Plant Vent Monitoring System consists of an in line shielded gross gamma monitor (RE 29), and an off-line specially shielded radioiodine sampler (RX 40) with an associated area radiation monitor (RE 35). The overall sampling and monitoring capabilities of this system are summarized in Table 2 for each type of effluent.

a. Locations of System Components

1) Location of RE 29

The detector for RE 29 is physically located about 13 feet above the roof on the north side at the 140'0" elevation. It is oriented to face the west side of the plant exhaust vent and views the plant vent by means of a sealed, collimated shield assembly. The readout meter for RE 29 is located on the PAM control board in the Control Room.

2) Location of RX 40

The plant vent iodine sampler unit is located outside at the 85' elevation against the north wall of the Fuel Handling Building, as shown in Figure 3, page 36.

3) Location of RE 35

The detector and local readout meter are located adjacent to the plant vent iodine sampler (RX 40) outside on the north end of the Fuel Handling building at the 85' El. The precise location of RE 35 is depicted in Figure 3. Remote readout and operating controls for RE 35 are located at the PAM 2 panel in the Control Room.

b. Operation of High Range Monitoring System

1) Remote Operations

a) Activation of Plant Vent Gross Gamma Monitor (RE 29)

The detailed steps for operating this system are identical to those for "Activation of Area Radiation Monitor RE 34" presented above in section 2.b.1)c), page 14. Interpretation of system readout is discussed below in section 3.c.1), page 46.

b) Activation of Iodine Sampler (RX 40)

This unit is operated completely from the Control Room (from the Pump and Purge Control Panel in the PAM 2 panel) there being no provisions for local operation. Refer to Appendix 1 for a description of the functions and controls of this panel and a figure illustrating its actual layout.

<u>NOTE:</u> It is planned that this system be used as a timed grab sampler to obtain particulate and radioiodine samples from the plant vent effluent stream. Because of the radioactivity levels associated with the anticipated upper range of use for this sampler, prudent selection and control of sample collection time can result in a sample having manageable radioactivity levels yet permitting accurate assessment of plant releases. Appendix 3 provides specific guidance in this respect. To assure the assessment of these radiological [illegible] and Radiation Protection personnel are responsible for the direction of Control Room personnel for operation for RX 40 for sampling and purging. All operations sampling and purging should be completed <u>prior</u> to departure for sample retrieval.

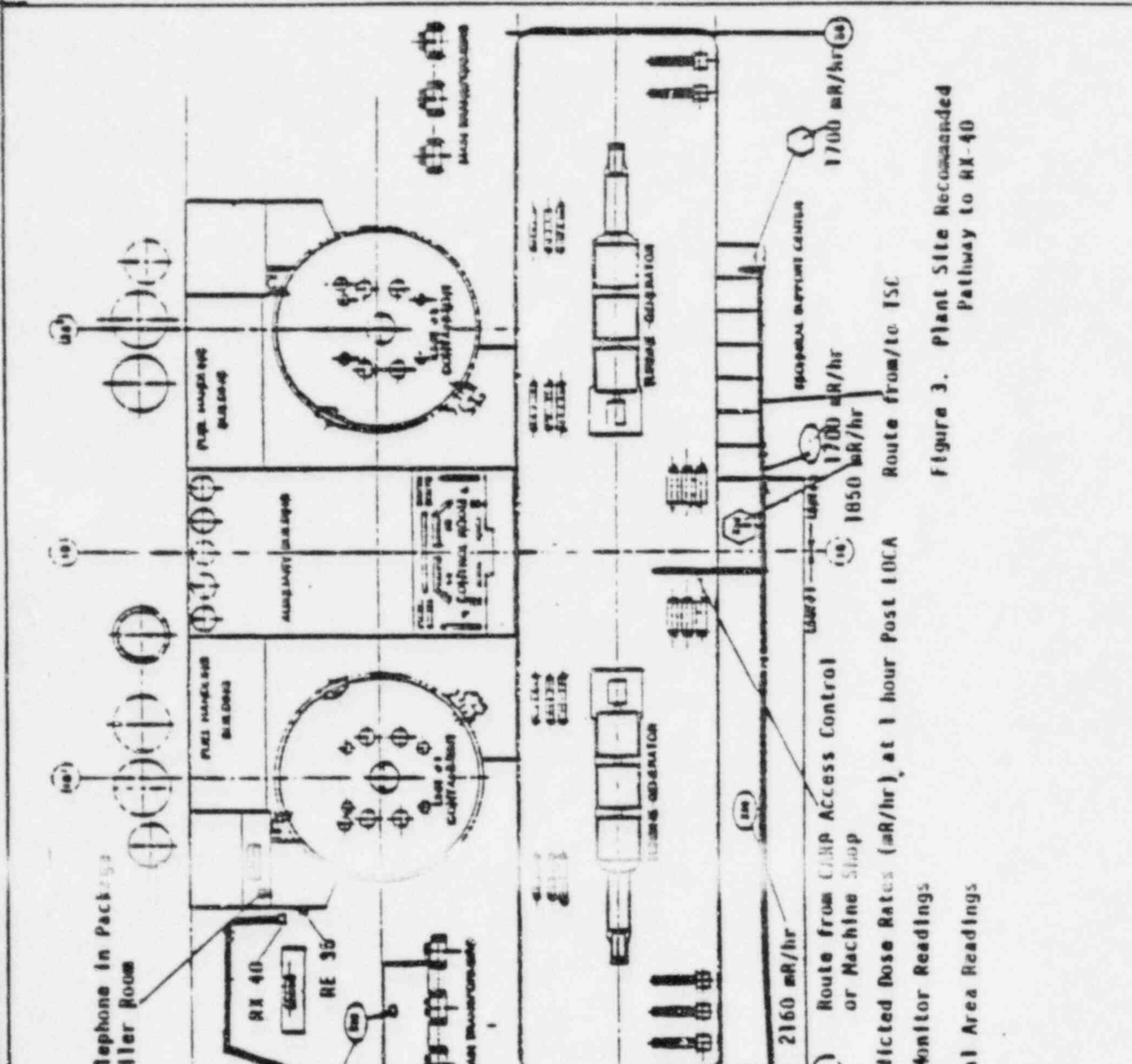

Telephone in Package Boiler Room
RX 40
RE 30
3585 mR/hr
2045 mR/hr
2160 mR/hr
Route from C&RP Access Control or Machine Shop
1850 mR/hr
1700 mR/hr
1700 mR/hr
Route from/to TSC
legend:
Maximum Predicted Dose Rates (mR/hr) at 1 hour Post LOCA
Area Monitor Readings
General Area Readings
Figure 3. Plant Site Recommended Pathway to RX-40

FIGURE 3

STEPS	REMARKS
1. Turn the panel power switch from "OFF" to "ON."	1. The white (or clear) indicator should light up.
2. Turn the pump "stop/start" switch from "STOP" to "START."	2. The red (pump) indicator light should be on and the pump operating. Should there be any flow fault or abnormality, the amber "FLOW FAULT" indicator will light up. Flow rate is preset to 1.3 scfm for this unit.

NOTE: This system is fully operational at this time. It may be necessary to make adjustments to the flow rate of the pumping system if a large change in the plant vent exhaust stream flow causes a departure from isokinetic sampling conditions. These changes should be noted on both the RE 29 chart recorder and subsequent RX 40 data sheets when made. The basis for making a flow rate adjustment and limits of departure from isokinetic operation are described fully in Appendix 1, page 65.

STEPS	REMARKS
3. If high radioiodine levels are either anticipated or are found to be highly probable (e.g., just after activation of iodine sampler), it may be necessary to readjust (decrease) the prescribed sampling interval. It should require about 30 to 40 seconds for RE 35 to begin increasing and level off at about 60 seconds after activating the RX 40 pumping unit. Some continued build-up due to plateout of iodines may also occur if plateout is significant. (Heat tracing should render iodine plateout insignificant.) The decision	3. High levels of radioiodines in the plant vent effluent stream may be reasonably expected if: (a) Previous [illegible] has shown so, (b) RE 29 is indicating substantial readings, and/or (c) Associated ARM (RE 35) readings suddenly rise after the iodine sampler unit (RX 40) is activated.

STEPS	REMARKS
to severely limit pumping time (perhaps to only a few minutes) may then be keyed to the behavior of RE 35.	Based on a sample line flow rate of 1.3 scfm, it requires about 40 seconds for sampled air to travel from the plant vent to the RX 40 unit. Although most of the sample radioactivity will probably consist of noble gases, a substantial quantity of radioiodines and/or particulates could accumulate in the cartridge chamber samples within a few minutes. To distinguish between these contributions, purging of the sample media and lines would be expected to reduce the noble gas component that made an increase in RE 35 readings. This may be noted (if significant) by observing the behavior of RE 35 during the purging as conducted below.
4. After the prescribed length of time, turn the "stop/start" switch from "start" to "stop".	4. This prescribed period to time should be based on the guidance of Appendix 3, RE 29, indications and actual experience with similar recent iodine samples.
5. Perform RX 40 sample chamber purge, after noting RE 35 area radiation reading.	5. Purge instructions for RX 40 are given in section 3.b.1)c), page 39.
6. Dispatch team to retrieve particulate and iodine sample as required for analysis.	6. Particulate and iodine retrieval is discussed in section 3.b.2)a). The reading of local ARM (RE 35) should give an indication of the general area dose rates in the immediate vicinity of RX 40. However, as a result

STEPS	REMARKS
	of the 4" of lead shielding around the RX 40 sample, a highly radioactive sample will not have any significant impact on this reading. Thus, RE 35 cannot be used as an indicator of sample activity.

c) Purging the Iodine Sampler (RX 40)*

(1) Iodine Sample Purge

To purge the iodine collecting sampler, turn the 100 PURGE/OFF/IOD L PURGE Selector Switch to 100 PURGE, and leave it in that position for 10 minutes. During this time, the sample will be valved off so that no material from the plant vent will enter the sampler. After the end of the purge period, return the switch to OFF.

(2) Iodine Line Purge

To purge the sample line leading to the iodine collection sampler, turn the Selector Switch to 100 L PURGE and leave it in that position for 10 minutes. During this time, the sample will be valved off so that no material from the plant vent [illegible] enter the sampler. After the end of the purge period, return the switch to OFF.

d) Activation of Area Radiation Monitor (RE 35)

Operation of RE 35 is identical in every respect to that of RE 34, which is discussed in section 2.b.1)c), page 14.

*Refer to section 4.b. of Appendix 1 for a system flow diagram of RX 40 and the associated table for a summary of valve line-ups in the various purge modes.

2) Local Functions

a) Changeout of Iodine Sampler (RX 40) Media

(1) Access to RX Area

Access to the Iodine Sampler Area (RX 40) may be made by proceeding outside around the Turbine Building north area as shown in Figure 3 (page 36). An alternative route, subject to plant conditions, is to proceed through the Turbine Building (at El. 85'0"). To remove highly radioactive samples from RX-40, the lead-shielded transfer cart may be required. (This equipment is described further in section 4.c. of Appendix 1.) This cart and accessories are stored at the RX 40 sampling cabinet indicated in Figure 3. Because of the possibility of handling highly radioactive samples, the following precautions should be taken prior to attempting iodine sample retrieval:

(a) Review readings of ARM RE 35 (as specified in section 3.b.1)b), step (3) on page 37).

(b) Verify that both the iodine sampler unit and sampling lines have been purged and the sampler is off.

(c) Use of protective clothing and equipment as prescribed by Chemistry and Radiation Protection.

(d) Use of routine and special dosimetry as prescribed by Chemistry and Radiation Protection.

(e) Perform all local operations on the sampler unit and retrieved iodine sample under the coverage of a qualified Chemistry and Radiation Protection representative.

(f) Verify the following special equipment to be taken for RX 40 retrieval and replacement: wipe rags, small plastic bags to contain the hand-held pig, tape, 160 pound porta-pig (4" i.d. diameter cavity), replacement silver zeolite cartridge with particulate filter inserted on the inlet side under the rim of the AgZ cartridge.

(g) Notify Control Room immediately prior to entering plant to attempt iodine sample retrieval.

(2) Particulate and Iodine Cartridge Retrieval (RX 40)

NOTE: The samples obtained from RX 40 should contain radioisotopes which are strong beta emitters; therefore, all surveys and all handling must consider the possible impact of potentially high beta to gamma ratios. For this reason, the prevention of direct contact with the sample is essential -- DO NOT TOUCH.

Since it is impossible to predict the type of accident or extent, this procedure uses worst case assumptions. It is highly unlikely that conditions will be as severe as indicated in the following remarks; but in any case, the retrieval personnel should be cognizant that these unpredictable conditions will have to be ascertained and evaluated for impact as this procedure is performed, and that the following steps address the extreme conditions.

STEPS	REMARKS
1. Upon arrival at RX 40 cabinet, perform dose rate survey of cabinet exterior, sampling line runs, and cabinet interior, emphasizing areas of possible gamma field streaming around the sampler shield housing.	1. Access actual radiological conditions to determine significant hazards (if any) present and appropriate course of action. Surveys should be performed using a teletector, if possible.

STEPS	REMARKS
2. Verify sample pump motor is off. (If the pump motor is found on, call the Control Room and have RX 40 pump shut off.)	2. Photohelic gauge/flow meter is located on front side of cabinet in the upper left-hand area.
3. Loosen the screws on the face of the slide-mounted canister from the front side of the RX 40 cabinet.	3. This may require a screw-driver.
4. Remove the west facing cabinet, left side, hinged door. (This can be done by opening the door and lifting upward while swinging the door back and forth to disengage the slip hinges.) Open the sample pig door fully and position the transfer cart directly in front of the sample shield housing.	4. Assure that the transfer cart is aligned with the sample shield housing face. Note orientation and function of the grasping tool before positioning cart.
5. Using the rear handle of the slide pulling rod, insert the latching tool shape into the slot of the slide-mounted cart-ridge holding fixture (within the sampler shield housing).	5. When oriented properly, the latch should be able to slide directly up against the slide-mounted cartridge holding fixture face.
6. Twist the pulling rod one quarter turn to latch onto the slide-mounted cartridge holding fixture and slowly pull the cartridge holding fixture into the sample transfer cart.	Assure positive lock on grappling mechanism before proceeding further.
7. Back the transfer cart off from RX 40 a short distance and survey the open end of the cart for a gamma dose rate reading that is indicative of the dose from the cartridge relative to the ambient conditions.	7. Under worst case assumptions, maximum ambient conditions are calculated to be 3.6 R/hr (60 mR/min) and maximum dose rate from the cartridge is projected to be about 30 R/hr (500 mR/min) at 1 foot from the edge of the cartridge

STEPS	REMARKS
	(about 9" in front of the transfer cart with the cartridge holder fully retracted into the transfer cart).
8. If the results of Step 7 indicate whole body dose rates during transfer of the cartridge to the hand-held pig will be less than 60 R/hr, proceed. Otherwise, record values, close and latch the transfer cart door, and report to the TSC for further instruction.*	8. Access, extraction of the cartridge holding fixture into the transfer cart, and egress for RX 40 sample retrieval under worst case assumptions are expected to require approximately 1000 mrem. This leaves 3000 mrem for cartridge handling and replacement plus a 1000 mrem (20%) contingency for unknowns. Sample changeout to the hand-held pig should take a maximum of 30 seconds of unshielded exposure and a total of two minutes for completion.
9. Work from behind the transfer cart and monitor ambient conditions while slowly inserting the reach rod to expose the cartridge beyond the cart cavity.	9. None.
10. Obtain a near contact dose rate reading with the cartridge, if possible, and obtain a reading at 1 foot from the face of the cartridge.	10. [illegible] off-scale reading on the contact dose rate warrants extreme caution in all subsequent handling. Worst case conditions indicate a maximum activity of 100 Curies on the cartridge with a corresponding dose rate of 316 R/hr at 1 foot from the face of the cartridge.

*If the cartridge holder assembly is to be removed from the RX 40 assembly without being replaced, a warning notice should be affixed to the associated pump and purge control panel in the PAM 2 of the Control Room. This is to prevent attempted use of RX 40 when the cartridge holder assembly is missing from the unit.

STEPS	REMARKS
11. Extend the reach rod completely so that the holding fixture is completely outside the cavity of the transfer cart and then rotate the reach rod in the transfer cart 90° so that the cartridge holding fixture will be in a horizontal plane with the particulate filter visible from the top.	11. None.
12. With the hand-held pig in one hand, cavity up, and the push-rod in the other hand, approach the exposed cartridge, center the hand-held pig beneath the center of the cartridge, holding it tight against the cartridge holding fixture, and use the push-rod to push the cartridge into the liner cavity of the hand-held pig.	12. Work from the side of the transfer cart so that its shielding is between the major part of the whole body and the unshielded cartridge. Keep fingers away from the top and outer top edge of the hand-held pig and hold the push-rod at the very end to maximize the distance from the hand on the push-rod to the cartridge to reduce extremity exposure. If for any reason the cartridge cannot be removed with the push-rod or if the cartridge somehow falls to the ground, DO NOT TOUCH the cartridge in trying to correct the problem. Use tongs or other remote means to handle the cartridge.
13. Set the hand-held cartridge on the ground, cavity up.	13. Work from the shielded side of the hand-held pig and avoid exposure from the unshielded cartridge at all times.
14. Wipe off the end of the push-rod where it contacted the cartridge with a wipe rag, slip the linercap over the push-rod, and press it into	14. The liner-cap is sized to friction fit into the liner so that this step will encase the cartridge to prevent subsequent spread of

STEPS	REMARKS
the liner cavity of the hand-held pig until the top edge of the liner-cap is approximately flush with the top of the liner cavity.	contamination. Place the contaminated wipes in a plastic bag and attempt to limit the spread of any contamination.
15. Use a clean wipe rag on the push-rod to wipe the cavity side of the liner.	15. Work from the side of the hand-held pig and avoid exposure to the unshielded cartridge.
16. Invert the hand-held pig, lower it into a small plastic bag, and seal the bag.	16. The plastic bag has to be small enough such that any excess does not foul the 1/16" clearance between the hand-held pig and the porta-pig.
17. Set the hand-held pig, unshielded side down, into the 160 pound porta-pig.	17. None.
18. Wipe off the RX 40 cartridge holding fixture with a clean wipe rag and refer to Figure 1-8B (Appendix 1, page 95) for illustration of reloading the sample holder fixture with fresh sampling media.	18. None.
19. Reinstall and secure all cabinet doors.	19. None.
20. Transport the porta-pig containing the hand-held pig to the TSC lab.	20. The sample iodine cartridge/particulate filter may either be taken to the TSC or sent for offsite analysis. (Refer to section 4 below.) All handling should be performed under the coverage of the Chemistry and Radiation Protection Department.

c. Interpretation of System Response

1) Plant Vent Gross Gamma Monitor (RE 29)

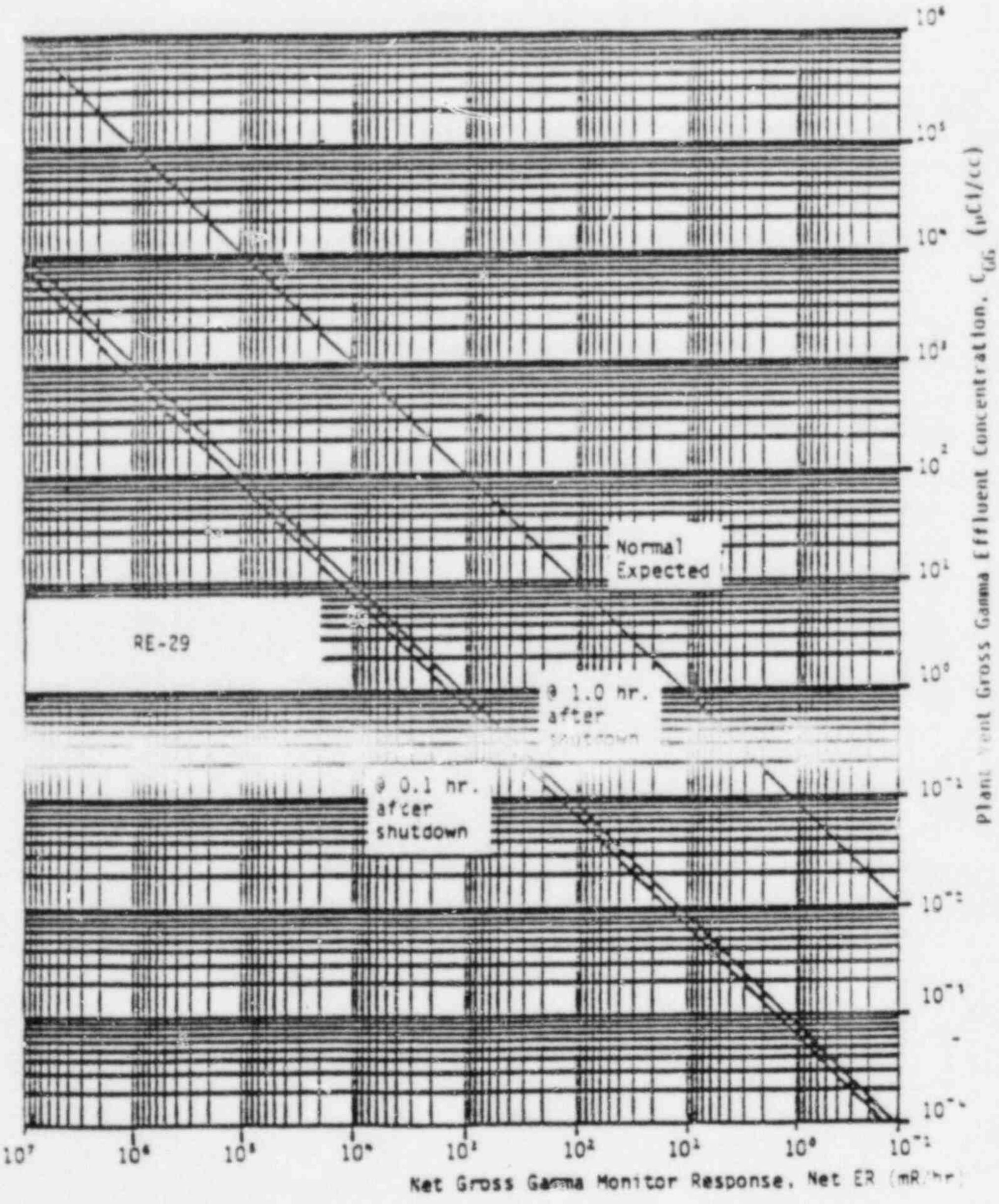
a) Effluent Concentration and Release Rate Determinations

The gross gamma radioactivity monitor of this channel continuously monitors the total gamma radioactivity (noble gases, radioiodines and particulates) in the adjacent portions of the plant exhaust vent. The monitoring system output is in units of mR/hr. To convert this into effluent radioactivity concentration, the most representative plot in Figure 4 is used and the gross gamma effluent concentration, C_{GG} (µCi/cc), is read off. The particular graph value of C_{GG} chosen is that corresponding to the net exposure rate reading of RE 29, Net ER (mR/hr).

Making the conservative* assumption that all effluents monitored by RE 29 are noble gases, the value for C_{GG} may be converted to the Xe-133 equivalent value as follows:

*Conservative because credit is not being taken for particulate and radioiodine components which may be determined separately by operation of grab sampling equipment.

Figure 4
Exposure Rate/Effluent Concentration Response Curve for RE 29
10 Cycle by 8 Cycle Log-Log



Choose most appropriate time (that is, the one most representative of actual time after plant shutdown) and determine the effluent concentration that corresponds to RE 29 monitor reading.

$$C^{133}_{GG} = \bar{C}_{GG} \cdot CF^{133}$$

where

$\bar{C}^{133}_{GG}$ = corresponding Xe-133 equivalent concentration, (μCi/cc)

and

CF^{133} = Xe-133 conversion factor for a particular time after plant shutdown (t_s), as specified in Figure 5.

The release rate from the plant vent can also be estimated from the RE 29 response as follows:

$$RR_{GG} = 4.72 \times 10^{-4} \cdot \bar{C}_{GG} \cdot F'$$

where

RR_{GG} = plant vent gross gamma (mostly due to noble gases radioactivity release rate, (Ci/sec)

$\bar{C}_{GG}$ = (from Figure 4)

and

F' = total plant vent exhaust air flow rate, (ft^3/min)

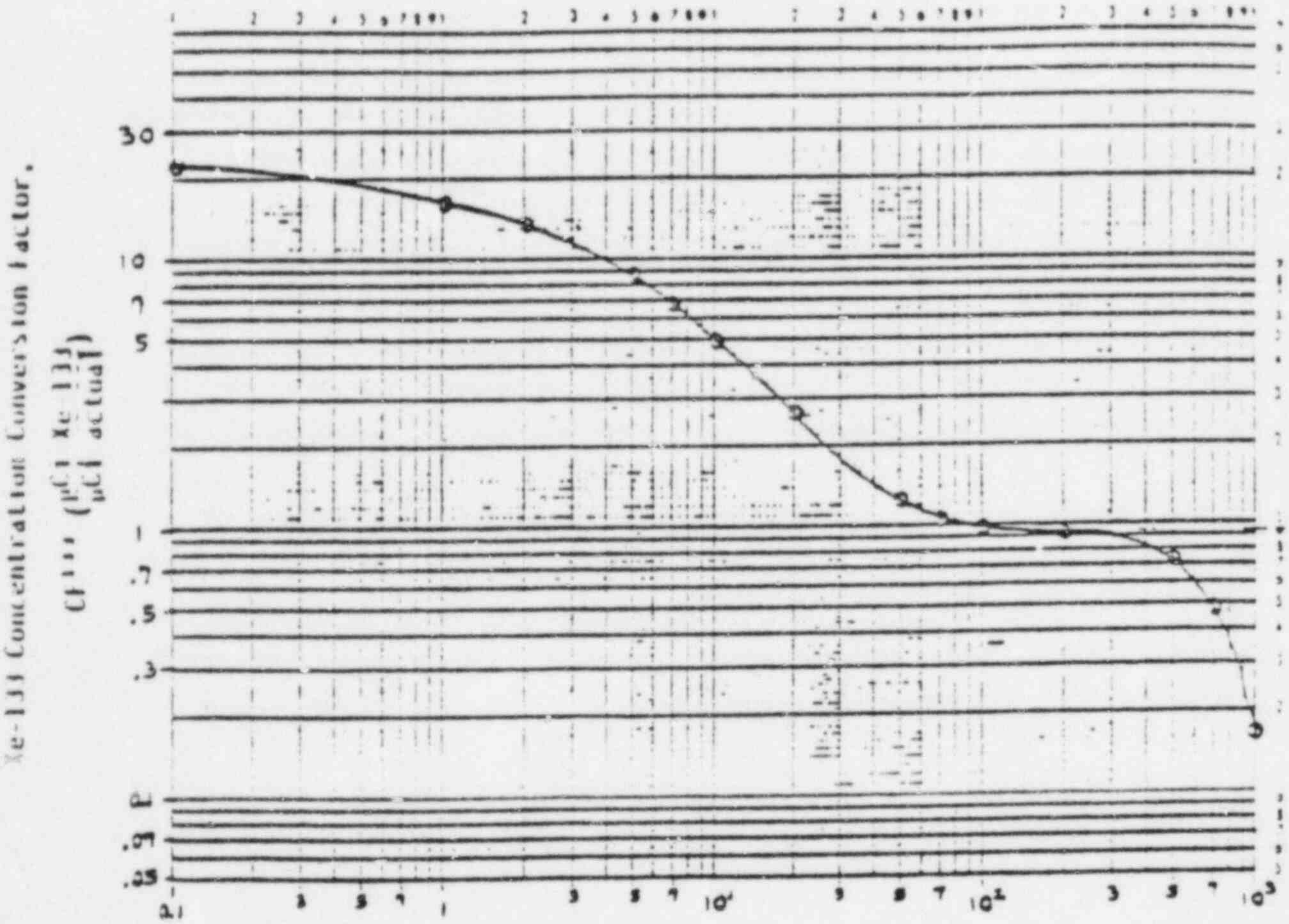
Possible systems contributing to the plant vent exhaust air flow, hence to the magnitude of F', are discussed in section 1 of the system description included as Appendix 1 to this procedure (page 58).

Similarly, the Xe-133 equivalent release rate, RR^{133}_{GG}, may be determined by substitution of

$$C^{-133}_{GG}$$

in place of $\bar{C}_{GG}$ above.

Figure 5
Xe-133 Equivalent Conversion Factor (CF^{133}) as a Function of Time After Plant Shutdown



Time After Shutdown, t_s (hours)

Conc. (Xe-133 Equivalent) = Conc. (Actual) · CF^{133}

b) System Limitations

There are a couple of practical limitations to using this system. The first of these is high detector background. This may arise from submersion of the detector in the general atmosphere around the 140' El. outside the Containment Building. Because the plant vent itself would be the likely source of submersion contribution and the atmospheric dispersion of the vent effluent detector submersion is not expected to be a severely limiting factor. (RE 29 is directionally shielded to reduce this possibility even further.) As long as background submersion levels are not substantial, the monitoring system background reading may be conservatively taken as zero. The second limitation, that of system sensitivity, depends on using a sufficiently short detector response time to see average gamma radioactivity levels of the plant vent effluent and the use of realistic conversion factors that account for various radioisotopes which may be present in the actual effluent stream being monitored, which have been done.

2) Plant Vent Iodine Sampler (RX 40)

The iodine cartridge and particulate samples removed from the h[illegible] iodine sampler unit are analyzed and interpreted in the usual manner. Due to the possibility of high radioactivity content, the sample may require special handling and preparation for analysis. Refer to Section 4 "Assessment and Handling of Retrieved Sampling Media". Conceivably, the radioactivity content of sample(s) might be sufficiently high to preclude any on-site analysis beyond employing direct sample exposure rate readings and precalculated radioactivity conversion factors such as presented in Appendix 3 for silver zeolite cartridges, charcoal cartridges and/or particulate filters.

4. Assessment and Handling of Retrieved Sampling Media (RX 40 and RE 32 Media)

Interpretation of sampling media analyses for samples retrieved from the midrange plant vent monitoring system is basically the same as for samples obtained from similar equipment during normal operation. These may include HPGe/MCA analyses such as DPP HP-9. The only additional considerations that might apply are the possibility of highly radioactive samples. Such highly radioactive samples are far more likely to be obtained using RX 40. In any case, hot samples may require using specialized handling and analysis techniques as prescribed in this procedure. Direct conversion factors specifically for silver zeolite, activated charcoal and 2-inch diameter particulate filter samples obtained using RX 40 are presented in Appendix 3 along with appropriate instructions regarding their use. Techniques of estimating sample radioactivity content, using dose rate conversion factors, are valid even if it is not possible to handle samples as required to prepare them for direct counting. An additional consideration of highly radioactive iodine samples is the possibility of off gasing of iodines and noble gases, the latter being produced by radioactive decay of iodines. For this reason, it is recommended that all hot samples for analysis be securely bagged prior to their entry to the counting room areas.

a. Laboratory Counting of Highly Radioactive Samples

This procedure addresses the handling and analysis of highly radioactive samples and begins with the delivery of the hand-held pig to the TSC lab. This procedure is also applicable to samples retrieved without the use of the hand-held pig by changing all applicable references for the pig to the sample of interest.

STEPS	REMARKS
1. Refer to Appendix 4 for aperture selection and install the lead aperture of interest in the TSC lab HPGe detector shield.	1. Select aperture size based on dose rate readings to yield detector response between minimum and maximum rates.

STEPS	REMARKS
2. Cover the detector shield and aperture with plastic and seal around the lower edge of the shield to prevent detector contamination.	2. None.
3. Remove or protect all unassigned TLDs from exposure to the potentially high dose rates.	3. The worst case ambient dose rates in the TSC lab, not considering any highly radioactive samples, are projected to be about 7 mR/hr. The potential for significantly higher dose rates resulting from a highly radioactive sample warrants consideration of protection of all TLDs in the TSC lab area.
4. Notify the Control Room of the immediate intent to remove the sample from the porta-pig and of the potential for a Temporary High Radiation Area alarm.	4. The Area Radiation Monitor in the TSC lab has an alarm setpoint of 100 mR/hr with an annunciation in the Control Room and the TSC lab.
5. Remove the hand-held pig from the porta-pig, place it in an additional plastic bag, and seal the bag.	5. Work from the shielded side of the hand-held pig and avoid exposure from the unshielded side of the pig.
6. Place the sealed hand-held pig, cavity down, on top of the lead aperture in the detector shield and center the pig over the aperture.	6. None.
7. Place lead bricks around the sample as necessary to minimize exposure to personnel.	7. The average dose rate in occupied vital areas shall not exceed 15 mR/hr when averaged over 30 days.

STEPS	REMARKS
8. Start a spectrum acquisition using the GSMCA program and observe the count rate on the MCA electronics rack.	8. Count rates greater than 10,000 cps result in excessive electronic dead time and should not be used for quantitative analysis.
9. If the count rate from Step 8 is less than 100 counts per second, the next largest aperture should be used. To do this, remove the hand-held pig and temporarily store it near the east door of the TSC lab by placing it on the floor, cavity down. Then remove the plastic cover from the shield, remove the present aperture and repeat step 1 with the next size aperture and repeat steps 2, 6, 7 and 8.	9. None.
10. Acquire a spectrum using the GSMCA program and write it to disk for retention and subsequent analysis.	10. None.
11. Store the hand-held pig in the porta-pig for further processing as directed by the Chemistry and Radiation Protection Engineer.	11. The sample may be retained or sent off site for additional analysis or disposed of as radioactive waste.
12. Analyze the spectrum using the GSRAP program for isotopic identification and concentrations, document results and submit findings to the Chemistry and Radiation Protection Engineer for approval.	12. The GSRAP program is operationally the same as GSRAP but it includes the correction to be applied for use of the lead apertures.
13. Dispose of the plastic cover and perform a contamination survey to release the area.	13. None.

C. FOLLOW-UP ACTIONS

1. Documentation

The use of standard forms with appropriate notations is encouraged because of availability and personnel familiarity. The practice of making notations regarding monitoring system response on associated traveling chart recorders can prove an invaluable aid in accurate documentation and follow-up. Calculation worksheets and specialized forms may, in some instances, be required for adequate documentation.

2. Notification of Results

Under conditions of plant emergency, timely flow of information is vital. Appropriate personnel having their preassigned responsibilities must be aware of the latest plant release conditions. These individuals should be promptly notified of significant releases of radioactivity to the environment. Notifications of such releases from the plant vent should be made to the Site Chemistry and Radiation Protection Coordinator or according to line authority channels specified in Figure 2 of EP G-2.

REFERENCES

1. Radiation Control Procedure G-8, "Measurement of Airborne Radioactivity."

2. Chemical Analysis Procedure B-10, "Multichannel Analyzer."

3. Chemical Analysis Procedure H-1, "Gamma Spectrum Acquisition with Hewlett-Packard 9845-B and ND-66."

4. Chemical Analysis Procedure H-3, "Gamma Ray Radionuclide Analysis Program."

5. Victoreen Radiation Detection Systems Description Manual, DC-688881-1.

APPENDICES

Appendix 1 Systems Description

Appendix 2 Typical Continuous Air Monitor Readout (CAM Plot)

Appendix 3 Guidance Regarding Operation of Remote Iodine Sampler (RX 40)

Appendix 4 Detector Response vs. Activity (2nd Corresponding Dose Rates) for Available Apertures

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SYSTEM DESCRIPTIONS

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SYSTEM DESCRIPTIONS

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APPENDIX 1

SYSTEMS DESCRIPTION

I. INTRODUCTION

Several ranges of monitoring and sampling devices are employed at Diablo Canyon to measure and quantify radioactive gaseous effluents associated with the plant vent. This is necessary because of 1) the widely varying concentrations of effluents which may be present during plant operation, ranging from normal conditions through the entire spectrum of possible accident circumstances, 2) the different types of radioactive gaseous effluents that may be present in the plant ventilation exhaust, and 3) the possibility of elevated radiation background levels in the vicinity of detection devices associated with effluent monitors during post-accident conditions. Components of the plant vent monitoring system are divided into three groups or ranges: Normal, midrange and high range. The basic categories and uses of these sampling/monitoring devices are presented in Table 1-1, as well as additional information and specifications regarding these components. Table 1-1 also includes descriptive information regarding area radiation monitors (ARM'S) which are associated with the various plant vent monitors. Figure 1-1 depicts functions and interrelationships among individual elements of the overall plant vent radiation monitoring system shown by type of effluent monitored or sampled. Specific locations, system descriptions and operation of these sampling and monitoring devices is presented below.

The plant ventilation duct being monitored is the exhaust stream for all major sources of radioactive gaseous effluents during an accident from the plant with the exception of the atmospheric steam dumps. The flow rate in the plant vent at the 220' El. (approximate location of the various sampling probes) will be determined by the presence or absence of the major effluent inputs shown in Table 1-2.

Based on the actual status of plant ventilation systems, Table 1-2 can be used to determine the total plant vent flow rate. This flow rate may then be used in conjunction with Figure 1-2 to determine the plant vent effluent stream velocity which is important to know when attempting to perform isokinetic sampling of the plant vent exhaust stream*. Using the system flow rates of Table 1-2, the following combinations of plant exhaust vent flows are likely (under emergency conditions):

*As stated earlier in section 2.b.1)a) "Activation of RE 32/33" (note on page) and section 3.b.1)b) "Activation of Iodine Sampler" (see note on page) it may be necessary to periodically adjust sampler flow rate to maintain isokinetic sampling conditions. To determine the need for any such adjustment and, if so, the specific adjustment required (refer below to section 1.a of this appendix, page 62).

APPENDIX 1 (Continued)

TABLE 1-1. PLANT VENT MONITORS AND SAMPLERS WITH ASSOCIATED AREA RADIATION MONITORS

Chl. No. Desig.	System or Component	Range Cat.	Ctrl. Rm. Readout	Detector Type	Detector Location	Readout Range	Readout Location	Vendor (Model No.)
RE 14 (A&B)*	Radio-Gas Sample/Monitor	N	Yes	GM	Plt Vent Rm of Fuel Handling Bldg. (115' El.)	$1X10^{-7}$ to $1X10^{-4}$ µCi/cc ($10-10^6$ cpm)	Control Room	Westinghouse (TBS)
RE 28 (A&B)*	Particulate Air Sampler/Monitor	N	Yes	Beta Scint.	"	$1X10^{-9}$ to $1X10^{-6}$ µCi/cc ($10-10^6$ cpm)	Control Room	Westinghouse (TBS)
RE 24	Supplementary Iodine	N	No, only an alarm annun.	Gamma Scint.	"	$1X10^{-7}$ to $1X10^{-4}$ µCi/cc	Same as detector location	Radeco/SAI (Process Air Monitor 571)
RE 32	Mid-Range Iodine Sampler/Monitor	M	Yes	Gamma Scint.	"	10^1 to 10^7 cpm	Control Room PAM 2 panel	Victoreen (843-32 and 842-31)
RE 33	Mid-Range Noble Gas Monitor	M	Yes	Beta Scint.	"	10^1 to 10^7 cpm	"	Victoreen (843-22B and 842-11)
RE 34	Area Rad. Mon. for Mid-Range Monitors	M	Yes	IC	"	10^{-1} to 10^7 mR/HR	"	Victoreen (845 System)
RE 29	Plant Vent Gross Gamma Monitor	H	Yes	IC	West side of Plt Vent Duct (outside) at 140'El.	10^{-1} to 10^7 mR/HR	Control Room PAM panel	Victoreen (845 System)
RE 40	Plant Vent Iodine Sampler	H	Control, But Sys. has No Readout	None	North End of Fuel Hdlg. Bldg. (85' El.)	Varies, Depending on Sampling Time (T_s)	None, System Operated from Crtl. Rm. PAM 2 Pnl.	Victoreen (909052)
RE 35	Area Radiation Monitor for Plant Vent Iodine Sampler	H	Yes	IC	North End of Fuel Handling Building (85' El.)	10^{-1} to 10^7 cpm	Control Room, PAM 2 Panel	Victoreen (845 System)

DETECTOR TYPES: GM = GEIGER-MULLER, SCINT. = SCINTILLATION, IC = ION CHAMBER
RANGE CATEGORY: N = NORMAL RANGE, M = MID-RANGE, H = HIGH RANGE
* These systems include back-up units.

APPENDIX 1 (Cont'd)

TABLE 1-2. PLANT VENT EFFLUENT INPUT STREAMS

VENTILATION SYSTEM	SYSTEM FLOW*
A. Auxiliary Bldg. Ventilation System	
1. Mode 1 (normal)	73,500 cfm
2. Mode 2 (normal plus engineered safety ventilation)	147,000 cfm
3. Mode 3 (engineered safety ventilation only)	73,500 cfm
B. Fuel Handling Area	
All Modes	35,570 cfm
C. Containment Purge	55,000 cfm

*Plant ventilation exhaust duct at the 220' El. has interior dimensions of 12'11" (155 inch) by 6'8.5" (80.5 inch).

Ventilation Input Source (Table 1-2)	Plant Vent Volume Flow Rate	Plant Vent Effluent Stream Velocity	Effluent Stream Velocity Range, ±20% of Isokinetic
A.3+B	109,250 scfm	21.0 ft/sec	16.8 - 25.2 ft/sec
A.3+C	128,500 scfm	24.7 ft/sec	19.8 - 29.7 ft/sec
A.3+B+C	164,250 scfm	31.6 ft/sec	25.3 - 37.9 ft/sec

APPENDIX 1 (Cont'd)

For the Midrange Monitor (RE 32/33), the sample line inlet velocity while operating at 2.0 scfm is 9.26 ft/sec (inside diameter of 13/16") while that of the High Range Sampler (RX 40) while operating at 1.3 scfm is 12.6 ft/sec (inside diameter of 9/16"). The corresponding inlet velocities of the probe tips for these monitor/sampler units are as follows:

Midrange Monitor (RE 32/33) ---- v_{inlet} = 21.7 ft/sec (based on D_{probe} = 17/32")

High Range Sampler (RX 40) ---- v_{inlet} = 20.8 ft/sec (based on D_{probe} = 7/16")

a. Determine Possible Need for Flow Adjustment of Sample

   1) Determine plant vent exhaust flow rate (cfm) by summing all input sources or obtain current value from operations (FR-12 chart of unit RMS board):

Exhaust Stream	# Fans x Flow Rate = System Flow
Fuel Handling Bldg.	____ fans x 35,750 cfm/fan = ________ cfm
Auxiliary Building	____ fans x 73,500 cfm/fan = ________ cfm
Cont. Purge	____ fans x 55,000 cfm/fan = ________ cfm
Cont. [illegible]	____ fans x 300 cfm/fan = ________ cfm
Plant Vent Flow	F'_{vent} = ________ cfm

APPENDIX 1 (Cont'd)

2) Calculate flow velocity of plant vent exhaust stream using the value of F'_{vent} and the following equation:

$$V_{flow} = 1.92x10^{-4} \cdot F'_{vent}\ (cfm) = \_\_\_\_\_\_ ft/sec$$

Alternately, the value of V_{flow} may be read directly from Figure 1-2 (page 42) corresponding to the particular F'_{vent} value determined in step (1) above.

3) Calculate the upper and lower limits of plant vent flow velocity which correspond to sampler probe inlet velocities which will maintain isokinetic sampling conditions within ±20%.

a) Lower Limit = V_{flow} x 0.8 = ________ ft/sec

b) Upper Limit = V_{flow} x 1.2 = ________ ft/sec

4) Using the sampler flow rate currently established and inlet probe tip cross-sectional area, determine the actual probe tip inlet velocity (for the sampler unit of interest):

$$V_{inlet} = 3.06 \cdot V'_{sampler}(scfm) / D^2_{probe}(in) =$$
____ ft/sec

Values of D_{probe} are as follows:

Sampler	D_{probe}
RE 32/33	17/32"
RX 40	7/16"

APPENDIX 1 (Cont'd)

5) If the step (4) value of V'_{inlet} falls between the upper and lower limits calculated above in step (3), the sampler is operating within ±20% of true isokinetic conditions. It may be desirable to adjust the sampler so as to be centered in the step (3) range. Conversely, if the step (4) value falls outside the step (3) range it will be necessary to adjust the sampler flow rate to within this range. Continue with step (6) if a flow rate adjustment of the sampler is desired.

6) Select the desired sampler flow rate value to be used:____ scfm.

7) Determine upper and lower (±20%) limits of sampler flow rate. Note these values and the midrange values of step (6) as follows:

a) Midrange flow rate selected: _______scfm
b) Upper flow rate limit = 1.2 x midrange value = _______ scfm
c) Lower flow rate limit = 0.8 midrange value = scfm

(NOTE: If it is determined to offset the midrange flow rate value (7)(a) from the midpoint of the range of the plant vent in step (3) above, it will be necessary to appropriately modify the multipliers applied to items (b) and (c) of this step.)

8) Refer to the monitor flow rate/gauge reading response curve and note below the actual system readout values (photohelic gauge) which corresponds to the calculations of step (7):

ΔP-Values

a) Midrange Reading: ________________ inches H_2O
b) Upper Limit Reading: ________________ inches H_2O
c) Lower Limit Reading: ________________ inches H_2O

(NOTE: For RE 32/33 and RX 40 systems, refer to graph in Figure 1-5, page 87 for the applicable flow response curve.)

Appendix 1 (Cont.)

9) Notify Site Chemical and Radiation Protection Coordinator of these results. If directed to make system flow rate adjustment, local access to the system will be required. Follow appropriate precautions and guidance specified above for sample media changeout (depending on which sampler/monitor system needs adjusting). Upon arrival at the system of interest, refer below to section 1.b of this appendix for the specific flow adjustment sequence.

b. Adjustment of Sampler/Monitor Flow Rate

This step sequence applies to the air pumping system for RE 32/33 and that for RX 40. It is assumed that local access has been already made to the monitor or sampler system of interest and that the new settings (ΔP-values of step 1.a.(8) are known to the entry team, the system has been thoroughly purged and shut down (if necessary to reduce dose rates, airborne, etc.) and that all considerations other than the particular flow adjustment sequence have already been addressed.

1) Proceed to the photohelic gauge on the cabinet panel and adjust the alarm points as instructed below.

2) The high and low alarm point adjustment knobs are located on the bottom part of the photohelic gauge, right and left and sides, respectively. If plans call to increase settings, adjust the "Hi" alarm side (right knob) first. If plans call to decrease settings, adjust the "Lo" alarm side (left knob) first. (This sequencing is used to avoid triggering the alarm.)

3) Adjust both "Hi" and "Lo" knobs to their planned levels in accordance with the guidance of step (2). It may be advisable to make the second adjustment stepwise to avoid overruning the current setting (i.e., allow the serve time to respond to the first adjustment) if a large change is to be made.

4) Verify that the air pumping system response is appropriate with new settings and depart area.

APPENDIX 1, (Cont'd)

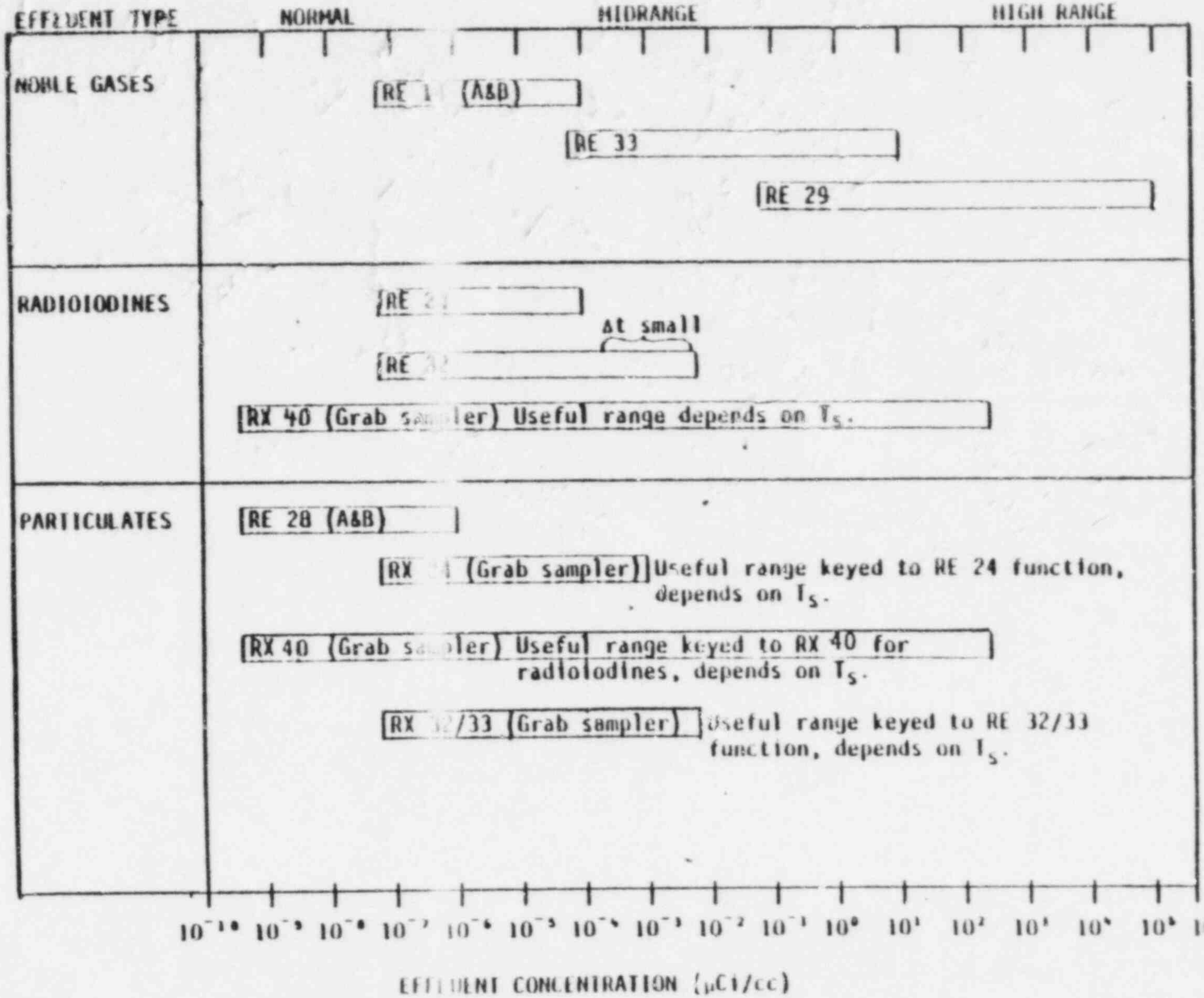


Figure 1-1 Effluent Concentration

APPENDIX 1 (Cont'd)

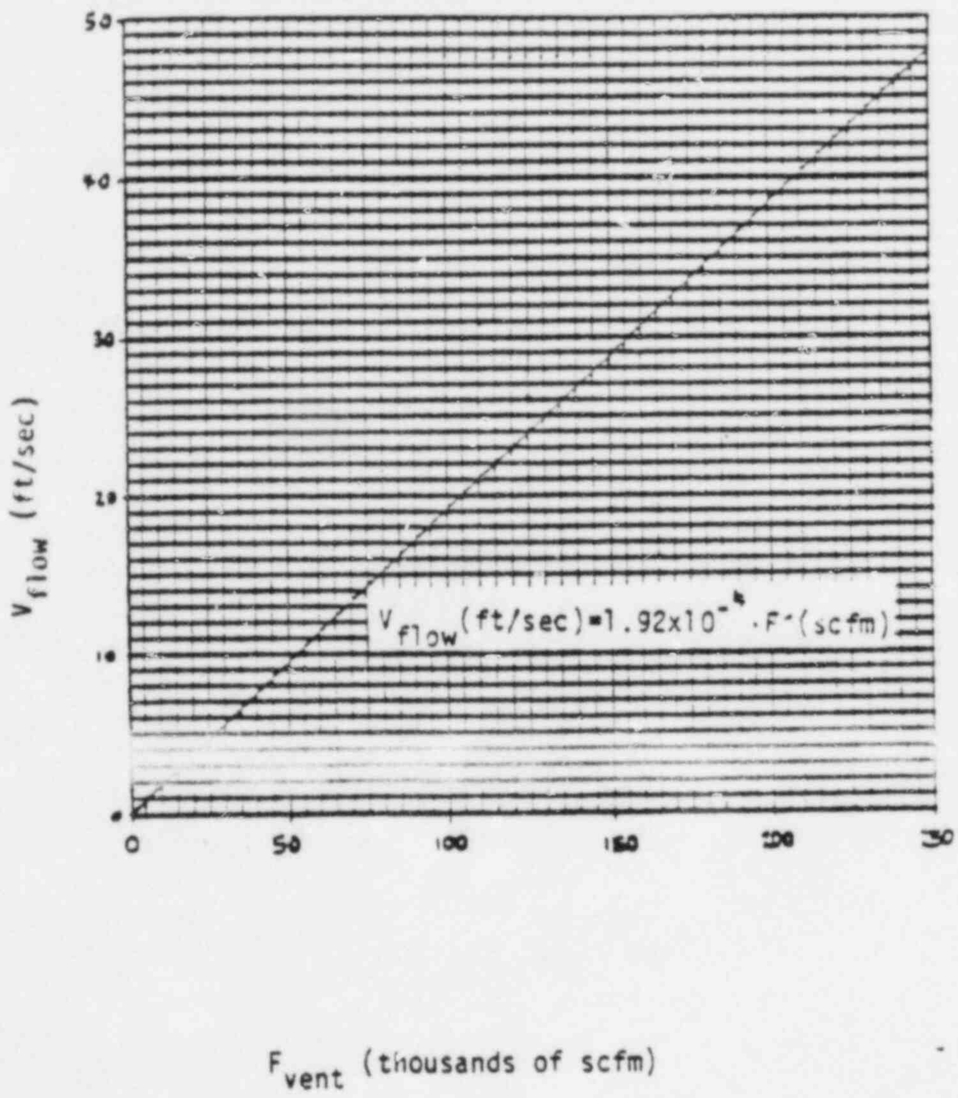


Figure 1-2. Plant Vent Duct Flow Velocity Versus Volume Flow Rate

APPENDIX 1 (Con't)

2. LOW RANGE (NORMAL) PLANT VENT MONITORING SYSTEM

a. System Components and Locations

1) Particulate Monitors (RE 28A&B)

These monitors are duplicate systems (one on standby for backup) which draw from the 220' elevation of the plant vent using an isokinetic sampling probe feeding through the sample line to a traveling belt particulate filter system. These Westinghouse units are designed for use during normal plant operating conditions and anticipated abnormal occurrences. Summary data and descriptive information on this system may be found in Table 1-1. In the event monitored effluent radioactivity levels exceed the capability of this system, determinations of effluent concentrations will be based on use of the higher range monitoring systems discussed below. These monitors are physically positioned on top of the low range radiogas monitors (RE 14A&B) which are located in the Plant Vent Room of the Fuel Handling Building, 115' elevation. This is illustrated in Figure 1 of the procedure. RE 28A&B have Control Room readouts with alarms. Failure and Hi Rad alarm conditions annunciate in the Control Room.

2) Radiogas Monitors (RE 14A&B)

The low range plant vent radiogas monitors are located immediately underneath the particulate monitors (RE 28A&B) which are described above in section 2.a.1). These Westinghouse radiogas monitors quantify radioactivity levels of noble gases and gaseous iodines present in the sample effluent immediately downstream of the particulate filter/monitor assemblies. Summary data and descriptive information on this system may be found in Table 1-1. Similar to the particulate systems, Control Room readouts are provided as well as Control Room annunciation upon failure or Hi Rad alarm condition. Should the radioactivity level of this system approach the detector upper limit, the midrange monitoring system would be brought into operation to maintain operational continuity of the overall plant vent monitoring system.

3) Normal Iodine Monitor (RE 24)

The low range iodine monitoring system (RADeCO Process Air Monitor 571, RADeCO/SAI) is located adjacent to the radiogas monitors (RE 14A&B), described in Section 2.a.2). Iodine samples are drawn from the plant vent effluent through an isokinetic probe with a heat-traced sampling line dedicated to this monitoring system. This system has a particulate prefilter followed by a silver zeolite which is used to collect radioiodines for I-131 photopeak monitoring by the gamma scintillation detector/SCA assembly. Summary data and descriptive information on this system may be found in Table 1-1. Similar to the particulate and radiogas systems, this system has local indications of effluent levels, flow conditions, etc. Control Room annunciation occurs upon failure, low flow, Low Rad, or Hi Rad alarm condition, without indication of the true nature of the alarm. Should the radioactivity level of this system approach the detector upper limit, the midrange monitoring system would be brought into operation to maintain operational continuity of the overall plant vent monitoring system.

3. Midrange Plant Vent Monitoring System (RE 32, RE 33 and RE 34)

The Victoreen midrange plant vent monitoring system consists of two basic elements: 1) a particulate filter and iodine sampler/monitor unit (RE 32), and 2) a noble gas monitor (RE 33) contained in a single sampler/monitor cabinet assembly.

APPENDIX 1 (Cont'd)

The iodine monitor uses a silver zeolite (AgZ) cartridge for iodine collection and a gamma scintillator with a single channel analyzer system to monitor in the 364 keV photopeak region due to the I-131 that may be present in the AgZ cartridge. The noble gas monitor uses a plastic beta scintillation detector to monitor the effluent stream after it has passed through the particulate and iodine collection media. The sampler/monitor unit and associated piping, etc., are illustrated in Figure 1-3.

Both monitors have readouts on the post accident monitoring panel #2 (PAM 2) in the Control Room. Included are readout indication, strip chart recorder, high alarm, failure alarm, and check source operation capabilities. The midrange unit also has purge and bypass capability which can be operated from the Control Room. When the radiation level exceeds the trip limit of the midrange system, it is automatically isolated out (to minimize high level contamination of the system and area) and the high range system governs. (NOTE: This trip limit is actually keyed to preset level on RE 29, the plant vent gross gamma monitor-which is part of the high range plant vent monitoring system described below in section 4 of this appendix.)

Principal components of the midrange plant vent monitor are summarized in Table 1-3 while their overall features of these components are illustrated in Figure 1-4.

APPENDIX 1 (Continued)

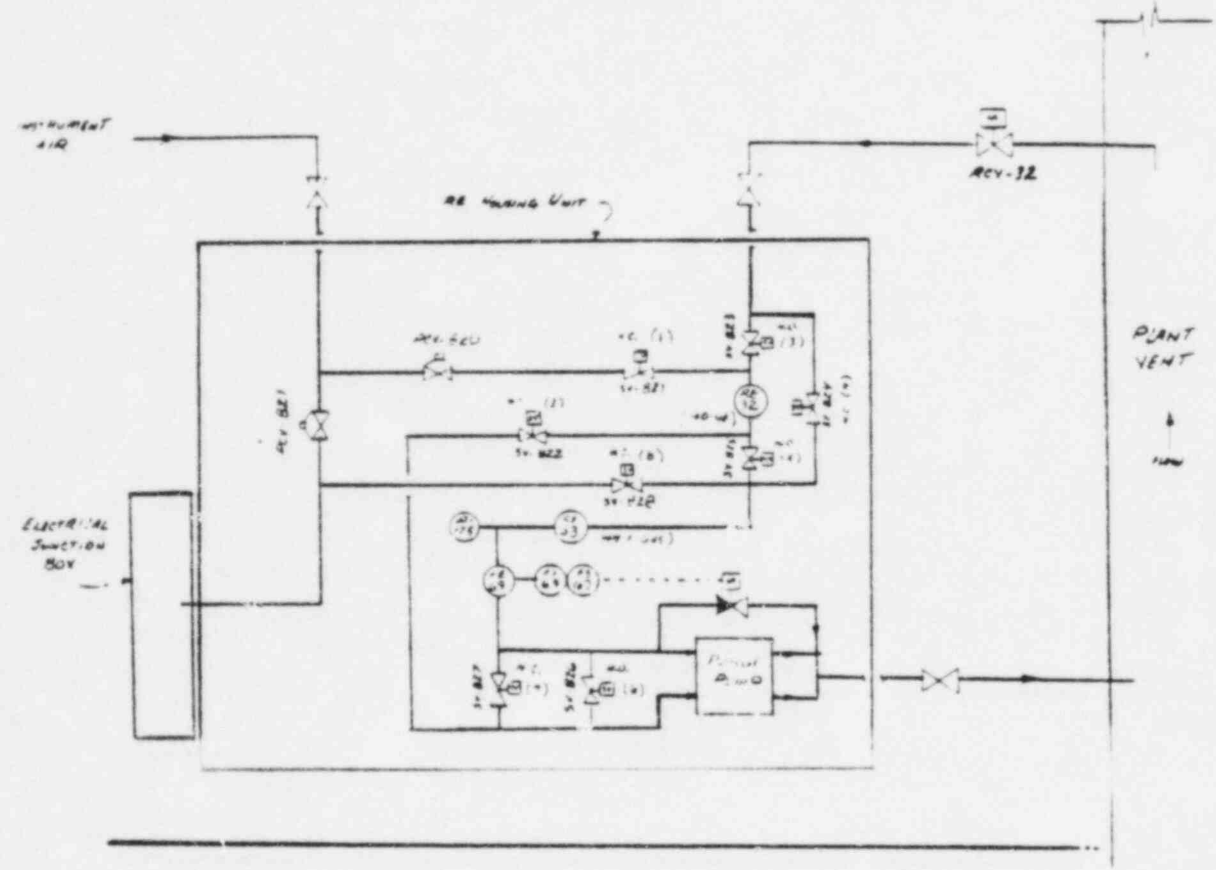


Figure 1-3. Overall System: RE 32/33

APPENDIX 1 (Cont'd)

TABLE 1-3

PLANT VENT MONITORING SYSTEM COMPONENTS BY CHANNEL

A. Midrange Plant Vent Monitors (RE 32 and RE 33)

	RE 32 Components and Description
Detector	2" x 2" NaI(Tl) gamma scintillation/photomultiplier tube, 843-32, (p. 35)*
Sample Collection Medium	Removable charcoal silver zeolite** cartridge, various suppliers, (N/A)
Mid-Radioiodines Readout Panel	Meter, reset, calibrate and alarm indicators, $10-10^7$ cpm, 842-31 (p. 78)

	Re 33 Components and Description
Detector	2"x1/100" plastic beta scintillator/photomultiplier tube 843-22 (p. 39)*
Mid-Radiogas Readout Panel	Meter, reset, calibrate and alarm indicators, 842-11, $10-10^7$ cpm, (p. 100)
Monitoring Equipment Cabinet	844-5-50
Sampling Chamber	Dual Chamber, 841-023 (p. 5)
Flow Orifice w/Gauge	0-8 inches H_2O readout, 844-22 (p. 113)
SS Compression/Vacuum Pump Unit	1-2 scfm flow range, 844-2 modified or MB-602 (p. 113)

*Item in parenthesis refers to location of description in Vendor's Technical Manual.
**Anticipated to be used with this system.

APPENDIX 1 (Cont'd)

TABLE 1-3 (Cont'd)

	RE 32 and 33 Shared Components and Description
Pump & Purge Control Panel (p. 103)	Pump, power, iodine purge, gas purge and flow fault switches/ indicators, 909-136 (p. 103)
L&N Recorder Unit	Two pen recorder, 430

B. Midrange Plant Vent Detector Area Radiation Monitor (RE 34)

Detector	Dual Coaxial Ion Chamber, 4 ranges/chamber, 847-1 (p. 14)
Readout Assemblies	Local Meter/Alarm Unit, 8 decade ($0.1-10^7$mR/hr) meter Audible/visual Alarm Indicator, 848-5
	Remote Meter/Alarm Control Panel (in Control Room), 8-decade ($0.1-10^7$mR/hr) meter, reset, calibrate, check source and alarm indicators, 846-2 (pp. 75-77).
L & N Recorder Unit	Two pen recorder, 430

C. Plant Vent Gross Gamma Monitor (RE 29)

Detector	Dual Coaxial Ion Chamber, 4 ranges/chamber, remotely-located amplifier assembly, 847A-1 (p. 25).

APPENDIX 1 (Cont'd)

TABLE 1-3 (Cont'd)

Readout Assembly	Remote Meter/Alarm Control Panel (in Package Boiler Room), 8 decade (0.1-10^7mR/hr) Meter, reset, calibrate, check source and alarm indicators, 846-2 (pp. 75-77).

D. Plant Vent Iodine Sampler (RX 40)

Equipment Cabinet	Housing cabinet, with slip hinge doors, 844-5-50
Iodine Sample Holder	Grab Samples, slide assembly inside 13.75" x 9.5" x 14.5" fixed, shielded (3"Pb) assembly. 909052 (p. 7)
Flow Orifice w/gauge	0-8 inches H_2O readout, 844-22 (p. 113)
SS Compression/Vacuum Pump Unit	102 scfm flow range, 844-2 modified or MB-6 oz. (p. 113)
Transfer Cart Assembly	Shielded (4" Pb) unit, wheel-mounted (6" dia.), chamber (8" dia. x 14" long), 1500 lb., 909051 (p. 116)
Pump and Purge Control Panel	Pump, power, iodine sample purge, iodine sample line purge, and flow fault switches/indicators, 909137 (p. 108)

E. Plant Vent Iodine Sampler Area Radiation Monitor
This item consists of the same components as the midrange Plant Vent Area radiation monitor (Item B)

APPENDIX 1 (Cont'd)

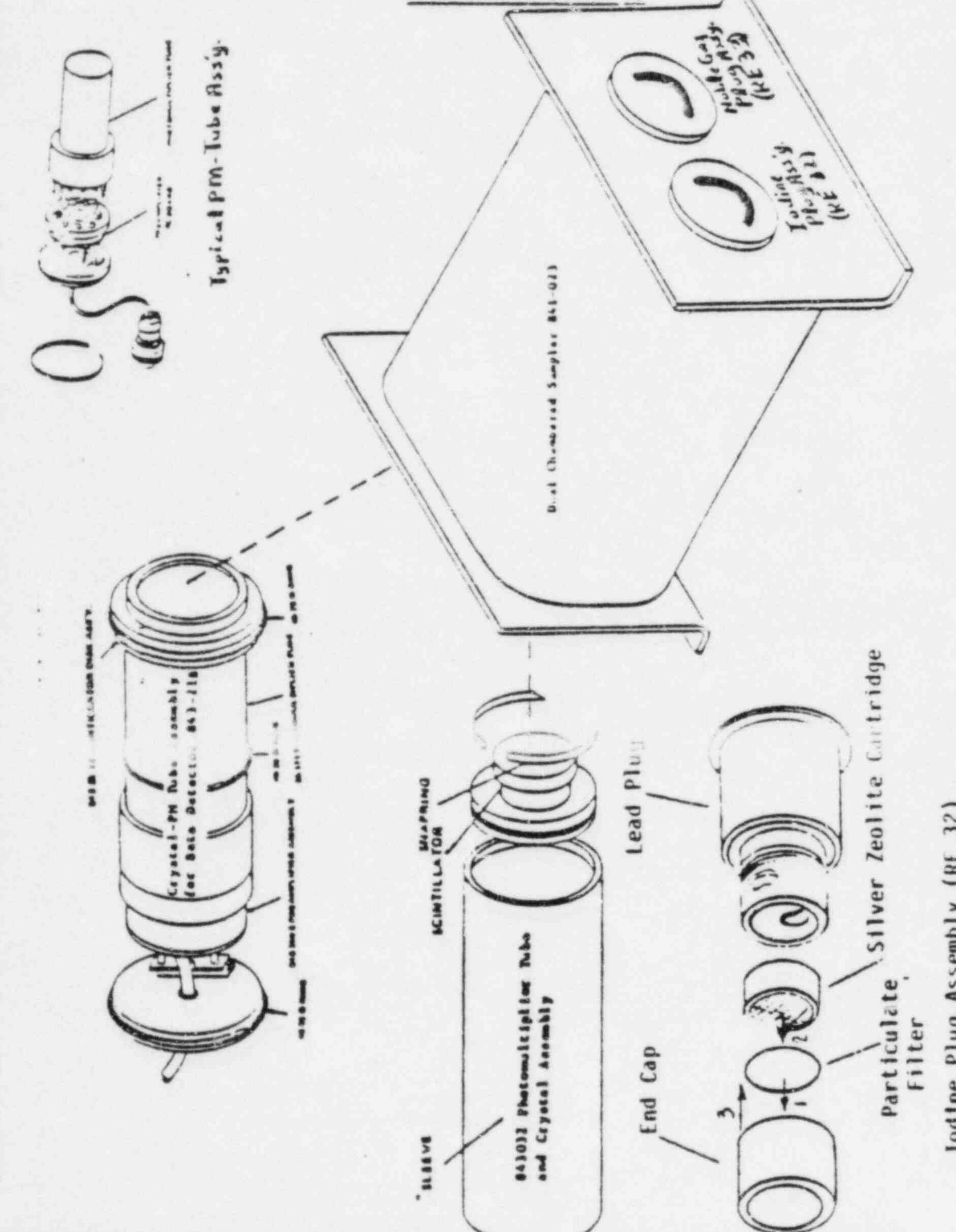


Figure 1-4A. Functional Elements of Midrange Plant Vent Monitoring System - Detector and Chamber Assemblies

APPENDIX 1 (Cont'd)

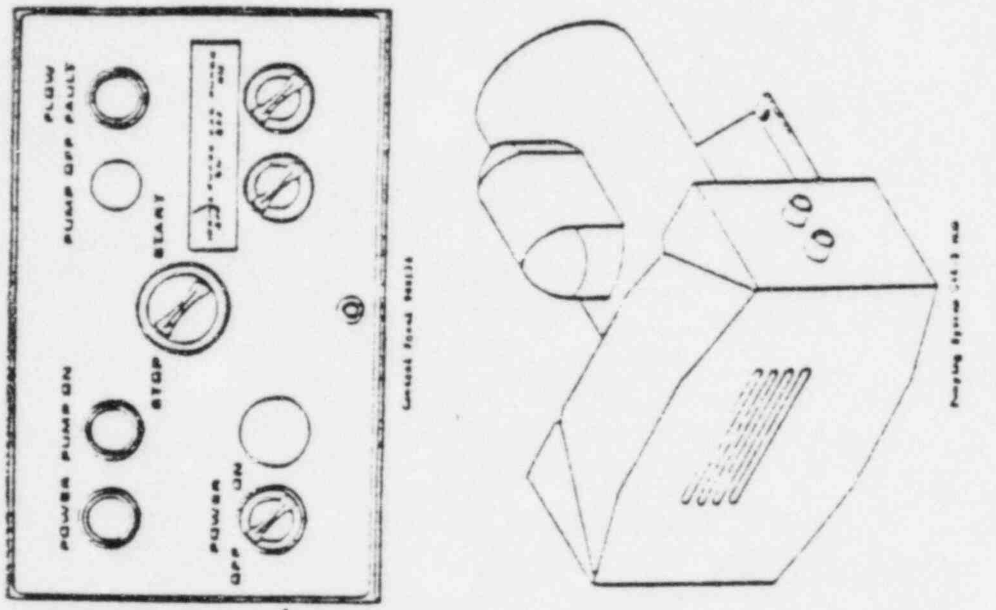


Figure 1-4C. Functional Elements of Midrange Plant Vent Monitoring System-Pump/Purge Control Panel and Pump Motor Assembly

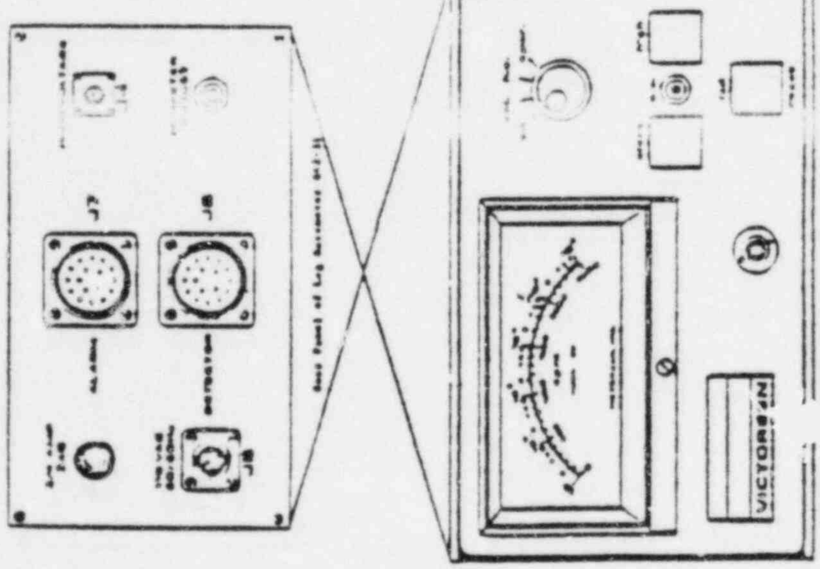


Figure 1-4B. Functional Elements of Midrange Plant Vent Monitoring System - Log Ratemeter (typical)

APPENDIX 1 (Con't)

a. Iodine Monitor (RE 32)

1) Iodine Sample Chamber and Detector Assembly

Both the iodine and noble gas detectors are housed in a common sample chamber having a minimum of 3-1/2 inches of lead shielding with 4π geometry. Principal items of this system are illustrated in Figure 1-4A. The use of both chambers in a common assembly reduces the amount of lead shielding to approximately 1100 pounds, including detector and filter opening plugs. These plugs are secured in position with wing nuts to facilitate filter changeout and maintenance operations. Because these plugs weigh approximately 20 pounds each and fit snugly into the sample shield chamber with O-ring seals, they should be handled with care. Mounted in the left port (as viewed from the rear of the RE 32/33 cabinet) is a screw-type iodine cartridge holder assembly attached to the inside face of its shield plug. The particulate 2" glass fiber filter is loaded ahead of the iodine cartridge in the holder to filter out particulate forms ahead of the iodine cartridge. Refer to Figure 1-4A for illustrations. The radioiodine detector consists of a 2" x 2" NaI(Tl) gamma scintillation crystal coupled to a photomultiplier tube assembly positioned about 5/16" in front of the inlet side of the particulate filter/iodine cartridge holder assembly. Electronic discrimination of the detector output allows the 364 keV energy region to be continuously monitored. (The discrimination levels are preset internally during instrument calibration.) Output of this detector/preamplifier/discriminator assembly is fed electrically into its own ratemeter panel (in PAM 2) located in the Control Room.

APPENDIX 1 (Cont'd)

2) Iodine Log Ratemeter (842-31)

The front and rear panels of the Iodine Log Ratemeter are illustrated in Figure 1-4B. All of the visible controls of the front panel of the ratemeter are of a type that would affect the function of the channel, but would not seriously damage it if they were to be misused. All vital controls are inside the ratemeter where they are not apt to be tampered with. The rear panel contains the connectors for connecting to detectors and ancillary equipment. Ratemeter output is fed into the associated traveling chart recorder unit located in the PAM 1 panel to provide a hard copy record of monitor channel RE 32 readings with time.

a) Front (Display) Panel - The front panel of the ratemeter, shown in Figure 1-4B, has the following displays or controls: (1) The Panel Meter, (2) Function Switch, (3) Alarm indicator pushbuttons (ALERT, HIGH AND FAIL/RESET), and (4) CS momentary pushbutton.

(1) The Panel Meter has two differently graduated scales: A scale in black reading from 10 to 10^7 counts per minute, and a DC voltmeter scale in red reading from 0 to 2500 VDC.

(2) The Function Switch has four positions marked OFF, CAL., HV, and OPER. When the switch is in the OFF position, power is removed from the monitor, and it is not in operation. When the switch is in the CAL. position, a calibrating signal is applied to the ratemeter that should cause the indicator needle to move to the position marked CAL. on the dial. When the switch is in the HV position, the panel meter is indicating the potential of the high voltage supply on the 0 to 2500 VDC lower (red) scale.

When the switch is in the OPER position, the monitor is in operation and the panel meter is showing the full six decades of readout on the upper (black) scale. The desired mode of operation may be selected with the function switch.

(3) There are three alarms: Alert, High and Fail. The amber indication light of the ALERT indicator pushbutton shows when a predetermined level of radiation has been exceeded. When the function switch is in the CAL. position, depressing the ALERT Pushbutton will show on the panel meter the level of radiation for which this alarm has been set without triggering the alarm. (This setting can only be changed by adjusting a potentiometer inside the ratemeter.)

The red indicator light of the HIGH indicator pushbutton provides a second warning when radiation continues to increase and exceeds a second predetermined level. The circuits connected to this indicator control are similar to those connected to the ALERT indicator pushbutton. When the Function Switch is in the CAL. position, depressing the HIGH pushbutton will show on the panel meter the level of radiation for which this alarm has been set without triggering the alarm. (This setting can only be changed by adjusting a potentiometer inside the ratemeter.)

The green light of the FAIL/RESET pushbutton indicator is on when the monitor is in normal operation, and goes out if there is an interruption caused by loss of power, circuit failure, or detector failure. The detector check source provides enough background radiation to keep the warning from actuating due to insufficient background electrical noise and radioactivity sources.

(4) Depressing the CS pushbutton actuates the check source provided with the channel detector and applies radiation to the detector. Deflection of the dial needle upscale assuming it is at a nominally low value indicates that the detector is functional.

b) Rear (Connection) Panel-Figure 1-48 also show the rear panel of the ratemeter. This panel mounts the following items: a 3/4 AMP 3AG fuse, ALARM J7 connector, HIGH VOLTAGE J4 connector, 100VAC 50/60 Hz J5 connector, DETECTOR J6 connector, and HV METER ADJUST. The 3/4 AMP 3 AG fuse protects the ratemeter from power surges on the incoming 100 VAC supply line. The connecting socket marked ALARM J7 carries connections for local alarms and optional, remote indication of channel failure. High voltage (up to 2500 VDC) is available for delivery to the detector through the J4 connector. Input power to the panel is supplied through the J5 connector. With the exception of high voltage, all inputs (outputs) to (from) the sensor assembly are transmitted through connector J6. The HV METER ADJUST is a potentiometer adjustment in the high voltage power supply circuit that is used to adjust the panel meter reading during calibration.

b. Noble Gas Monitor (RE-33)

1) Noble Gas Sample Chamber and Detector Assembly

The noble gas detector is situated in the chamber area adjacent to the iodine cartridge chamber area (right side, as viewed from the RE 32/33 cabinet rear side) and consists of a 2" x 1/100" plastic beta scintillation crystal coupled to a photomultiplier tube assembly. This detector assembly monitors a 2-11/16" diameter, 3" deep chamber (280 cc) of air after it has been drawn through the particulate filter and iodine cartridge. The noble gas detector electronic output is fed through a baseline electronic discriminator (preset internally during calibration) for biasing out low amplitude pulses normally associated with equipment noise, gamma background, etc. Output of this detector/preamplifier assembly is fed electrically into its own ratemeter panel (in PAM 2) located in the Control Room.

2) Noble Gas Log Ratemeter (842-11)

The Noble Gas Log Ratemeter unit is of exactly the same design as the Iodine Log Ratemeter with the single exception that it does not contain an analyzer board, which provides the I-131 photopeak discrimination capability of the Iodine monitor (RE 32). The ratemeter output is fed into the associated traveling chart recorder unit located in the PAM 1 panel to provide a hard copy record of monitor channel RE 33 readings with time.

c. Air Pumping System (RE 32/33)

1) Pump and Purge Control Panel

The control panel shown in Figure 1-4C operates the pump motor of RE 32/33 and also provides a means for remote operation of the sample chamber purge valves. Controls and indicators on the front panel are as follows: POWER Indication Light, PUMP ON Indicator Light, FLOW FAULT Indicator Light, POWER OFF/ON Selector Switch, STOP/START Selector Switch, IODINE PURGE OFF/ON Selector Switch, and GAS PURGE OFF/ON Selector Switch. The POWER OFF/ON Selector Switch connects line power to the system and activates the white POWER ON Indicator Light on the panel face. The STOP/START Selector Switch activates the pump motor through the motor starter when the local motor control switch on the motor starter is in the AUTO position. The red PUMP ON Indicator

Light is so connected that it is in parallel with the pump motor and will light when either the manual switch on the control panel or the switch at the motor starter is used to start this pump motor.

When activated, the IODINE PURGE Selector Switch operates a relay which controls actions of solenoid valves in the iodine sampling line, as summarized in Table 1-4 (for RE 32).

When activated, the GAS PURGE Selector Switch operates a relay which controls actions of solenoid valves in the gas sampling line, as summarized in Table 1-4 (for RE 33).

2) Pump Assembly

The gas sample pumping system (1.0 to 2.0 scfm) shown in Figure 1-4C, uses a moving diaphragm type pump driven by a 115 VAC, 60 Hz, single phase pump motor. The pump may be either operated remotely from the Pump and Purge Control Panel (909136) in the Control Room, or it may be controlled manually by use of a motor control switch inside the circuit panel box on the end of the sampler/monitor cabinet. This motor control switch may be set to one of three positions: AUTO - permits pump motor on/off control remotely from the Control Room (PAM 2), OFF - disables all pump motor control switches, with the pump off, and HAND - manually turns pump motor on, disabling the PAM 2 pump motor switch function. Gas flow drawn through the sampling system chambers is regulated by the operation of a bypass valve the has been manually set at 2.0 scfm, which corresponds to a gauge ΔP reading of 5.6 inches of water. Figure 1-5 provides a graph of the sampler pressure drop/flow rate relationship. The flow meter indicator reads out from 0 to 8 inches of water. Figure 1-5 may thus be used to determine the corresponding flow rate required to maintain isokinetic sampling conditions (within ±20%) as discussed above in section 1 of this appendix.

Flow of gas in the system is measured by the flow control system which delivers a signal to the Pump and Purge Control Panel in the event of abnormal flow condition. Either a low flow or high flow condition will cause the amber FLOW FAULT indicator to light up.

APPENDIX 1 (Cont'd)

TABLE 1-4
VALVE ACTIONS DURING SYSTEM PURGING OPERATIONS*

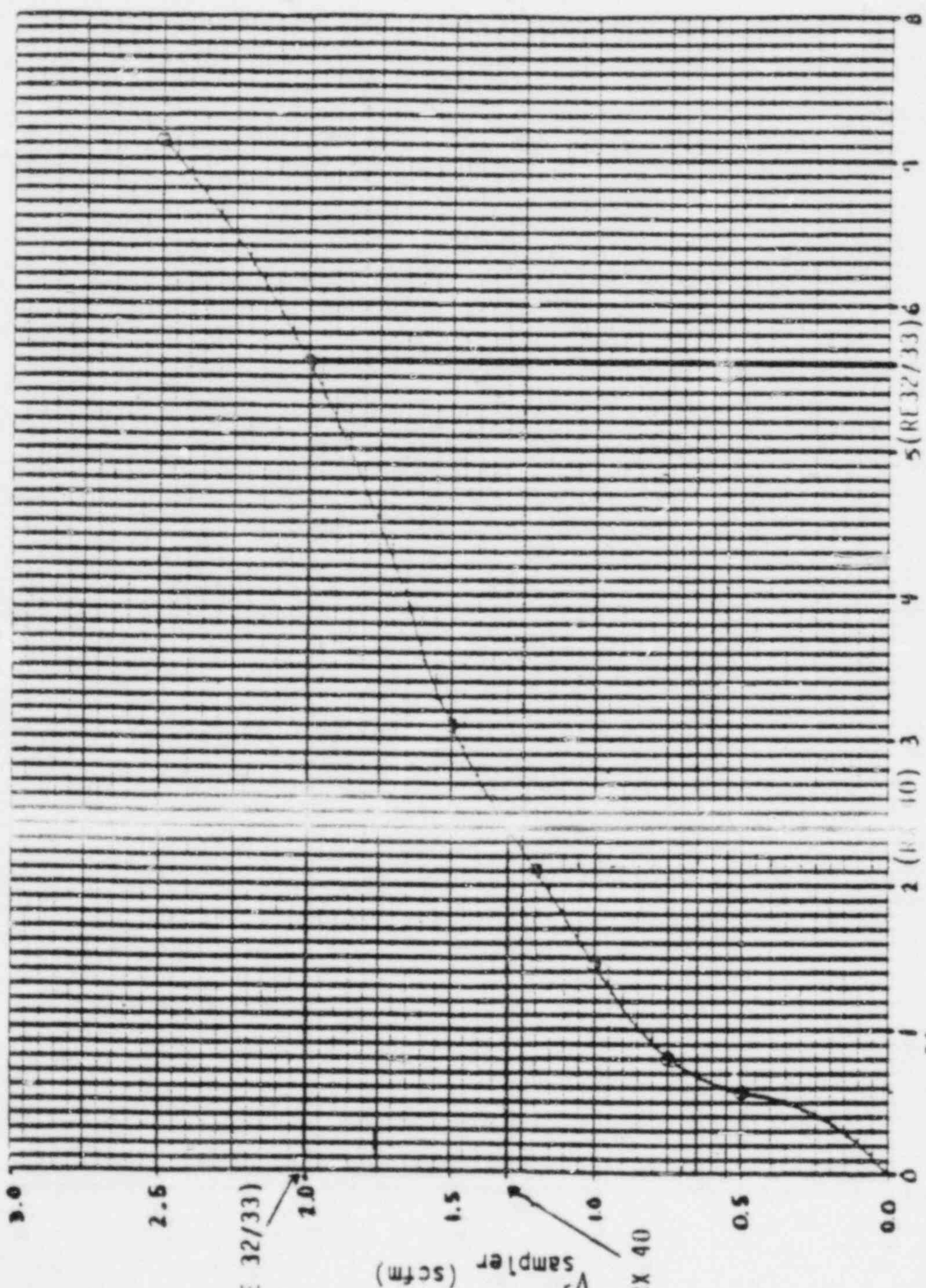
SYSTEM	VALVE ACTIONS	
RE 32	Valve #3	closes, stopping flow of the sample to the iodine sampler.
	Valve #4	opens, creating a bypass route for the sample gas.
	Valve #5	closes, isolating the downstream end of the sampler line from the bypass route.
	Valve #1	opens, admitting purge air to the iodine sampler.
	Valve #2	opens, allowing purge air to leave the iodine sampler.
	Valve #6	closes, stopping gas sampler air from one side of the pump.
	Valve #7	opens, allowing spent purge air from the iodine sampler to go through both sides of the pump.
RE 33	Valve #5	closes, stopping the flow of the gas sample from the iodine sampler to the gas sampler.
	Valve #2	opens, making a path for the sample gas from the iodine sampler to escape.
	Valve #8	opens, allowing purge air into the gas sampler. Spent purge air leaves the gas sampler by the normal route.
Iodine Sampler Purge	Valve #10	closes, stopping flow of sample gas to the collecting sampler.
	Valve #6	opens, admitting purge air to the collecting sampler.
Iodine Sample Line Purge	Valve #7	opens, creating a bypass route past the collecting sampler.
	Valve #8	closes, stopping flow of gas into the collecting sampler.
	Valve #9	closes, isolating the collecting sampler from the pumping system.
	Valve #5	opens, admitting purge air to the iodine sampling line.

*The overall sampling system (including valving, sampling lines, etc.) for RE 32/34 is illustrated in Figure 1-2 while that of RX 40 is illustrated in Figure 1-6.

APPENDIX 1 (Cont'd)

Operating Set Points

RE 32/33 V' = 2.0 scfm P_{op} = 5.6" H_2O
RX 40 V' = 1.3 scfm P_{op} = 2.4" H_2O
RE 24* V' = 1.55scfm P_{op} = ___



*Flow response of RE 24 system is not shown on this graph.

Figure 1-5. Flow Response of RE 32/33 and RX 40 Air Pumping Systems (both .250/.248 orifice)

APPENDIX 1 (Con't)

d. Associated Area Radiation Monitor (RE 34)

An area radiation monitor (ARM) is provided in the midrange monitor (RE 32/33) equipment area. The physical location of this monitoring unit is depicted in Figure 1 of the procedure. The function of this monitor is to provide plant staff (or other personnel) with an indication of area radiation levels so that their subsequent exposures may be maintained as low as reasonably achievable. This may either result in disallowing personnel access altogether or taking special precautions prior to entering the area to obtain samples, or perform other tasks. The ARM monitor consists of a local detector with an adjacent readout device, and a Control Room (remote) readout which has a ratemeter indicator, high alarm, failure alarm, associated strip chart recorder, and the capability for performing system checks. Principal elements of this system are depicted in Figure 1-6.

1) Ion Chamber Detector Assembly (847-1)

Figure 1-6 illustrates an exterior view of the housed detector assembly and a schematic cross-section of the dual coaxial ion chambers. Specifications for this detector unit are shown in Table 1-5. The detector assembly employs a dual coaxial ion chamber with a high and low range ion current output, as shown in Figure 1-4. Each range covers four exposure rate decades. The chambers operate synchronously with each output measured the same way.

The collector for the high-range chamber is a conventional axially located electrode mounted in the usual way with a ceramic insulator and a guard. The guard is connected to the low-level or signal ground. The low-range collector is a cylindrical electrode surrounding the high-range chamber wall. The low-range chamber wall surrounds the low-range collector. Although not shown in Figure 1-6, the low-range collector is supported, like the high-range collector, by a ceramic insulator, and protected by a guard that is connected to the low-level or signal ground. A collecting voltage of -150 VDC is applied to both the high-range and the low-range chamber walls. Surrounding the low-range chamber wall is a protective cover that is grounded to the instrument chassis.

TABLE 1-5

GENERAL SPECIFICATIONS FOR
ION CHAMBER DETECTOR (847-1)

FEATURE	SPECIFICATION
Dimensions:	
Offset from Mounting Surface	1-1/4 in. (3.2 cm)
Largest Diameter	9 in. (22.9 cm)
Height	11-3/4 in (29.8 cm)
Weight	9-1/8 lb (4.14 kg)
Mounting	Wall bracket
Connector	AN 3102-18-1P
Range	8 decades from 0.1 to 10^7 mR/hr
Precision	± 10% in any decade
Circuitry	All Solid State
Type of Radiation Detected	Gamma or X-Ray
Energy Dependence	80 keV to 3 MeV ± 10%
Directional Dependence	Less than 10% in any direction with ^{60}Co
Type of Detector	Dual coaxial ionization chamber at atmospheric pressure
Pressure Limits	15 psig
Temperature Limits	-4°F to +140°F (-20°C to + 60°C)
Humidity	0 to 90%

APPENDIX 1 (Continued)

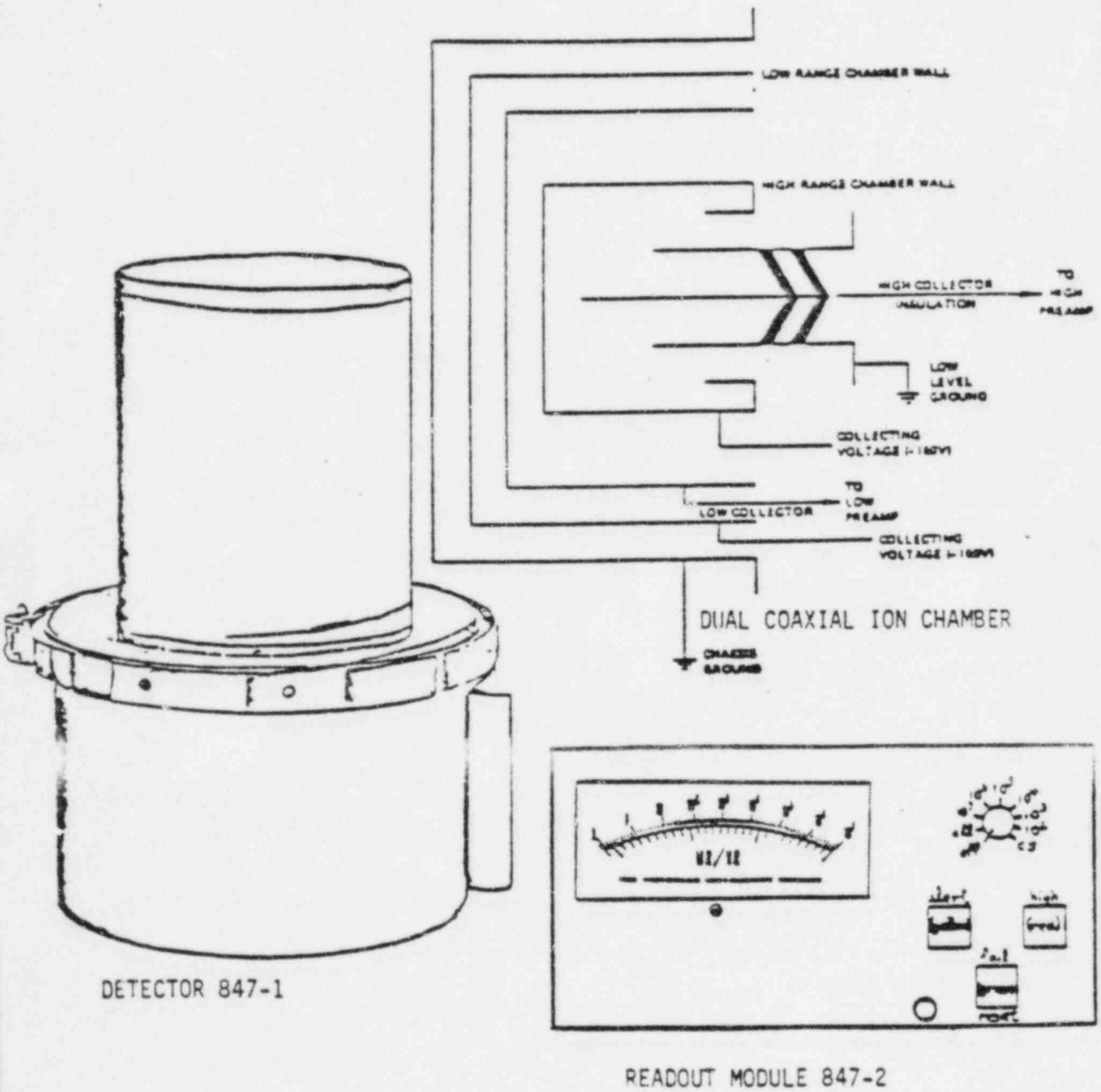


Figure 1-6. Principal Elements of Area Radiation Monitoring System

APPENDIX 1 (Con't)

2) Readout Meter Assembly (846-2)

The readout meter unit responds to the detector output in terms of "mR/hr" as shown in Figure 1-6. The meter readout is switchable between an eight decade ALL mode (top scale) and three decade range (lower scale), each with two decade overlaps as follows:

MODE	RANGE COVERED
ALL	0.1 to 10^7 mR/hr
THREE DECADE	0.1 to 10^2 mR/hr 1 to 10^3 mR/hr 10 to 10^4 mR/hr 10^2 to 10^5 mR/hr 10^3 to 10^6 mR/hr 10^4 to 10^7 mR/hr

This all solid state device has a stated precision of ±10% of the maximum reading in any decade and has both recorder and computer output capability. Alarm indicator lights appear on the readout instrument front panel for ALERT (amber) and HIGH (red) conditions. The actual levels of these alarms are set internally during instrument calib[illegible] an alarm condition occurs, the indicator will continue to show its alarm condition until the RESET button has been manually depressed. An instrument failure warning system is also incorporated on the front panel. As long as the FAIL (green) indicator light is on, the system is operating properly. Upon loss of signal from the detector, the FAIL Light will turn off. Activation of the check source (CS) switch on the front panel should produce an upscale deflection of the readout panel meter (assuming it is at a nominally low value) indicating that the detector is functional. This action will not produce an alarm condition on the readout meter assembly.

APPENDIX 1 (Cont'd)

4. High Range Plant Vent Monitoring System (RE 29, RE 35 and RX 40)

The High Range Plant Vent Monitoring System consists of two basic subsystems:

(1) Plant exhaust vent gross gamma monitor (RE 29) and

(2) the plant vent high range iodine sampler (RX 40) with associated area radiation monitor (RE 35).

a. Gross Gamma Radioactivity Monitor (RE 29)

The gross gamma radioactivity monitor consists of a model 847-1A dual coaxial, shielded ion chamber and a model 846-2 readout panel in the Control Room PAM panel similar to that of RE-34 (area radiation monitor) discussed above in section 3.e of this appendix. These are pictured in Figure 1-6, while the detector specifications are stated in Table 1-5.

b. Plant Vent Iodine Sampler (RX 40)

Should radioactivity levels of plant vent effluents rise to the operating level of the RE 29 monitor, it would be virtually impossible to detect radioiodines in the presence of the noble gases. Because of the high radiation levels from the plant vent itself, personal exposures from entering the monitor area to obtain grab samples would be prohibitive. For this reason, a separate iodine grab sampler (RX 40) has been installed at a remote location. The basic components of this sampler are illustrated in Figure 1-7 and listed in Table 1-3.

The system has an isokinetic probe at the 220' elevation of the plant vent with a heat traced sample line extending down to the 85' elevation where the sampler is located. The remote sampler consists of an

APPENDIX 1 (Cont'd)

iodine collection canister/holder which is loaded with both a particulate prefilter an iodine cartridge, and a regulated air pumping system similar to that of RE 32/33. Gas flow drawn by the pumping system is regulated by the operation of a bypass valve that has been manually set for a system flow rate of 1.3 scfm, which corresponds to a gauge ΔP reading of 2.4 inches of water. Figure 1-5 provides a graph of the sampler pressure drop/flow rate relationship. The flowmeter indicator reads out from 0 to 8 inches of water. Figure 1-5 may thus be used to determine the corresponding flow rate required to maintain isokinetic sampling conditions (within ±20%) as discussed above in section 1 of this appendix. The sampler has the capability to purge the iodine canister and the sample line. The purge is performed remotely from PAM 2 panel located in the Control Room. The layout of this panel is illustrated in Figure 1-8A. The valve line-up during the purge mode is listed above in Table 1-4 for RX 40. A lead-shielded transfer carriage may be used to remove highly radioactive iodine cartridges from the RX 40 cabinet and transport them for laboratory or offsite analysis. The elements of this shield and transfer system are shown in Figure 1-8B.

c. Plant Vent Iodine Sampler Area Radiation Monitor (RE 35)

The area radiation monitor associated with the iodine grab sampler unit is identical in components and operation to that of Area Radiation Monitor RE 34 described above in section 3.e. of this appendix. The elements of this ARM unit are pictured in Figure 1-6 above. As shown in Figure 3 of the procedure, this unit is located very near to the iodine grab sampler along the north wall of the Fuel Handling Building at the 85'0" elevation.

APPENDIX 1 (Cont'd)

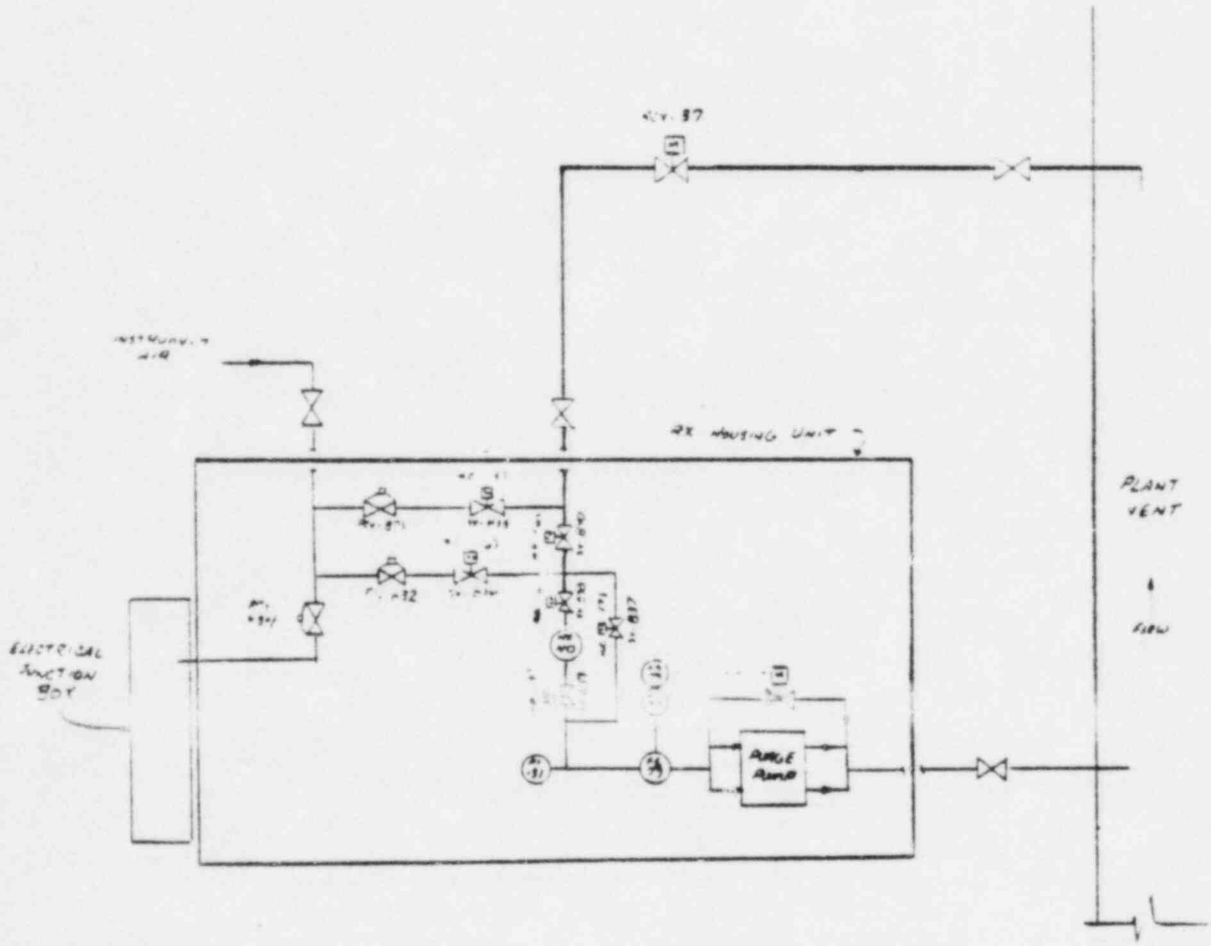


Figure 1-7 Overall System: RX 40

APPENDIX 1 (Cont'd)

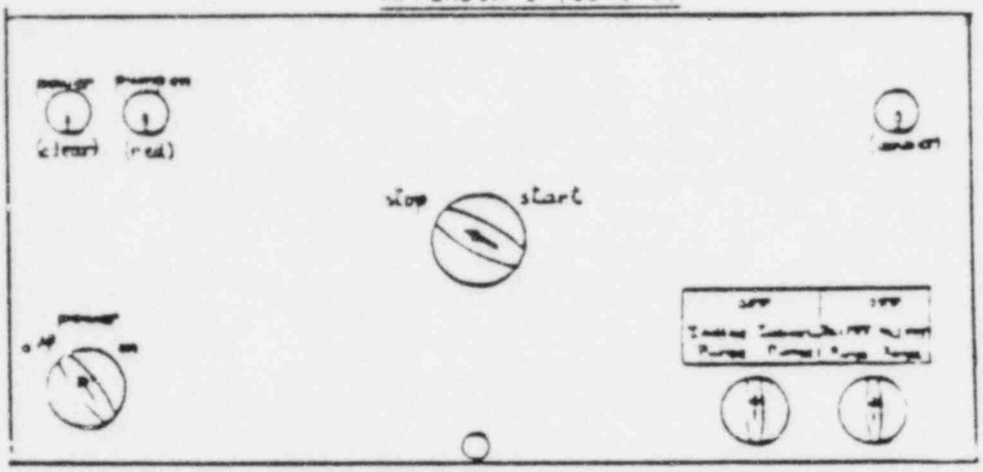


Figure 1-8A. Pump and Purge Control Panel for RX 40

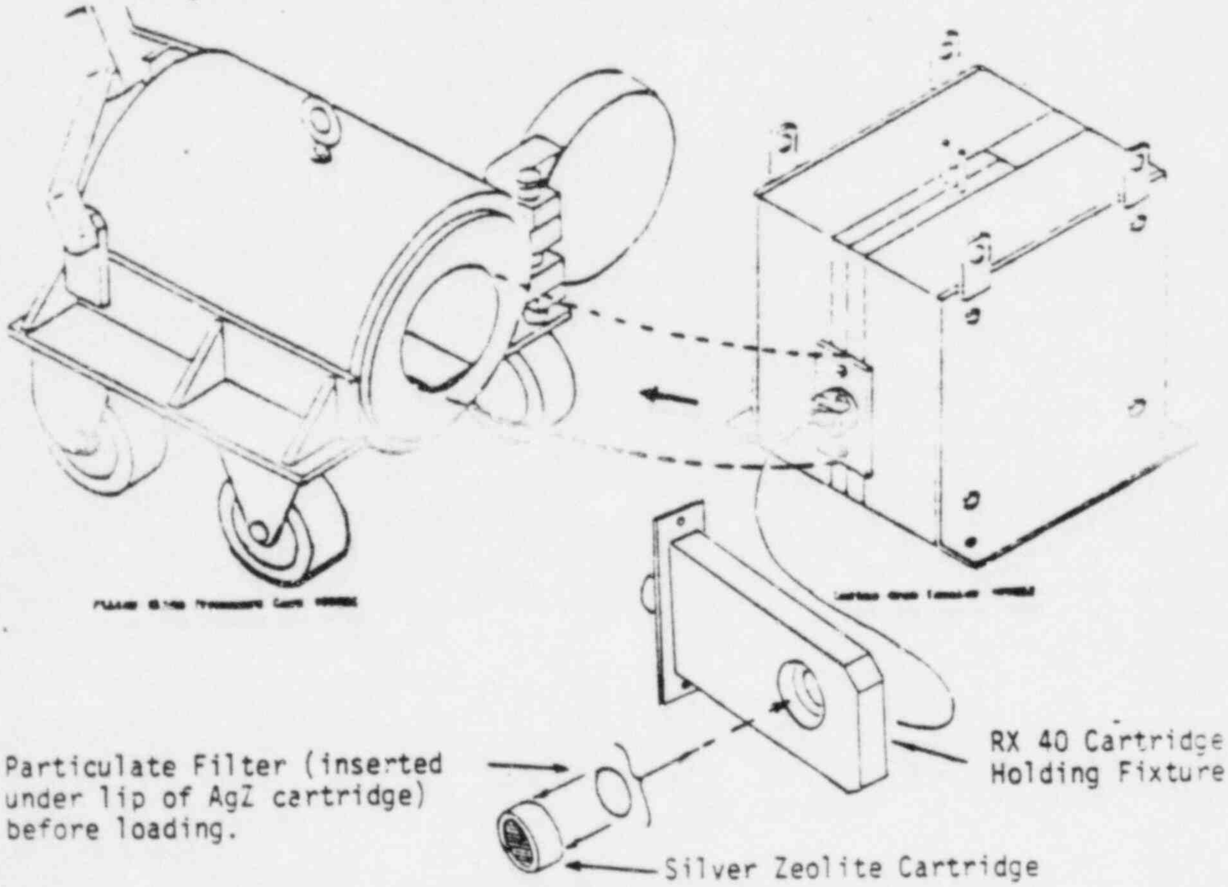


Figure 1-8B. Grab Sampler and Transport Cart for RX 40

APPENDIX 1 (Cont'd)

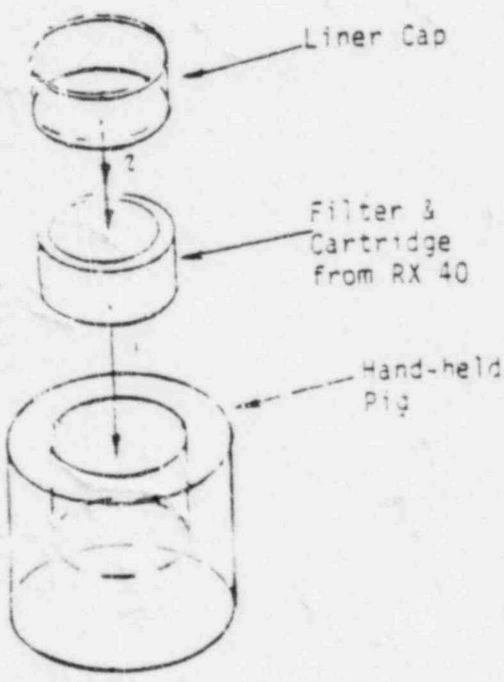
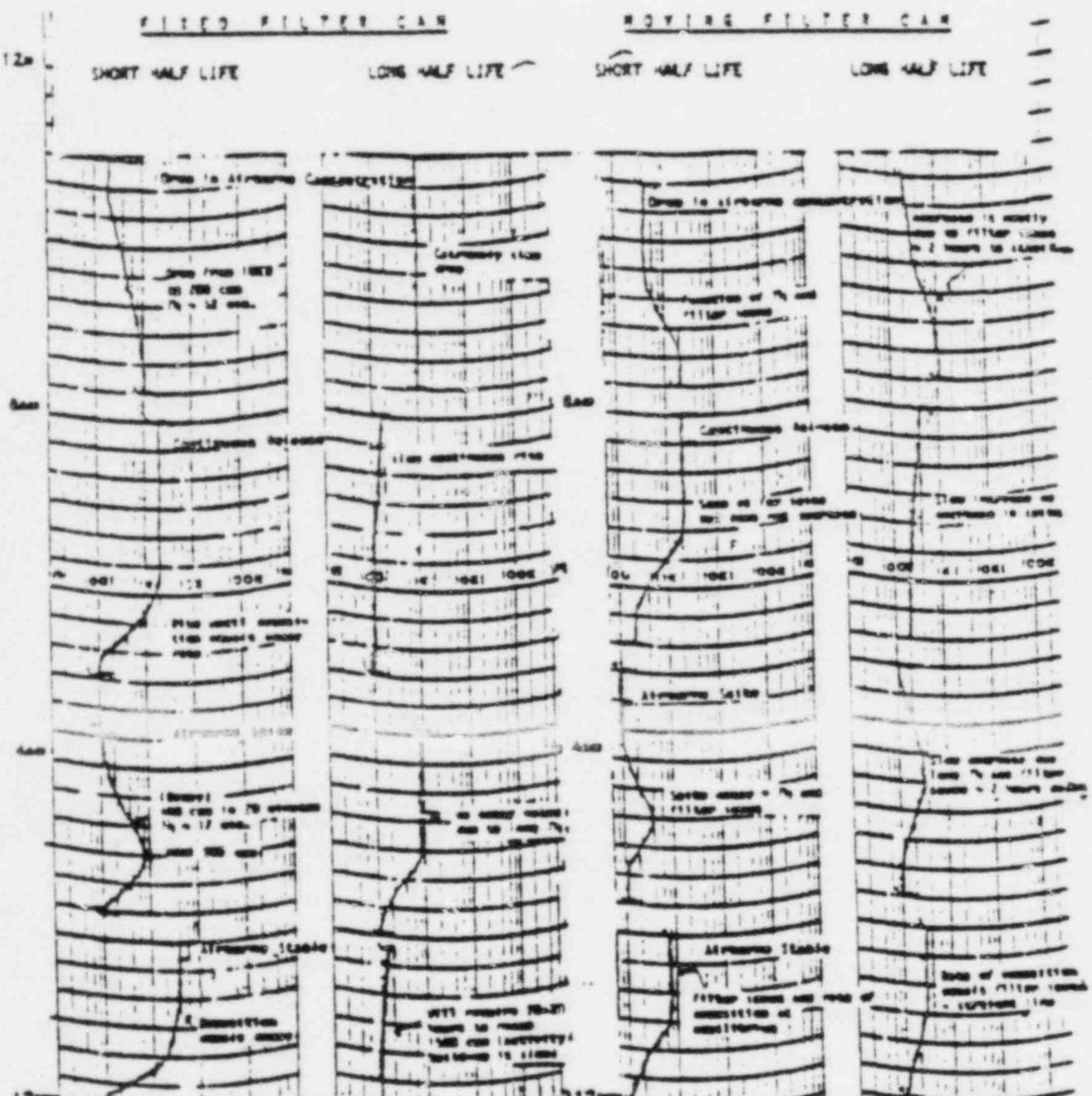


Figure 1-8C. Hand-held Pig.

APPENDIX 2

Typical Continuous Air Monitor Readout (CAM Plot)



APPENDIX 3

GUIDANCE REGARDING OPERATION OF REMOTE IODINE SAMPLER (RX 40)

Rx 40 may be used to greatest advantage if sampling time can be estimated and limited to avoid build-up of high radioactivity levels in associated sampling media, particularly the silver zeolite cartridges used to collect radioiodines from the sampled effluent stream. If an upper estimate of radioiodine concentrations can be obtained, a maximum sample collection time (T_s) for RX 40 can be determined and thus limit the accumulation of radioiodine activity in the sample cartridge to a preset level. In many cases it may be possible to limit the cartridge radioactivity content to a level which can be directly analyzed on the HPGe/MCA system (or other suitable counting equipment). When this is not possible, it will be necessary to use appropriate conversion factors. This appendix provides guidance for estimating effluent radioiodine concentrations, establishing a sample collection time to limit accumulation of sample radioactivity and the determination of sample radioiodine content, corresponding effluent radioiodine concentration and release rate.

It is possible to apply similar reasoning to the particulate samples also retrieved using RX 40. The principal differences are those of sample collection efficiency and plateout factor (if significantly different from unity).

A. Determination of Sample Collection Time (T_s)

To limit sample radioiodine content to a desired level the following expression may be used:

$$T_s = \frac{A_I^{limit}}{C_I^{est.} \cdot e_s \cdot 28,320 \left(\frac{cc}{ft^3}\right) \cdot f_I \cdot V'} = 3.1\times10^{-5} \frac{A_I^{limit}}{C_I}$$

where

T_s = sample collection time, (min)

A_I^{limit} = preset sample radioiodine limit, (μCi)

C_I^{est} = estimated radioiodine concentration in plant vent effluent stream, (μCi/cc)

APPENDIX 3 (Cont'd)

e_s = sample medium collection efficiency, (dimensionless)

= 0.94 for AgZ

f_I = radioiodine sample plateout correction factor (taken as 1 with heat tracing on), (dimensionless)

V = sample stream flow rate, (ft^3/min)

= 1.3 ft^3/min for RX 40

Because of a finite travel time from the sampling point to RX 40 approximately 40 seconds), a practical lower limit of about 2 to 3 minutes for T_s may be required to preclude substantial errors in measuring an actual value for sample collection time. The value for C_I^{est} will depend on plant

conditions. The basis for making estimates of C_I for the plant vent effluent stream are provided in EP RB-9.

B. Determination of Sample Radioiodine/Particulate Contents, Effluent Concentrations and Release Rates.

Once a radioiodine/particulate sample is obtained from RX 40 (or RE 32), its radioiodine content may be determined by direct gamma spectroscopy. If sample radioactivity levels are prohibitive or if time does not permit, its radioactivity content may be estimated using an appropriate exposure rate conversion factor. Due to the time-varying isotopic composition in such a sample, it is necessary to account for the effects of radioactive mixture age (t_s). Three broad ranges of sample age may be used to cover these effects on the conversion factors as follows:

$$A_I = k \cdot ER_I$$

where

A_I = estimated sample content, (μCi)

k = iodine sample exposure rate to radioactivity conversion factor tabulated below for t_s ranges of interest, (μCi/mR/hr)

ER_I = net gamma only exposure rate at contact (½" away) with face of sample cartridge using a teletector survey meter, (mR/hr)

APPENDIX 3 (Cont'd)

The applicable k-values are tabulated as follows:

TABLE 3-1

CONVERSION FACTORS FOR IODINE ACTIVITY FROM EXPOSURE RATE

Range	Sample Age	Silver Zeolite with Particulate
Short-Term	0 hrs. $< t_s \leq$ 2 hrs.	1.4
Intermediate-Term	2 hrs. $< t_s <$ 10 days	1.6
Long-Term	10 days $< t_s$	3.0

The assumption tht the total activity of the sample is iodine, including that of the particulate filter, is a conservative assumption. Although it is not possible to accurately predict the fraction of the sample that will be non-halogen particulates, the following should be noted:

1) The extent of conservatism in the above assumption is dependent on the relative percentage of non-halogen particulates in the containment atmosphere.

   a) NUREG-0737 specifies that 1% of the core inventory is available as non-halogen particulates to the reactor coolant system. With this considered as an upper limit of the activity to the containment building, the fraction of total activity as iodines (F_I) as a function of sample age t_s is:

t_s (hrs)	F_I
0	0.90
10	0.80
70	0.645
200	0.489
500	0.248
700	0.150
1000	0.062

APPENDIX 3 (Cont'd)

b) Any smaller percentages of non-halogen iodines will obviously improve the accuracy of this assumption to the extreme of zero non-halogen particulates and 100% iodines with correspondingly less conservatism.

2) Any results bordering on an important decision point can be more accurately estimated by removing the particulate filter and measuring the dose rate on the silver zeolite cartridge <u>only</u> for subsequent conversion to radioactivity using the following equation:

$$A_I = \frac{k \cdot ER_I}{0.96}$$

Where: 0.96 = the predicted fraction of non-particulate iodines (Regulatory Guide 1.4)

A_I = (previously specified above)

k = (previously specified above)

ER_I = (previously specified above)

Once the radioiodine content of the sample is known, the actual radioiodine concentration, averaged over the sample collection interval (T_s), may be determined as follows:

$$\bar{C}_I = \frac{A_I}{e_s \cdot Vol \cdot f_I}$$

where

$\bar{C}_I$ = actual effluent stream radioiodine concentration, (μCi/cc)

A_I = (previously specified above)

e_s = (previously specified above)

and f_i = (previously specified above)

APPENDIX 3 (Cont'd)

Vol = effluent stream sampled air volume, (cc)

$$= 28,320 \left(\frac{cc}{ft^3}\right) \cdot V' \left(\frac{ft^3}{min}\right) \cdot T_s\ (min)$$

$$Vol \begin{matrix} \text{for RE 32} \\ \text{or} \\ \text{RX 40} \end{matrix} = 28,320 \left(\frac{cc}{ft^3}\right) \cdot \begin{matrix} 2.0 \\ \text{or} \\ 1.3 \end{matrix} \left(\frac{ft^3}{min}\right) \cdot T_s\ (min) = \begin{matrix} 5.66 \times 10^4 \\ \text{or} \\ 3.68 \times 10^4 \end{matrix}\ T_s$$

From C_I, the corresponding plant vent effluent release rate for radioiodines may be calculated as follows:

$$RR_I = 4.72 \times 10^{-4} \cdot F' \cdot C_I$$

where

RR_I = average plant vent radioiodine release rate during T_s, (Ci/sec)

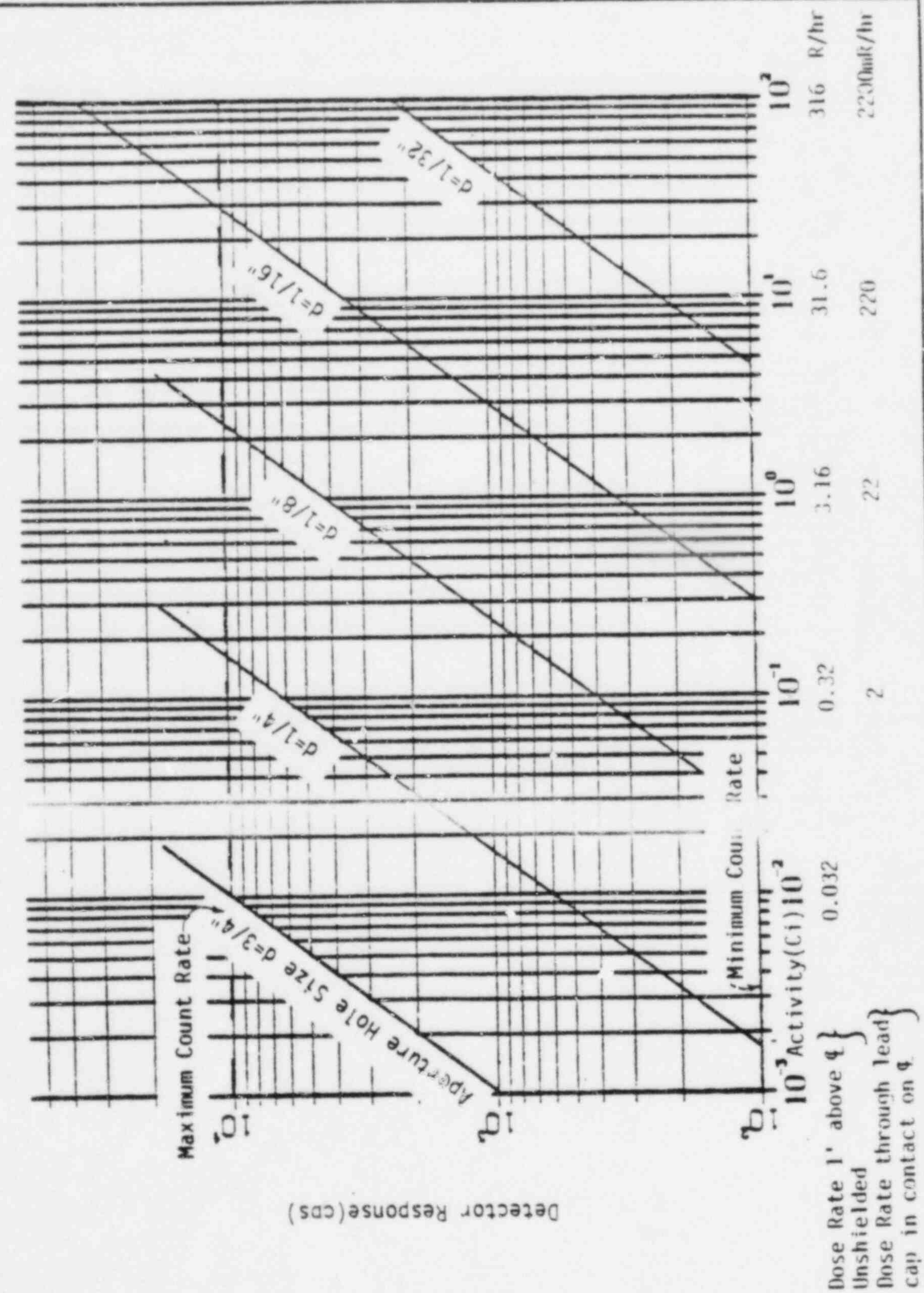
and

F' = total plant vent exhaust flow rate, (ft^3/min)

Possible systems contributing to the plant vent exhaust air flow, hence to the magnitude of F', are discussed in section 1 of the systems description (which is included in Appendix 1 to this procedure).

APPENDIX 4

DETECTOR RESPONSE VS. ACTIVITY (AND CORRESPONDING DOSE RATES)
FOR AVAILABLE APERATURES



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PACIFIC GAS AND ELECTRIC COMPANY

PG&E — 77 BEALE STREET, SAN FRANCISCO, CALIFORNIA 94106 TELEPHONE (415) 781-4211

February 8, 1984

PGandE Letter No.: DCL-84-049

Mr. John B. Martin, Regional Administrator
U. S. Nuclear Regulatory Commission, Region V
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596-5368

Re: Docket No. 50-275, OL-DPR-76
Docket No. 50-323
Diablo Canyon Units 1 and 2
Emergency Plan Implementing Procedures Updates

Dear Mr. Martin:

In accordance with Section V, "Implementing Procedures," of 10 CFR 50, Appendix E, PGandE is submitting one copy of the updates to the detailed Implementing Procedures for the Diablo Canyon Power Plant Units 1 and 2 Emergency Plan as listed in Attachment 1. Concurrently, two copies of each update are being submitted to the Document Control Desk.

Some of the updates contain privacy/proprietary information. This privacy/proprietrary information has been bracketed in accordance with NRC Generic Letter 81-27 and is identified in Attachment 2.

Kindly acknowledge receipt of the above material on the enclosed copy of this letter and return it in the enclosed addressed envelope.

Sincerely,
ORIGINAL SIGNED BY

J. O. Schuyler

Enclosures

cc w/enc: R. Fish, NRC (Region V)
[redacted]
Service List

cc w/o enc: G. W. Knighton

8402140167 840208
CF ADOCK 05000275
CF

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1/1

ATTACHMENT 1

Updates Included In This Submittal

DIABLO CANYON EMERGENCY PLAN
IMPLEMENTING PROCEDURES

Volume 3A

Table of Contents
EP G-4, Revision 3

Volume 3B

Table of Contents
EP RB-12 Revision 1

ATTACHMENT 2

Location of Proprietary/Privacy Information

EP, G-4; pages 4 & 5 of 14; pages 8 - 11 of 14;
Summary of Personnel Accountability and Assignments,
pages 1, 2 & 3 of 3.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

March 2, 1984

50-275/323 Diablo Canyon

MEMORANDUM FOR: Chief, Document Management Branch, TIDC

FROM: Director, Division of Rules and Records, ADM

SUBJECT: REVIEW OF UTILITY EMERGENCY PLAN DOCUMENTATION

The Division of Rules and Records has reviewed the attached document and has determined that it may now be made publicly available.

J. M. Felton, Director
Division of Rules and Records
Office of Administration

Attachment: As stated