Wisconsin Electric POWER COMPANY
231 WEST MICHIGAN, MILWAUKEE, WISCONSIN 53201

September 14, 1981

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. NUCLEAR REGULATORY COMMISSION
Washington, D. C. 20555

Dear Mr. Denton:

DOCKET NOS. 50-266 AND 50-301
RESPONSE TO NUREG-0737
UPDATE TO SCHEDULE REQUIREMENTS
AND IMPLEMENTATION STATUS

This letter provides additional information related to the requirements of NUREG-0737, "Clarification of TMI Action Plan Requirements", for the Point Beach Nuclear Plant, Units 1 and 2. This information includes Revision 2 to our Schedule Table and Notes which provides schedule and implementation status, as of September 14, 1981. Each item is addressed relative to the requirements and schedules stated in NUREG-0737 with clarification provided for those items completed, updated, or otherwise modified since our March 31, 1981 response. Your review of this response should be made with reference to prior Wisconsin Electric Power Company submittals. We have not repeated the pertinent notes referenced in the Schedule Table for those items whose status has not changed since our December 23, 1980 and March 31, 1981 submittals. Additional attachments to the Schedule Table and Notes are included with this submittal.

The total scope of work involved in the TMI backfit effort is not always apparent from a list of schedule commitments. It does not show the effort involved to properly plan and schedule the implementation of all the items. There are many major projects that are being implemented at the same time in order to accomplish the required plant modifications. Some of these are as follows:

1. Purchase of about 200 new or replacement instruments to implement the TMI requirements, environmental qualification requirements, and Regulatory Guide 1.97 requirements.

2. Electrical changes in containment require additional new containment penetrations.

3. A total of thirteen new instrument racks are needed to process the new instrumentation signals.

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4. Racks must be located in a qualified area with acceptable cable routing capability.

5. Power supply requirements to new equipment and other design considerations require two new station vital batteries. Associated work involves procurement of batteries, three chargers, six inverters, various distribution panels and construction of two battery rooms and two equipment rooms.

6. Displays and controls must be integrated into the control room. Two 15-foot long Auxiliary Safety Instrumentation Panels (ASIP) are required in the control room.

7. Operator and human factor considerations require evaluations as to proper location of each display and control. The result is indicators being added to every panel of the control board.

8. To make room for the ASIP panels and meet new requirements, the present radiation monitoring system must be replaced.

9. A new radiation monitoring system must be designed, procured, located and installed.

10. Technical Support Center instrumentation and Safety Parameter Display System (SPDS) must be factored into the plant changes.

11. Fire detection system design and installation must be factored into the plant changes.

12. Meteorological data requirements and emergency plan considerations must be factored into the plant changes.

13. Emergency response facilities and requirements must be factored into the plant changes.

14. A new computer system must be designed, procured and installed which integrates items 9 through 13 and results in an improved monitoring and display of plant process variables while meeting new NRC requirements.

15. For all of these changes, about 30,000 feet of conduit and 300,000 feet of cable will be installed.

16. Throughout all these changes, the operators must safely operate the plant while coping with retraining, relicensing, changing emergency operating procedures and changing emergency planning procedures.

The schedules given for each item listed in the attached Schedule Table are our best estimates for proper installation or completion. The schedule dates reflect our best efforts to coordinate the large number of interrelated items to ensure that they become improvements to our operating

plant. Arbitrarily scheduling one item ahead of another may disrupt the overall plan, cause wasted effort, and possibly result in delays to other items or final implementation of that item. A review of our commitments and magnitude of work in progress will demonstrate that we are attempting to implement NUREG-0737 requirements, in a very careful and deliberate manner that meaningfully improves the operation of the plant. Revisions to our schedule would remove some of the benefit we are trying to achieve by proper planning.

The statement made in the abstract of SECY-81-437, Report On A Survey By Senior NRC Management To Obtain Viewpoints On The Safety Impact Of Regulatory Activities From Representative Utilities Operating and Constructing Nuclear Power Plants, July 1, 1981, applies directly to the TMI backfit schedule, i.e., "the pace and nature of regulatory actions have created a potential safety problem which deserves further evaluation by the agency." We believe that the schedule listed in the attached Schedule Table allows us to deal properly with the many difficult technical issues listed in the executive summary of SECY-81-437, e.g., proper control of the large number of workmen in an operating plant, proper management of resources and priorities, allowance for coordination of the various requirements, minimum impact on plant operating staff, allowance for orderly transition and training, and focus of attention on primary areas of responsibility.

We would be pleased to respond to any questions you may have regarding the schedule or the attached technical material.

Very truly yours,

Sol Burstein
Executive Vice President

Enclosures

Subscribed and sworn to before me
this 14th day of September, 1981

Notary Public, State of Wisconsin

My commission expires 13 September

Copy to NRC Resident Inspector

RESPONSE TO NUREG-0737

POST-TMI REQUIREMENTS

FOR OPERATING PLANTS

Point Beach Nuclear Plant, Units 1 and 2
Docket Nos. 50-266 and 50-301

Schedule Table and Notes
Revision 2 - September 14, 1981

POST-TMI REQUIREMENTS FOR OPERATING REACTORS

Clarification Item	Shortened Title	Description	NRC Implementation Schedule	PBNP Applicability	PBNP Schedule	Remarks	
I.A.1.1	Shift Technical Advisor	1. On duty	1/1/80	Yes	Completed	On duty since 1/1/80 - Reference 1 and 12a	1,
		2. Tech Specs	12/15/80	Yes	Completed	Reference 12a and 15	
		3. Trained per LL Cat B	1/1/81	Yes	Completed	Note I.A.1.1.3	
		4. Describe long-term program	1/1/81	Yes	Completed	Reference 17	
I.A.1.2	Shift Supervisor Responsibilities	Delegate non-safety duties	1/1/80	Yes	Completed	Reference 1	
I.A.1.3	Shift Manning (Reference 4a)	1. Limit overtime	11/1/80	Yes	Completed (1/10/81 Implementation Date)	PBNP Approved Procedure 4.3, Operations Division Personnel Assignments and Scheduling, Rev. 0	2
		2. Min. Shift Crew	7/1/82	Yes	N.A.	Note I.A.1.3.2	
I.A.2.1	Immediate Upgrading of RO and SRO Training and Qualifications	1. SRO Experience	5/1/80	Yes	Completed		
		2. SROs be ROs 1 yr.	12/1/80	Yes	Completed		2
		3. Three mo. training on shift	8/1/80	Yes	Completed	Note I.A.2.1.1/4 Reference 9a	
		4. Modify training	8/1/80	Yes	Completed		
		5. Facility Certification	5/1/80	Yes	Completed	Note I.A.2.1.5	
I.A.2.3	Administration of Training Programs	Instructors Complete SRO Exam	8/1/80	Yes	Completed	Note I.A.2.3	
I.A.3.1	Revise Scope and Criteria for Licensing Exams	1. Increase scope	5/1/80	Yes	Completed		
		2. Increase passing grade	5/1/80	Yes	Completed		
		3. Simulator exam	6/1/80	N.A.	---	Note I.A.3.1.3	

N.A. = Schedule not applicable to PBNP
TBD = To be determined at a later date per the remarks
(1) = Revision 1 dated March 31, 1981.
(2) = Revision 2 dated September 14, 1981.

Clarification Item	Shortened Title	Description	NRC Implementation Schedule	PBNP Applicability	PBNP Schedule	Remarks	
I.C.1	Short-Term Accident and Procedures Review	1. SB LOCA	6/1/80	Yes	Completed		
		2. Inadequate Core Cooling					
		a. Reanalyze and propose guidelines	1/1/81	Yes	Completed	Generic procedures already submitted to NRC - Reference 16	1
		b. Revise procedures	First refueling outage after 1/1/82	Yes	12/31/82	Note I.C.1	2
		3. Transients and accidents					
		a. Reanalyze and propose guidelines	1/1/81	Yes	Completed		1
		b. Revise procedures	First refueling outage after 1/1/82	Yes	12/31/82	Note I.C.1	2
I.C.2	Shift and Relief Turnover Procedures	Implement shift turnover checklist	1/1/80	Yes	Completed	Reference 9b	2
I.C.3	Shift-Supervisor Responsibility	Clearly define superv and oper responsibilities	1/1/80	Yes	Completed		
I.C.4	Control-Room Access	Establish authority limit access	1/1/80	Yes	Completed	Reference 9b	2
I.C.5	Feedback of Operating	Licensee to implement procedures	1/1/81	Yes	Completed (1/1/81 Effective Date)	PBNP Administrative Procedure 3.15.7, Rev. 0, approved 12/19/80, "Procedure for Feedback of Operating Experience to Plant Staff"	
I.C.6	Verify Correct Performance of Operating Activities	Revise performance procedures	1/1/81	Yes	Completed	PBNP Administrative Procedure 4.13, Rev. 9, effective 6/20/80, "Equipment Isolation Procedure"	

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Clarification Item	Shortened Title	Description	NRC Implementation Schedule	PBNP Applicability	PBNP Schedule	Remarks	
I.D.1	Control Room Design Reviews	Preliminary assessment and schedule for correcting deficiencies	TBD	Yes	TBD	Note I.D.1	2
I.D.2	Plant Safety Parameter Display Console	1. Description	TBD	Yes	Completed	Note I.D.2	2
		2. Installed	TBD	Yes	5/1/83 (Projected)		
		3. Fully implemented	TBD	Yes	9/1/83 (Projected)		
II.B.1	Reactor Coolant System Vents	1. Design vents	7/1/81	Yes	Completed	Note II.B.1	
		2. Install Vents (LL Cat B)	7/1/82	Yes	12/1/82		
		3. Procedures	1/1/82	Yes	3/1/82		
II.B.2	Plant Shielding	1. Review designs	1/1/80	Yes	Completed		
		2. Plant modifications (LL Cat B)	1/1/82	Yes	9/1/82	Note II.B.2.2	1
		3. Equipment qualification	6/30/82	Yes	6/30/82	Note II.B.2.3	2
II.B.3	Post Accident Sampling	1. Interim system	1/1/80	Yes	Completed		
		2. Plant modifications (LL Cat B)	1/1/82	Yes	1/1/82	Note II.B.3 Reference 29	2
II.B.4	Training for Mitigating Core Damage	1. Develop training program	1/181	Yes	Completed	Note II.B.4	1
		2. Implement program					
		a. Initial	4/1/81	Yes	Completed		2
		b. Complete	10/1/81	Yes	10/1/81		

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Clarification Item	Shortened Title	Description	NRC Implementation Schedule	PBNP Applicability	PBNP Schedule	Remarks	
II.D.1	Relief and Safety Valve Test Requirements	1. Submit program	1/1/80	Yes	Completed	Reference 10a	
		2. RV and SV Testing (LL Cat B)					
		a. Complete testing	7/1/81	Yes	6/30/82		
		b. Plant-specific report	10/1/81	Yes	~5/1/82	Note II.D.1.2	2
		3. Block-Valve testing	7/1/82	Yes	N.A.	Note II.D.1.3	
II.D.3	Valve Position Indication	1. Install direct indications of valve valve position	1/1/80	Yes	Completed	Note II.D.3.1 Reference 9b	
		2. Tech Specs	12/15/80	Yes	Completed	Reference 15	1
II.E.1.1	Auxiliary Feedwater System Evaluation	1. Short term	7/1/81	Yes	TBD	Note II.E.1.1	
		2. Long term	1/1/82	Yes	TBD		
II.E.1.2	Auxiliary Feedwater System Initiation and Flow	1. Initiation					
		a. Control grade	6/1/80	Yes	N.A.		
		b. Safety grade	7/1/81	Yes	Original Plant Design	References 1, 2, 3, and 12a	
		2. Flow Indication					
		a. Control grade	1/1/80	Yes	Completed	Note II.E.1.2	
		b. LL A Tech Specs	12/15/80	Yes	Completed	Reference 12a and 15	1
		c. Safety grade	7/1/81	Yes	8/1/81		
II.E.3.1	Emergency Power for Pressurizer Heaters	1. Upgrade power	1/1/80	Yes	Original Plant Design	References 1, 2, 3 and 12a	
		2. Tech Specs	12/15/80	Yes	Completed	Reference 15	1
II.E.4.1	Dedicated Hydrogen Penetrations	1. Design	1/1/80	Yes	Original Plant Design	References 1, 2, and 3	
		2. Install	7/1/81	Yes	N.A.		

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Clarification Item	Shortened Title	Description	NRC Implementation Schedule	PBNP Applicability	PBNP Schedule	Remarks	
II.E.4.2	Containment Isolation Dependability	1-4. Imp. diverse isolation	1/1/80	Yes	6/1/83*	Note II.E.4.2.1/4	2
		5. Cntmt pressure setpoint					
		a. Specify pressure	1/1/81	Yes	Completed	Reference 42	
		b. Modifications	7/1/81	Yes	N.A.		2
		6. Cntmt purge valves	1/1/81	Yes	Completed	Administratively closed - Reference 45	
		7. Radiation signal on purge valves	7/1/81	Yes	Original Plant Design	Reference Point Beach FFDSAR Section 4.2 and Figure 5.2-8	
		8. Tech Specs	12/15/80	Yes	Completed	Reference 15	1
II.F.1	Accident Monitoring	1. Noble gas monitor	1/1/82	Yes	5/1/82* }	Note II.F.1.1/2	2
		2. Iodine/particulate sampling	1/1/82	Yes	5/1/82* }		1
		3. Containment high-range radiation monitor	1/1/82	Yes	10/1/82*	Note II.F.1.3	
		4. Containment pressure	1/1/82	Yes	10/1/82*	Note II.F.1.4	
		5. Containment water level	1/1/82	Yes	10/1/82*	Note II.F.1.5	
		6. Containment hydrogen	1/1/82	Yes	12/1/82*	Note II.F.1.6	
II.F.2	Instrumentation of Detection of Inadequate Core Cooling	1. Subcool meter	1/1/80	Yes	Completed	Note II.F.2.1	1,2
		2. Tech Spec (LL Cat A)	12/15/80	Yes	Completed	Reference 15	
		3. Install level instruments (LL Cat B)	1/1/82	Yes	12/1/82*	Note II.F.2.3	2
II.G.1	Power Supplies for Pressurizer Relief Valves, Block Valves, and Level Indicators	1. Upgrade to emerg sources	1/1/80	Yes	Original Plant Design	Reference 12a	2
		2. Tech Specs	12/15/80	Yes	Completed	Reference 15	1

* = Schedule is based on delivery of equipment on schedule.
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Clarification Item	Shortened Title	Description	NRC Implementation Schedule	Applicability	PBNP Schedule	Remarks	
II.K.1	IE Bulletins	79-05, -06, -08	Bulletin specific	Yes	Completed	Reference 33	2
II.K.2	Orders on B&W Plants	8. Upgrade AFW system	See II.E.1.1	N.A.	---		
		9. FEMA on ICS	8/17/79	N.A.	---		
		10. Safety-grade trip	7/1/81	N.A.	---		
		11. Operator training, drilling	Complete	N.A.	---		
		13. Thermal-mechanical report	1/1/82	Yes	1/1/82	Note II.K.2.13	
		14. Lift frequency of PORVs and SVs	See II.K.3.7				
		15. Effects of slug flow on OTSGS	Completed	N.A.	---		
		16. RCP seal damage	Completed	N.A.	---		
		17. Voiding in RCS	a. Complete	N.A.	---		
			b. 1/1/82	Yes	1/1/82	Note II.K.2.17	
		19. Benchmark analysis of seq. AFW flow	a. Complete	N.A.	---		2
			b. 1/1/82	Eliminated	N.A.	Reference 34	
		20. System response to SB LOCA	Complete	N.A.	---		
II.K.3	Final recommendations, B&O Task Force	1. Auto PORV isolation					
		a. Design	7/1/81	Yes	N.R.		
		b. Test/install	1st refueling 6 mos after staff approval	Yes	N.R.	Note II.K.3.1 and Reference 4	1
		2. Report on PORV failures	1/1/81	Yes	Completed	Note II.K.3.2	1
		3. Reporting SV and RV failures and challenges	1/1/81	Yes	Completed	Note II.K.3.3	1
		5. Auto trip on RCPS					
		a. Propose modifications	7/1/81	Yes	TBD	Note II.K.3.5	2
		b. Modify	3/1/82	Yes	TBD		

N.R. = Not Required
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Clarification Item	Shortened Title	Description	NRC Implementation Schedule	PBNP Applicability	PBNP Schedule	Remarks	
II.K.3 (Continued)	Final recommendations, B&O Task Force	7. Eval of PORV opening probability	1/1/81	N.A.	---		
		9. PID controller	1/1/81	Yes	Completed	Controller change made upon initial notification by vendor prior to TMI-2 (References 4 and 43)	2
		10. Proposed anticipatory trip modifications	Plant specific	Yes	Original Plant Design	References 4 and 43	
		11. Justify use of certain PORV	Plant specific	Yes	N.A.	As part of the original Plant design (different from TMI-2), Point Beach has Copes-Vulcan PORVs which corresponds to the Westinghouse data base, and, thus, no justification is needed.	
		12. Anticipatory trip on turbine trip					
		a. Confirmation or proposed modifications	1/1/81	Yes	Original Plant Desgn	Reactor trip caused by turbine trip bypassed below 50% power as detected by the power range detectors. (Reference 43)	2
		b. Modify	1st refuel 60 mo. after staff approval	N.A.	---		
		13. HPCI & RCIC init levels					
		a. Analysis	1/1/81	N.A.	---		
		b. Modify	7/1/81	N.A.	---		
		14. Iso condenser isol modification	1/1/82	N.A.	---		
		15. Isolation of HPCI and RCIC modification	7/1/81	N.A.	---		
		16. Challenges and failures to relief valves					
		a. Study	4/1/81	N.A.	---		
		b. Modify	1st refueling or 1 yr after approval	N.A.	---		

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Clarification Item	Shortened Title	Description	NRC Implementation Schedule	PBNP Applicability	PBNP Schedule	Remarks
II.K.3 (Continued)	Final recommendations, B&O Task Force	17. ECCS system outages	1/1/81	Yes	Completed	Note II.K.3.17 - Reference 23 | 1,2
		18. ADS actuation				
		a. Study	4/1/81	N.A.	---	
		b. Propose mods	4/1/82	N.A.	---	
		c. Modification	1st refuel 6 mo after staff approval	N.A.	---	
		19. Interlock recirc pump modification	7/1/81	N.A.	---	
		20. Loss of SVC	7/1/81	N.A.	---	
		21. Restart of CCS and LPCI				
		a. Design	1/1/81	N.A.	---	
		b. Modification	1st refueling 60 mo after staff approval	N.A.	---	
		22. RCIC suction				
		a. Verify procedures	1/1/81	N.A.	---	
		b. Modification	1/1/82	N.A.	---	
		24. Space cooling for HPCI/RCIC modifications	1/1/82	N.A.	---	
		25. Power on pump seals				
		a. Propose mods	1/1/82	Yes	1/1/82	
		b. Modification	7/1/82	Yes	N.A.	Note II.K.3.25
		27. Com ref. level	7/1/81	N.A.	---	
		28. Qual of ADS accumulators	1/1/82	N.A.	---	
		29. Performance of isolation condensers	4/1/81	N.A.	---	
		30. SB LOCA methods				
		a. Schedule outline	11/15/80	Yes	TBD	
		b. Model	1/1/82	Yes	TBD	Note II.K.3.30
		c. New analyses	1/1/83 or 1 yr after staff approval	Yes	TBD	

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Clarification Item	Shortened Title	Description	NRC Implementation Schedule	PBNP Applicability	PBNP Schedule	Remarks	
II.K.3 (Continued)	Final recommendations, B&O Task Force	31. Compliance with CFR 50.46	1/1/83 or 1 yr after staff approval	Yes	TBD	Note II.K.3.31	
		40. RCP seal damage	See II.K.2.16	N.A.	---		
		43. Effects of slug flow	See II.K.2.15	N.A.	---		
		45. Manual depressurization	1/1/81	N.A.	---		
		46. Michelson concerns	Completed	N.A.	---		
		57. Manual act of ADS	TBD	N.A.	---		
III.A.1.1	Emergency Preparedness, Short Term	Short-term improvements	Completed	Yes	Completed		
III.A.1.2	Upgrade Emergency Support Facilities	1. Interim TSC, OSC and EOF	1/1/80	Yes	Completed	Note III.A.1.2 Reference 9b	1,2
		2. Design	Reference 15b	Yes	Completed	Reference 28	2
		3. Modifications	Reference 15b	Yes	2/1/82	Reference 13, 28 and 38	
III.A.2	Emergency Preparedness	1. Upgrade emergency plans to App. E, 10 CFR 50	4/1/81	Yes	Completed	Note III.A.2.1 Reference 12b and 17a	1,2
		2. Meteorological data	6/1/83	Yes	TBD	Note III.A.2.2 - References 13, 28 and 38	1,2
III.D.1.1	Primary Coolant Outside Containment	1. Leak reduction	Completed	Yes	Completed	Currently changing to a yearly testing schedule for both units coincident with refueling outages (References 1, 2, and 3)	
		2. Tech Specs	12/15/80	Yes	Completed	Reference 15	1
III.D.3.3	Inplant Iodine Monitoring	1. Provides means to determine presence of radioiodine	Completed	Yes	Completed	Reference 12a	2
		2. Modifications to accurately measure I_2	1/1/81	Yes	Completed	Note III.D.3.3 - Reference 12a	1,2
III.D.3.4	Control Room Habitability	1. Review	1/1/81	Yes	Completed	Note III.D.3.4	
		2. Modification	1/1/83	Yes	1/1/83	Note III.D.3.4	1

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I.A.1.1.3 SHIFT TECHNICAL ADVISOR TRAINING

Shift Technical Advisor training was completed prior to the March 1, 1981 commitment (Reference 5) as described in the attachments to Reference 17, with the exception of training for mitigating core damage as addressed in II.B.4. Shift Technical Advisory training to meet the requirements of NUREG-0737 is therefore considered completed for the Point Beach Nuclear Plant Duty and Call Technical Advisors (DCTA's).

I.C.1 SHORT-TERM ACCIDENT AND PROCEDURES REVIEW

The program to achieve compliance with NUREG-0737, Item I.C.1, was presented to the NRC in a meeting held on June 18, 1981, and submitted to the NRC by Owners Group letter, OG-61, dated July 7, 1981, R. W. Jurgensen to S. H. Hanauer (Reference 36). The previous program submittal to the NRC (Reference 20) resulted in several basic concerns which could not be easily resolved within the scope of the material submitted. These NRC concerns and the need to better organize the set of emergency procedures resulted in a new configuration which was presented to the NRC at the June 18, 1981 meeting. Owners Group letter OG-61, Reference 36, requested that an NRC response be received by August 1 in order to allow timely implementation of the procedures program. As of this writing, the NRC has not responded to that request. Due to this lack of NRC response, and what appears to be a developing relationship between SPDS, control room review and procedures, a specific commitment to complete the procedures effort cannot be defined at this time. If the procedures effort only consists of organizing and rewriting the emergency procedures consistent with the program described in OG-61, this can be completed before the end of 1982. If other related efforts are required, e.g., control room review, a revised schedule will have to be determined. The requirements for emergency procedures as described in NUREG-0799, if fully implemented, will extend this effort into 1982. Comments on NUREG-0799 were provided in C. W. Fay to Secretary of the Commission letter dated August 25, 1981 (Reference 44).

I.D.1 Control Room Design Reviews

The control room design review requirements as defined in NUREG-0700 and NUREG-0801 have not been issued in their final form as of this writing; nor has a schedule for completion been established by the NRC. In addition, NUREG-0799 states that the design of the SPDS, control room review and procedures should be performed in consideration of each other. This is a principle we endorse because we have tried to apply this to all of the TMI backfit items as well as our preliminary review of Regulatory Guide 1.97. We will inform the NRC of our schedule when all the requirements have been issued in final form.

I.D.2 Plant Safety Parameter Display Console

Two projects are underway that relate to the safety parameter display console. The first project is a joint effort with eleven other utilities and Quadrex Corporation to design a Safety Assessment System and demonstrate its effectiveness. This group of utilities met with the NRC on May 14, 1981 for the

purpose of describing the program and showing some of the detailed information about the project. The presented material was submitted to the NRC via Ward Wogsland to Leo Beltracchi letter dated May 19, 1981 (Reference 26a). The second project deals with the procurement and installation of the hardware system. Wisconsin Electric on August 24, 1981, signed an agreement with Electronics Associates, Inc. (EAI) for the supply of a computer system and associated software on which to implement the safety parameter display console. The description of these two projects was submitted to the NRC as Attachment "C" from Sol Burstein to H. R. Denton letter dated June 1, 1981 (Reference 28). The implementation of the NUREG-0696 requirements and our position on Regulatory Guide 1.97 were also included in that submittal (Reference 28).

The schedule for installation and initial operation of the SPDS is projected to be May of 1983. The system should be fully implemented by September of 1983. The schedule requires a few additional months because the computer system purchased from EAI to implement the SPDS will replace the presently installed plant computer and will be performing all of process computer functions as well as providing the total data base to the Technical Support Center.

II.B.1 REACTOR COOLANT SYSTEM VENTS - DESIGN

The Point Beach reactor coolant system gas venting systems were purchased from Combustion Engineering. The system design is shown in the attached schematic and provides for parallel vent paths from both the reactor vessel head vent and/or the pressurizer steam space to the pressure relief tank (PRT) and/or containment atmosphere. The parallel paths ensure vent capability from both vessels even considering a single failure. Each path is provided with an orifice to limit flow in the event of a downstream leak or break. The orifice size is 7/32" diameter. Leakage through a hole this size (<3/8" diameter) is within the capability of makeup from the charging system. The isolation valves used are pilot-operated Target Rock solenoid valves which fail closed. A solenoid valve in each vent path provides series valving to ensure isolation. Appropriate manual isolation, vent, drain, and test connection valves are provided to permit on-line maintenance, meet all testing requirements and allow flexibility.

Power for the solenoid valves will be obtained from 125V DC safety-grade busses normally supplied by a charger with battery backup. Two busses will be used for the gas vent system solenoid valves with one bus supplying power to one valve in each vessel vent path and one series vent valve. The other bus will supply the other (parallel) vessel vent valve and the other series vent valve. A loss of either power supply does not prevent venting of either vessel.

The connecting piping between the reactor vessel head vent and the pressurizer steam space vent will provide a continuously sloped path which allows for gas (steam) venting from the vessel to the pressurizer.

Redundant, direct position indication is available for each solenoid valve. Single indication will be provided since separation cannot be assured (magnetic reed switches in the solenoid housing).

A wide-range pressure transmitter will be connected to the manifold of piping which connects to each solenoid valve. This will allow monitoring of the system for leaks and during operation. The transmitter signal will be processed in the Foxboro Spec 200 racks. All controls and indications will be in the control room on the ASIP.

Installation of the gas vent system will require a cold shutdown of each unit for access to the reactor vessel head, refueling cavity, and pressurizer. Removal of the existing vent systems must be considered in the overall work scheduling since returning to power without a vent system would take long, be more difficult and increase personnel exposure. The construction must, therefore, be scheduled into a refueling outage of sufficient length to accommodate removal, installation, and testing.

Final system design and construction drawings have recently been received from the system vendor. However, based on a final detailed field review, some changes must be made to the layout for each unit to ensure access and operability of all components. In addition, material availability by the fall 1981 refueling outage for Unit 1 is uncertain and, thus, it is doubtful that the system installation will be completed during 1981. Installation of the gas vent systems should be able to be completed on Unit 2 by June 1, 1982 and on Unit 1 by December 1, 1982, the next scheduled refueling outages. Full operability of the systems will be based on the installation schedule of the ASIP panels.

Use of the gas vent system is addressed as part of the accident response procedures referenced in I.C.1. These procedures will be completed and available for training and operational review by March 1, 1982.

II.B.2.2 PLANT SHIELDING

The initial post TMI-2 shielding and plant access calculations for Point Beach were performed using the source terms specified in NUREG-0578 (Reference 1). The clarification in NUREG-0737 changed the assumptions used to develop the source terms and this impact was preliminarily evaluated by the same consultant that performed the initial calculations. Based on the results of this evaluation with regard to plant changes, it has been recommended that a complete re-evaluation be done. This evaluation would affect the implementation of the shielding modifications being evaluated for the Point Beach Nuclear Plant in three areas of the auxiliary building. Installation of permanent shielding, relocation of plant equipment, or the use of temporary portable shielding to reduce post-accident exposure of equipment and personnel is being considered. Each of these is described below.

A consultant has begun the basic design evaluations for relocation of portions of the Unit 1 safety injection lines. This relocation could eliminate the major radiological contributor to exposure of adjacent electrical equiment and reduce the dose rates for personnel access in the corridor beneath the existing piping. Since these modifications require the unit to be at cold shutdown and the purchase of safety-grade equipment, not yet designed, implementation by the fall refueling outage in 1982 would be the earliest achievable date. Although work has begun on this modification, we do not believe that it is in the best interest of safety to make a change in an operating plant to a basic safety system which alters the initial design. The conditions

which are requiring such a change should be recognized to be a subset of conditions of an extremely low probability accident; an assumed unrealistic, worst case source term; and further, a postulated failure of normally highly reliable equipment. These conditions may not be consistent or logical but simply produce the worst case combination of factors.

A complete access study was performed with the existing piping configuration (Reference 1) and post-accident operations can be performed by minimizing access times. No equipment should fail due to radiation exposure within thirty days following the postulated accident (Reference 2). Based on the above and a parallel effort to satisfy the evaluation, documentation, and reporting requirements of IE Bulletin 79-01B, "Environmental Qualification of Safety-Related Electrical Equipment", it is Wisconsin Electric's position that further effort on this change should be postponed until all other alternatives are considered.

Shielding for electrical equipment near a portion of the Unit 2 safety injection lines is under evaluation. Installation of any required modifications may be possible by the September 1, 1982 implementation date. No change in the safety injection line in this area is possible which does not increase the access and equipment concerns. The option of equipment evaluation is discussed in II.B.2.3 below.

Proposals for the evaluation and design of portable and permanent shielding in the current of the C-59 control panel (References 1 and 2) are currently being evaluated. Installation will not be possible by the January 1, 1982 NRC implementation date. It is anticipated that portable shielding can be ordered soon and may be available by April 1, 1982. The permanent shielding changes must be designed to be structurally compatible with the existing structure and this requires a longer lead time. It is estimated that construction could begin in spring 1982 coincident with other structural changes scheduled in that area of the auxiliary building. Projected completion of this work is September 1, 1982.

Additionally, wall penetrations for piping and electrical runs between the auxiliary and control buildings were identified as requiring shielding. This was made necessary by implementation of IE Bulletin 80-11, which required the removal of concrete block which filled the unused portions of these wall openings. New shielding for these penetrations has been designed for installation. This work has begun and is scheduled for completion prior to the June 30, 1982 NRC implementation date.

We are aware of the present differences between segments of the scientific and nuclear industry communities and the NRC concerning source terms specified. To the extent that these differences remain unsolved and change, the final implementation of any modifications may be altered.

II.B.2.3 PLANT SHIELDING - EQUIPMENT QUALIFICATION

Motor controls centers 1B32 and 2B32 which are subject to the postulated radiation sources from the Unit 1 and Unit 2 safety injection lines, respectively, are being added to the electrical equipment considered under IE Bulletin 79-01B. This equipment is, therefore, being considered on the same schedule

and under the same requirements as the other IE Bulletin 79-01B electrical equipment. Any modifications to be performed to meet II.B.2.2 will follow the completion of this evaluation.

II.B.4 TRAINING FOR MITIGATING CORE DAMAGE

NUREG-0737 established the current requirements for training for mitigating core damage. The primary requirements are that the program be developed by January 1, 1981, and that training be completed by October 1, 1981.

Development of a detailed Point Beach training course on mitigating core damage was originally delayed because it was unclear exactly at what depth the program should be taught, lack of pertinent technical information, and because qualified manpower was unavailable in the Point Beach training group that could be diverted from attending to the other training requirements resulting from TMI-2. Those other training requirements include Shift Technical Advisor training, additional simulator training, and augmented licensed operator training to meet new and increasing NRC requirements.

It was anticipated that material from vendor courses would become available which could be adapted to Point Beach. It was also anticipated that additional qualified training personnel could be made available to prepare the program. Prior to 1981 only a limited amount of vendor material was available and, therefore, the January 1, 1981 deadline could not be met. Also, because of the concurrent demands placed on all levels of nuclear plant personnel, it has been difficult to even retain experienced personnel and impossible to increase manpower available for training, except at the expense of other areas.

As an alternative, we then issued a purchase order for our nuclear steam supply system vendor to provide a program specific to Point Beach. The NSSS vendor program was not ready until after March 1981; consequently, we were not able to meet the April 1, 1981 deadline either. The program description and content was provided on March 31, 1981 (Reference 22) as an attachment entitled, "Point Beach Nuclear Plant, Mitigating Core Damage Training Program", Revision 0, March 16, 1981. Table 1 of that attachment provided the specific training requirements for plant personnel.

Part 1 training for this program was integrated into and completed as part of the licensed operator retraining program. All licensed plant personnel and Duty Technical Advisors completed this training prior to March 31, 1981. The remainder of the training program began on August 30, 1981. Completion of training for all individuals involved is scheduled for completion by October 1, 1981.

II.D.1.2 PERFORMANCE TESTING OF BWR AND PWR RELIEF AND SAFETY VALVES (NUREG-0578, SECTION 2.1.2)

As the NRC is aware, the program (Reference 10a) has been expanded to include additional testing as explained in Mr. R. C. Youngdahl's July 24, 1981 letter to Mr. H. R. Denton entitled "Status of EPRI PWR Safety and Relief Valve Test Program, NUREG-0737, Item II.D.1" (Reference 39). Because of this additional

testing, the schedule for completion of the test reports and plant-specific analysis has been revised as identified in Mr. Youngdahl's letter.

Since the Wisconsin Electric effort for Point Beach Nuclear Plant is dependent upon the overall test program, it is necessary to revise the schedule contained in Reference 23 as follows:

a. Complete Testing - June 30, 1981

b. Plant-Specific Report - Three months after piping data from the testing program is available for use. A tentative date of May 1, 1982 is projected.

The Point Beach Nuclear Plant utilizes Crosby safety relief valves (HB-BP-86, 4-K2-6) and Copes-Vulcan power-operated relief valves (D-100 with 2-½ operator and 17-4 ph plug and cage) on both nuclear units. While a directly comparable Copes-Vulcan PORV is included in the test program, the test results for different Crosby safety relief valves (interpolation between a 3K6 and a 6M6) will be the basis for demonstrating acceptable valve performance.

The Copes-Vulcan PORV was tested at the Wyle facility in late July 1981. For all tests, the valve opened and closed on demand. After disassembly, no damage was observed that would affect valve performance.

A Crosby 3K6 valve was been subjected to a series of tests in late July and August at the Combustion Engineering facility. While the preliminary data indicates that for some tests the EPRI screening criteria were not met, the valve did open and relieve pressure; some valve "chattering" was observed. Testing of a Crosby 6M6 valve had not been initiated as of August 31, 1981.

II.D.1.3 RELIEF AND SAFETY VALVE TESTING REQUIREMENTS - BLOCK VALVE TESTING

A small number of block valves are part of the EPRI testing program test configuration. While the operability of block valves is not a safety issue, the testing performed by EPRI at the Marshal Facility will be documented. Block valve results that come out of the PORV test program will therefore be utilized, but it is not our intention to do any block valve testing beyond that program. Point Beach Nuclear Plant has been analyzed for a spectrum of break sizes that bound the size of a stuck-open PORV and block valve. The analysis shows the Plant to be safe for this postulated event.

II.D.3.1 DIRECT INDICATION OF RELIEF AND SAFETY VALVE POSITION

Adapters and lift indicating switch assemblies will be mounted on the pressurizer safety valves to provide direct indication of valve position. The assemblies will be purchased from Crosby for use on Crosby valves. These switch assemblies use magnetically operated reed switches to provide separately powered redundant open, midpoint and closed indications. These indications will be located in the control room.

The lift indicating switch assemblies are not presently qualified but Crosby is expected to qualify the assemblies in the future. The reason the lift indicating switch assemblies will be installed is that they are easier to environmentally qualify than the presently installed acoustic monitoring system. The presently installed acoustic monitoring system will continue to be used until the new assemblies are installed.

Installation of the lift indicating switch assemblies is presently planned for the spring 1982 refueling of Unit 2 and the fall 1982 refueling of Unit 1.

II.E.1.1 AUXILIARY FEEDWATER SYSTEM EVALUATION

Over the past several years, the NRC has requested information regarding the design, instrumentation and operation of the auxiliary feedwater (AFW) systems for the Point Beach Nuclear Plant, Units 1 and 2 (References 1, 2, 3, 4a, 12, and 24). Wisconsin Electric has responded to these requests and provided the necessary information to satisfy each point raised. The only remaining item to be addressed is that of automatic protection of the AFW pumps if the AFW system water supplies are not completely protected from damage following a seismic event or tornado.

Wisconsin Electric continues to maintain the position that the condensate storage tanks, although not Class I water sources, are reliable and designed to specific, adequate seismic criteria. In the absence of NRC acceptance of this as sufficient, we have subsequently agreed to study the feasibility and desirability of providing pump protection through automatic AFW pump trips on low suction pressure as an alternative to automatic switchover, which would decrease rather than increase system reliability.

Wisconsin Electric has reluctantly decided to implement the automatic AFW pump trips as part of the instrumentation effort in progress. We have completed the basic design of the AFW suction pressure instrumentation channels. The procurement of safety-grade, environmentally qualified equipment is in progress and installation will be integrated with the other instruments, equipment and cable routing. Implementation will require the Foxboro Spec 200 racks for both units to be installed and operational, which is scheduled for early 1982. The design of the modifications to be made to the AFW pump control circuitry has not yet begun. A complete and thorough review of any design will ensure that no decrease in the reliability or operability of the AFW system results from these changes. A schedule for this work has yet to be determined.

II.E.1.2 AUXILIARY FEEDWATER SYSTEM INITIATION AND FLOW - FLOW INDICATION

The auxiliary feedwater system indication of flow to each steam generator was implemented for Unit 1 during the fall 1980 refueling outage. The Unit 2 steam generator flow indication was implemented during the spring 1982 outage. A single channel is shown schematically in Figure II.E.1.2. Auxiliary feedwater pump discharge flow is also monitored and indicated on the control board for operator use.

The auxiliary feedwater system and flow indication has been described in References 1, 2, 3, 9, 12, 23, 24 and submittals by Wisconsin Electric in response to IE Bulletin 79-06B.

The steam generator flow indication instrumentation channels implemented are being environmentally qualified to meet the requirements of IE Bulletin 79-01B. The model of Foxboro transmitter used in the system is currently undergoing a complete 79-01B environmental testing program. This program is scheduled for completion by June 30, 1982. Any changes required of the installed transmitters will follow the program completion.

Ultimately, power to the flow indication instrumentation channels will originate from highly reliable, battery-backed, Class IE power sources. Implementation of this power source will, however, require the completion of an instrument bus upgrade involving new chargers, batteries, inverters, and electrical distribution equipment. The design of this modification is nearly complete. Construction and installation will be completed consistent with other TMI modifications, with operation expected by July 31, 1982. Until then, the channels will be powered by diverse, highly reliable, non-battery-backed power sources. Full implementation of this modification is dependent upon new controls located on the ASIP.

Periodic testability has been designed into the channel circuitry. Channel component purchase, handling, and installation was covered under the Quality Assurance program implemented at Point Beach. Display of auxiliary feedwater flow to each steam generator is continuous and was installed taking into consideration operator use, control room human engineering, and available space on existing control boards.

II.E.4.2.1/4 CONTAINMENT ISOLATION DEPENDABILITY - IMPROVED DIVERSE ISOLATION

As originally designed, Point Beach met the NRC criteria for diversity of isolation and manual, single valve restoration (Reference 3: NUREG-0578, Item 2.1.4, LL Cat. A). Two out of three areas of NRC concern have been previously completed. These were revisions to administrative and operating procedures and modification to the remote control switch for outboard purge valve CV-3212 (Reference 2).

The remaining item is the addition of isolation valves inside containment to piping for letdown, seal water return, and steam generator blowdown. Note redundant, diversely actuated isolation outside of containment already exists. Auxiliary charging has been removed from this list since it already has inside isolation and the normally closed manual valve outside will be locked closed or administratively controlled if opened. The blowdown valves were added to this list due to the location outside of containment of the existing isolation valves in an area which might possibly be subject to falling debris from a block wall.

The addition of inside containment isolation valves on the letdown, seal water return, and steam generator blowdown lines is in the process of being implemented utilizing the services of an outside consultant for the piping and support design and analysis.

The remote air-operated isolation valves have been ordered from Copes-Vulcan. The delivery schedule for the valves is 48 weeks and, thus, installation could take place during the fall 1982 refueling outage for Unit 1 and the spring 1983 refueling outage for Unit 2 with completion by June 1, 1983.

Yet to be purchased, however, are the manual isolation, vent, and drain valves required to test the auto-isolation valves. Of the nine vendors who were asked to bid on supplying these valves, only two have responded. The shorter delivery time is 26 weeks while the longer is 46 to 60 weeks. We intend to purchase Anchor/Darling valves per the 26-week schedule provided the vendor has acceptable QA and certification/documentation programs. This should not delay the installation of the isolation valves.

II.F.1.1/2 ACCIDENT MONITORING - NOBLE GAS, IODINE, AND PARTICULATE

Wisconsin Electric is currently in the process of upgrading the entire radiation monitoring system for the Point Beach Nuclear Plant. Wisconsin Electric has purchased an Eberline radiation monitoring system and anticipates that it will be installed and operational by April 1, 1982. Accident monitoring for effluents has been integrated into the upgraded system. The effluent monitoring equipment which was purchased from Eberline consists of three model SPING-4 monitors, one model SPING-3 monitor and four model SA-11 monitors. The SPING monitors will be used for monitoring exhaust stacks and the SA-11 monitors will be used to monitor steam releases. It was originally envisioned that the SPING monitors would satisfy the exhaust stack sampling and monitoring criteria. However, due to changes issued in the NRC clarifications, the SPING monitors will not satisfy the particulate and iodine sampling criteria of II.F.1.2. They will, however, still provide the full range of noble gas monitoring required. In view of this, a separate sampling system (referred to as the Isokinetic Stack Sampling System [ISSS]) is being purchased from another vendor and will be integrated into the upgraded system. An overall system description is provided. The details of each of the above effluent monitors (SPING, SA-11 and ISSS) follows the overall system description .

System Description

The upgraded radiation monitoring system is a microprocessor-based radiation detection system. The heart of the system is eight Data Acquisition Modules (DAM) and four SPING monitors. Each SPING has a DAM built into it. Each DAM has a microcomputer which performs the tasks of data acquisition, history file management, operational status check, and alarm determination. Each DAM is capable of serving nine detector inputs and six analog inputs. The operator interface with the system is through a Control Terminal (CT-2) and a color graphics minicomputer (CRT-1). A functional block diagram of the system is shown in the attachment.

System Operation

Radiation is detected and the signals processed by the electronics in a component called an interface box. The output signals from the interface boxes are input to the microcomputer. These signals are converted to count rate by the microcomputer which then performs all mathematical calculations and control functions. The mathematical calculations include the application

of conversion factors and background subtraction. Each microcomputer maintains a history file for each of its input channels. The history file consists of the last four hours of ten-minute averages, the last twenty-four hours of one-hour averages and the last twenty-four days of one-day averages. Each DAM (and SPING) has a local readout panel. The local readout device is capable of accessing the current status of any channel associated with that particular DAM. The DAM's are connected to two CT-2's. Each CT-2 drives a CRT-1. Each CT-2 has its own keyboard, printer and system status annunciator. The annunciator consists of an audible alarm and status lights. Each CT-2 includes a microcomputer which performs the functions of polling each DAM for operational status and data, logging any changes in status and associated data, logging history files automatically, performing calculations on history file data and annunciating alarm conditions and communication error messages. The CRT-1 operates independently of the CT-2 and has access to all of the CT-2 information. The CRT-1 constantly displays all channels which are in alarm and gives the operator the capability of graphically trending any channel. In addition, each DAM can be locally interrogated for current status and history files by a portable terminal. The Point Beach control room will be equipped with one CT-2 and one CRT-1. The Point Beach Technical Support Center will be equipped with either a CT-2 or CRT-1, but not both.

The entire upgraded radiation monitoring system will be powered from the vital (instrument) busses. The instrument bus provides power to each DAM. The DAM provides the power to each of its associated channels. In addition, each DAM is equipped with a battery which provides for eight hours of continuous operation in the event of a power failure.

A. <u>SPING Monitor</u>

The Eberline SPING monitor is a self-contained microprocessor-based radiation detection system used to sample and monitor particulates, iodine and noble gases in the air. The sample intake (refer to attached figure) goes through a filter paper on which particulates are deposited, then through a charcoal cartridge to trap iodines and then into the gas chamber for low and medium range noble gas measurement. The sample then passes through a high-range noble gas chamber, through the pump and to the sample outlet. The SPING-3 is the only SPING which is not equipped with a high-range noble gas chamber. The high-range noble gas chamber is the only differentiator between a SPING-3 and a SPING-4.

The upper counting range of the particulate, iodine, and low-range noble gas channels is 10^6 cpm. The beta particulate channel is approximately 12% (4π) efficient for Cs-137 beta particules. The I-131 gamma scintillation channel is approximately 4% (4π) efficient for the 364 keV gamma from I-131 decay. The low-range noble gas channel's useable range is from 1×10^{-7} to 4×10^{-2} μCi/cc for Xe-133. The medium-range noble gas channels range is from 2.5×10^{-2} to 1×10^{3} μCi/cc for Xe-133. The high-range gross gamma channel has a range of 1×10^{0} to 1×10^{5} μCi/cc for Xe-133. An area monitor measures ambient radiation levels and has a range of 1 μR/hr to 100 mr/hr.

The SPING features stainless steel plumbing through the sampler stages, a photohelic flow indicator with low and high flow setpoints, remote flush valves, a manual grab sample port with hose barbs, a sealed diaphram air pump and a connection plug for a portable terminal.

1. Instrumentation

a. The particulate filter is monitored by a beta scintillation detector from one side (Eberline model RDA-3A) and a solid-state alpha detector on the other side (Eberline model RDS-1). Counts from the beta detector are a measure of the amount of beta-emitting isotopes on the filter. The alpha detector measures the radon levels in the sample to provide a measure of the contribution of these daughter products to the beta particulate levels. This contribution can then be corrected by subtracting a factored amount of the alpha measurement from the beta measurement. This technique is used to compensate for the effects of fluctuating radon/thoron levels in the beta particulate measurement.

b. The charcoal cartridge is monitored by a 2" x 2" NaI gamma scintillation detector. This detector (Eberline model RDA-2A) is gain stabilized to minimize the effects of drift caused by fluctuations in temperature and/or aging. The measurement is accomplished using a single channel analyzer (SCA) with its window calibrated to the 364 keV energy of I-131. There is an additional SCA with its window calibrated to an energy above the I-131 energy to provide a measure of the background in the iodine window. The effects of a fluctuating background are compensated for, by subtracting the background.

c. The low-range noble gas monitor is a beta scintillation detector (Eberline model RDA-3A). Background correction for this channel is derived from the gamma background detector which is an energy compensated Geiger-Mueller (G-M) detector (Eberline model 10450-B28). Since the external (ambient) gamma radiation has a measurable effect on the beta measurement (particulate and gas), the gamma background channel is used as a source of subtraction for both the gas measurement and the particulate measurement.

d. An energy compensated G-M detector (Eberline model 10450-B28) monitors the gas volume for the medium-range noble gas measurement. Its output is proportional to the gamma emission of the sample. An additional identical detector, the background detector, is provided in the sampler shield as a measure of external background at the sampler. Thus, the effect of a fluctuating external background on the medium-range gas channel are nullified by measuring and subtracting the background.

e. An energy compensated G-M detector (Eberline model 10450-B28) monitors the gas volume of a section of 1" stainless steel tubing in the SA-9 high-range noble gas sampler of the SPING-4. Its output is proportional to the gamma emission of the sample.

f. Each SPING is equipped with a local area monitor. This detector is an energy compensated G-M tube (Eberline model DAI-1-CC) which is calibrated in radiation dose rate and provides a measure of the gamma field at the instrument.

g. Radioactive check sources are provided to enable periodic checking of the detectors and electronics for proper response. The following list summarizes the channels with check sources.

CHANNEL	CHECK SOURCE
Beta Particulate	30 μCi Cs-137
Iodine	0.5 μCi Ba-133
Low-Range Noble Gas	30 μCi Cs-137
Area Monitor	0.5 μCi Sr-90, Y-90
High-Range Noble Gas	0.5 μCi Sr-90, Y-90

h. A complete list of detector specifications, sampler specifications and calibration procedures is included in the attachment.

2. The SPING-4 monitors will be used to monitor the exhaust flow of the Unit 1 containment purge exhaust stack, Unit 2 containment purge exhaust stack and the auxiliary building exhaust stack. These monitors will be located in the electrical equipment rooms. The sample connect point for these monitors will be downstream of the stack filters. The SPING-3 monitor will be used to monitor the exhaust flow of the Point Beach radwaste packaging area exhaust stack. The SPING-3 will be located in the radwaste packaging area. The sample connect point for the SPING-3 will be located downstream of the filters. ANSI N13.1-1969 will be used as the guidelines for the design of nozzles and piping layout.

B. SA-11 Monitor

The upgraded radiation monitoring system includes four SA-11 monitors for steam line monitoring. The SA-11 is comprised of a lead-shielded detector which views the main steam line upstream of the safety valves for gamma radiation. A typical location diagram is shown in the attachment. The detector is an energy compensated G-M tube (Eberline model 10450-B28). The detector output is proportional to the gamma emission from the steam line. The detector output is input to a single channel on a DAM. The SA-11 monitor is equipped with a remotely actuated check source (0.5 μCi Sr-90, Y-90). The range of the SA-11 is from $1x10^{-1}$ to $1x10^{4}$ mR/hr. The exact conversion to μCi/cc of Xe-133 has not yet been determined. The calibration procedure for this monitor is expected to yield the appropriate conversion factors. The calibration procedure is currently being developed. The monitor and detector specifications are included in the attachment.

C. Isokinetic Stack Sampling System (ISSS)

The ISSS is being designed to satisfy the requirements of II.F.1.2. However, due to the untimely response of vendors to the Wisconsin Electric request for proposal, exact design details cannot be presented at this time. The conceptual design and specifications will be presented. It is anticipated that this system will be installed and operational by May 1, 1982. This system will be installed on the auxiliary building exhaust stack and the radwaste packaging area exhaust stack since they are the only viable early release paths in an accident situation.

A functional block diagram of the ISSS is shown in the attachment. A representative sample will be drawn at an isokinetic rate with respect to stack flow. The unit will maintain isokinetic sampling capability up to the design flow of 62,000 cfm with an error of less than ±20%. The system will be capable of continuous operation. The stack flow sensor and sample flow monitor will be high quality devices. The flow controller will be capable of both automatic and manual operation. The stack flow transmitter will provide a 4-20 ma signal for input to the DAM analog input boards. The Flow Control Valve (FCV) will be of high quality. System temperature control will be provided. Local indicators for stack velocity and flow and sample velocity and flow will be provided. The length of the line between the sample withdrawal and the sample collector will be as short as possible. The collector must be shielded. Quick changeout of the collection media is required to minimize personnel exposure.

All vendors were advised that particulates and radioiodines were the species to be collected. Vendors were directed to propose a collector which meets the requirements of NUREG-0737. Vendors were supplied with a list of references which included NUREG-0737, ANSI N13.1 and Regulatory Guide 1.97, Revision 2.

D. Procedures for Release Rate Calculations

Copies of the current procedures and calculational methods for quantifying releases are in the attachment. These procedures are part of the Point Beach Emergency Plan Implementing Procedures. These procedures will be updated as required in order to reflect the upgraded radiation monitoring system.

II.F.1.3 ACCIDENT MONITORING - CONTAINMENT HIGH-RANGE RADIATION MONITOR

Additional in-containment high-range radiation monitoring will be provided for Point Beach Nuclear Plant by six gamma ionization chambers supplied by General Atomic Company. Three RD-23 detectors with an eight decade range will be located on floor- or beam-mounted seismic supports located on the 66' El. operating level in each unit's containment. Power for each detector and signal processing will be provided by RP-2C readout modules mounted in new auxiliary instrumentation racks located in the computer room above the control room. Each detector will be supplied power from a separate safety-grade instrument bus via an individual power supply associated with the RP-2C readout module. Power for each bus originates with a battery/charger-supplied inverter to ensure continuous operation. Separation and seismic support provide IE qualification for the detector channels.

The output of the individual detector channel will be processed by Foxboro Spec 200 instrumentation to be installed in the same area. The outputs will be isolated and routed to the ASIP for display and high-level alarm annunciation. Additional outputs will be provided for the plant computer and instrumentation systems.

Installation of the in-containment monitors can be accomplished during the next refueling outage for each unit, fall 1981 for Unit 1, and spring 1982

for Unit 2, provided the supports are received in time. Operation of the entire system is dependent upon delivery and installation of the ASIP (September 1982), Foxboro racks (late 1981 and early 1982 for Unit 1 and 2, respectively) and the auxiliary racks (not yet ordered).

II.F.1.4 CONTAINMENT PRESSURE MONITOR

New high-range pressure transmitters will be installed to provide containment wide-range pressure indication. Indication and recording will be provided in the control room.

This indication system is typical of many that are being installed. It consists of several components, each with their own schedule, as follows:

1. Foxboro pressure transmitters have been delivered and are on-site. Transmitter mounts meeting seismic design criteria and Quality Assurance standards must be fabricated. It is expected that these transmitter mounts will be fabricated and the transmitters mounted by the end of 1981, for both Unit 1 and Unit 2.

2. Foxboro Spec 200 analog process racks have been ordered. These racks will power the transmitters and process and isolate the transmitter output signals. Delivery of the Unit 1 racks is expected near the end of 1981 and delivery of the Unit 2 racks is expected early in 1982.

3. Interconnecting cables must be pulled and terminated. These cables connect the transmitters to the Foxboro racks, the racks to the main control board in the control room, the racks to the Auxiliary Safety Instrumentation Panel (ASIP) in the control room, and the racks to the computer system. These cables will be installed during 1981 and 1982 as equipment is installed.

4. Power for the white and yellow powered Foxboro Spec 200 racks will be supplied by new battery-inverter power supplies. The batteries will be located in new battery rooms which will be constructed. It is estimated that the new power supplies will be available June 30, 1982.

5. Readouts in the control room will be mounted on the existing main control board (panel C01) and the new ASIPs (panels 1C20 and 2C20). The C20 panels will be ordered and it is expected that they can be designed, fabricated, and delivered by June 30, 1982.

Although portions of the high-range containment pressure indicating system may be operating sooner on an interim basis, it is currently expected that the final configuration of the analog indications in the control room will be operational during September of 1982. The same constraints that apply to the high-range containment pressure system also apply to most of the other indication systems that require display in the control room.

II.F.1.5 CONTAINMENT WATER LEVEL

DeLaval-Gems transmitters and receivers have been delivered and are on-site. The Unit 1 transmitters will be installed during the fall 1982 refueling if seismically designed transmitter mounts can be fabricated with the proper Quality Assurance provisions in time for installation this refueling. It is planned to install the Unit 2 transmitters during the spring 1982 refueling. The receivers will be wall mounted in the computer room. Installation of the receivers is expected during the latter part of 1981.

The Foxboro Spec 200 racks will be used to distribute the receiver outputs to the computer and to the ASIP. The constraints and implementation schedule mentioned in II.F.1.4 with respect to the racks, cables, power supplies, and ASIP also apply to the containment water level indications.

II.F.1.6 CONTAINMENT ATMOSPHERE HYDROGEN ANALYZER

Redundant hydrogen sensors powered by independent power supplies will be provided in each containment. The analyzers that will be ordered are manufactured by Exo Sensors, Inc. The order has not been placed as yet pending the outcome of Exo Sensor's qualification test program which is in progress.

It is planned to mount the sensors in the Unit 2 containment during the spring 1982 refueling and to mount the sensors in the Unit 1 containment during the fall 1982 refueling. Cable runs are expected to be installed in the Unit 1 containment during the fall 1981 refueling. Cables have already been installed in the Unit 2 containment.

The microprocessors will be installed in auxiliary racks in the computer room. These auxiliary racks have not been ordered as yet.

The Foxboro Spec 200 racks will be used to distribute the analyzer outputs to the computer and to the ASIP. The constraints mentioned in II.F.1.4 with respect to racks, cables, power supplies and the ASIP also apply to the containment atmosphere hydrogen analyzer indications. It is expected that the system from sensors to indicators in the control room can be operational for both units by December of 1982.

II.F.2.1 INSTRUMENTATION FOR DETECTION OF INADEQUATE CORE COOLING - SUBCOOLING METER

The final subcooling system which will meet all of the NRC requirements has been designed as part of the qualified instrumentation system being added to the plant. This added system is intended to provide the means by which the large number of instrumentation changes can be properly incorporated into the existing plant. This new system consists of five instruments and an ASIP for each unit. The ASIP is located in the control room at a location which allows for easy viewing of the panel-mounted display devices. Subcooling display meters will be located on the ASIP. The operability of the final subcooling meter is dependent upon the delivery, installation and operational checkout of the new racks and panels. The new panels are each fifteen feet

long and their installation in the control room must be carefully planned and implemented. The ordering of these panels has been delayed due to the continuing need to add instrumentation to them and route cable and conduit through them as new requirements are recognized. The design of these panels is close to being finalized and the procurement of these panels is about to begin. It is our plan to have the ASIP panels delivered in June of 1982 and the displays located on these panels should be operational by September of 1982. This includes the final configuration of the subcooling display. The subcooling capability described in References 1 and 2 is judged to be sufficient until the final system is operational in the Plant.

II.F.2.3 REACTOR VESSEL WATER LEVEL

The reactor vessel water level system uses redundant, separately powered wide- and narrow-range Foxboro differential pressure transmitters located inside containment, four transmitters per unit. These transmitters have been delivered and are on-site. Installation of the Unit 1 transmitters will be performed during the fall 1981 refueling outage if seismically designed transmitter mounts can be fabricated with the proper Quality Assurance provisions in time for installation this refueling. It is planned to install the Unit 2 transmitters during the spring 1982 refueling.

The top fluid connection to the reactor vessel head will be made by Westinghouse Electric Corporation. It is planned that this connection will be installed in Unit 1 during the fall 1981 refueling and in Unit 2 during the spring 1982 refueling.

The bottom fluid connection to an incore instrumentation thimble guide tube coupling will be made by NUS Corporation. It is planned that this connection will be installed in Unit 1 during the fall 1981 refueling and in Unit 2 during the spring 1982 refueling.

At the high point of the top tap fluid lines, a chamber will be installed with sufficient capacity to refill the fluid lines to the transmitters once. This chamber acts as a water reservoir; it does not contain a bellows or diaphram. The chamber, its supports, and supports for the fluid lines will be seimically designed and fabricated with the proper Quality Assurance provisions. It is expected that these elements of the system will be installed in Unit 2 during the spring 1982 refueling outage and in Unit 1 during the fall 1982 refueling outage.

Chromel-alumel thermocouples will be attached to the vertical runs of the fluid lines to provide temperature compensation. It is expected that these thermocouples will be installed in Unit 2 during the spring 1982 refueling and in Unit 1 during the fall 1982 refueling.

The reactor vessel incore thermocouples and the thermocouples on the vertical runs of the fluid lines will be processed by input cards in the new computer multiplexing system. The computer multiplexing system will output weighted-average signals to the Foxboro racks. It is expected that the computer multiplexing system will be installed by November 1982.

The top tap fluid line is being designed to penetrate through the refueling canal wall in order to maintain proper elevations. This fluid penetration through the refueling canal wall will be fabricated and a hole will be drilled through the wall to accept the penetration. It is expected that this penetration will be installed in Unit 2 during the spring 1982 refueling and in the Unit 1 during the fall 1982 refueling.

Foxboro Spec 200 analog process racks will be used to power the differential pressure transmitters, perform the computations, and distribute the output signals to the computer and ASIP. The constraints mentioned in II.F.1.4 with respect to the racks, cables, power supplies and ASIP also apply to the reactor water level system. It is expected that the system from sensors to indicators in the control room can be operational for both units by December of 1982.

A detailed description of the vessel level system showing the tap locations, fluid line routing, transmitter location, signal processing and parameter displays will be submitted by October 1, 1981. The system utilizes vessel differential pressure to determine level but it is not a Westinghouse-designed or supplied system. The questions on the Westinghouse system sent to Wisconsin Electric by the NRC in Reference 41 will be addressed, where applicable, in our October 1, 1981 submittal.

II.K.3.5 AUTOMATIC TRIP OF REACTOR COOLANT PUMPS DURING LOSS-OF-COOLANT ACCIDENT

The Owners Group of Westinghouse utilities submitted material in OG-60, R. W. Jurgensen to P. S. Check letter dated June 15, 1981 (Reference 31), which documented post-test analysis of LOFT test L3-1 and L3-6. Reference 31 stated that the schedule to submit a proposed automatic RCP trip, if such a trip is determined to be necessary, will not be required until at least three months after the NRC has approved the small break model.

III.A.1.2 UPGRADING EMERGENCY SUPPORT FACILITIES

The conceptual design information for the emergency response facilities at Point Beach was submitted to the NRC in letters dated February 18, 1981 (Reference 15a) and June 1, 1981 (Reference 28).

The instrumentation described in Reference 2 was installed in the temporary Technical Support Center prior to March 1, 1981 and is fully operational with the following exceptions:

1. Wind speed and direction indicators cannot be installed on a temporary basis,
2. The remaining T_h and T_c for Unit 2 will be installed by October 1, 1981,
3. Containment sump level, and
4. Containment high-range radiation.

Items 3 and 4 will be operational when the new instrumentation racks and ASIP's are installed and operational by September 1982. The value of connecting them to the temporary Technical Support Center (TSC) will be determined at that time.

When the new TSC is completed, the interim instrumentation system will be moved to the emergency operations work area. This move should occur by February 1, 1982, at which time the new TSC can be considered operational. This system is judged to be adequate until the final computer-based plant data system is operational around September of 1983.

A training session was held on March 11, 1981 for all Duty and Call personnel and all Duty Technical Advisors to cover the parameters display. User instructions have been developed for the interim system and are located close to the display panel.

Clarification of various emergency response facilities items is as follows. This item (III.A.1.2) is being considered to be applicable to the physical facilities of the TSC, OSC and EOF. The Emergency Plan is addressed in II.A.2.1, the meteorological data system is addressed in III.A.2.2, and the plant safety parameter display console is addressed in I.D.2. Since the technical data system is part of the same computer system as the SPDS, it will be considered in I.D.2.

III.A.2.1 EMERGENCY PREPAREDNESS - UPGRADED EMERGENCY PLANS TO APPENDIX E, 10 CFR 50

Copies of the revised PBNP Radiological Emergency Response Plan, as well as copies of the State and local plans, were submitted on December 30, 1980 (Reference 12b).

The PBNP Plan submitted was complete except for the fifteen-minute notification and Table B-1. In Reference 30, a public notification system was described for PBNP. Revisions of the local radiological emergency response plans will be made by the counties for inclusion in the State plan for submittal to the Federal Emergency Management Agency. A revision to the PBNP Emergency Plan will be made after the public notification system is operational. The functional requirements of Table B-1 were discussed in Reference 12b and an alternate Table B-2 was presented.

The Emergency Plan Implementing Procedures were submitted on February 27, 1981 (Reference 17a), including a description of methods to assess and monitor potential off-site consequences of an emergency.

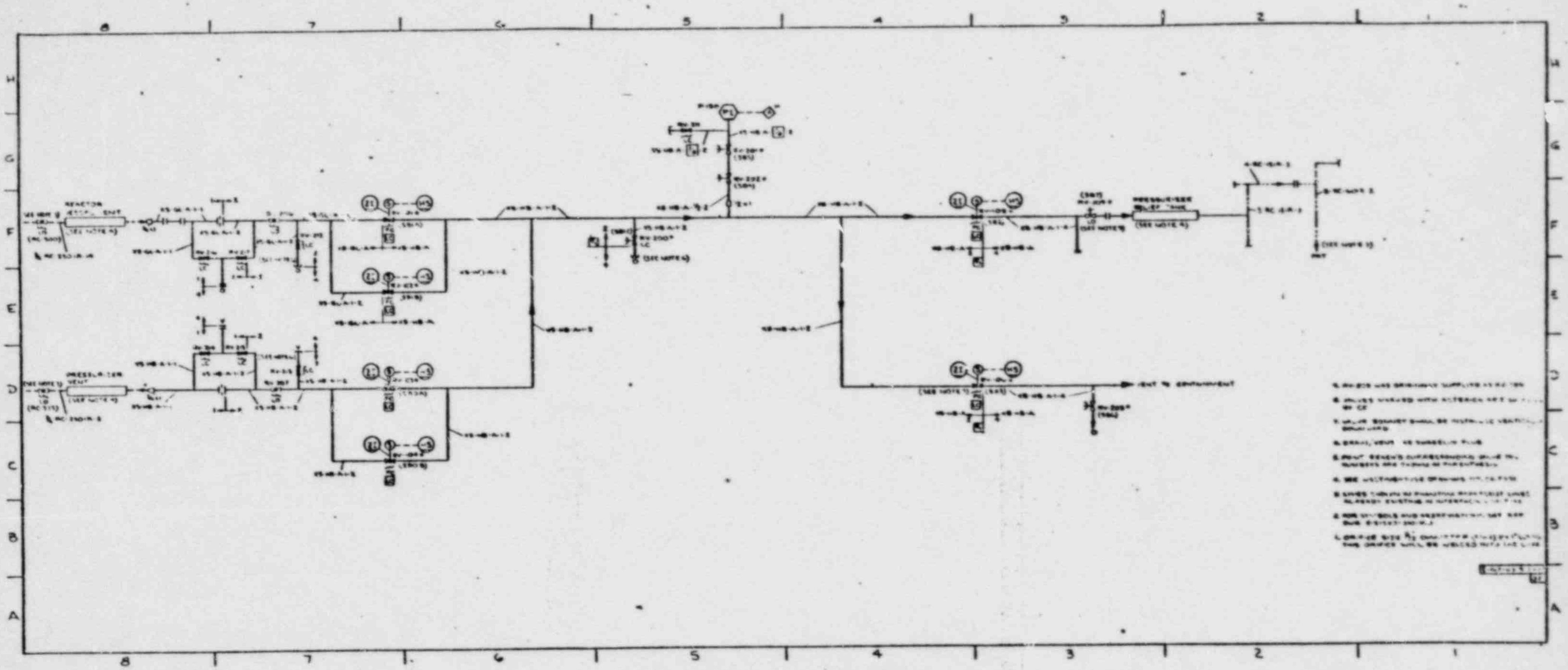
The upgraded Emergency Plan and its associated implementing procedures were implemented on March 31, 1981 in accordance with 10 CFR 50.47S2.

Personnel at PBNP and the corporate headquarters that have a role in emergency response to an incident at PBNP have received training and have been entered into a retraining program on the Emergency Plan and applicable Emergency Plan Implementing Procedures.

III.A.2.2 EMERGENCY PREPAREDNESS - METEOROLOGICAL DATA

Wisconin Electric has provided in Reference 13 a description of its plans for upgrading the meteorological measurements program at Point Beach. Reference 38 stated that our submittal of a complete functional description of all elements of the upgraded program discussed in Section G of Reference 13 will be provided prior to January 1, 1982.

The meteorological measurements program is being design to interface with the computer system being installed to meet NUREG-0696 requirements (See Note I.D.2). This means of implementing the meteorological program will result in some delay in its implementation, but will result in an integrated system that is superior to any another means of implementation we were able to envision. The result is that Milestone 4 and Milestone 5 of Appendix 2 of NUREG-0654 will not be completed by April 1, 1982 and July 1, 1982, respectively. Projected completion dates will be provided prior to January 1, 1982.



REACTOR COOLANT GAS VENT SYSTEM

APPROVED
REFERENCE
DESIGN

II.B.1

WISCONSIN ELECTRIC POWER CO.
POINT BEACH UNITS 1 & 2

REACTOR COOLANT
GAS VENT SYSTEM

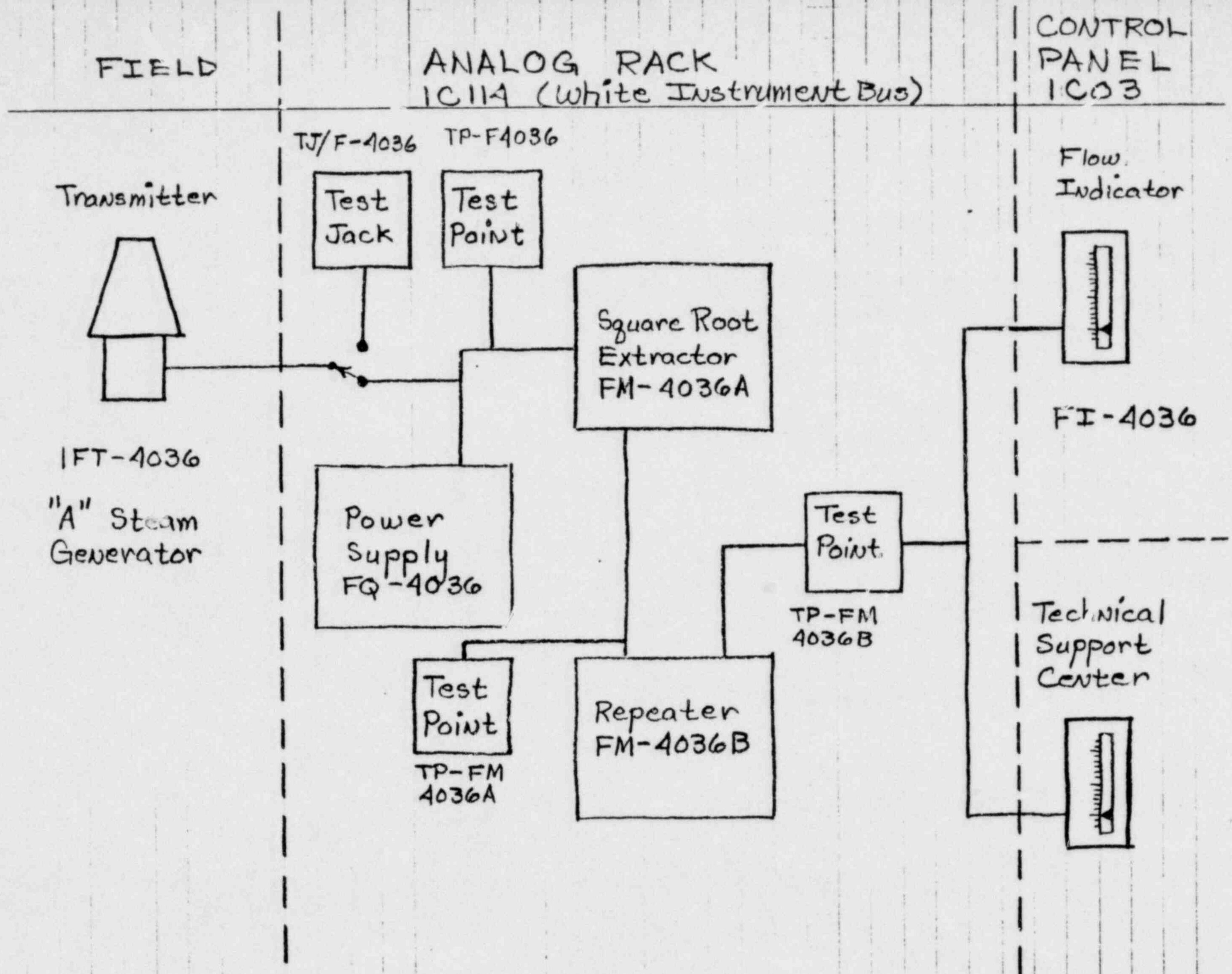


Figure II.E.1.2 - AFW Flow to Steam Generator

REFERENCES

1. S. Burstein (WE) letter to H. R. Denton (NRC), December 31, 1979, "Implementation of NUREG-0578"

2. C. W. Fay (WE) letter to H. R. Denton (NRC), March 14, 1980, "Implementation of NUREG-0578"

3. A. Schwencer (NRC) letter to S. Burstein (WE), April 9, 1980, "Evaluation of Compliance with Category "A" Lessons Learned Requirements"

3a. D. G. Eisenhut (NRC) letter To All Operating Reactor Licensees, May 7, 1980, "Five Additional TMI-2 Related Requirements (Applicable) to Operating Reactors"

4. C. W. Fay (WE) letter to H. R. Denton (NRC), June 11, 1980, "Implementation of Five Additional TMI-2 Related Requirements"

4a. C. W. Fay (WE) letter to H. R. Denton (NRC), June 11, 1980, "Additional Information Auxiliary Feedwater System"

5. C. W. Fay (WE) letter to H. R. Denton (NRC), November 3, 1980, "Status of Duty and Call Technical Advisor Training"

6. C. W. Fay (WE) letter to H. R. Denton (NRC), December 1, 1980, "Revised Emergency Plan"

7. C. W. Fay (WE) letter to H. R. Denton (NRC), November 3, 1980, "Operating Licenses DPR-24 and DPR-27, Interim Criteria for Shift Staffing"

8. C. W. Fay (WE) letter to H. R. Denton (NRC), September 22, 1980, "Comments on Draft NUREG-0696, Functional Criteria for Emergency Response Facilities"

9. S. Burstein (WE) letter to H. R. Denton (NRC), October 20, 1979, "Implementation of NUREG-0578" - including TMI Accident Review Task Force Report (Section 3.6.A)

9a. P. F. Collins (NRC) letter to C. W. Fay (WE), October 28, 1980, regarding Item I.A.2.1.3 of NUREG-0737.

9b. R. F. Heishman (NRC) letter to Sol Burstein (WE), November 20, 1980, Inspection Report No. 50-266/80-19 and No. 50-301/80-19.

10. R. W. Jurgensen (WOG) letter to S. H. Hanauer (NRC), OG-47, December 15, 1980, "Westinghouse Owners Group Response to Item I.C.1 of NUREG-0737"

10a. R. C. Youngdahl (EPRI) letter to D. G. Eisenhut (NRC), December 15, 1980, PWR Utilities Position on NUREG-0737, Item II.D.1, Performance Testing of BWR and PWR Relief and Safety Valves (NUREG-0778, Section 2.1.2)

11. S. H. Hanauer (NRC) letter to R. A. Newton (WE), December 17, 1980, request for a basis document for the emergency procedure guidelines.

12. C. W. Fay (WE) letter to H. R. Denton (NRC), December 23, 1980, "Response to NURG-0737, Schedule Requirements as Related to Point Beach Nuclear Plant, Units 1 and 2"

12a. R. F. Heishman (NRC) letter to Sol Burstein (WE), December 23, 1980, Inspection Report No. 50-266/80-20 and No. 50-301/80-20.

12b. C. W. Fay (WE) letter to H. R. Denton (NR``. December 30, 1981, "Point Beach Nuclear Plant Emergency Plan"

13. C. W. Fay (WE) letter to H. R. Denton (NRC), January 9, 1981, "Additional Response to NUREG-0737"

13a. C. W. Fay (WE) letter to H. R. Denton (NRC), January 19, 1981, "Response to NUREG-0737"

14. R. W. Jurgensen (WOG) letter to S. H. Hanauer (NRC), OG-48, January 28, 1981, "Emergency Operating Instruction Background Documents"

15. C. W. Fay (WE) letter to H. R. Denton (NRC), February 4, 1981, "Technical Specification Change Request No. 65"

15a. Sol Burstein (WE) letter to S. J. Chilk (NRC), February 18, 1981, "Emergency Operatings Facility"

15b. D. G. Eisenhut (NRC) letter To All Licensees of Operating Plants and Holders of Construction Permits, February 18, 1981, "Post-TMI Requirements for the Emergency Operations Facility (Generic Letter 81-10)"

16. C. W. Fay (WE) letter to H. R. Denton (NRC), February 23, 1981, "Additional Responses to NUREG-0737"

17. C. W. Fay (WE) letter to H. R. Denton (NRC), February 26, 1981, "Duty and Call Technical Advisor Training"

17a. C. W. Fay (WE) letter to H. R. Denton (NRC), February 27, 1981, "Emergency Plan Implementing Procedures"

18. C. W. Fay (WE) letter to H. R. Denton (NRC), March 4, 1981, "NUREG-0737 Schedule Requirements"

19. R. W. Jurgensen (WOG) letter to J. R. Miller (NRC), OG-52, March 13, 1981, WCAP-9804, "Probabilistic Analysis and Operational Data in Response to Item II.K.3.2 for Westinghouse NSSS Plants"

20. R. W. Jurgensen (WOG) letter to S. H. Hanauer (NRC), OG-54, March 18, 1981, "Westinghouse Owners Group Update on Item I.C.1 of NUREG-0737 Activities"

21. E. R. Mathews (WPS) letter to Sol Burstein (WE), March 19, 1981, "Letter of Intent to Provide Mutual Assistance"

22. C. W. Fay (WE) to H. R. Denton (NRC), March 31, 1981, "Emergency Plan"

23. C. W. Fay (WE) to H. R. Denton (NRC), March 31, 1981, "Response to NUREG-0737 Update to Schedule Requirements and Implementation Status"

24. C. W. Fay (WE) to H. R. Denton (NRC), April 9, 1981, "Requirements for Auxiliary Feedwater System"

25. C. W. Fay (WE) to H. R. Denton (NRC), April 14, 1981, "Post-TMI Requirements for the Emergency Operations Facility"

26. C. W. Fay (WE) to H. R. Denton (NRC), May 7, 1981, "Containment Pressure Setpoint, NUREG-0737 Item II.E.4.2"

26a. W. A. Wogsland (WOG) letter to L. Beltracchi (NRC), May 19, 1981, "Proprietary Handouts, SAS Meeting, May 14, 1981"

27. D. G. Eisenhut (NRC) to R. W. Jurgensen (WOG), May 28, 1981, "WOG Procedures Development and Evaluation Program"

28. Sol Burstein (WE) to H. R. Denton (NRC), June 1, 1981, "Emergency Response Facilities"

29. R. A. Clark (NRC) to Sol Burstein (WE), June 1, 1981, "Clarification of Post-Accident Sampling Requirements of NUREG-0737, II.B.3"

30. C. W. Fay (WE) letter to H. R. Denton (NRC), June 2, 1981, "Emergency Plan Public Notification System"

31. R. W. Jurgensen (WOG) letter to P. S. Check (NRC), OG-60, June 15, 1981, "Response to NRC Letter of May 30, 1981"

32. R. A. Clark (NRC) to Sol Burstein (WE), June 17, 1981, "Review of the Westinghouse Owners Group submittal for Action Plan Item I.C.1"

33. R. A. Clark (NRC) to Sol Burstein (WE), June 17, 1981, "Safety Evaluation by the Office of Nuclear Reactor Regulation" (RE: IEB 79-06A and 79-06A, Revision 1, Item II.K.1)

34. R. A. Clark (NRC) to Sol Burstein (WE), June 26, 1981, "Elimination of Item II.K.2.19"

35. C. W. Fay (WE) to H. R. Denton (NRC), July 6, 1981, "NUREG-0737 Schedule Update"

36. R. W. Jurgensen (WOG) to S. H. Hanauer (NRC), OG-61, July 7, 1981, "Summary of WOG Program to Address NUREG-0737, Item I.C.1."

37. R. A. Clark (NRC) to Sol Burstein (WE), July 10, 1981, "Order Confirming Licensee Commitments on Post-TMI Related Issues"

38. C. W. Fay (WE) letter to H. R. Denton (NRC), July 17, 1981, "Meteorological System Description"

39. R. C. Youngdahl (EPRI) letter to H. R. Denton (NRC), July 24, 1981, "Status of EPRI PWR Safety and Relief Valve Test Program, NUREG-0737, Item II.D.1"

40. R. A. Clark (NRC) to Sol Burstein (WE), July 28, 1981, "Request for Additional Information on Auxiliary Feedwater System"

41. R. A. Clark (NRC) letter to Sol Burstein (WE), August 5, 1981, "Westinghouse Reactor Vessel Level Instrumentation for Monitoring Inadequate Core Cooling"

42. R. A. Clark (NRC) to Sol Burstein (WE), August 14, 1981, "Containment Isolation Pressure Setpoint"

43. R. A. Clark (NRC) to Sol Burstein (WE), August 19, 1981, "TMI Task Plan Items II.K.3.9, II.K.3.10, and II.K.3.12 for Point Beach Nuclear Plant, Units 1 and 2"

44. C. W. Fay (WE) to Secretary of the Commission (NRC), August 25, 1981, "Comments on NUREG-0739, Draft Criteria for Preparation of Emergency Operating Procedures"

45. Sol Burstein (WE) to H. R. Denton (NRC), August 28, 1981, "Technical Specification Change Request No. 68, Containment Purge Valve Operability"

ATTACHMENT

TO

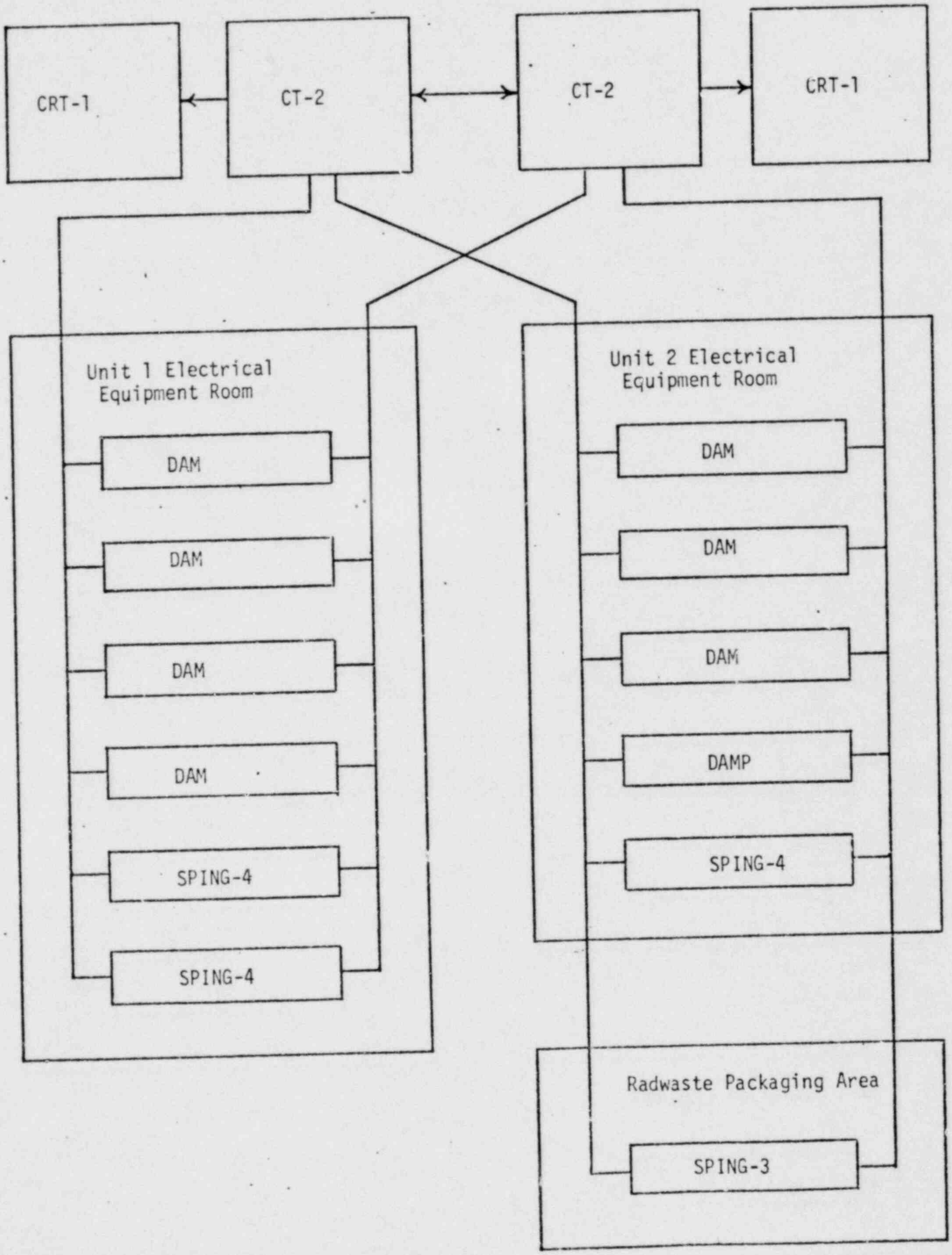
RESPONSE TO NUREG-0737

DATED SEPTEMBER 14, 1981

RADIATION MONITORING SYSTEM

POINT BEACH NUCLEAR PLANT

RADIATION MONITORING SYSTEM
FUNCTIONAL BLOCK DIAGRAM



MODEL RDS-1

A. GENERAL DESCRIPTION

The Model RDS-1 is a combination filter holder assembly and alpha detector. The detector is of solid state design to provide energy resolution and is followed by an amplifier and a line driver. Addition of an IB-3R (analog readout system) or an IB-3C (digital readout system) provides the interface to the readout electronics.

When installed in a proper sampler assembly, the RDS-1 provides a method of monitoring the particulate filter with both an alpha and beta detector that furnishes a dynamic measurement of radon. This measurement can be subtracted from the beta channel, enhancing sensitivity and credibility of the beta measurement.

B. SPECIFICATIONS

1. Detector: Silicon diffused junction type (cleanable) with 490 mm² area.

2. Filter: 47 mm dia. Millipore SM or equivalent recommended.

3. Counting efficiency: Approximately 20% of 2 pi from a plated 47 mm dia. ^{210}Pu source in the filter holder.

4. Amplifier: Charge sensitive input allowing very high input sensitivity with excellent noise rejection. Feedback provides stability and control. Gain is fixed for approximately +0.1V output when exposed to a ^{210}Pu source.

5. Connector: Amphenol #165-34 (mating connector is on IB-3).

6. Power requirement: 24 VDC at 40 mA (provided by IB-3).

7. Temperature: Operational from 30° to 130°F (0°C to 55°C). Total gain change is less than ±5%.

8. Mechanical Size:

a. 2 inch lead — 7.12 inches (18.1 cm) long x 2.70 inches (6.85 cm) dia. overall.

b. 3 inch lead — 8.12 inches (20.6 cm) long x 2.70 inches (6.85 cm) dia. overall.

Weight:

a. 2 inch lead shield — 7.4 pounds (3.36 kg).

b. 3 inch lead shield — 9.75 pounds (4.43 kg).

C. THEORY OF OPERATION

1. GENERAL

Particles contained in the air stream are deposited on the filter. Alpha radiation emitted by this particulate is detected, amplified, and transmitted to the interface box (IB-3).

Use of a solid state detector provides good energy resolution for alpha radiation while showing little or no sensitivity to gamma or beta radiation.

2. FUNCTIONAL THEORY

a. *Detector*

When alpha particles bombard the detector, they enter the depletion region of the back biased-diode junction. While these particles are in the depletion region, they give up energy by causing ion pairs to be created. These ion pairs are created at the rate of one ion pair per 3.23 eV of energy given up by the alpha particle.

Because of the high electric field, these ion pairs are swept out of the depletion region and the total resulting charge is applied to the preamplifier input..

b. *Amplifier*

Transistors Q1 and Q2 form a charge-sensitive preamplifier with an output proportional to the charge input from the detector. The feedback capacitor C5 determines the sensitivity of this circuit. Constant current source CR1 sets Q1 bias current and, due to its high impedance, provides a very high voltage gain from Q1. Q2 is an emitter follower that provides a low output impedance from the preamplifier.

Transistors Q3 and Q4 provide gain and cable drive. Feedback for gain control is via R7/RT1 and R3. RT1 compensates for the temperature characteristics of the detector.

D. DISASSEMBLY AND REASSEMBLY: (Refer to assembly print)

CAUTION

If the detector face is scratched or if the detector receives too much shock, it can be permanently dam-

aged. The detector can be cleaned by using common solvents such as trichloroethylene or methanol. Typically, then the device is forced-air dryed. The contacts to the active area are ultrasonically bonded and can be pulled loose if excessively strained.

Avoid ambients or chemicals containing fluoride ions. Since the oxide used to stabilize the detector surface is adversely affected by the fluoride ion, drastic changes in the performance of this device may occur.

1. DETECTOR (Refer to Drawing 10748-C01)

a. Disconnect the RDS-1 from its interface box.

b. Remove the clamp nut (item 17).

c. Remove the filter retainer (item 8).

d. Remove the center body (item 9).

e. Loosen the three set screws (item 4).

f. Pushing with the cable (item 15), force the detector out.

The amplifier and detector assembly are now exposed.

To reassemble, reverse procedures. Before tightening the set screws to hold the detector, adjust the detector so that the case protrudes 1/16 inch past the housing (item 11).

E. MAINTENANCE

When cleaning the detector, observe the CAUTION above. To change the filter, remove the filter retainer and old filter. Center the new filter on the O-Ring. Replace the retainer.

NOTE

The solid state detector in the RDS-1 is light sensitive. When the filter paper is being changed, the detector connector should be disconnected before removing the RDS-1 from its shield.

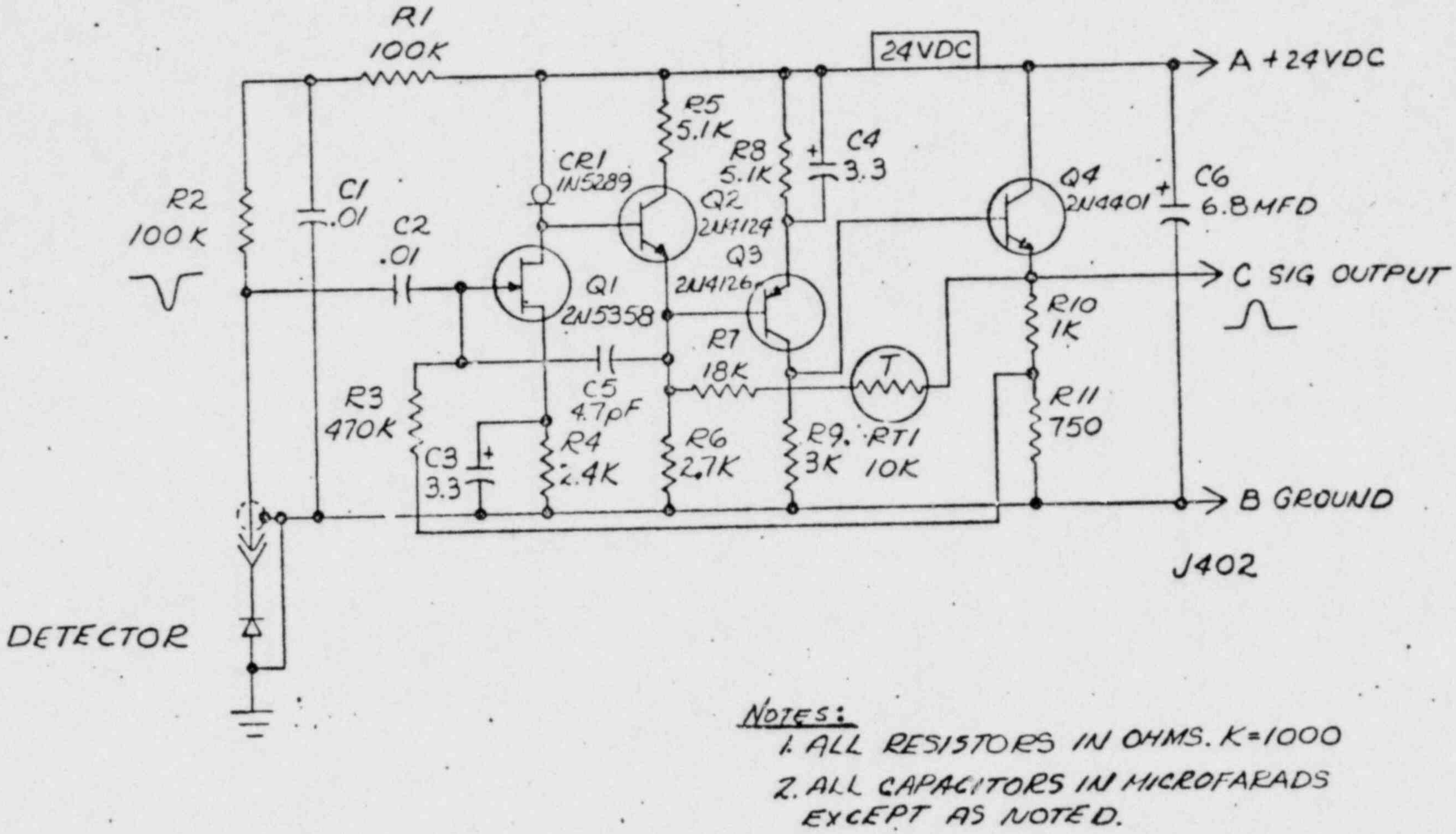
F. TROUBLESHOOTING

Through the use of the schematic, board component assembly, and the section on theory of operation, one should be able to solve the problems that may be encountered.

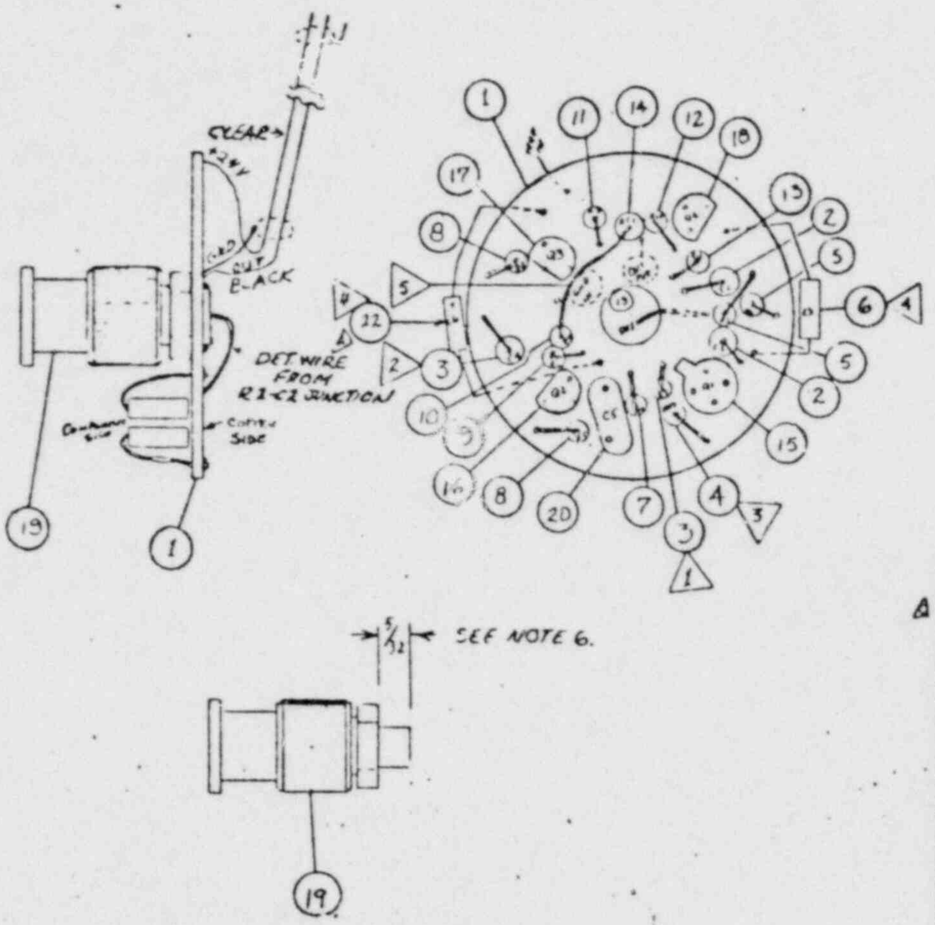
PARTS LIST

The following table lists the electronic items incorporated in the RDS-1 and should contain any part necessary for normal electronic repair. Unless otherwise specified, callouts of manufacturers and manufacturers' part numbers are to be considered typical examples only and not restrictions against using equivalent parts with the same operating characteristics. When ordering parts from Eberline, specify model number, serial number, reference designation and value, or a word description if the part has no reference designation. Eberline will automatically substitute equivalent parts when the one called out by manufacturers' part number is not available.

REF DESIG.	PART	DESCRIPTION	MFR & PART NO.
	Detector	Solid State, Alpha	Harshaw DJC-500-50-100B
C1, C2	Capacitor	0.01 μF, 80V	Sprague 192P1039R8
C3, C4	Capacitor	3.3 μF, 15V Tantalum	CS13B, Case A
C5	Capacitor	4.7 pF, 1kV Disc Ceramic	Sprague 10TCC-V47
C6	Capacitor	6.8 μF, 35V, Tantalum	CS13B, Case B
CR1	Diode	Current Regulator, 0.43mA	1N5289
J402	Connector	5 Pin, Male	Amphenol 165-33
Q1	Transistor	FET	2N5358
Q2	Transistor	NPN	2N4124
Q3	Transistor	PNP	2N4126
Q4	Transistor	NPN	2N4401
R1, R2	Resistor	100k, 1/4W, 5%	
R3	Resistor	470k, 1/4W, 5%	
R4	Resistor	2.4k, 1/4W, 5%	
R5, R8	Resistor	5.1k, 1/4W, 5%	
R6	Resistor	2.7k, 1/4W, 5%	
R7	Resistor	18k, 1/4W, 5%	
R9	Resistor	3k, 1/4W, 5%	
R10	Resistor	1k, 1/4W, 5%	
R11	Resistor	750, 1/4W, 5%	
RT1	Sensistor	10k at 25°C	TI TG-1/8



RDS-1 Schematic, 10748-B11C.

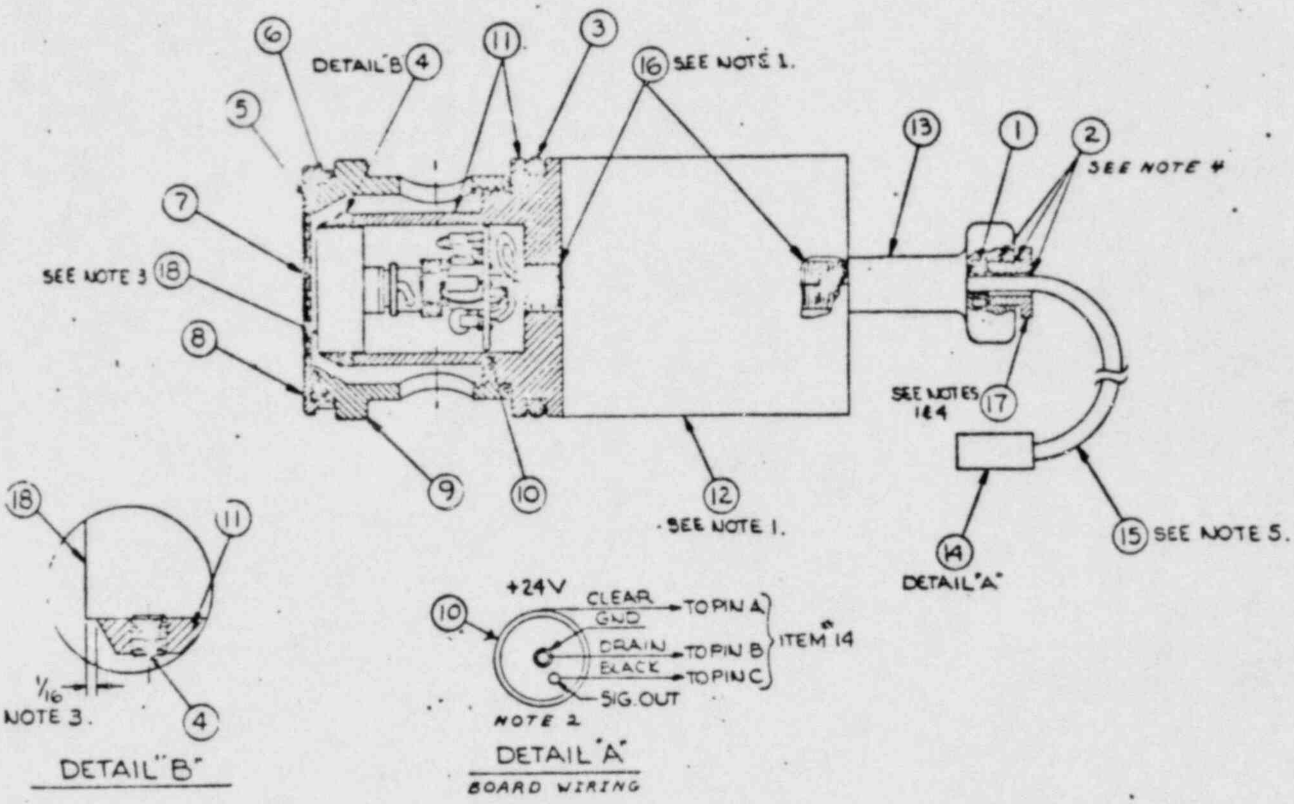


NOTES:

1. "+" END TO BOARD
2. "–" END TO BOARD
3. "BAND" END TO BOARD
4. MOUNT R3 & C6 ON COPPER SIDE OF BOARD. KEEP THE BODY WITHIN THE O.D. OF THE BOARD.
5. JUMPER BETWEEN RT1 & R7. INSULATE LEADS.
6. SAND OFF END OF CONNECTOR TO 5/32" LONG.

NO.	QUAN	PER.	DESCRIPTION
1	1	ASSY	PC BOARD, 10748-B10
2	2	"	CAPACITOR, .01 @ 80V, SPRAGUE 192P (C1 & C2)
3	2	"	" 3.3 µF @ 15VDC, CS-13B (C3 & C4)
4	1	"	CURRENT REGULATOR, 1N5283 (CR1)
5	2	"	RESISTOR, 100K 1/4 W (R1, R2)
6	1	"	" 470K " (R3)
7	1	"	" 2.4K " (R4)
8	2	"	" 5.1K " (R5, R8)
9	1	"	" 2.7K " (R6)
10	1	"	" 18K " (R7)
11	1	"	" 3.0K " (R9)
12	1	"	" 1.0K " (R10)
13	1	"	" 750Ω " (R11)
14	1	"	SENSISTOR 10K, TI # TM 1/8 (RT1)
15	1	"	FET, 2N5358 (Q1)
16	1	"	TRANSISTOR 2N4124 (Q2)
17	1	"	" 2N4126 (Q3)
18	1	"	" 2N4401 (Q4)
19	1	"	CONNECTOR, BNC, GREMAR 7092 (OR CANNON # 150.00-1220)
20	1	"	CAPACITOR 4.7 pF @ 1KV (C5)
21		"	CABLE, BELDEN 8761
22	1	"	CAPACITOR 6.8 µF @ 35VDC CS-13 (C6)

RDS-1 Circuit Board Assembly, 10748-B09C.



NOTES:

1. APPLY A THIN UNIFORM COAT OF LOC-TITE TO THREADS (ITEMS 12 & 13) DO NOT USE LOC-TITE ON THREADS OF ITEM 17.
2. INSULATE BARE DRAIN WIRE BEFORE SOLDERING TO "GND" ON P.C. BOAD. USE CLEAR VINYL TUBING
3. △ ADJUST DETECTOR (ITEM 18) TO STICK OUT 1/16" PAST END OF THE DETECTOR BODY (ITEM 11)
4. △ APPLY A COAT OF CLEAR RTV (3M # 666) TO THREADS AND CABLE BEFORE ASSY. WIPE OFF EXCESS AFTER TIGHTENING.
5. △ CABLE LENGTH FROM CLAMP NUT (ITEM 17.) TO CONNECTOR TIP, 15±1."

NO.	QUAN	PER	DESCRIPTION
1	2	ASSY	O-RING, 3/16 I.D. x 3/8 O.D. x .103 THK. PARKER [illegible]
△ 2	A/R	"	RTV, CLEAR 3M # 666
3	1	"	O-RING 2 3/4 O.D. x 2 3/8 I.D. x .210 THK PARKER 2-332 [illegible]
4	3	"	SET SCREW # 6-32 ALLEN HD x 1/8 LG. S.S.
5	1	"	O-RING 1 7/8 O.D. x 1 3/4 I.D. x .070 THK. PARKER [illegible]
6	1	"	O-RING 2 1/8 I.D. x 2 5/16 O.D. x .103 THK PARKER [illegible]
7	1	"	SCREEN, 10748-A03
8	1	"	FILTER DISC RETAINER, 10748-B04
9	1	"	CENTER BODY, 10748-B05
10	1	"	P.C BOARD ASS'Y, 10748-B09
11	1	"	DETECTOR BODY, 10748-B06
12	1	"	SHIELD, 10748-B14
13	1	"	HANDLE 10748-A08
14	1	"	CONNECTOR, AMPHENOL # 165-23
△ 15	22"	"	CABLE, BELDEN # 8761 OR EQUAL
16	A/R	"	LOC-TITE # 312
17	1	"	CLAMP NUT, 10748-A12
18	1	"	DETECTOR, SOILD STATE, HARSHAW [illegible]
19			
20			

RDS-1 Mechanical Assembly, 10748-B01G.

RDA-XX

A. GENERAL DESCRIPTION

The RDA radiation detectors are a series of scintillation type detectors intended for installation in sampler assemblies that monitor radiation in installed systems. The -XX in the model number is replaced by a number and a letter defining the type of scintillation crystal and the housing type. The last X defines the housing: A for aluminum, S for stainless steel. The first X defines the crystal: 1 for ZnS(Ag) alpha, 2 for 2 inch x 2 inch NaI (Tl) stabilized gamma, 3 for plastic beta, 4 for 2 inch x 2 mm NaI (Tl) gamma, 5 for 2 inch x 2 inch NaI (Tl) gamma. Other types are readily available also.

B. SPECIFICATIONS

1. Photomultiplier Tube: 2 inch , 10 dynode with S11 photocathode. This is a selected high resolution type for pulse height analyzing applications.

2. High Voltage: Maximum 1800V, typically in 600-1200V range depending on application.

3. Current: 120MΩ resistance requires 10 μA at 1200V.

4. Connection: Single MHV coaxial connector supplies high voltage and signal connection.

5. Magnetic Shield: Included.

6. Scintillation Crystal:

a. -1 type: 2 inch diameter ZnS(Ag) with 1 mg/cm^2 aluminized mylar window.

b. -2 type: 2 inch x 2 inch NaI(Tl) with ^{241}Am seed imbedded for automatic gain stabilization.

c. -3 type: 2 inch diameter x .010 inch thick plastic with 1.6 mg/cm^2 aluminum window.

d. -4 type: 2 inch diameter x 2 mm thick NaI(Tl) for low energy gamma, stabilized.

e. -5 type: 2 inch x 2 inch NaI(Tl).

7. Size: 2.62 inch diameter x 9.25 inches long (6.7 x 23.5 cm), excluding connector.

8. Temperature: 0 to 140°F (-18 to 60°C).

C. THEORY OF OPERATION

When radiation reacts in the crystal, a small flash of light is generated. The light photons are coupled to the photomultiplier tube where they release electrons from its photocathode. These electrons are accelerated along the dynode string in the tube, gaining in number at each dynode, until they reach the anode. The gain is controlled by the high voltage applied to the tube. The number of electrons collected (pulse amplitude) for each radiation event in the crystal is dependent on the amount of light generated (type of crystal and radiation energy) and the high voltage applied.

D. MAINTENANCE

1. PREVENTIVE MAINTENANCE

The assembly does not require any scheduled maintenance.

2. DISASSEMBLY AND REASSEMBLY

a. *Disassembly*

Remove the retaining ring at the connector end. Slide the internal assembly out.

CAUTION

The crystal is not attached except by the optical coupling compound; do not let it fall.

Remove the crystal from the photo tube. The photo tube may be unplugged from its socket.

b. *Reassembly*

Plug the photo tube into the socket. Place a small quantity (approximately 1/4 cm^3) of optical coupling compound (Dow-Corning 4-X® compound or equal) on the crystal and press and rotate against the photo tube until uniformly seated. Slide the assembly into the housing and install the retaining ring.

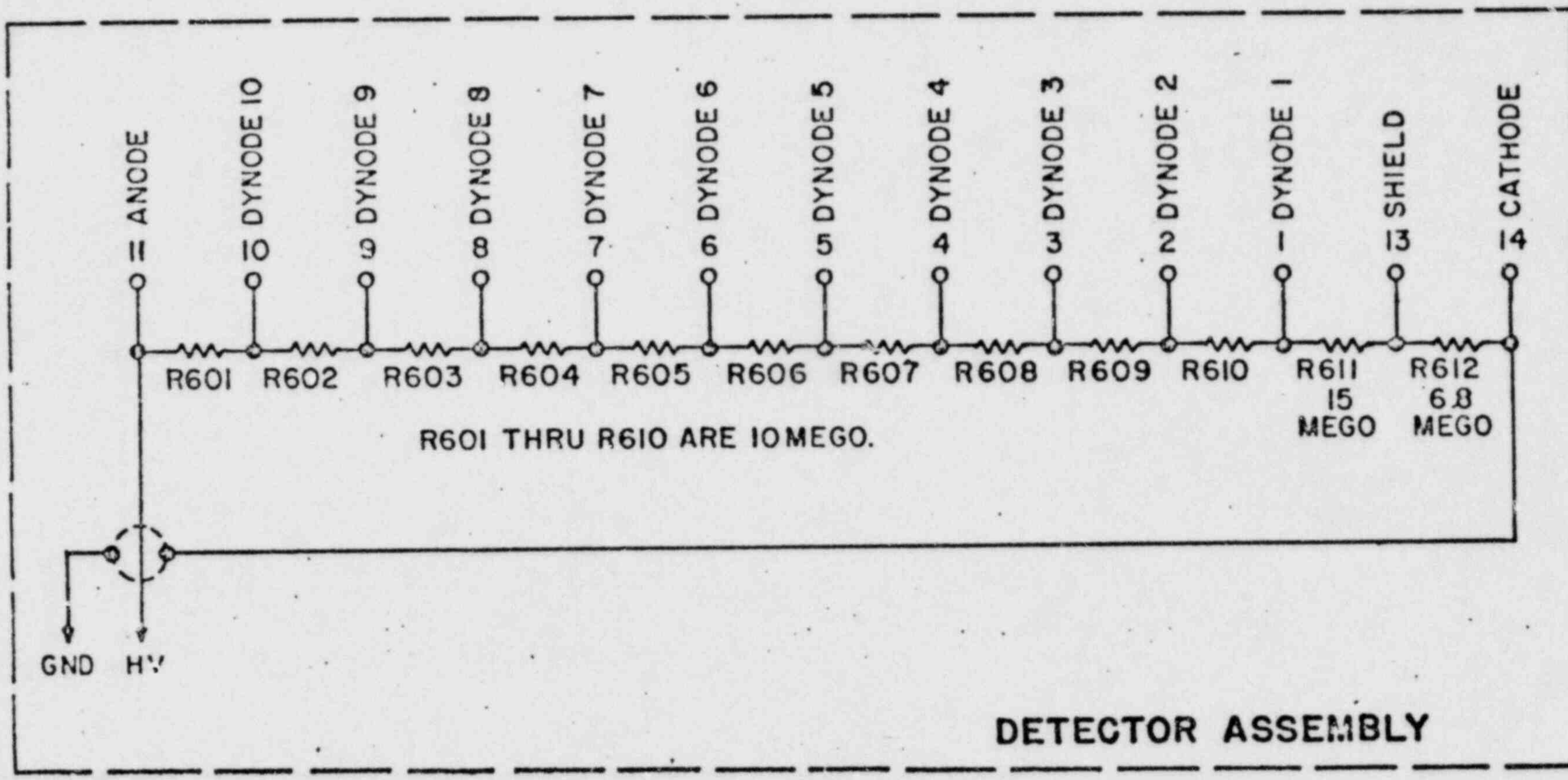
c. *Crystals*

Refer to the attached drawings for crystal assemblies.

PARTS LIST

The following table lists the electronic items incorporated in the RDA-XX and should contain any part necessary for normal electronic repair. Unless otherwise specified, callouts of manufacturers and manufacturers' part numbers are to be considered typical examples only and not restrictions against using equivalent parts with the same operating characteristics. When ordering parts from Eberline, specify model number, serial number, reference designation and value, or a word description if the part has no reference designation. Eberline will automatically substitute equivalent parts when the one called out by manufacturers' part number is not available.

REF DESIG.	DESCRIPTION	MFR & PART NO.
1. *All RDA-XX*		
	Connector Assembly	Eberline 10661-B05
	Connector, MHV	Amphenol 27025
	Socket Assembly	Eberline 10661-B21
	Photomultiplier Tube	Eberline 10613-A19
2. *RDA-1X*		
	Crystal Assembly	Eberline 10661-B18
	Phosphor Crystals, ZnS(Ag)	
	Aluminized Mylar, 0.00025 inch thick	Eberline M-11
3. *RDA-2X*		
	Detector Crystal, Stabilized	Eberline 10658-A01
4. *RDA-3X*		
	Aluminized Mylar	Eberline M-10
	Aluminized Mylar	Eberline M-11
	Plastic Scintillator, 0.010 inch thick	Pilot "B"
5. *RDA-4X*		
	Detector Crystal	Eberline 10661-A24
	Stabilization Pulser	Harshaw AM145G113K-X
6. *RDA-5X*		
	Detector Crystal	Harshaw 8D8



D/A Schematic, 10613-B14.

NO.	QUAN	PER	DESCRIPTION
1	1	ASS'Y	HOUSING 10661-B02 or 10661-B17
2	1	..	CONNECTOR ASS'Y 10661-B05
3	1	..	'O' RING, PARKER #2-141
4	2	..	RETAINING RING, RAMSEY #RR-237
5	1	..	PM TUBE, EIC #10663-A19
6	1	..	MAGNETIC SHIELD, 10661-B19
7	1	..	FOAM TAPE, 3/16" THK x 1/4 WIDE [illegible]
8	1	..	IDENT. PLATE, 10661-B20
9	1	..	CRYSTAL ASSEMBLY, SEE TABLE BELOW
10	1	..	SHIELD, 10661-A29 NOTE 2

MODEL NO. DESCRIPTION

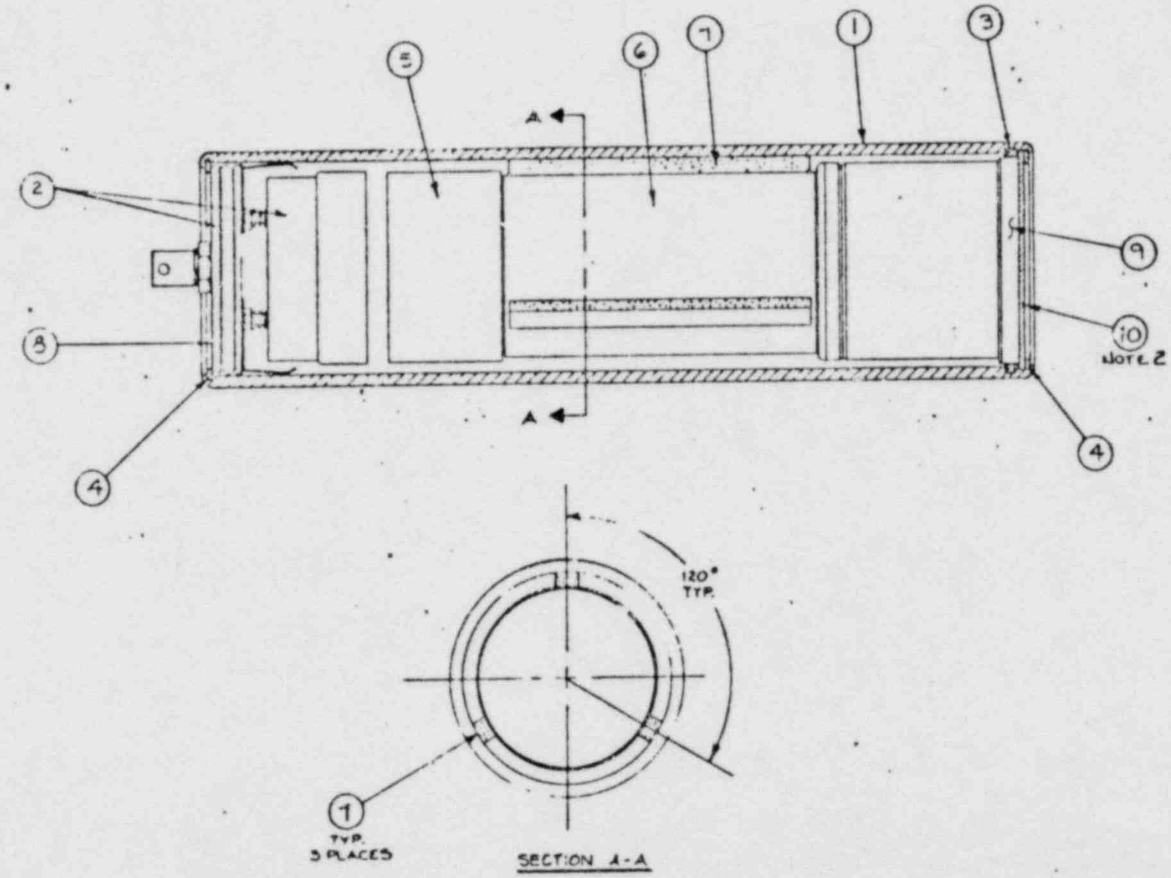
RDA - X X

DETECTOR SERIES — RDA

CRYSTAL TYPE — first X
1 = ALPHA, 10661-B18
2 = GAMMA (STAB. 2x2) 10658-A01
3 = BETA, PILOT 'B', 0.010 THICK 10661-B04
4 = LOW ENERGY GAMMA 10661-A24 ASS'Y 10661-B26
5 = GAMMA (2x2) HARSHAW #808

HOUSING MATERIAL — second X
S = STAINLESS STEEL (10661-B02)
A = ALUMINUM (10661-B17)

RDA-☐X	ASS'Y DWG. NO.	DESCRIPTION
[1]	10661-B18	ALPHA ZnS
[2]	10658-A01	GAMMA 2x2 NaI(Tl), STABILIZED
[3]	10661-B04	BETA, PILOT 'B' 2" DIA
[4]	10661-B26	GAMMA LOW ENERGY
[5]	—	GAMMA 2x2, HARSHAW #808



NOTES:

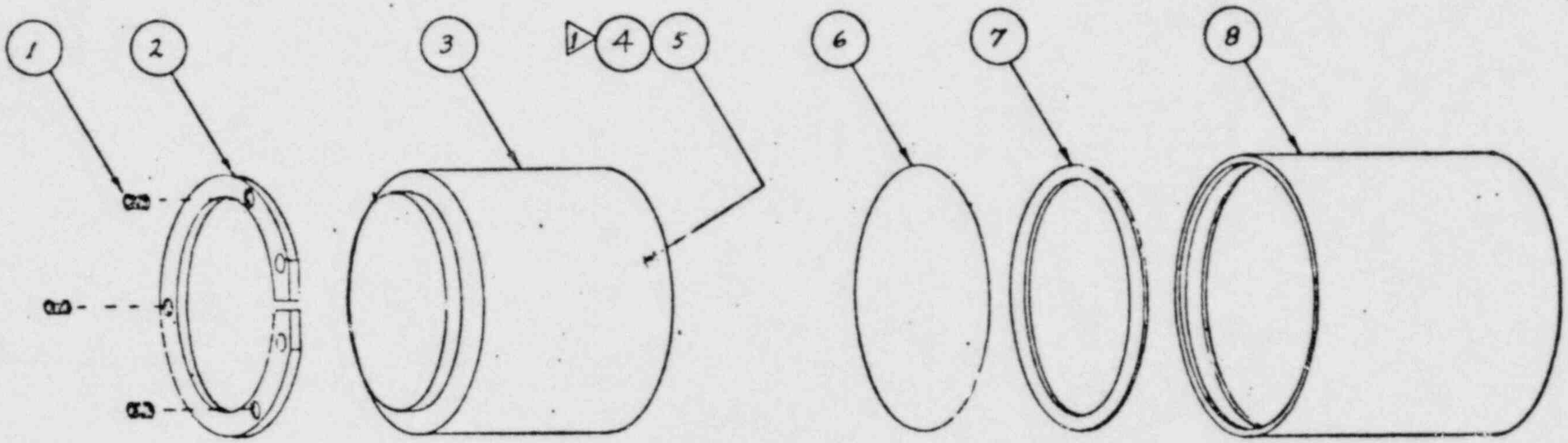
1. STAMP MODEL AND SERIAL NUMBER ON IDENTITY PLATE, ITEM 8.
2. SHIELD, ITEM 10, IS USED ON RDA-2X ONLY.

RDA-XX Assembly, 10661-C01E.

NOTES:

1. APPLY ITEM 5 TO ITEM 3. REMOVE BACKING MATERIAL, MASK OFF ~1/16 ON OUTER EDGE AND APPLY AN EVEN COATING OF ZnS (Ag) (ITEM 4) AND PRESS FIRMLY IN PLACE. DUST EXCESS OFF CRYSTALS. PRESS TO MYLAR (ITEM 6) AND TRIM FLUSH WITH EDGE OF LIGHT PIPE.

NO.	QUAN.	PER.	DESCRIPTION
1	3	ASSY.	SET SCREWS, #6-32 ALLEN HD x 3/16" LG. SS.
2	1	"	LIGHT PIPE RETAINER, 10661-B06
3	1	"	LIGHT PIPE 10661-B07
4	AR	"	CRYSTALS, ZnS(Ag)
5	AR	"	DOUBLE STICKY TAPE, 3M # 666
6	1	"	ALUMINIZED MYLAR WINDOW, .25 ga LIGHT TIGHT.
7	1	"	SEAL 10661-A14
8	1	"	CRYSTAL HOUSING 10661-B15

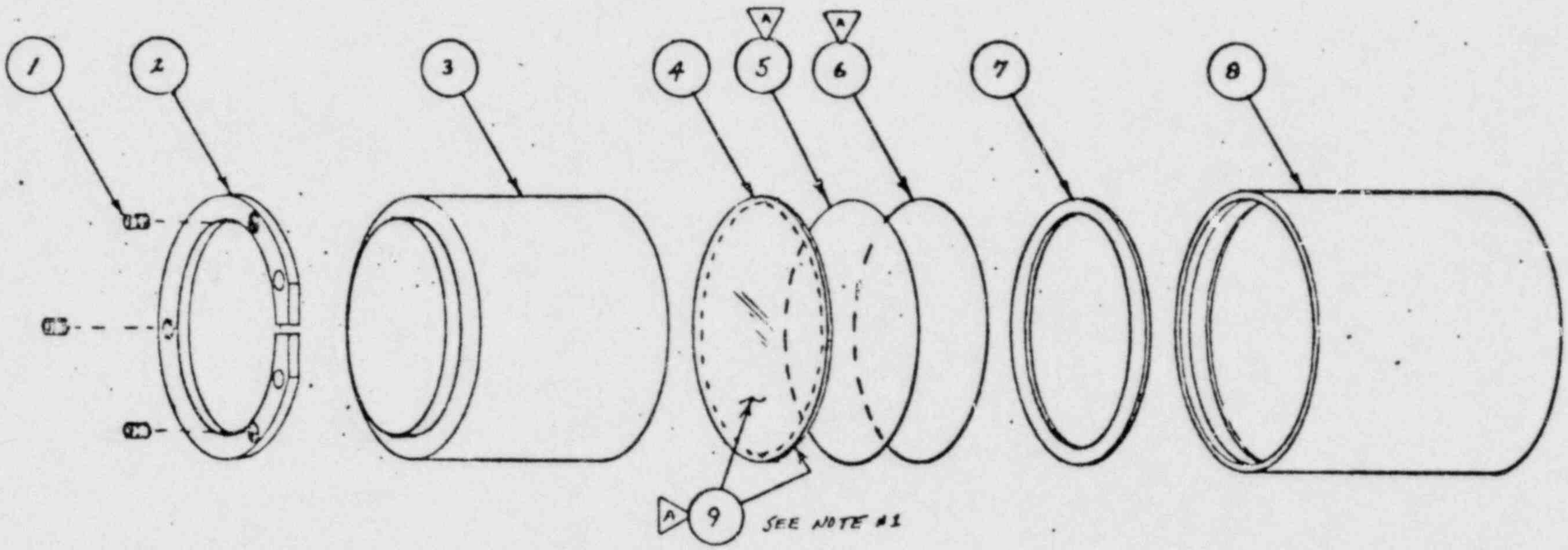


RDA-1X Alpha Crystal Assembly, 10661-B18.

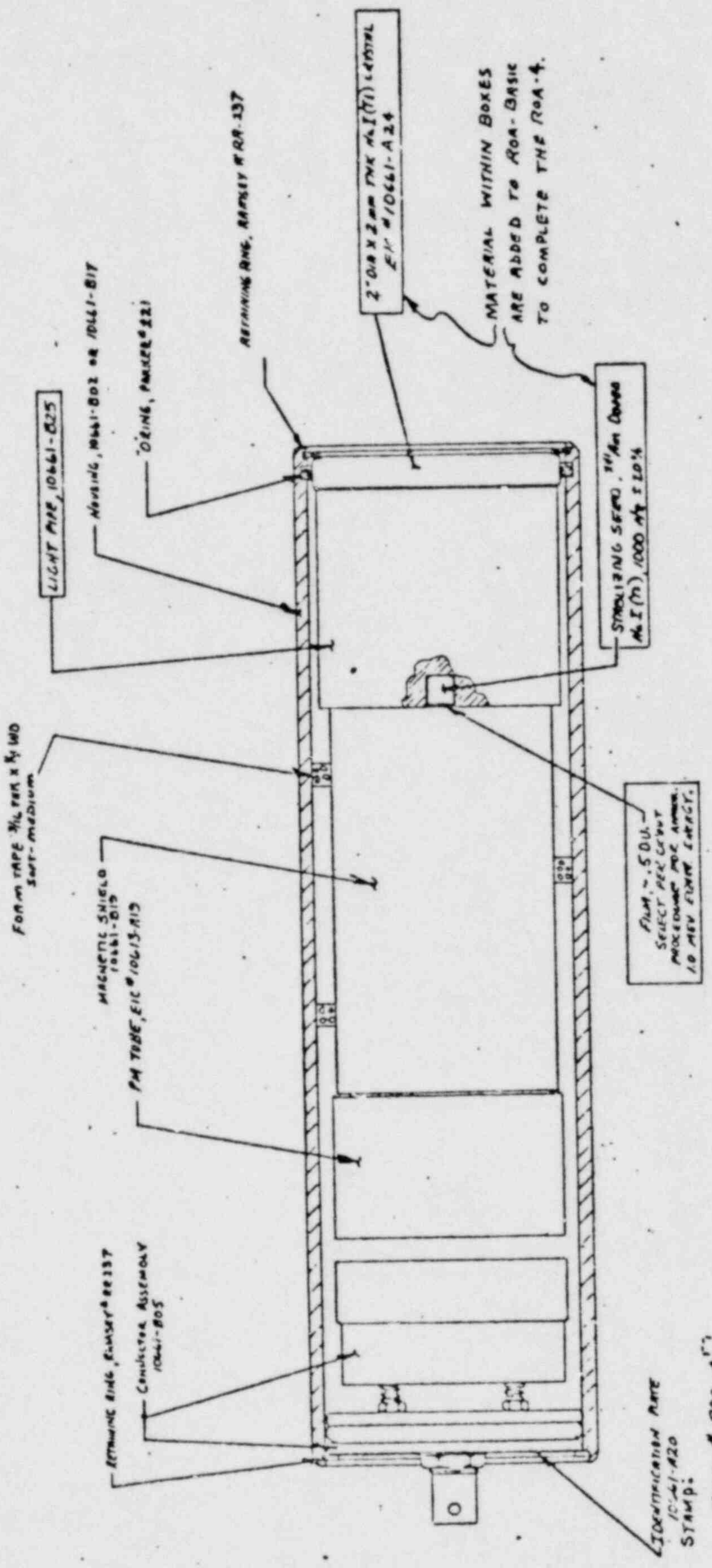
NOTE:

A 1. USE DOUBLE STICKY TAPE (9) TO SECURE THE BETA CRYSTAL (4) TO THE LIGHT PIPE (3). MAKE SURE THERE ARE NO AIR BUBBLES BETWEEN THE TWO. USE A RING OF DOUBLE STICKY TAPE AROUND THE EDGE OF THE BETA CRYSTAL OPPOSITE THE LIGHT PIPE, TO SECURE THE M-10 MYLAR. THE M-11 MYLAR IS HELD IN PLACE BY PRESSURE BETWEEN THE BETA CRYSTAL AND HOUSING.

	NO.	QUAN.	PER.	DESCRIPTION	
	1	3	ASSY.	SET SCREWS, #6-32 ALLEN HD. x 3/16 LG. SS.	
	2	1	"	LIGHT PIPE RETAINER.	10661-B06
	3	1	"	LIGHT PIPE	10661-B07
	4	1	"	CRYSTAL	10661-A10
A	5	AR		ALUMINIZED MYLAR	M-10
A	6	AR	"	ALUMINIZED MYLAR	M-11
	7	1	"	SEAL	10661-A14
	8	1	"	CRYSTAL HOUSING	10661-B15
A	9	AR	"	DOUBLE STICKY TAPE	3M # 666



RDA-3X 2 Inch Crystal Assembly, 10661-B04A.



RDA-4X Assembly, 10661-B26.

DA1-1 and DA1-6

A. GENERAL DESCRIPTION

Remote Detector Assemblies DA1-1 and DA1-6 are Geiger-Mueller (G-M) type detectors. They contain their own high voltage supply, pulse amplifier, low voltage regulation and line driver. Low voltage power is supplied by the system 12V line.

The assembly may also contain a check source assembly (optional) that is operated remotely. The presence of this option is indicated by a "CC" suffix on the model number, e.g. DA1-6-CC.

The signal from the detector is amplified and then processed by a line driver. The signal is carried on a twisted-pair cable to the microcomputer where it is processed and displayed.

The DA1-1 and DA1-6 differ only in the type of G-M tube used and the high voltage generated for those tubes.

B. SPECIFICATIONS

1. MECHANICAL

a. Size: 9.5 inches high x 3.9 inches wide x 4.85 inches deep (24.1 x 9.9 x 12.3 cm).

b. Weight: 2.50 pounds (1.13 kg). Add 0.25 pounds (0.1 kg) if the check source option is installed.

2. SENSITIVITY

DA1-1 — 0.01 to 100 mR/h (approximately 1,200 counts per minute (cpm) per mR/h).

DA1-6 — 0.1 to 10,000 mR/h (approximately 80 cpm per mR/h).

3. LOW VOLTAGE

+12V at 50 mA. Optional check source requires 12V at 200 mA when actuated.

4. HIGH VOLTAGE

Internal high voltage supply +900V for DA1-1 and +500V for DA1-6.

5. OUTPUT

3.4 VDC (nominal) alternating polarity into a twisted pair cable. Maximum normal cable length is 5000 feet (1523 m). Use 18-gauge wire if cable run is more than 2000 feet.

6. MOUNTING

Mounted with four screws through the back plate.

7. CONNECTIONS

Signal output and power input:

Amphenol 165-11 connector mates with Amphenol 165-10.

8. SATURATION

DA1-1 — Remains operational to 10 R/h field.

DA1-6 — Remains operational to 1000 R/h field.

C. THEORY OF OPERATION

1. GENERAL

The high voltage section develops the potential applied to the G-M detector. When radiation reacts in the detector, a negative pulse is generated and coupled to the amplifier. This pulse is amplified and coupled to the electronics channel to be processed and displayed as dose rate.

2. FUNCTIONAL THEORY

a. *High Voltage Supply*

Transistor Q204 is connected as a blocking oscillator and gets its feedback for oscillation from T201. The voltage is stepped up by T201 and fed back by V201 and Q206 to control the current of Q204, thus keeping power dissipation to a minimum. The high voltage is determined by the voltage regulator (V201).

b. *Amplifier*

Q210 is an emitter-follower amplifier biased in the Class A region. When an input pulse occurs, the voltage on the emitter of Q201 decreases by an amount equal to the magnitude of the input pulse. Pin 2 of A202 (a voltage comparator) is connected to the emitter of Q201 and thus the voltage on the positive input of the comparator also decreases during each input pulse. Pin 3, the negative input of A202, is held at a constant potential by C207. The initial voltage difference be-

tween Pin 2 and Pin 3 is set by the value of R207 and the current flowing through it. When the voltage on Pin 2 decreases to a value equal to or less than the voltage at Pin 3, the comparator turns on and its output goes low. After the pulse, when Pin 2 returns to its initial value, the comparator's output goes high. This action causes A204, a 4-bit binary counter, to register a count. Taps are provided to divide the input count rate by 2, 4, 8, or 16. Normally the divide-by-2 tap is used and input count rate is reduced by a factor of 2. A204 drives A203, a 50Ω line driver, which is connected to drive a balanced twisted-pair line.

c. *Low Voltage*

A201 is an integrated circuit voltage regulator providing a fixed 5V output. R216 reduces A201's power dissipation.

d. *Check Source*

When a check source command occurs (from the computer or Display III switch), the circuit to actuate the check source solenoid is completed. The solenoid action moves the radiation source to within close proximity of the detector, providing a repeatable reference reading.

If the optional check source is installed, the detector assembly is shipped with the limit stop set for minimum effect when unactuated, and the check source contribution to detected counts is masked by background.

D. MAINTENANCE

1. DISASSEMBLY AND REASSEMBLY

a. Remove the unit from the mounting plate by opening the two latches at the top and bottom of the assembly.

b. Remove the three O-ring screws on the sides of the assembly. Remove the chassis. Avoid putting undue stress on the wires. This exposes all circuitry and mechanisms for maintenance.

c. Reassemble in the reverse order.

2. PREVENTIVE MAINTENANCE

Keep the assembly as clean and dry as possible. Unless the unit is opened regularly, this should be of no concern since the operating components are sealed from the environment. No scheduled preventive maintenance is necessary.

3. CALIBRATION

No calibration control is available or necessary on the DA1-1 or DA1-6.

All calibration is performed by the computer software.

4. TROUBLESHOOTING

Determine if the proper voltages are present. (See the schematic, 10S03-C07.)

For low voltage measurements, use a voltmeter with an input impedance of 20,000 ohms per volt or greater.

For high voltage measurements, use an electrostatic voltmeter or a DVM with a 1000MΩ probe. If an electrostatic voltmeter or a 1000MΩ probe for the DVM is not available, a regular voltmeter may be used for an indication, if loading is taken into account.

The voltages should be checked in the following order to isolate the failure. All voltages are referred to ground (chassis).

a. J201, pin A, approximately +12V; pin F, 0V (ground).

b. C208 positive, +5 ±0.2V.

c. R202-C201 junction (with an electrostatic voltmeter): DA1-1, 900 ±30V; DA1-6, 500 ±20V.

Representative waveforms and other voltages appear on the schematic.

Some G-M tube failures cause a multiple-pulse output from the tube. This would appear as a sudden increase in channel reading, especially in low fields. If this condition is simply calibrated out, a probable non-linearity in reading exists. To prove the multiple pulsing, two methods can be used:

(1) Check the sensitivity of the G-M tube by connecting a pulse counter to the output connector, pin D. With the detector exposed to a known γ field, the sensitivity should be (approximately) as follows: DA1-1, 600 cpm per mR/h; and DA1-6, 40 cpm per mR/h.

(2) Connect an oscilloscope to pin 7 of A202. Observe the pulses. At low count rates, pulses should occur singly, not in pairs or groups.

5. CABLE RECOMMENDATION

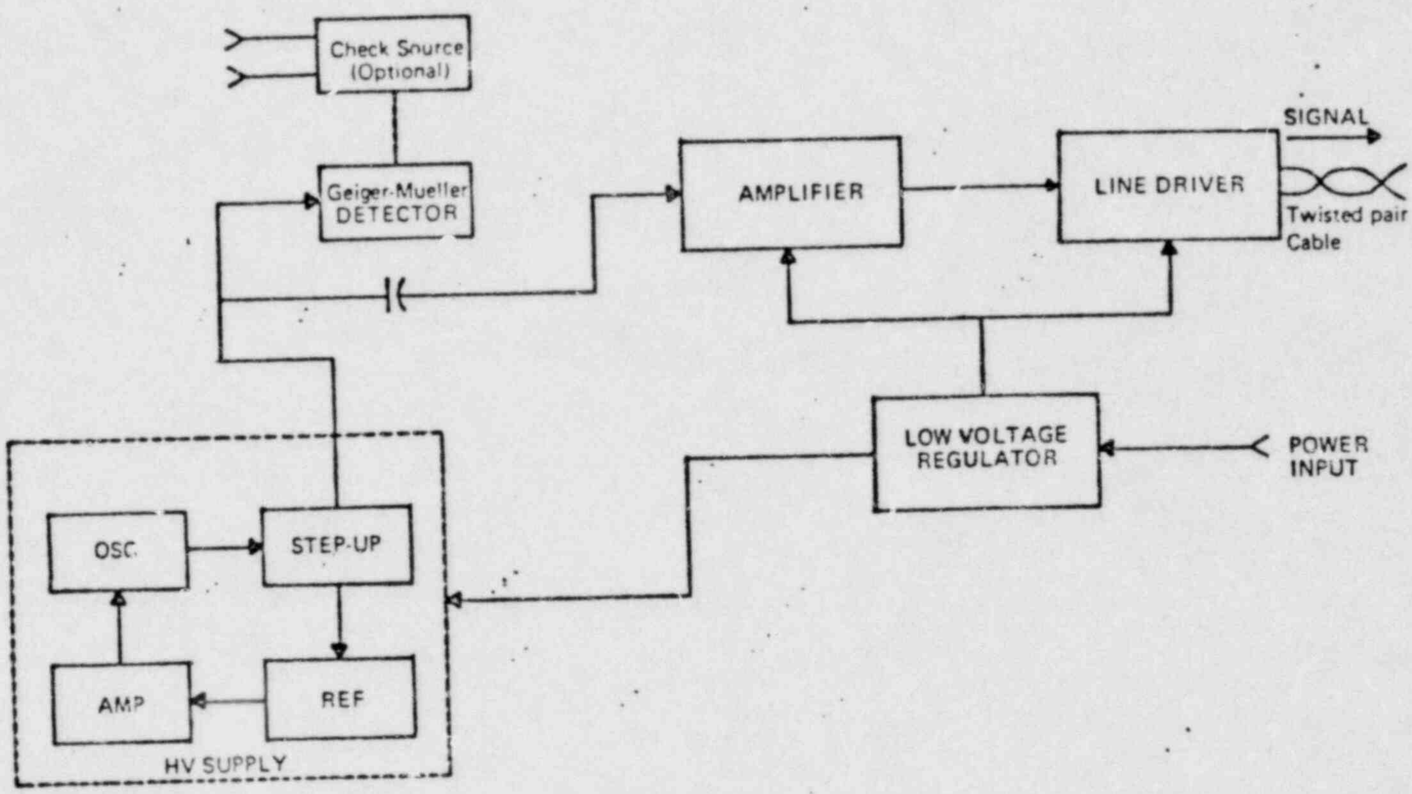
Cable Length	Alpha	Belden	Conductor Size
Less than 2000 ft.	6010	8777	22 AWG
2000 ft.-5000 ft.	6023	9773	18 AWG

PARTS LIST

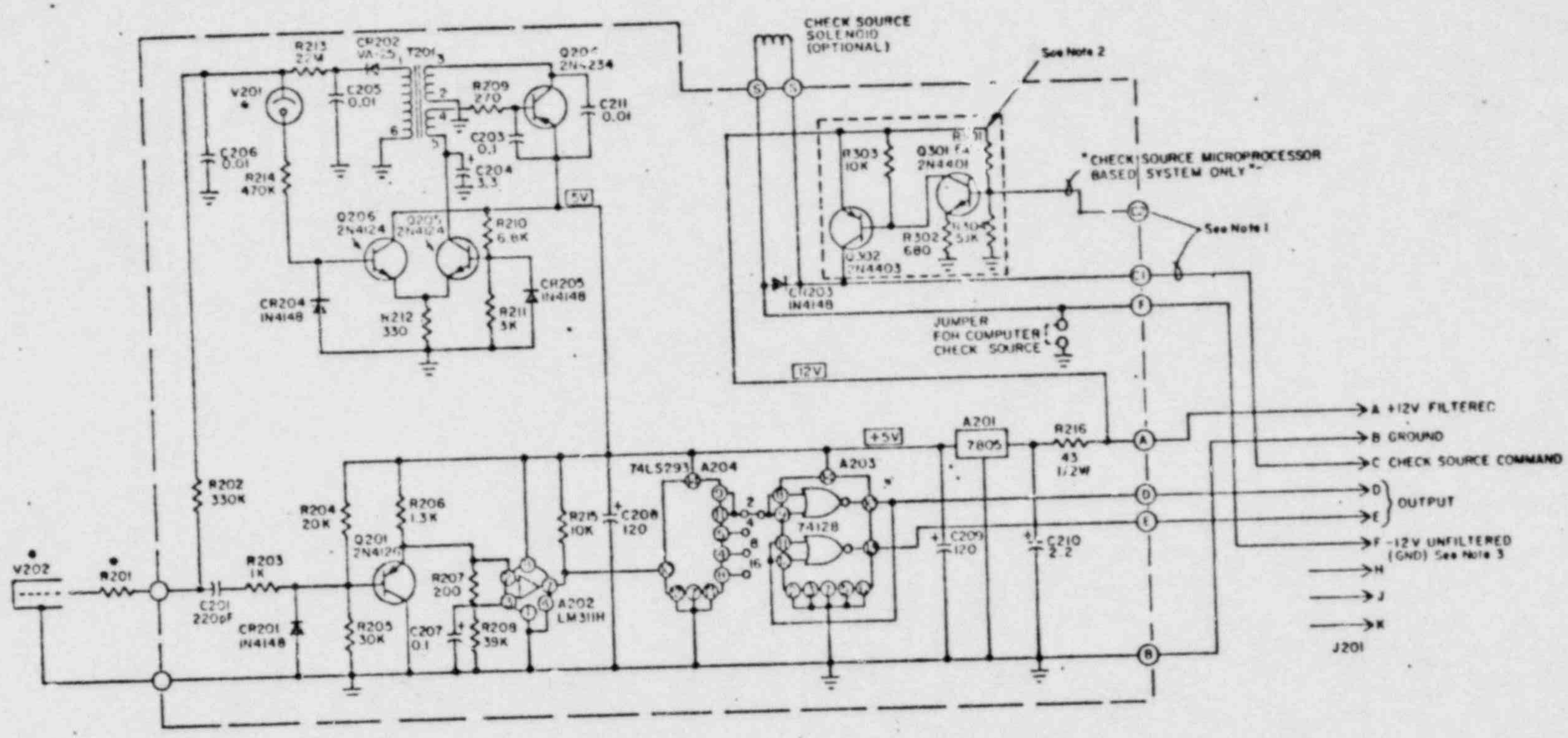
The following table lists the electronic items incorporated in the DA1-1 and DA1-6, and should contain any part necessary for normal electronic repair. Unless otherwise specified, callouts of manufacturers and manufacturers' part numbers are to be considered typical examples only and not restrictions against using equivalent parts with the same operating characteristics. When ordering parts from Eberline, specify model number, serial number, reference designation and value, or a word description if the part has no reference designation. Eberline will automatically substitute equivalent parts when the one called out by manufacturers' part number is not available.

REF DESIG.	PART	DESCRIPTION	MFR & PART NO.
A201	Integrated Circuit	Voltage Regulator, +5V, 1A	Fairchild 7805UC or National LM340T-5.0
A202	Integrated Circuit	Comparator	National LM311H
A203	Integrated Circuit	Quad NOR 50Ω Line Driver	Texas Instruments SN74128N
A204	Integrated Circuit	4-Bit Binary Counter	Texas Instruments SN74LS293N
C201	Capacitor	220pF, 3kV	CRL DD30-221
C203	Capacitor	0.1 μF, 80V	Sprague 192P1049R8
C204	Capacitor	3.3 μF, 15V, Tantalum	CS13, Case A
C205, C206	Capacitor	0.01 μF, 2kV	Sprague BL-510
C207	Capacitor	0.1 μF, 35V, Tantalum	CS13, Case A
C208, C209	Capacitor	120 μF, 10V, Tantalum	CS13, Case C
C210	Capacitor	2.2 μF, 20V, Tantalum	CS13, Case A
C211	Capacitor	0.01 μF, 200V	Sprague 192P10392
CR201, 203 CR204, 205	Diode	Silicon	1N4148
CR202	Diode	2500V PIV	Varo VA-25
Q201	Transistor	PNP, Silicon	2N4126
Q204	Transistor	PNP, Silicon	2N4234
Q205, Q206	Transistor	NPN, Silicon	2N4124
R202	Resistor	330k, ±10%, 1/4W	
R203	Resistor	1k, ±10%, 1/4W	
R204	Resistor	20k, ±10%, 1/4W	
R205	Resistor	30k, ±10%, 1/4W	
R206	Resistor	1.3k, ±10%, 1/4W	

REF DESIG.	PART	DESCRIPTION	MFR & PART NO.
R207	Resistor	200, ±5%, 1/4W	
R208	Resistor	39k, ±10%, 1/4W	
R209	Resistor	270, ±10%, 1/4W	
R210	Resistor	6.8k, ±10%, 1/4W	
R211	Resistor	3k, ±5%, 1/4W	
R212	Resistor	330, ±10%, 1/4W	
R213	Resistor	22M, ±10%, 1/4W	
R214	Resistor	470k, ±10%, 1/4W	
R215	Resistor	10k, ±10%, 1/4W	
R216	Resistor	43, ±5%, 1/2W	
T201	Transformer	Blocking Oscillator	Microtran M8149
	O-Ring	Housing Seal	Eberline 10031-A176
1. DA1-1			
V201	High Voltage Regulator	900V Corona Tube	Victoreen 5841 or GV3A-900
V202	Detector	G-M Tube	Eberline 10450-B12
2. DA1-6			
R201	Resistor	10M, ±10%, 1/4W	
V201	High Voltage Regulator	500V Corona Tube	Victoreen GV3B-500
V202	Detector	G-M Tube, Energy-compensated	Eberline 10450-B28



System Block Diagram, 10803-A14.



• SEE TABLE FOR COMPONENT VALUES

	V201	V202	R201	RANGE
DA1-1	900V	10450-812	[illegible]	0.01-100mR/hr
DA1-6	500V	10453-828	10 MEGΩ	0.1-10,000mR/hr

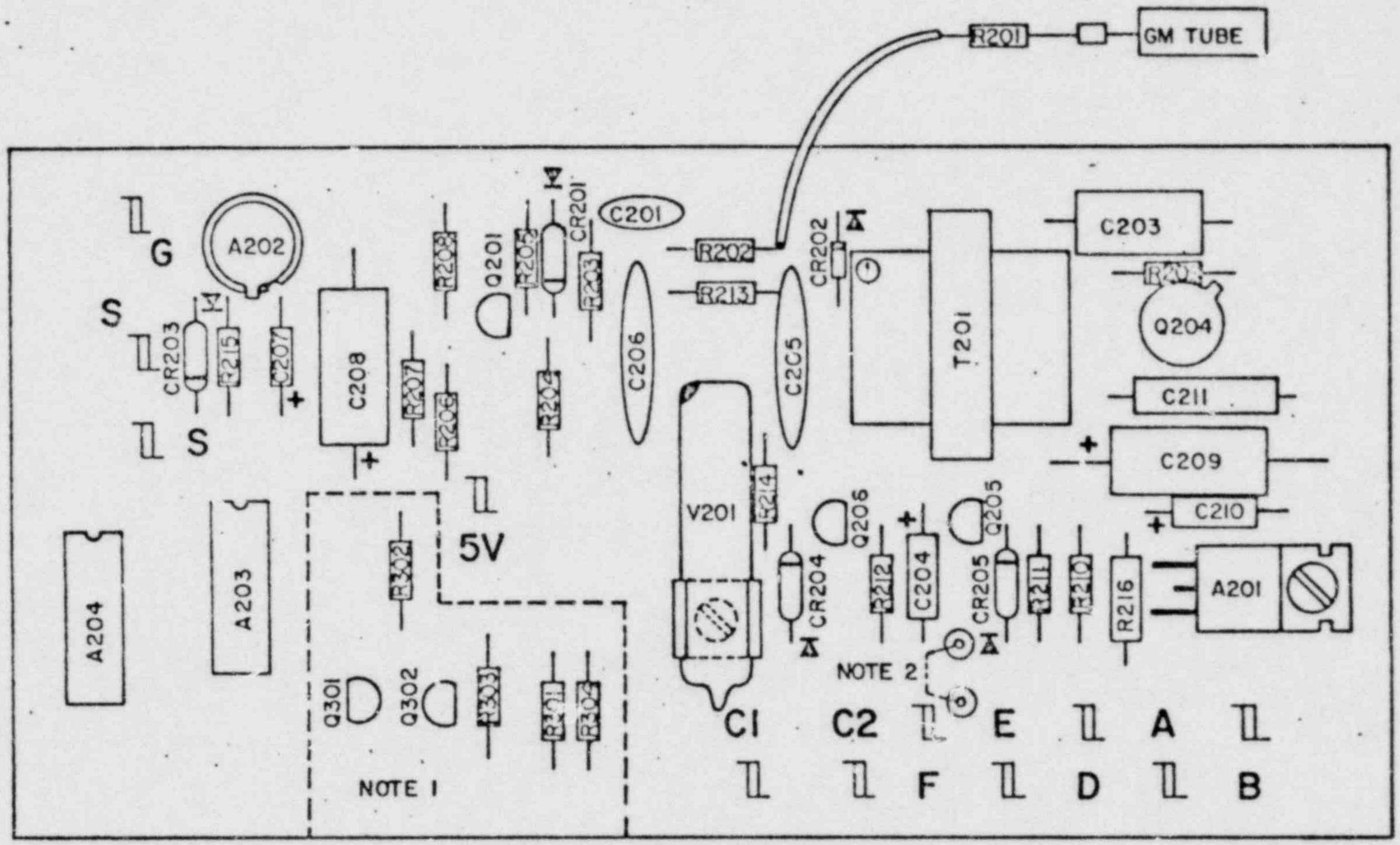
NOTES

1. Check Source Command connected to C1 for 24V Analog Check Source, Model DA1-X-CS, connected to C2 for 12V computer Check Source, Models DA1-X-CC.

2. Check Source Actuation Circuit for Microprocessor Based Systems. Components not normally installed for Analog systems.

3. For Analog Systems F is connected to -12V Unfiltered to power 24V Check Source Solenoid. IN Microprocessor Systems F is connected to Ground to Power +12V Check Source Solenoid.

DA1-GM Schematic, 10803-C07L.



NOTES:

1. THE 300 SERIES COMPONENTS ARE USED WITH THE OPTIONAL COMPUTER CONTROLLED CHECK SOURCE.
2. JUMPER INSTALLED FOR COMPUTER CONTROLLED CHECK SOURCE.

DA1-1 or DA1-6 Component Layout, 10803-C18A.

NOBLE GAS DETECTOR

A. GENERAL DESCRIPTION

The Noble Gas Detector assembly is a beta-gamma detector intended for use in sampler assemblies. The detecting element is an argon-filled, halogen-quenched Geiger-Mueller (G-M) tube mounted in a holder which forms part of the shield when installed in a sampler. The detector assembly is connected to a microcomputer system via an IB-4A interface box.

B. SPECIFICATIONS

1. G-M Tube: Argon-filled, halogen-quenched, energy-compensated.

2. Operating Voltage: 550 ±50V.

3. Sensitivity: Approximately 80 cpm per mR/h in a ^{137}Cs field.

4. Dead Time: Approximately 20 microseconds.

5. Plateau: 100V minimum length with slope approximately 15 percent per 100 volts.

6. Environment: Operating temperature range -40°F to +167°F (-40°C to +75°C).

7. Connector: BNC series.

8. Size: 2.75-inch (7.0 cm) diameter x 8.11-inch (20.6 cm) length.

9. Weight: Approximately 6 pounds (2.7 kg).

C. OPERATION

The Noble Gas Detector assembly is operational when connected to a functioning IB-4A interface box. No adjustments are available.

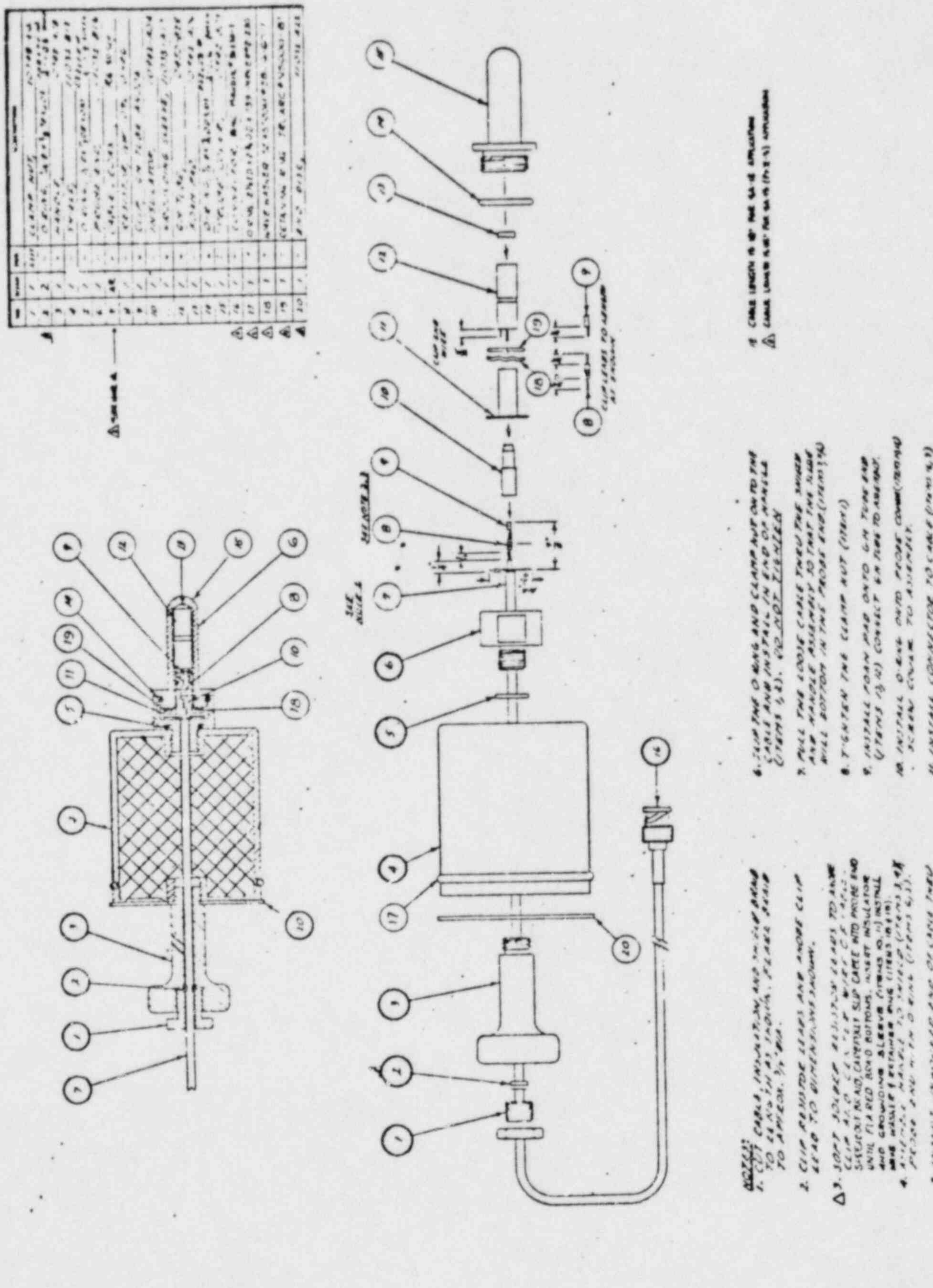
D. MAINTENANCE

The Noble Gas Detector assembly requires no scheduled maintenance. In general, keep the device as clean and dry as practical.

PARTS LIST

The following table lists items incorporated into the Noble Gas Detector assembly and should contain any part necessary for normal repair. Unless otherwise specified, callouts for manufacturers and manufacturers' part numbers are to be considered typical examples only and not restrictions against using equivalent parts with the same operating characteristics. When ordering parts from Eberline, specify model number, serial number, reference designation and value, or a word description if the part has no reference designation. Eberline automatically substitutes equivalent parts when one called out by the manufacturers' part number is not available.

REF DESIG.	PART	DESCRIPTION	MFR & PART NO.
		Probe Cover	Eberline 10942-B03
		Foam Pad	Eberline 10942-A06
		G-M Tube	Eberline 10450-B28
		Grounding Sleeve	Eberline 11032-A17
		Insulator	Eberline 10942-A04
		Probe End	Eberline 11032-B16
	Resistor	10M, 1/8W, ±10%	
	O-Ring	3/4 inch ID x 15/16 inch OD x .103 inch	Parker 2-116 BUNA-N
	O-Ring	1/2 inch ID x 5/8 inch OD x .070 inch	Parker 2-014 BUNA-N
	O-Ring	2-1/2 inch ID x 2-3/4 OD x .139 inch	Parker 2-230 BUNA-N
	O-Ring	3/16 inch ID x 3/8 inch OD x .103 inch	Parker 2-106 BUNA-N
		Wave Washer	Seastrom 5806-60-1
		Retaining Ring	TRUARC N5000-81



Detector Assembly, 11032-C12D.

SA-9

A. GENERAL DESCRIPTION

The Model SA-9 sampler assembly comprises a lead-shielded detector and a length of tubing which determines the sample volume. The SA-9 is used for the sampling of gaseous or liquid effluents. The detector is an energy-compensated Geiger-Mueller (G-M) tube which views a section of one-inch outside diameter (o.d.) stainless steel tubing. This section of tubing acts as the sample volume. The sample tube can be changed to one of another diameter and the distance between the detector and the sample tube varied; either of these changes alters the detector sensitivity. The one-inch tubing is standard and serves as the basis for calibration. Any alterations to adjust detector sensitivity should be done by Eberline. Proper operation of the detector and counting circuitry may be verified by actuation of the check source mechanism which is installed in the SA-9. A Model IB-4A interface box is used to connect the SA-9 sampler assembly to either digital- or analog-based monitoring systems.

B. SPECIFICATIONS

1. MECHANICAL

a. *Shielding:* 3-inch (7.62 cm) thick lead.

b. *Sample Volume:* Dependent upon tube diameter.

c. *Sample Tube:* 1 inch o.d. x .032 inch wall stainless steel hydraulic grade tubing (standard).

d. *Connections:* Stainless steel "Swagelok" compression type tube fitting, inlet and outlet.

e. *Weight:* Approximately 315 pounds (143 kg).

f. *Size* (with IB-4A mounted): 13.5 inches long x 13.0 inches wide x 13.7 inches high (34.3 cm x 33.0 cm x 34.8 cm).

2. ELECTRICAL

a. *Detector High Voltage:* 500 VDC (supplied by IB-4A).

b. *Solenoid Voltage:* 12 VDC (standard).

C. CHECK SOURCE OPERATION

NOTE

The check source contains a licensable quantity of radioactive material (.5 μCi of $^{90}Sr^{90}Y$).

When a check source command is requested, voltage is applied to the check source solenoid. Rotary action of the solenoid moves the radioactive source in line with a small hole in the detector mounting block. The beta radiation from the source, which is normally shielded from the G-M tube detector, shines through the hole, striking the detector and causing an up-scale reading. Removal of voltage to the solenoid allows the solenoid spring to return the radioactive source to its normally shielded position.

D. MAINTENANCE

1. DETECTOR OR CHECK SOURCE SOLENOID ACCESS

The G-M tube detector and check source are mounted in the same assembly. To access this assembly, the 3-inch-thick lead shield (opposite the sample tube) must be removed. This shield is held in position by four 3/8-16 hex bolts. Once the shield is removed, the detector assembly may simply be pulled from the center shield.

NOTE: When replacing the lead shield, make sure the detector and solenoid wires are dressed into the slot in the shield.

2. CALIBRATION SOURCE (EIC #11058-00)

The calibration source available for the SA-9 sampler assembly is a one-inch o.d. tube sealed at both ends and containing a known concentration of ^{85}Kr gas. The calibration source must be inserted in place of the sample tube.

Remove the four 3/8-16 hex bolts holding the 4-inch lead shield in place. The shield may then be moved to clear the fittings on the sample tube. Once the sample

tube is removed, replace the 4-inch thick lead shield and secure it in place with at least one of the 3/8-16 hex bolts. This ensures proper calibration source geometry. Insert the calibration source into the slot in the 4-inch shield from either side of the sampler assembly.

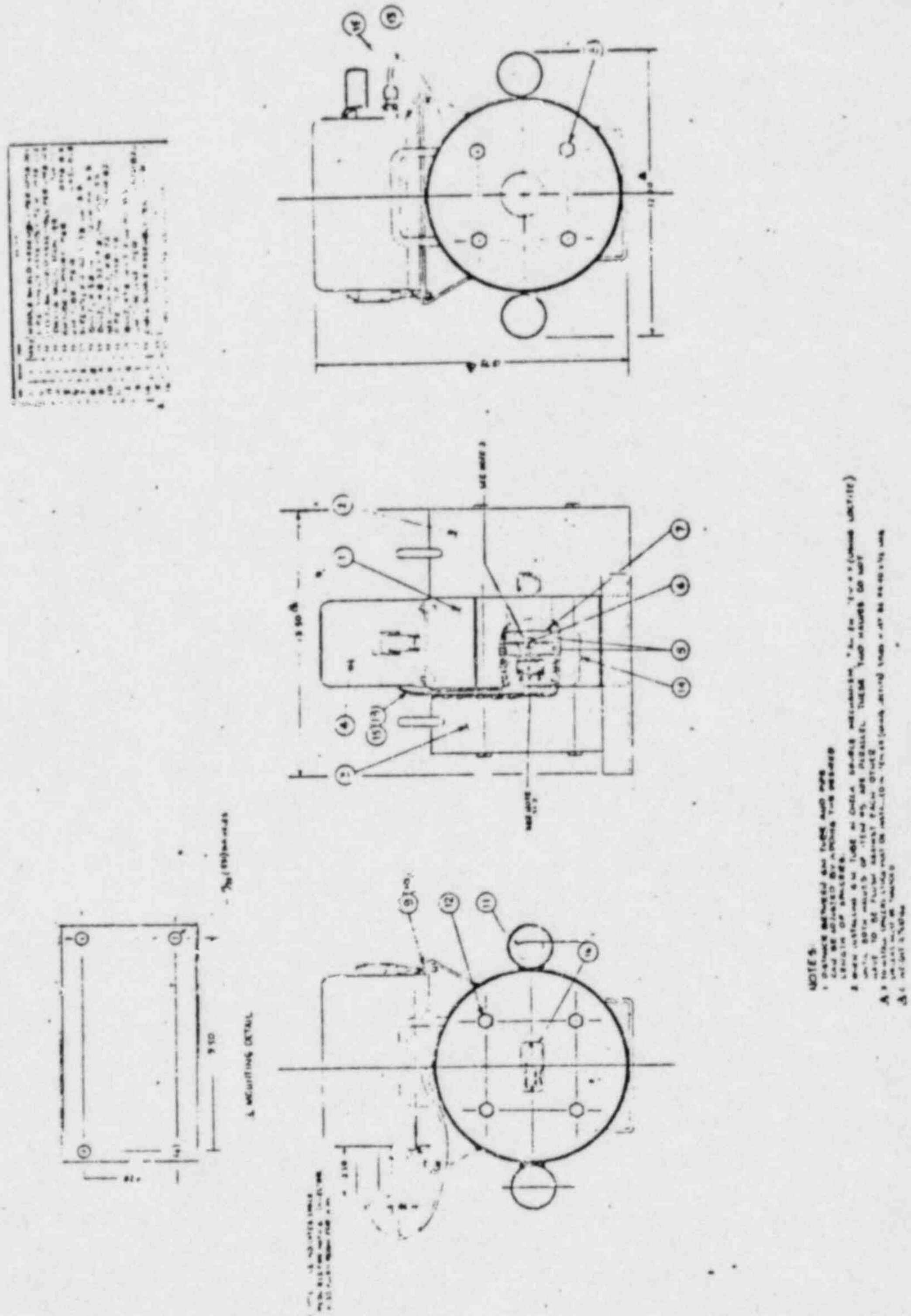
CAUTION

Do not handle the stainless steel section of the calibration source. Carry it by the aluminum end cap.

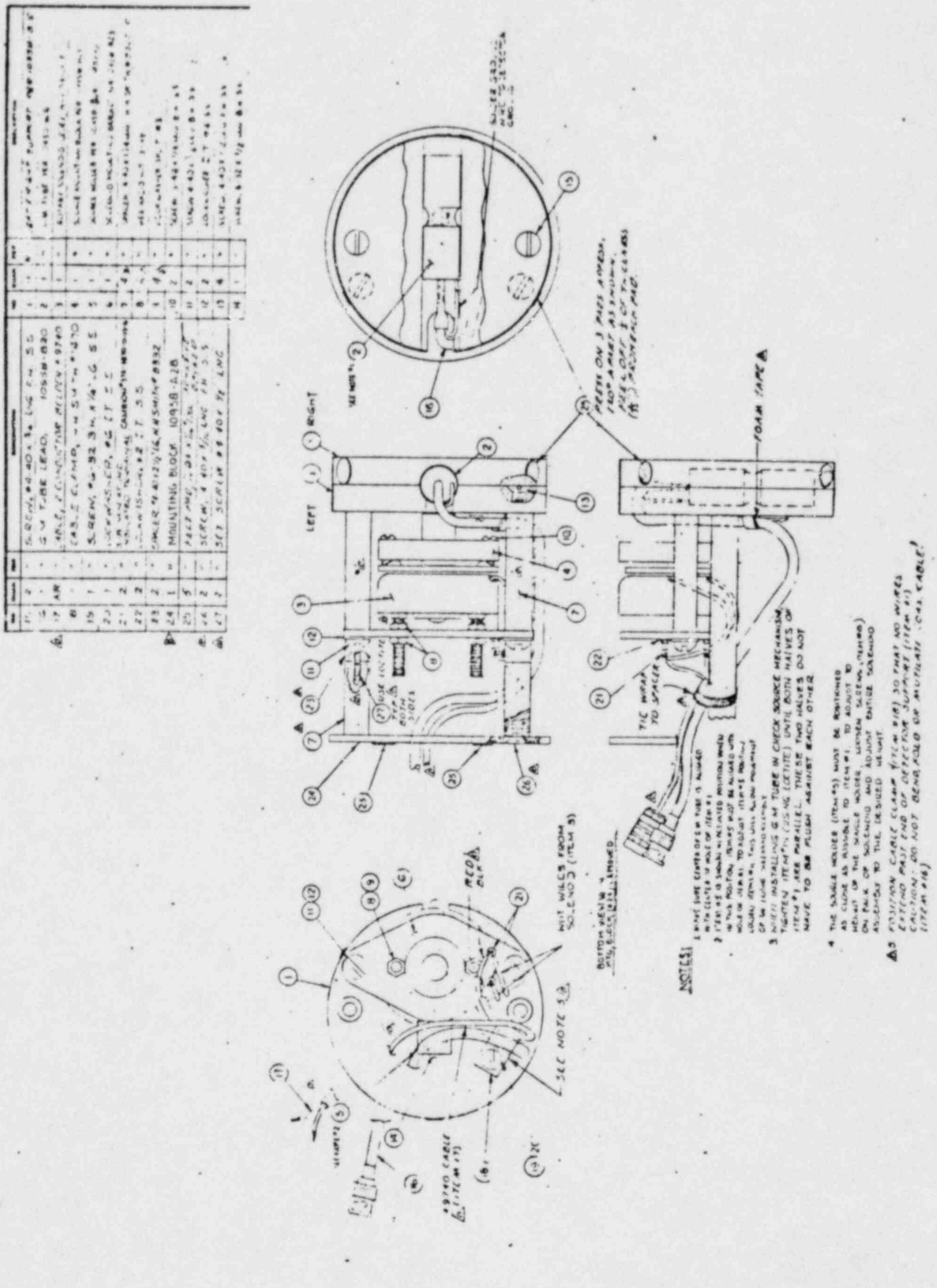
E. PARTS LIST

There are only two spare parts for the SA-9 sampler assembly.

PART	DESCRIPTION
10450-B28	G-M Tube
Ledex #H-1079-032	Solenoid



SA-9 Overall Assembly, 10958-D27B.



Check Source Mechanism and Detector Assembly, 10958-C25D.

A. GENERAL DESCRIPTION

The Model SA-11 detector assembly comprises a lead-shielded detector which views a duct or pipe for gamma radiation. The detector is an energy-compensated Geiger-Mueller (G-M) tube. Proper operation of the detector and counting circuitry may be verified by actuation of the check source mechanism which is installed in the SA-11.

B. SPECIFICATIONS

1. MECHANICAL

a. Shielding: 3-inch (7.62 cm) thick lead

b. Weight: Approximately 220 pounds (100 kg)

c. Size (with IB-4A mounted):

10.5 inches long x 13.0 inches wide x 13.7 inches high (26.7 cm x 33.0 cm x 34.8 cm)

d. Mounting:

Mounts to a flat surface with four 1/2-inch bolts through the mounting plate.

2. ELECTRICAL

a. Detector High Voltage: 500 V DC

b. Solenoid Voltage: 12 V DC (std.)

C. CHECK SOURCE OPERATION

NOTE

The check source contains a licensable quantity of radioactive material (0.5 μCi of $^{90}Sr^{90}Y$).

When a check source command is requested, voltage is applied to the check source solenoid. Rotary action of the solenoid moves the radioactive source in line with a small hole in the detector mounting block. The beta radiation from the source, which is normally shielded from the G-M tube detector, shines through the hole, striking the detector and causing an up-scale reading. Removal of voltage to the solenoid allows the solenoid spring to return the radioactive source to its normally shielded position.

D. MAINTENANCE

1. DETECTOR OR CHECK SOURCE SOLENOID ACCESS

The G-M tube detector and check source are mounted in the same assembly. For access to this assembly, the 3-inch-thick lead shield must be removed. This shield is held in position by four 3/8-16 hex head bolts. Once the shield is removed, the detector assembly may simply be pulled from the center shield.

NOTE: When replacing the lead shield, make sure the detector and solenoid wires are dressed into the slot in the shield.

2. CALIBRATION

Primary calibration of an SA-11 was performed and is recorded as Eberline document number 12000-02.

E. PARTS LIST

There are only two spare parts for the SA-11 detector assembly.

Part	Description
10450-B28	G-M Tube
Ledex H-1079-032	Solenoid

SA-13

A. GENERAL DESCRIPTION

The SA-13 sampler assembly affords combined particulate, iodine, noble gas and gamma background monitoring in one lead-shielded assembly. Three inches of lead shielding are provided to reduce the effect of ambient gamma radiation; one inch of lead between individual samplers reduces the effect of one sampler on another detector. The SA-13 includes two energy-compensated Geiger-Mueller (G-M) tube detectors which are used for mid-range noble gas and gamma background measurement.

Normally, beta scintillation detectors view the particulate and low-range gas samples, while a stabilized gamma scintillation detector views the iodine sample. It should be noted that "low" and "mid-range" noble gas measurements use the same sample volume but with different detector sensitivities.

The SA-13 also accommodates an optional solid-state alpha detector to subtract radon daughter background from the beta particulate measurement.

Check sources are available for the beta particulate, iodine and noble gas channels.

B. SPECIFICATIONS

1. SAMPLING MEDIUM

a. *Beta particulate*

2-inch (5.08 cm) diameter fixed filter: Hollingsworth Hose, Type H-70 recommended, or with radon subtraction (47mm dia.): Millipore SM recommended.

b. *Iodine*

2-inch (5.08 cm) diameter x 3/4-inch (1.90 cm) thick, metal-cased cartridge containing approximately 65 cm^3 of teda impregnated activated charcoal. Eberline No. IC-1 recommended.

c. *Gas*

17.2 cu. in (281 cm^3) volume

2. SHIELDING

3 inch (7.62 cm) lead minimum (4 Pi shield available). 1 inch minimum between individual sample stations.

3. CONNECTIONS

1.00 inch (2.54 cm) o.d. stainless steel tubing, "Swagelok" compression fittings recommended.

4. MATERIAL

a. All internal parts and plumbing: stainless steel.

b. All seals: Buna-N.

c. G-M tube cover (mid-range gas): Nylatron.

d. Beta windows: Mylar.

e. Outer case: 1020 steel, .104 inch (2.64 mm) thick.

5. WEIGHT

Approximately 900 pounds (409 kg). Add approximately 180 pounds (81.8 kg) for 4 Pi shielding.

6. SIZE

17.75 inches long x 15.25 inches wide x 13.50 inches high, including tubing (45.08 cm x 38.74 cm x 34.29 cm).

C. OPERATION

NOTE

Normally the three sampling stations of the SA-13 are connected for series sample flow. The plumbing connections to each sample station are external so that a change in flow path (such as direction of flow through the filter) can be accomplished easily. The following text describes the most common station configuration: Particulate, Iodine and Noble Gas Measurement with Radon Subtraction.

The particulate sampling station is on the left as the SA-13 is viewed from the front. (The serial number tag is on the front). The sample enters the front tube and is drawn through the particulate filter. The filter is held in position by the RDS-1 alpha radon detector and is in a fixed geometry between the RDS-1 and the RDA-3X beta detector. Since the alpha radiation cannot penetrate the filter paper, particulate is deposited on the

side of the paper facing the alpha detector. The beta radiation must therefore pass through the filter paper and the backing screen before it reaches the beta scintillation detector. This decreases beta detector sensitivity somewhat, but the ability to measure radon daughter background negates the decrease in beta sensitivity. If radon subtraction is not installed, air flow through the filter paper is reversed, causing the particulate to be deposited on the beta detector side of the filter paper.

The iodine sampling station is to the right of the particulate sampling station (center of the SA-13). The sample exits the particulate filter and is drawn into the iodine sampling station. There it passes through a charcoal cartridge which is viewed by a gamma scintillation detector. The charcoal cartridge is held in place by a removable cartridge holder and is in a fixed geometry with the RDA-2X detector.

The sample exits the iodine charcoal cartridge and is drawn into the noble gas sampling station. This is a fixed, cylinder-shaped volume viewed at one end by a beta scintillation detector (RDA-3X). The other end of the cylinder is a lead plug which supports the mid-range noble gas detector. This detector is located on the center line of the gas volume cylinder and is surrounded by the sample.

An energy-compensated G-M tube mounted on the rear of the SA-13 extends into the lead shield. This detector is located on the same side of the SA-13 as the noble gas sampling station and is used to measure ambient background gamma radiation. This measurement can be used to correct for contribution of background radiation in the particulate and noble gas measurements.

D. MAINTENANCE

NOTE

The air flow pump should be stopped before attempting to remove filter holders or detectors.

1. FILTER CHANGE

To change the filter on the iodine charcoal cartridge, loosen the thumb screws and swing the retainer aside. Pull the filter holder assembly from its shield. Unscrew the cap and change the cartridge or filter paper. Replace the holder assembly in the shield, position the retainer and tighten the thumb screws.

To change the filter on the RDS-1, follow the same procedure as that noted above to remove the filter holder assembly from the shield. To remove the cap, simply pull it off. Avoid twisting the cap, since this can tear the filter paper. Use care to center the millipore filter on the O-Ring when replacing the cap.

2. RDA-XX DETECTOR CHANGE

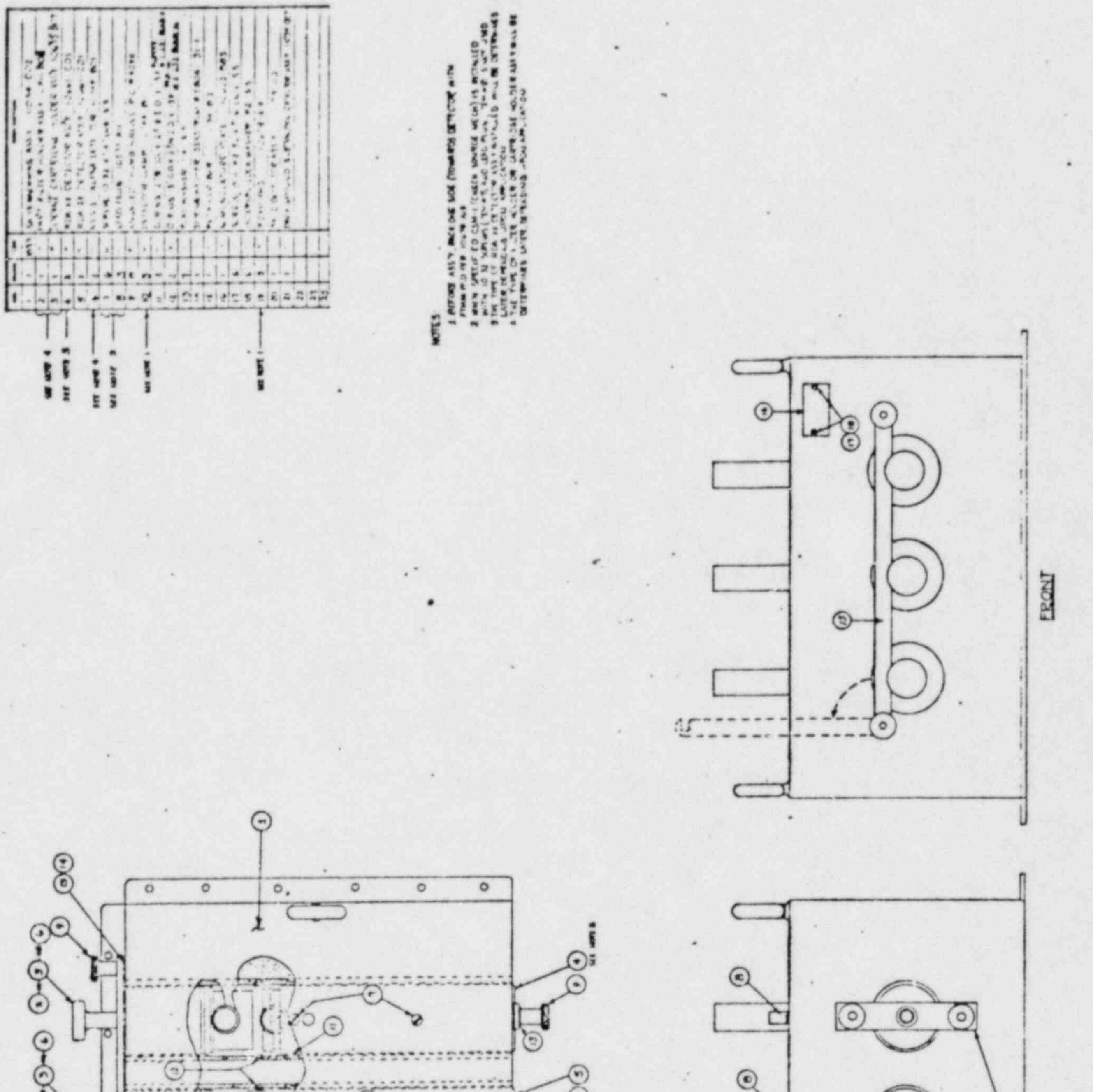
Open 4-Pi shield doors, if installed. Remove the clamp and gently pull the detector from the shield. O-Ring pressure and tight clearances may make this difficult. If necessary, use the bail attached to the back plate of the detector as a handle to pull with. Replace by pushing the detector into the shield to the mechanical stop and replacing the clamp.

3. MID-RANGE GAS DETECTOR CHANGE

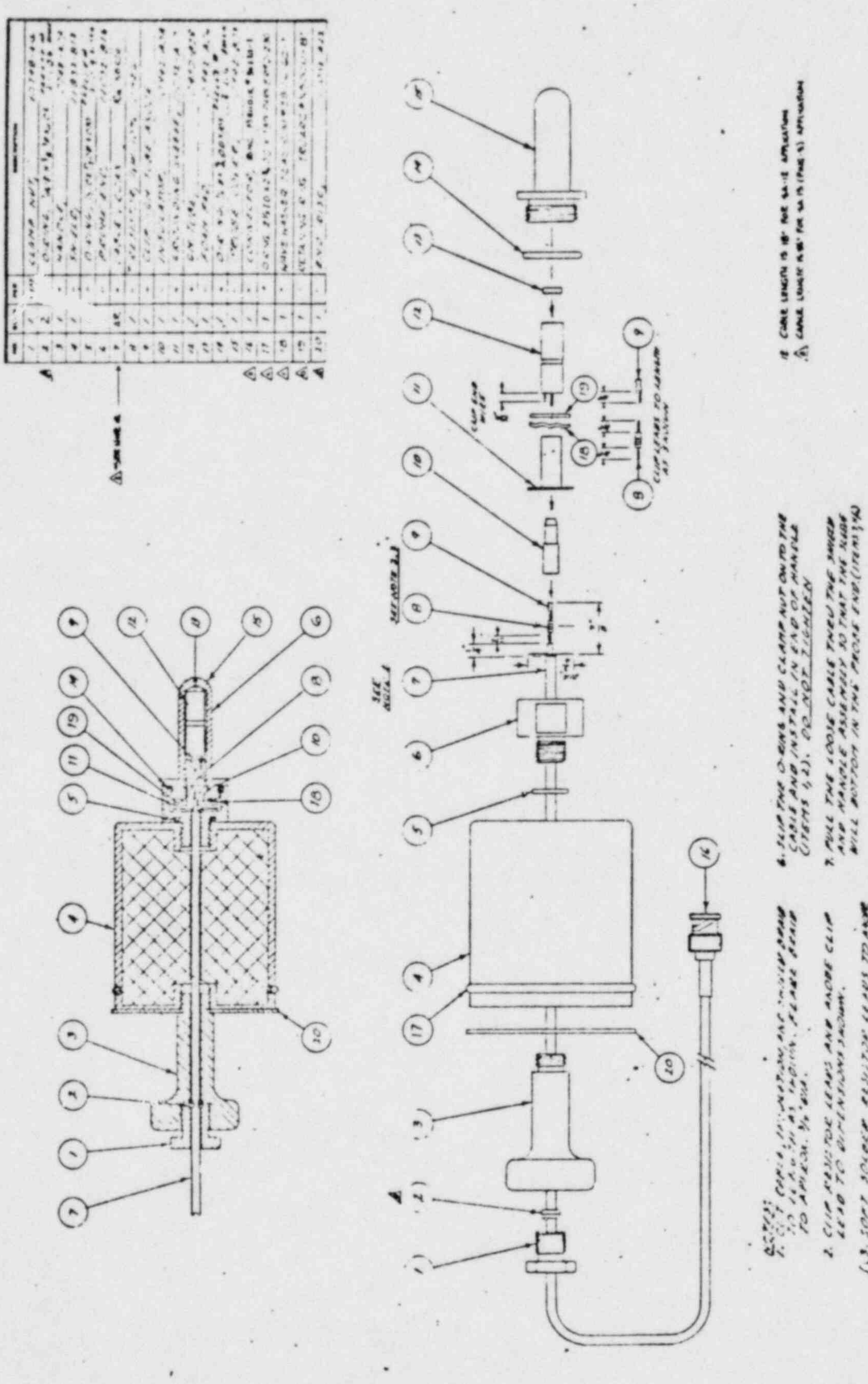
Loosen the thumb screws and swing the retainer aside. Pull the detector assembly from the shield. Unscrew the detector cover, unplug the G-M tube and replace it. Reverse the procedure for installation, making sure the retainer is in place and the thumb screws are tight.

4. BACKGROUND DETECTOR

Open 4-Pi shield doors, if installed. Remove the four 4-40 screws that hold the BNC bulkhead connector to the SA-13. Remove the connector/detector assembly. Unplug the G-M tube and replace it. Reverse the procedure for installation.

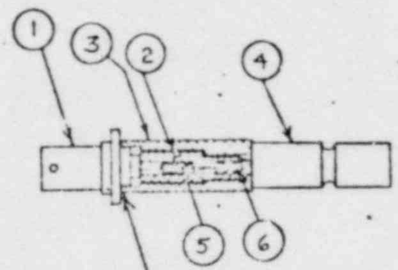


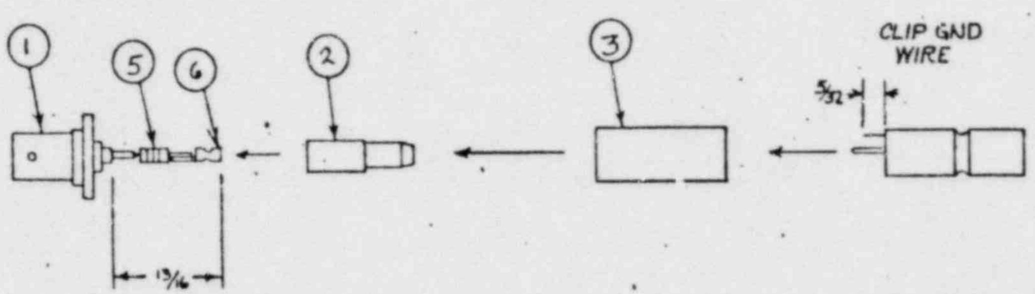
SA-13 Final Assembly, 11034-D01A.



SA-12 Detector Assembly, 11032-C12D.

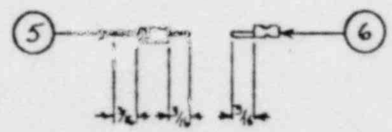
NO.	QUAN	PER	DESCRIPTION
1	1	ASSY	BNC CONNECTOR UG-290A/U
2	1	"	INSULATOR 11034-A05
3	1	"	GROUNDING SLEEVE 11034-A04
4	1	"	G.M. TUBE 10450-B28
5	1	"	RESISTOR, 10MEG, 1/8W, 10%
6	1	"	CLIP, G.M. TUBE ANODE





NOTES:

1. CLIP RESISTOR LEADS AND ANODE CLIP LEAD TO DIMENSIONS SHOWN
2. SOFT SOLDER RESISTOR LEADS TO ANODE CLIP AND BNC CONNECTOR LEAD. SLIP INSULATOR AND SLEEVE OVER ANODE CLIP AND RESISTOR, AND SOFT SOLDER SLEEVE TO BNC CONNECTOR FLANGE
3. INSTALL G.M. TUBE



Background Subtraction Detector Assembly, 11034-C03.

SECTION 3
CALIBRATION

This procedure assumes that each subassembly has been tested and calibrated. A good working knowledge of system components and their interconnection is required prior to proceeding. The following procedure assumes the SPING-3/4 is equipped with the High Range Noble Gas Option (Option #1). If your monitor does not have this option ignore steps indicated with "*."

A. METHOD 1

Since the background subtraction capabilities of the SPING-3/4 can cause some interaction between detector channels and the effects of ambient background to the calibration of given detector, the following procedure minimizes error in calibration.

1. DETECTOR QUALITY

Before the actual calibration process is begun, detector quality and control settings should be proven and/or reset. Use the forms and graphs in your calibration and checkout data package for reference. The appropriate IB-X manual section explains all their controls and settings fully.

a. Beta Detectors (Particulate and Low Range Noble Gas) (RDA-3A)

Run a plateau of counts per minute (cpm) vs high voltage. These data should compare very closely with the data provided in your data package if a comparable ^{90}Sr-^{90}Y source is used. Set the high voltage on the plateau region below the increase in background count rate.

Complete checkout of an RDA-3A and an IB-2 can be performed utilizing the following Eberline checkout procedures.

SUBASSEMBLY	CHECKOUT PROCEDURE
IB-2	10429-A113
RDA-3A	10429-A220
RDA-3A with IB-2	10429-A232

b. Alpha Detector (RDS-1)

Using a ^{230}Th source, run a pulse height spectrum of cpm vs. threshold setting. These data should compare very closely with the data in your data package when referred to energy (threshold volts). Note that the data supplied have threshold voltages

calibrated to alpha energy. Calibration of energy to threshold voltage is accomplished by adjusting the gain control on the amplifier board.

Complete checkout of an RDS-1 and a IB-3C can be performed utilizing the following Eberline checkout procedures.

SUBASSEMBLY	CHECKOUT PROCEDURE
RDS-1	10429-A228
IB-3C	10429-A133
RDS-1 with IB-3C	10429-A229

c. Iodine (RDA-2A)

Run a pulse height spectrum of cpm vs. threshold volts. The data should exactly duplicate the data provided in your data package when referred to energy. The threshold must be calibrated to energy for use later in the calibration procedure.

Complete checkout of an RDA-2A and an IB-2 can be performed utilizing the following Eberline checkout procedures.

SUBASSEMBLY	CHECKOUT PROCEDURE
IB-2	10429-A113
RDA-2A	10429-A219
IB-2 with RDA-2A	10429-A231

d. Gamma Detectors (Medium Range and High Range Noble Gas, Area Monitor and Gamma Background)

The gamma detectors listed above are all energy-compensated G-M tube type detectors which, when connected to their interfacing electronics (IBs), have a known sensitivity (in air) to a given gamma field. The following list depicts by channel designation the Eberline G-M tube type, its nominal sensitivity, interfacing electronics and Eberline checkout procedure number.

NOTE: The sensitivity is the count rate out of the electronics and not the G-M tube sensitivity.

Channel Designation	EIC GM Tube Number	Sensitivity CPM/mR/hr	Interfacing Electronics	Checkout Procedure
Medium Range Noble Gas	10450-B28	40	IB-4A	10429-A255
*High Range. Noble Gas	10450-B28	40	IB-4A	10429-A255
Gamma Background	10450-B28	40	IB-4A	10429-A255
Area Monitor (DA1-1)	10450-B12	600	Part of Detector Assembly	10429-A137

The checkout procedure for an IB-4A is 10429-A195.

2. CALIBRATION (utilizing the microcomputer)

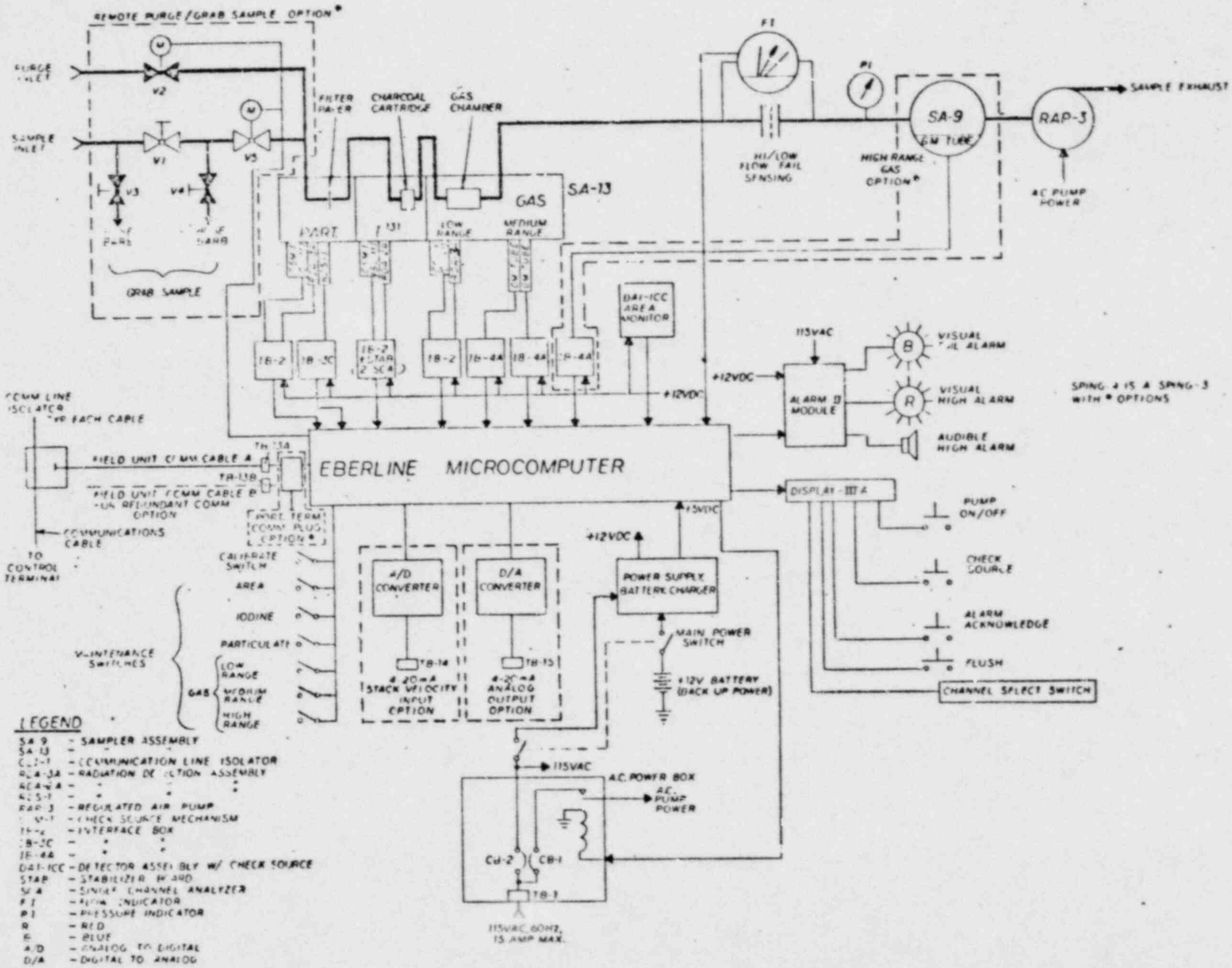
The following procedure requires editing each channel file three times. The first edit adjusts each channel for a calibration constant of 1.00E + 00 and no subtraction. The readings for each channel are then output as cpm from their associated detector. The second edit is performed after fixed background rates are determined and factors for background measured by other channels are determined. This then provides the proper point to determine channel calibration constants. After calibration constants are determined, the background subtraction measurement for radon is determined. At this point the third edit of channels is performed and the SPING-3/4 is calibrated. During the third edit the remainder of each channel file can be edited to include selection of alarm setpoints, sample flow rate and automatic logging. 1st, 2nd and 3rd Edit Data Sheets are provided at the end of this section. Copies may be made to aid in calibration. After the unit is calibrated, it is helpful to retain the final edited channel parameter file print-out for each channel. This printout can also provide historical documentation of actual value used by the monitor for that time period.

3. FIXED BACKGROUND

a. Flip the calibration switch to ON and turn the pump OFF. Note that calibration switch forces a printout of data on each channel every 10 minutes.

b. From the Control Terminal, perform the First Edit of all channel files within the unit being calibrated for the following:

Units = cpm (enter 03 after menu of units is typed on editing line 02)



SPING-3 Block Diagram, 11044-C15B.

Calibration Constant = +1.00+00

Bkg. 1 and 2 Ch. No. = 0

Bkg. 1 and 2 Factor +0.00+00

Fixed Bkg. SUB = +0.00+00

See 1st Edit Data Sheet.

c. Place new, clean filters in the particulate channel and iodine channel. The sampler may be purged with nitrogen or radioactive-free air at this time to reduce any residual radioactive deposits.

d. Disconnect the particulate, iodine and low range gas channels detectors (1, 3 and 5) at their interface boxes. Command the check source for channels 1, 3, and 5. This procedure shields the check sources from the area detector (Ch. 6). Under these conditions, ambient background, as well as a fixed background subtraction for the area monitor, can be determined as follows:

1) Allow 20 minutes to elapse (2 printouts on the Control Terminal's printer); then record the last printout for Channel 6. Label this value "A." Record the last printout for Channel 8. Label this value "B."

2) Reconnect the detectors for channels 1, 3, and 5. Wait until check sources have retracted; then wait for the second printout of data with calibration status. Record the last printout for Channel 6 and label this value "A1." Record the last printout for Channel 8 and label this value "B1."

3) Value "A1" minus value "A" = CONTRIBUTION FROM CHECK SOURCES which should be entered as the fixed subtraction rate for Channel 6. Record this value in space 6-1 on the 2nd Edit Data Sheet. Value "B1" minus value "B" equals CONTRIBUTION FROM CHECK SOURCES which should be entered as fixed subtraction rate for Channel 8. Record this value in space 8-1 on the 2nd Edit Data Sheet.

NOTE: If results are negative ignore and enter values of +0.00+00.

NOTE: The contributions from fixed radiation (cosmic rays and/or contamination in the shielding materials) are generally relatively low compared to high ambient gamma levels. If the final installation of the SPING-3/4 is in a high ambient background (i.e., 1.0 mR/h or above), effects

of the fixed background contribution are of little consequence for the final measurement. Under these conditions, further corrections for fixed background subtraction can be omitted by going to step 4.

The data may still be optimized under these conditions by elevating the ambient background and determining the count rate in a channel of interest (as in step 4) and then projecting that reading to actual ambient. The zero offset from this calculation will be a fixed rate that should be subtracted on the particular channel.

e. Obtain the last printout for Channel 1 (beta particulate). This number is both the fixed background and the contribution from ambient. Assuming that 95 percent is fixed, multiply this value by 0.95 to obtain fixed subtraction rate. Record this value in space 1-2 on the 2nd Edit Data Sheet.

   Repeat the above procedure for Channel 5 (low range noble gas) by obtaining the last printout for Channel 5. Record the adjusted value in space 5-2 on the 2nd Edit Data Sheet, cpm x 0.95.

   Repeat the above procedure for Channel 7 (mid range noble gas) by obtaining the last printout for Channel 7. Record the adjusted value in space 7-2 on the 2nd Edit Data Sheet, cpm x 0.95.

   *Repeat the above procedure for Channel 9 (high range noble gas) by obtaining the last printout for Channel 9. Record the adjusted value in space 9-2 on the 2nd Edit Data Sheet, cpm x 0.95.

   Enter the following values for fixed background subtraction from the 2nd Edit Data Sheet by editing the associated channel parameter file.

   1) Value in space 1-2, into Channel 1
   2) Value in space 5-2, into Channel 5
   3) Value in space 6-1, into Channel 6
   4) Value in space 7-2, into Channel 7.
   5) Value in space 8-1, into Channel 8.
   *6) Value in space 9-2, into Channel 9.

4. FLUCTUATING BACKGROUND

   a. At this point, determine the factors for background measured by other channels.

Iodine (Ch. 3) uses an adjacent energy window (Ch. 4) as its background measuring source. Channel 4 is set to measure an equal window just above the ^{131}I energy. Scatter from higher energy gamma smears through both windows approximately equally, so background in both windows will be equal except for the slope of the scatter through those windows. The factor corrects for this.

Gamma background (Ch. 8) is utilized as a background measuring source for the noble gas channels. The measuring device is an energy-compensated G-M detector similar to the ones used in the mid and high range noble gas channels. It is located in the rear of the lead shield assembly (SA-13).

An external gamma radiation field will contribute to the readings of the beta detectors used for particulate (Ch. 1) and noble gas measurements (Ch. 5) and the gamma detectors used for mid and high range gas measurements (Ch. 7 and Ch. 9). The gamma background detector (Ch. 8) is used to measure the external gamma field to subtract from the beta particulate detector (Ch. 1), the beta gas detector (Ch. 5) and mid and high range gamma gas (Ch. 7 and Ch. 9) measurements.

1) Obtain data from Channel 3 and label "C."

2) Obtain data from Channel 4 and label "D."

NOTE: During factory calibration, background factors for Channels 1, 5, 7 and 9 [steps b.2), 3), 4) and 5) below] are not calculated. Any values calculated would not be correct for the local conditions at the monitor's ultimate location. The factory calibration provides a conservative measurement since the contribution from ambient background will increase the detected radiation values. To nullify the effects of fluctuating ambient background radiation, the background factors should be measured, calculated and entered into the channel parameter files as follows:

b. Elevate the external field at each detector by 50 or 100 times ambient (i.e. if ambient equals 0.03 mR/h, use a 1.0 mR/hr field). For best results, use a source with an energy which will approximate the energy of the ambient source of radiation. Wait for at least two printouts and use the last printout.

   1) Elevated background channel readings.

      a) Obtain data from Channel 1 and label "E."

      b) Obtain data from Channel 5 and label "F."

c) Obtain data from Channel 6 and label "G."

d) Obtain data from Channel 3 and label "C1."

e) Obtain data from Channel 4 and label "D1."

f) Obtain data from Channel 7 and label "H."

g) Obtain data from Channel 8 and label "I."

*h) Obtain data from Channel 9 and label "J."

c. At this point, calculate the fixed background subtraction factor and the background factor for Channels 1, 3, 5, 7 and 9 as follows:

1) Channel 3

a) $\frac{\text{Value C1}}{\text{Value D1}}$ = factor for Channel 3 BKG #1

Record in space 3-1 on the 2nd Edit Data Sheet.

b) Value D from 4.a.2) above multiplied by the factor for Channel 3 a) above minus Value C from 4.a.1) above, i.e.,
[(Value D x factor for Ch 3 BKG #1) - Value C] equals the fixed subtraction for Channel 3.

If the result is negative, record a zero; if the result is positive, record it in space 3-2 on the 2nd Edit Data Sheet.

2) Channel 1

$\frac{\text{Value E}}{\text{Value I}}$ = factor for Channel 1 BKG #2 Factor

Record in space 1-1 on the 2nd Edit Data Sheet.

3) Channel 5

$\frac{\text{Value F}}{\text{Value I}}$ = factor for Channel 5 BKG #1 Factor

Record in space 5-1 on the 2nd Edit Data Sheet.

4) Channel 7

$\frac{\text{Value H}}{\text{Value I}}$ = factor for Channel 7 BKG #1 Factor

Record in space 7-1 on the 2nd Edit Data Sheet.

*5) Channel 9

$\frac{\text{Value J}}{\text{Value I}}$ = factor for Channel 9 BKG #1 Factor

Record in space 9-1 on 2nd Edit Data Sheet.

5. SECOND EDIT

Enter all values from the 2nd Edit Data Sheet by editing Channels 1, 3, 5, 6, 7, 8, and 9 channel parameter files.

6. CALIBRATION CONSTANTS .

At this point, calibration constants can be determined.

a. The area monitor (Ch. 6) calibration constant can be determined by data taken in step 4.b.1)c), Value G. The field intensity in mR/h, divided by count rate, equals the calibration constant (use intensity in R/h for calibration constant in R/h).

EXAMPLE:

If the count rate obtained in 4.b.1)c) is 1200 cpm and the field intensity is 2.0 mR/h, then 2 mR/h divided by 1200 equals 1.67 x 10^{-3} for the calibration constant, if units are mR/h. Record this value in space 6-2 on the 3rd Edit Data Sheet.

b. Noble Gas Monitors (Channels 5, 7, and 9) may be calibrated only with a known concentration of gas, or by utilizing the calibration techniques in Method 2. Fill the sampler assemblies (SA-13 and SA-9) with a known concentration of gas. Wait for two printouts (minimum) and obtain the data from the last printout. Concen- tration of the sample divided by the count rate obtained equals the calibration constant.

1) Low Range Noble Gas

EXAMPLE: Channel 5. The following data were obtained by Eberline using known concentrations of ^{133}Xe and ^{85}Kr in air:

25 cpm for 1×10^{-6} $\mu Ci/cm^3$ of ^{133}Xe

52 cpm for 1×10^{-6} $\mu Ci/cm^3$ of ^{85}Kr

NOTE: Count rates are at the detector. Note that the IB-2 or IB-4A counts down by two. With the monitor calibration factor at 1.0, the apparent count rates would be 12.5 cpm and 26 cpm, respectively.

With the sampler filled with $1 \times 10^{-4} \mu Ci/cm^3$ of ^{85}Kr, a count rate of 2600 cpm was obtained. So:

1×10^{-4} $\mu Ci/cm^3$ divided by 2600 cpm equals a calibration constant of 3.85×10^{-8} $\mu Ci/cm^3/cpm$.

With the sampler filled with 2.2×10^{-4} $\mu Ci/cm^3$ of ^{133}Xe, a count rate of 2750 cpm was obtained. So:

2.2×10^{-4} $\mu Ci/cm^3$ divided by 2750 cpm equals a calibration constant of 8.00×10^{-8} $\mu Ci/cm^3/cpm$.

Under operating conditions, this calibration constant can and should be manipulated to agree with laboratory determinations of the concentration and isotopic mix of the sampled gas using calibration Method 2.

After determining the calibration constant, record the value in space 5-3 on the 3rd Edit Data Sheet.

2) The calibration constants for Channel 7 and Channel 9 are determined in a similar manner with their constants entered on the 3rd Edit Data Sheet in spaces 7-3 and 9-3, respectively.

c. The Iodine monitor (Ch.3) measures the 364-keV energy emitted by ^{131}I. Since ^{131}I is an impractical calibration standard, ^{133}Ba is used as the calibration standard. The gamma energy of interest of ^{133}Ba is 356 keV, so the IB-2 PHA/Line Driver threshold must be adjusted accordingly.

NOTE: The voltage measurements are taken between common ("C," grey test point) and threshold ("THLD," green test point). Adjust the threshold (THLD) control. The voltage divided by 2 equals the energy. The threshold voltage plus one-half the window voltage [Threshold volts + (window volts x .5)] divided by 2 equals the energy of the peak in MeV.

Adjust the threshold for 0.662 volts to center the analyzer on the 356 keV peak. Place the ^{133}Ba source in the filter holder so it is closest to the detector. Wait for two printouts (minimum) and obtain data from the last printout. Label this

data "K." Remove the ^{133}Ba source. Readjust the energy window for ^{131}I (THLD = 0.678 volts).

The data obtained must now be corrected for the gamma abundance ratio of ^{133}Ba (69 percent) to ^{131}I (82 percent). This correction factor (0.82 divided by 0.69) is 1.19. Therefore, data "K" multiplied by the correction factor is the count rate that would be obtained if the source had been ^{131}I of the same activity. Label this result "K1."

EXAMPLE:

1-7/8 inch (4.76 cm) dia. (active area) ^{133}Ba source, 0.0531 μCi

Count rate obtained = 2175 cpm ("K")

2175 x 1.19 = 2588 cpm ("K1")

Value "K1" divided by the activity of the source would then result in the sensitivity of the detector if all the iodine were on the front surface of the charcoal cartridge. Under operating conditions, iodine would probably be evenly distributed through the cartridge, so the reduction in the efficiency must be corrected for.

Prior data indicate that deposits at the center of the cartridge yield 60 percent of the front surface value and the deposits at rear surface yield 42 percent of the front surface value. Assuming an even distribution, a correction factor of 0.74 must be applied to the data.

EXAMPLE:

2588 cpm ("K1") divided by .0531 μCi (source activity) = 48.738 cpm/μCi

48,738 cpm/μCi x .74 = 36,066 cpm/μCi

1/36,066 = calibration constant 2.77×10^{-5} μCi/cpm

The calibration constant is then the reciprocal of the last corrected data. Record this value in space 3-3 on the 3rd Edit Data Sheet.

d. The beta particulate monitor (Ch.1) is a measure of the beta activity on the filter paper. A plated source of ^{90}Sr-^{90}Y is the calibration standard. The source is inserted into the filter holder in place of the paper. After two printouts (minimum), obtain the data from the last printout and label the value "L." The value "L" divided by the activity of the source* equals the 2π efficiency. The 2π efficiency multiplied by 0.5 will give the 4π efficiency. The calibration constant is the

inverse of the result of the 4π efficiency multiplied by 2.2×10^6. (2.2×10^6 is the conversion factor from disintegrations per minute to microcuries).

*The difference in backscatter factor between the source and a filter paper must be considered in assigning source activity. Typically this difference causes the apparent source activity to increase about 25 percent.

EXAMPLE: 1-7/8-inch (4.76 cm) dia. active area ^{90}Sr-^{90}Y source, 1838 cpm 2π

Value "L" divided by 1838 cpm equals 2π efficiency

2π efficiency x 1/2 = 4π efficiency

$$\frac{1}{4\pi \text{ Efficiency} \times 2.2 \times 10^6} = \text{Calibration Constant}$$

Record this value in space 1-3 on the 3rd Edit Data Sheet.

e. At this point , determination of the background subtration for the radon contribution must be made.

The alpha particulate channel (Ch.2) monitors the same filter paper as the beta channel. Since radon daughters emit both alpha and beta particles, the decay of these daughters appears as beta particulate radiation. The effects of these radon daughters are nullified by measuring the radon alpha on the Channel 2 detector and subtracting a factored amount from the beta channel. The following determines the factor.

1) Replace the calibration source with a clean filter paper.

2) Turn on the pump.

3) Allow the pump to run for at least two hours (minimum).

4) Obtain the data from the last printout of Channel 1 and label "M."

5) Obtain the data from the last printout of Channel 2 and label "N."

6) A determination must be made at this point on the validity of the data. The data are valid only if no long lived particulates, such as fission products, are included in the data. Inclusion of such data in the determination of the factor will result in over-subtraction of radon background. If there is no possibility of such particulates, proceed to 6.e.8), below.

7) Shut off the sample flow. Wait for a minimum of 2 hours. This allows the radon daughters to decay off by approximately four half lives. The last printout of Channel 1 should then be 0.062 or less of data "M" 6.e.4). If data are less, all contributions were from radon; proceed to 6.e.8), below.

Obtain the data from the last printout and subtract from value "M." Label this result "M." This corrects the background determination for any long lived isotopes.

8) To determine the subtraction factor, data "M" is divided by value "N". Record this value in space 1-4 on the 3rd Edit Data Sheet.

EXAMPLE:

Data after two hours running, Channel 1 = 200 cpm ("M")

Data after two hours running, Channel 2 = 100 cpm ("N")

Data after two hours off, Channel 1 = 10 cpm

200 cpm ("M") divided by 100 cpm ("N") equals 2.00×10^{0} Bkg. factor

7. ALARM SETPOINTS

a. At this time, desired alarm set points should be edited into channel parameter files. The set point values are entered in fixed decimal point scientific notation. The trend alarm is in percent/minute change.

8. SAMPLE FLOW

It is important to enter the sample flow rate into channels (1, 2, 3, 5, 7 and 9) which depend upon sample flow for proper measurement. Line 20 should be edited with the sample flow rate in cubic centimeters per minute in their channel parameter files. If the unit uses the analog input to measure sample flow rate and/or stack flow rate, Lines 19, 20, 21 and 22 should be edited to the appropriate values for each flow dependent channel (1, 2, 3, 5, 7 and 9). See the Analog Input Option manual section for further information.

a. <u>Sample Flow Measurement</u>

The sample flow rate is indicated by the Photohelic[R] gauge (FI) in liters per minute (lpm). Since this is not a "standard" or mass independent measurement, the reading on the instrument must be corrected for density altitude. The theoretical

correction factor for the flowmeter is to multiply the reading by the square root of the ratio of the operating absolute pressure to a standard atmosphere 14.7 psia (29.92 inches of Hg).

$$\text{Standard Flow} = \text{Observed Flow} \times \sqrt{\frac{\text{operating absolute pressure}}{29.92 \text{ inches Hg}}}$$

where the operating absolute pressure is operating gauge pressure plus atmospheric pressure. As an example, at an altitude of 4700 feet above sea level the atmospheric pressure is 12.37 psi (25.19 inches Hg). If the operating pressure is 6 inches Hg vacuum as measured on the pump suction gauge (PI), The operating absolute pressure is -6 + 25.19 = 19.19 inches Hg. Thus the correction factor would be

$$\sqrt{\frac{19.19}{29.92}} = 0.80$$

If the observed flow is 75 lpm, the corrected or standard flow is

75 lpm x 0.80 = 60 lpm

This is the value to be input as the sample flow rate in Line 20 of the flow-dependent channel's channel parameter file. Do not use the uncorrected Photohelic^R gauge reading.

b. Sample Flow Adjustment

It is important to keep the correction factor in mind when adjusting the sample flow rate. In this case, knowing the standard flow rate to be set and applying the correction factor to yield indicated or observed flow allows the value to be set in by adjusting the flow rate. The flow rate is adjusted by means of the adjustment screw on the RAP-3 (regulated air pump) regulator. The steps to set the flow rate are as follows:

a) Knowing the desired standard flow, divide by the theoretical correction factor.

b) The calculated observed flow can then be set by adjusting the RAP-3 regulator until the Photohelic^R gauge indicates the observed flow rate. It may be helpful to read the RAP-3 and Photohelic^R flowmeter manual sections.

As an example:

It is desired to set the sample flow rate to 60 lpm. The pump pressure is 5.4 inches of Hg of vacuum and the

barometric pressure is 24.5 inches of Hg. The observed flow rate is calculated to be:

$$\text{Observed flow} = \frac{\text{standard flow}}{\sqrt{\frac{\text{operating absolute pressure}}{\text{standard atmospheric pressure}}}}$$

$$= \frac{60 \text{ lpm}}{\sqrt{\frac{-5.4 + 24.5}{29.92}}}$$

$$= \frac{60}{\sqrt{\frac{19.1}{29.92}}} = \frac{60}{\sqrt{0.64}} = \frac{60}{0.80}$$

$$= 75.1$$

The RAP-3 regulator is then adjusted for an indicated (observed) flow of 75.1 lpm.

9. Third Edit

Perform the third edit by entering all values from the 3rd Edit Data Sheet into the channel parameter files. A copy of each edited channel parameter file should be retained to aid in interpretation of historical data.

B. METHOD 2

On-line calibration of the monitor may be accomplished quickly and dynamically during operation by correlating laboratory data with SPING-3/4 data.

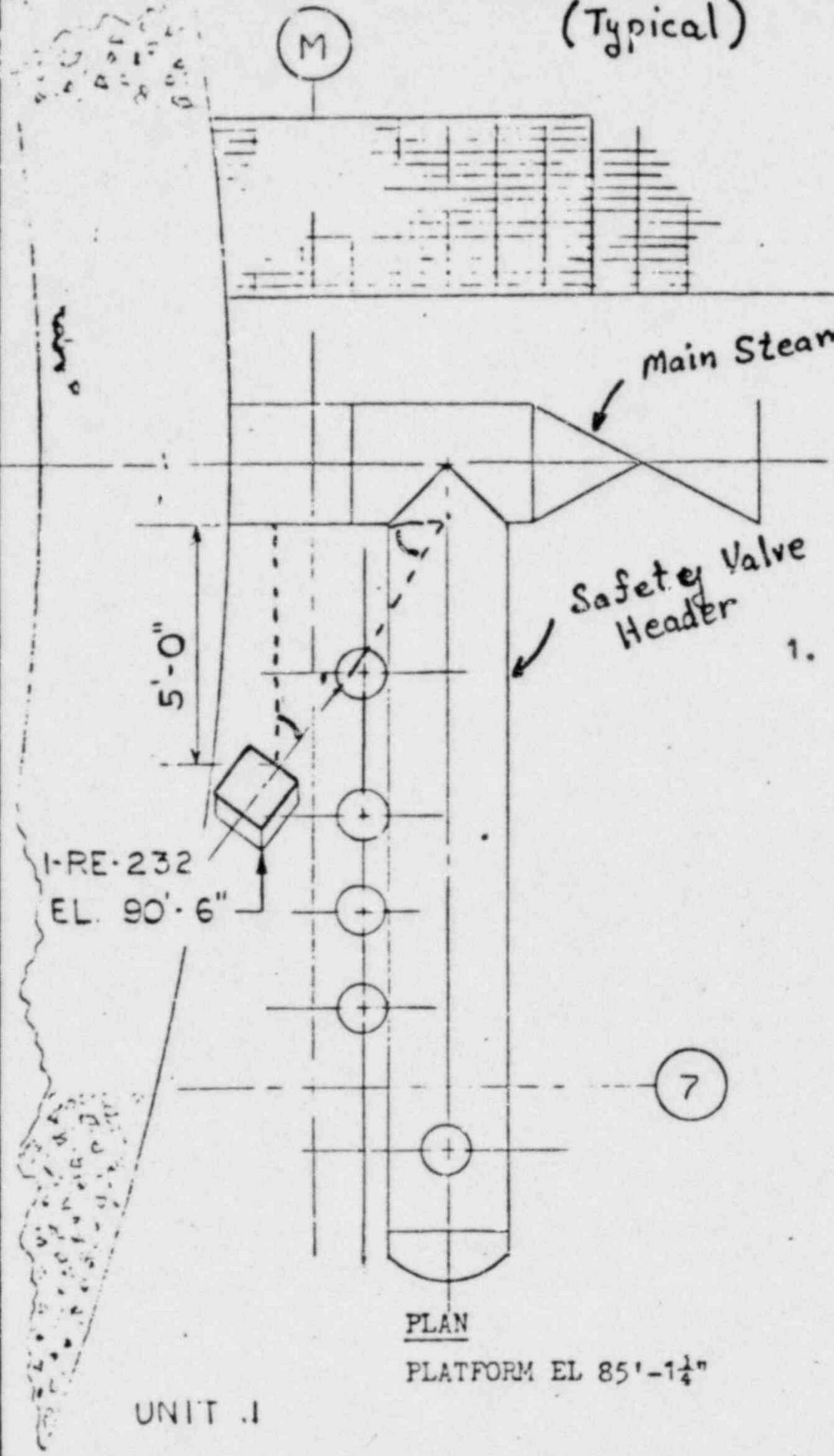
At filter change time, the spent filter (or a gas sample) may be analyzed in the laboratory for activity (or concentration). These data are then compared to the data from the SPING-3/4. Adjustments can then be made to the calibration constant of the corresponding channel in the SPING-3/4.

This method is valid only if the laboratory methods of determination are more accurate than the SPING-3/4.

Since the beta detector (Ch. 1 and 5) has a definite change in efficiency with different beta energies (isotopes), data from the laboratory analysis should include isotopic mix so this effect can be evaluated.

Any changes to the calibration constant which are greater that that which is deemed reasonable should be cause for complete recalibration per Method 1.

Steam Line Monitor Location (Typical)



1. SCALE: ¼" = 1'-0"

ISSUE	DESCRIPTION	CHKD	CORR	APPR	DATE
4	-				
3	REVISED MONITOR LOCATION	AVL			7/22/81
2	REVISED TITLE ADDED RE NO.	AVL			4/20/81
1	ORIGINAL ISSUE	AVL			1/14/81

LOCATION UNIT 1 MAIN STEAM RELEASE MONITOR

POINT BEACH NUCLEAR PLANT

STONE & WEBSTER ENGINEERING CORP.

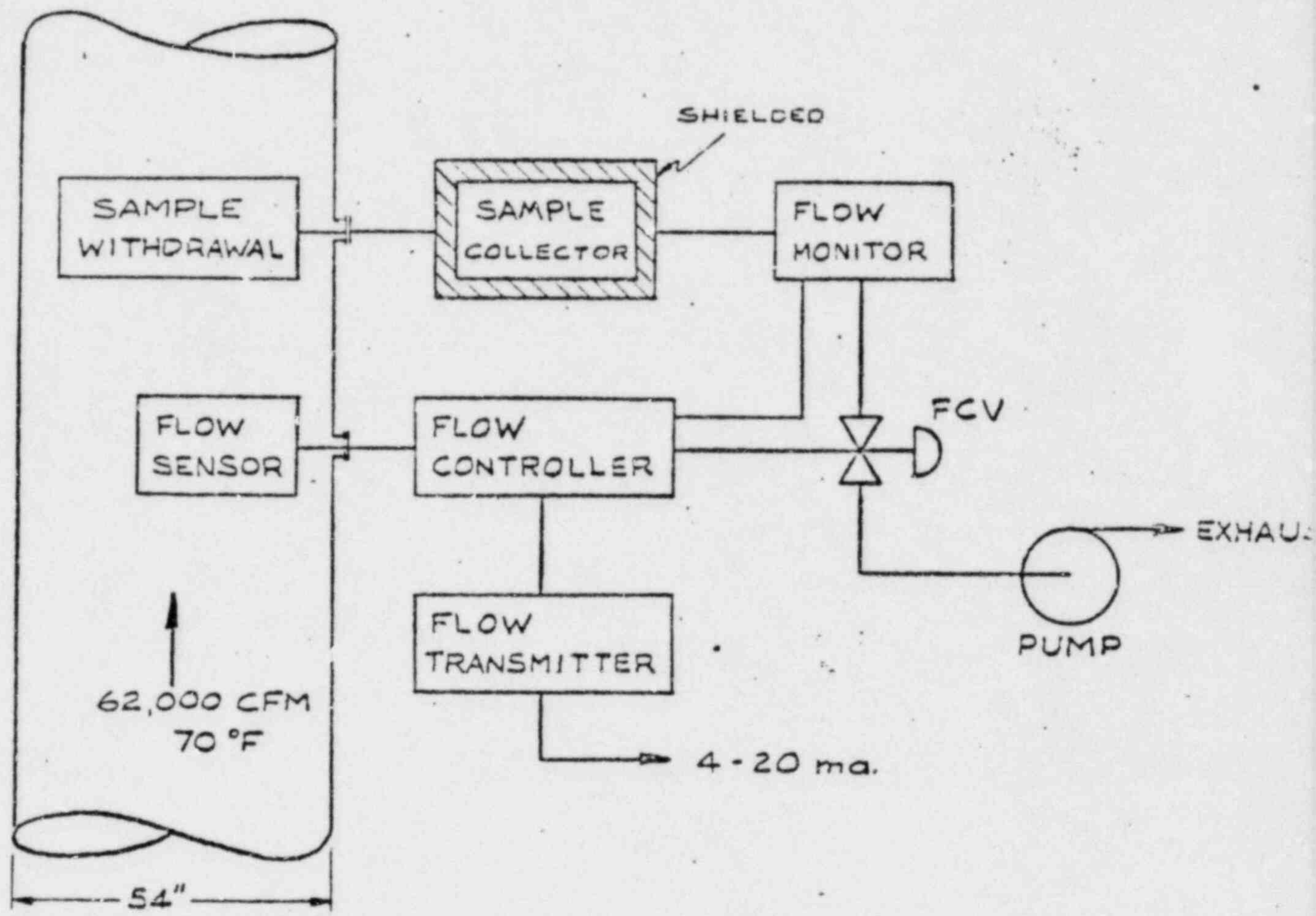
DWG. NO. 13754.01-SK-1016-3

PRINTS | APP. CARD | ISSUE

9860.15 DESIGNED BY | DRAWN BY | DSGN CHKD BY | CHKD BY

DSGN ENGR | PROJ ENGR

SUBJECT ISOKINETIC STACK SAMPLER SYSTEM



LOCAL INDICATORS FOR:
STACK VELOCITY & FLOW
SAMPLE VELOCITY & FLOW

ESTIMATION OF SOURCE TERM

1.0 GENERAL

The purpose of this procedure is to estimate the source term (stack release rate in Ci/second) using the low range operational stack monitors, the Eberline RMS II Radiation Monitoring Systems or direct contact radiation measurements on the plant effluent vents. The plant effluent vent stacks are:

1.1 Auxiliary Building Vent (ABVNT)

1.2 Drumming Area Vent (DAVNT)

1.3 Unit 1 Containment Purge Vent (CONT 1)

1.4 Unit 2 Containment Purge Vent (CONT 2)

1.5 Gas Stripper Building Vent (GSBVNT)

1.6 Combined Air Ejector Decay Duct (CAE)

1.7 Main Steam Safety Valves and Atmospheric Dump Valves

2.0 REFERENCE

2.1 EDS Report to Wisconsin Electric Power Company concerning NUREG-0578, March 7, 1980.

3.0 PRECAUTIONS

3.1 If fuel damage or loss of reactor coolant system integrity has occurred, some or all of the following would be present:

3.1.1 The letdown radiation monitor (R9) may be unusually high or offscale.

3.1.2 The containment radiation monitors (R11 and R12) may be unusually high or offscale.

3.1.3 The containment area monitors (R2 and R7) may be unusually high or offscale.

3.1.4 The charging pump area monitor (R4) may be unusually high or offscale.

3.2 Health Physics procedures and requirements must be followed when applicable (i.e., entering a high radiation area).

3.3 Evaluation of the radiation monitoring system readouts and radiological hazards must be completed prior to any attempt to enter the auxiliary building or facade to take a contact reading on any stack.

4.0 INITIAL CONDITIONS

4.1 Applicable portions of EPIP 1.2, "Plant Status", is completed.

5.0 PROCEDURE FOR Xe-133 EQUIVALENT RELEASE RATE ESTIMATE - WORKSHEET NO. 1

5.1 Chemistry/Health Physics Supervisor or Designated Alternate

5.1.1 Obtain EPIP-05 and EPIP-06 of EPIP 1.2, "Plant Status," for the radiation monitoring systems.

NOTE: IF EPIP-05 AND EPIP-06 IN EPIP 1.2, "PLANT STATUS," ARE NOT COMPLETED, OBTAIN THE METER READINGS FOR EACH PLANT EFFLUENT VENT STACK FROM THE REMOTE CONTROL ROOM READOUT AND RECORD THIS ON WORKSHEET NO. 1 AND THEN PROCEED WITH STEP 5.1.3.

5.1.2 Enter the meter readings and flow rates in the appropriate columns on Worksheet No. 1 for the indicated vents. If the readings are offscale, not monitored, or the monitors are inoperable, enter the appropriate word "offscale," "not monitored," or "inoperable" in the meter reading column for the vent affected.

5.1.3 Designate individuals in accordance with ALARA concepts to obtain meter readings of the vents whose Eberline RMS II data is not available and the main steam header by performing Section 5.2 of this procedure if required.

NOTE: IF STEP 5.1.3 NEEDS TO BE COMPLETED BECAUSE EBERLINE RMS II DATA IS NOT AVAILABLE, OR IF A STEAM GENERATOR TUBE RUPTURE IS BELIEVED TO HAVE OCCURRED WHICH PRODUCES THE POTENTIAL FOR RELEASES, OR RELEASES ARE IN PROGRESS FROM THE MAIN STEAM HEADER OR THE ATMOSPHERIC STEAM DUMP, THEN PERFORM SECTION 5.3 OF THIS PROCEDURE AFTER APPROPRIATE MEASUREMENTS HAVE BEEN TAKEN IN SECTION 5.2.

5.1.4 Perform Section 5.3 of this procedure to determine the gross Xe-133 equivalent release rate estimate.

5.2 Direct Stack Survey Team Designees

NOTE: THE FOLLOWING SECTION WILL NOT BE INITIATED UNTIL THE EVALUATION DISCUSSED IN PRECAUTION 3.3 HAS BEEN COMPLETED AND THE SITE MANAGER (DUTY & CALL SUPERINTENDENT), THE DUTY & CALL HEALTH PHYSICS SUPERVISOR, AND THE DUTY SHIFT SUPERVISOR HAVE APPROVED INITIATION. THIS SECTION WILL BE ACCOMPLISHED UNDER THE DIRECTION OF HEALTH PHYSICS SUPERVISION.

5.2.1 Determine the most direct and desirable route to the plant effluent stack to be monitored.

5.2.2 Determine the Health Physics requirements to be met for the passage to the vent areas.

5.2.3 Determine the appropriate survey instrument to be used for the plant effluent vent to be monitored.

5.2.4 Proceed by the route determined in Step 5.2.1 to the stack and record the survey instrument reading in contact with the stack in the columns provided on Worksheet No. 1, Part C, Plant Effluent Vent Stack Contact Readings.

NOTE: IN THE CASE OF THE MAIN STEAM SAFETY VALVES AND ATMOSPHERIC STEAM DUMP VALVES, THE READING WILL BE TAKEN IN CONTACT WITH THE CENTERLINE OF THE MAIN STEAM HEADER, THREE FEET FROM THE MAIN STEAM LINE. SHIELD THE PROBE (WITH A MINIMUM OF .25 INCHES OF LEAD) ON THE SIDES FACING THE MAIN STEAM LINE AND THE CONTAINMENT.

5.3 Chemistry/Health Physics Supervisor or Designated Alternate

5.3.1 Choose the appropriate vent stack readouts in Part A, B, or C of Worksheet No. 1 to convert readings to a Xe-133 equivalent release rate. That is if the low range monitors go offscale, use the high range monitors. Conversely, if the normal monitors are onscale, use the normal monitors, or if both normal and high range monitors are offscale or inoperable, use the vent stack contact readings.

5.3.2 Use the appropriate attached conversion curves for each of the plant effluent vent to convert the chosen vent stack readout, (cpm or R/hour) and flow rate, from Step 5.3.1 to an Xe-133 equivalent release rate in Curies/second and record the value on Worksheet No. 1, Part D, Estimate of Gross Xe-133 Equivalent Release Rate. Enter the appropriate word "offscale," "not monitored," or "inoperable" for the cases where the plant effluent vent was not monitored, offscale, or inoperable.

NOTE: THE FOLLOWING QUALIFYING NOTES MUST BE RECOGNIZED.

1. If the actual flow rate is different than the conversion curves flow rate, a ratio of:

   $$\frac{\text{Actual Flow Rate}}{\text{Conversion Curve Flow Rate}}$$

   should be applied to determine the release rate.

   (Ratio) X Conversion Curve Release Rate = Adjusted Xe-133 = Equiv. Release Rate

2. If the main steam header vent release rate needs to be determined, the following steps must be applied.

   a. Obtain from the Shift Supervisor an estimated flow rate through the main steam header in lbm/hour of steam being dumped to the environment and the specific volume (v) of the steam. At 1000 psia, specific volume is 0.4[illegible] ft.^{3}/lbm. At 500 psia, specific volume is 0.928 ft.^{3}/lbm.

   $$\underline{\hspace{4cm}}\ \text{lbm/hr} \times v\ \frac{\text{ft.}^3}{\text{lbm}} \times 7.86\ \frac{\text{cc}}{\text{ft.}^3}\ \frac{\text{hr.}}{\text{sec.}}$$

   b. Convert contact reading obtained at the main steam header to μCi/cc using the appropriate attached conversion curve for the main steam header.

   ____________________ μCi/cc

   c. Multiply flow rate obtained in Step (a) by the concentration obtained in Step (b) to obtain the release rate (Xe-133 equivalent) from the main steam header.

   $$\underset{\text{(cc/sec.)}}{\text{Flow Rate}} \times \underset{(\mu\text{Ci/cc})}{\text{Concentration}} = \underset{\text{Release Rate}}{\text{Main Steam Header}}$$

5.3.2 Sum the values (1) through (7) on Worksheet No. 1, Part D, to determine the gross Xe-133 equivalent release rate.

NOTE: IF GRAB SAMPLE RESULTS ARE AVAILABLE, THE RESULT OF SUCH SAMPLES SHOULD BE MORE ACCURATE THAN GROSS MONITOR READINGS AND HENCE SHOULD BE USED IN LIEU OF THE RELEASE RATES CALCULATED ABOVE OR IN ADDITION TO THE ABOVE IF THE RELEASE IS FROM AN UNMONITORED RELEASE PATH.

5.3.3 Report the calculated gross Xe-133 equivalent release rate to the Shift Supervisor and the Technical Support Manager.

WORKSHEET NO. 1

Xe-133 EQUIVALENT RELEASE RATE

A. LOW RANGE OPERATIONAL VENT STACK READOUTS

Vent	Meter Reading (cpm)	Flow Rate (cfm)	Conversion Curve Attachment No.
Auxiliary Building		61400	1.3-1
Drumming Area		43100	1.3-2
Unit 1 Containment Purge		12500/25000	1.3-3 and 1.3-4
Unit 2 Containment Purge		12500/25000	1.3-5 and 1.3-6
Gas Stripper Building		13000	1.3-7
Combined Air Ejector Decay			1.3-8

B. EBERLINE RMS - II VENT STACK READOUTS

Vent	Meter Reading (R/hour)	Flow Rate (cfm)	Conversion Curve Attachment No.
Auxiliary Building		61400	1.3-9
Drumming Area		43100	1.3-10
Unit 1 Containment Purge		12500/25000	1.3-11 and 1.3-12
Unit 2 Containment Purge		12500/25000	1.3-11 and 1.3-12
Gas Stripper Building			1.3-13
Combined Air Ejector Decay			1.3-14

C. PLANT EFFLUENT VENT STACK CONTACT READINGS

Vent	Meter Reading (mr/hr or R/hr)	Flow Rate (cfm)	Conversion Curve Attachment No.
Auxiliary Building		61400	1.3-15
Drumming Area		43100	1.3-16
Unit 1 Containment Purge		12500/25000	1.3-17 and 1.3-18
Unit 2 Containment Purge		12500/25000	1.3-17 and 1.3-18
Gas Stripper Building		13000	1.3-19
Combined Air Ejector Decay			1.3-20
Main Steam Header			1.3-21

D. ESTIMATE OF GROSS Xe-133 EQUIVALENT RELEASE RATE

Vent	Xe-133 Equivalent Release Rate (Curies/Sec.)
1. Auxiliary Building	
2. Drumming Area	
3. Unit 1 Containment Purge	
4. Unit 2 Containment Purge	
5. Gas Stripper Building	
6. Combined Air Ejector Decay Duct	
7. Main Steam Header	
8. Sum	(Gross Xe-133 Equiv. Release Rate)

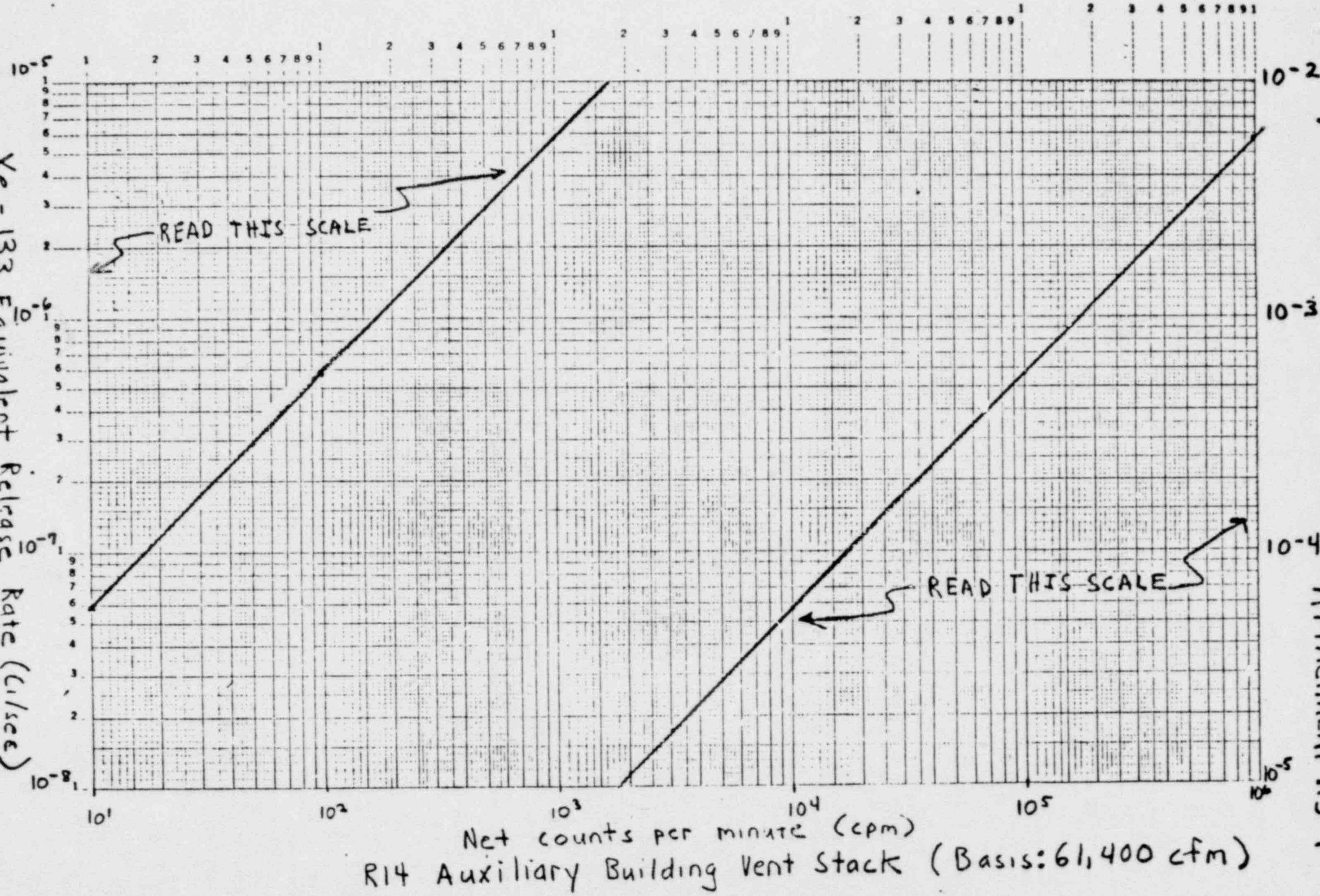
OR

9. Grab Sample Results = ____________ Ci/sec.

Completed By ________________________________ Time ______________

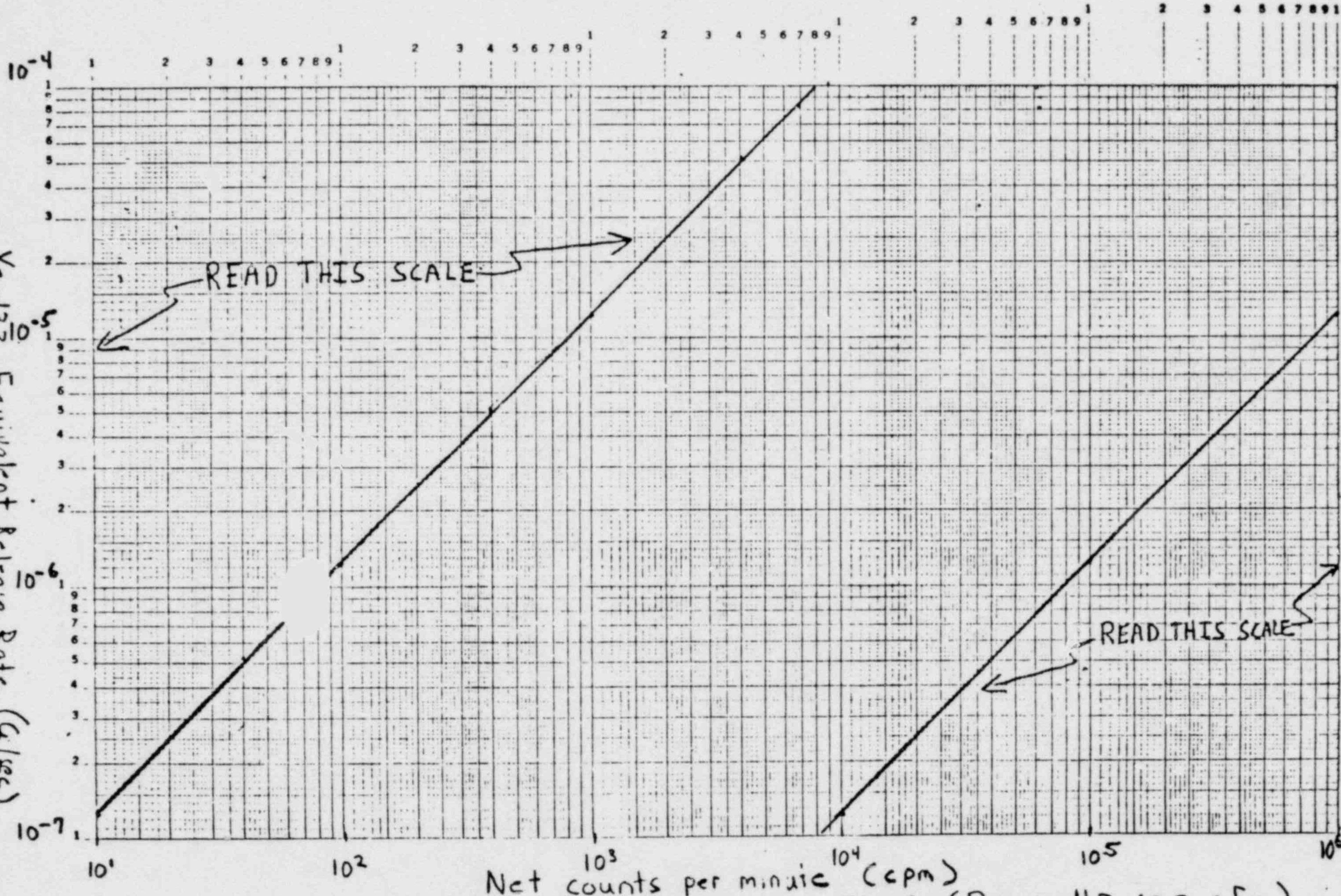
Date ______________

ATTACHMENT 1.3-1



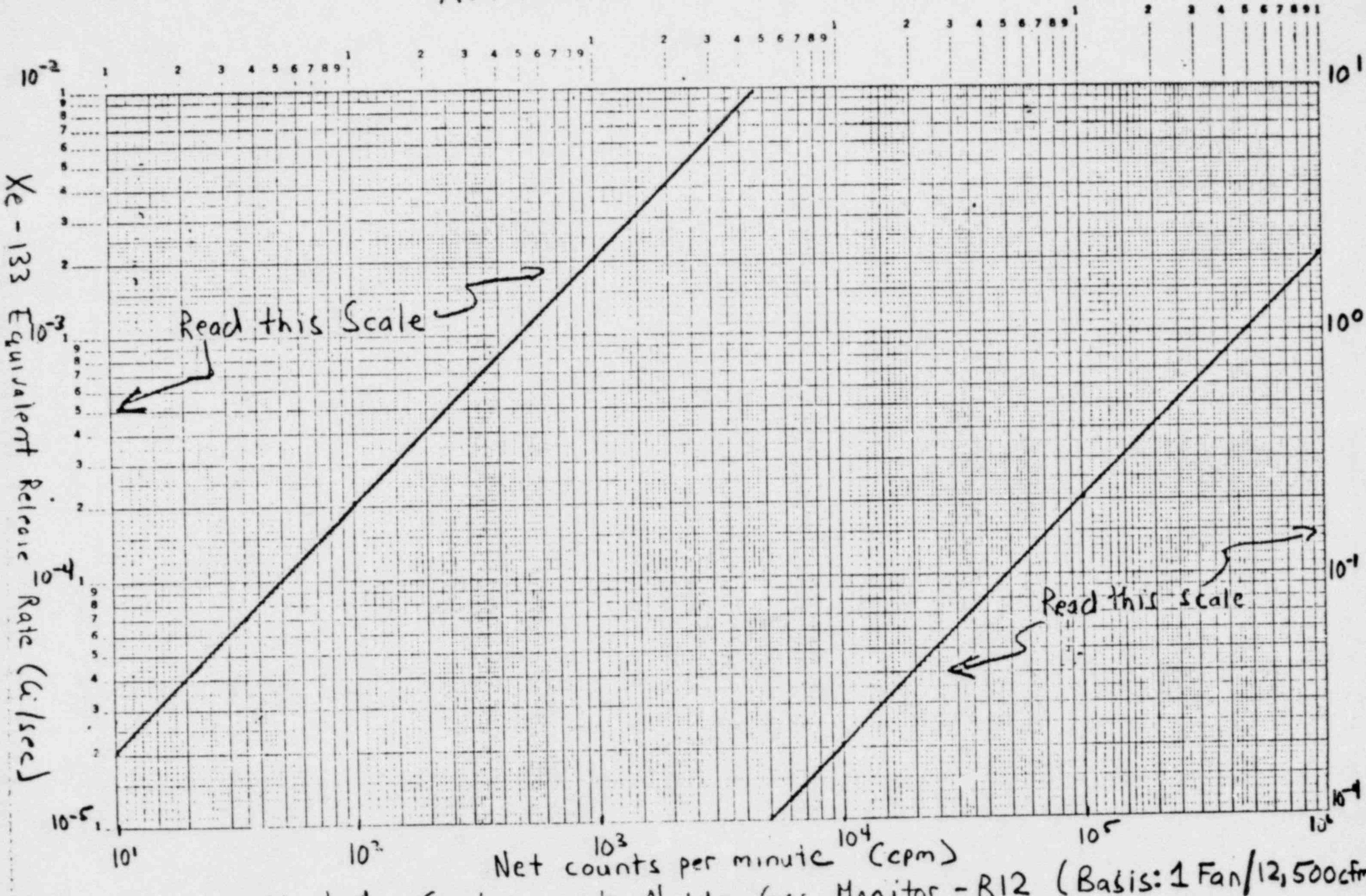
ATTACHMENT 1.3-1

ATTACHMENT 1.3-2



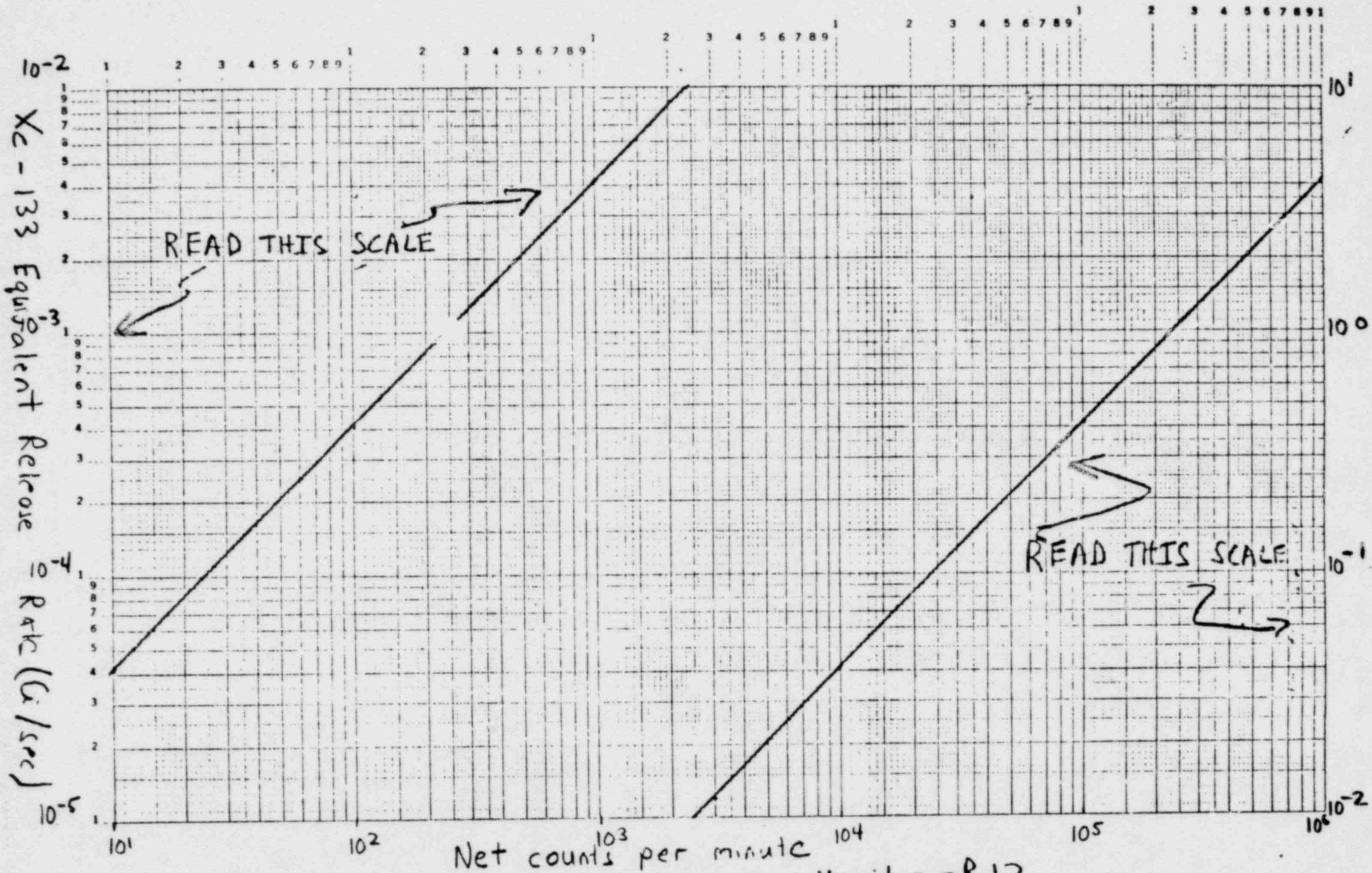
K&E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7522

ATTACHMENT 1.3-3



Unit 1 - Containment Noble Gas Monitor - R12 (Basis: 1 Fan/12,500 cfm)

ATTACHMENT 1.3-4

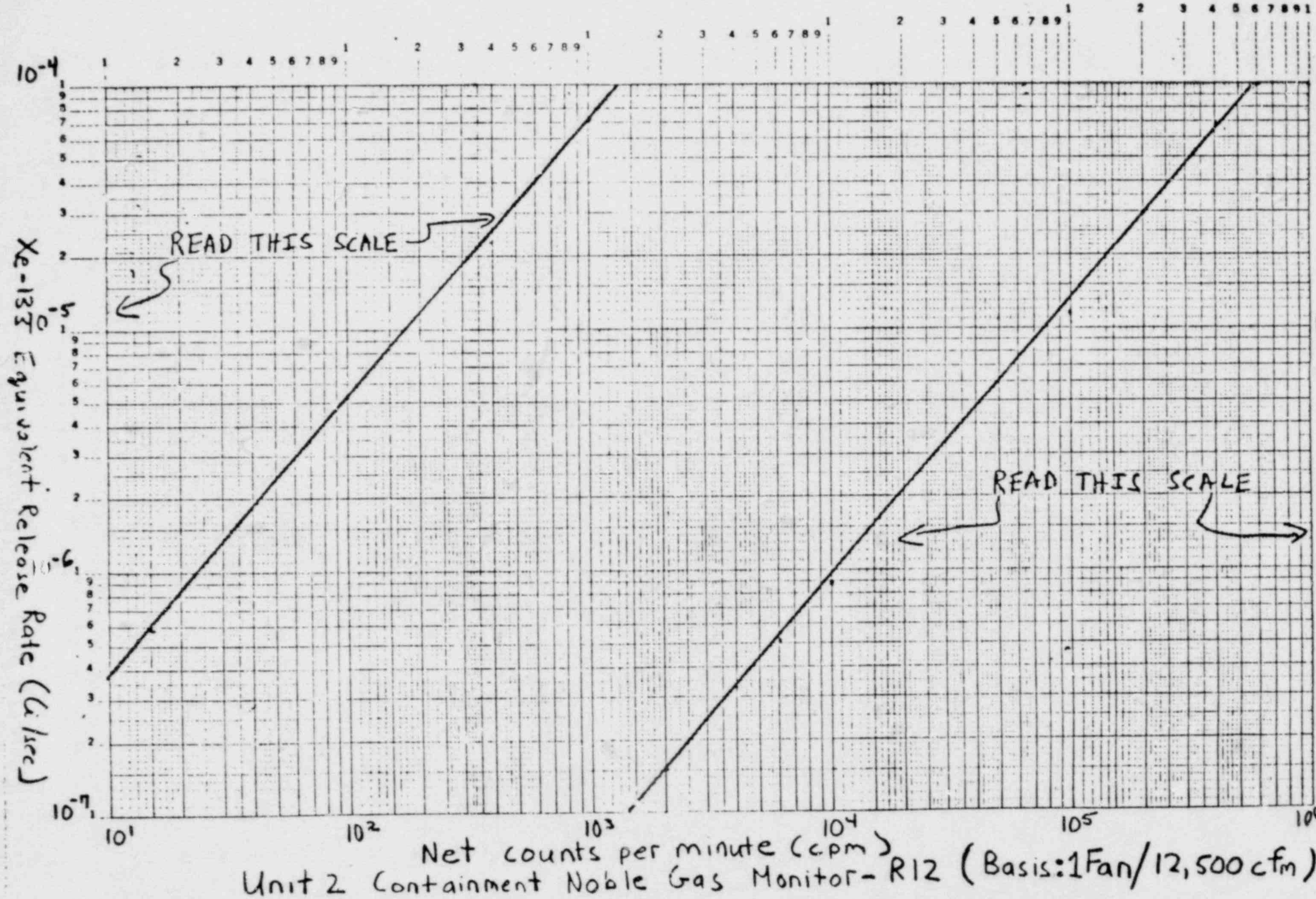


Unit 1 - Containment Noble Gas Monitor - R12

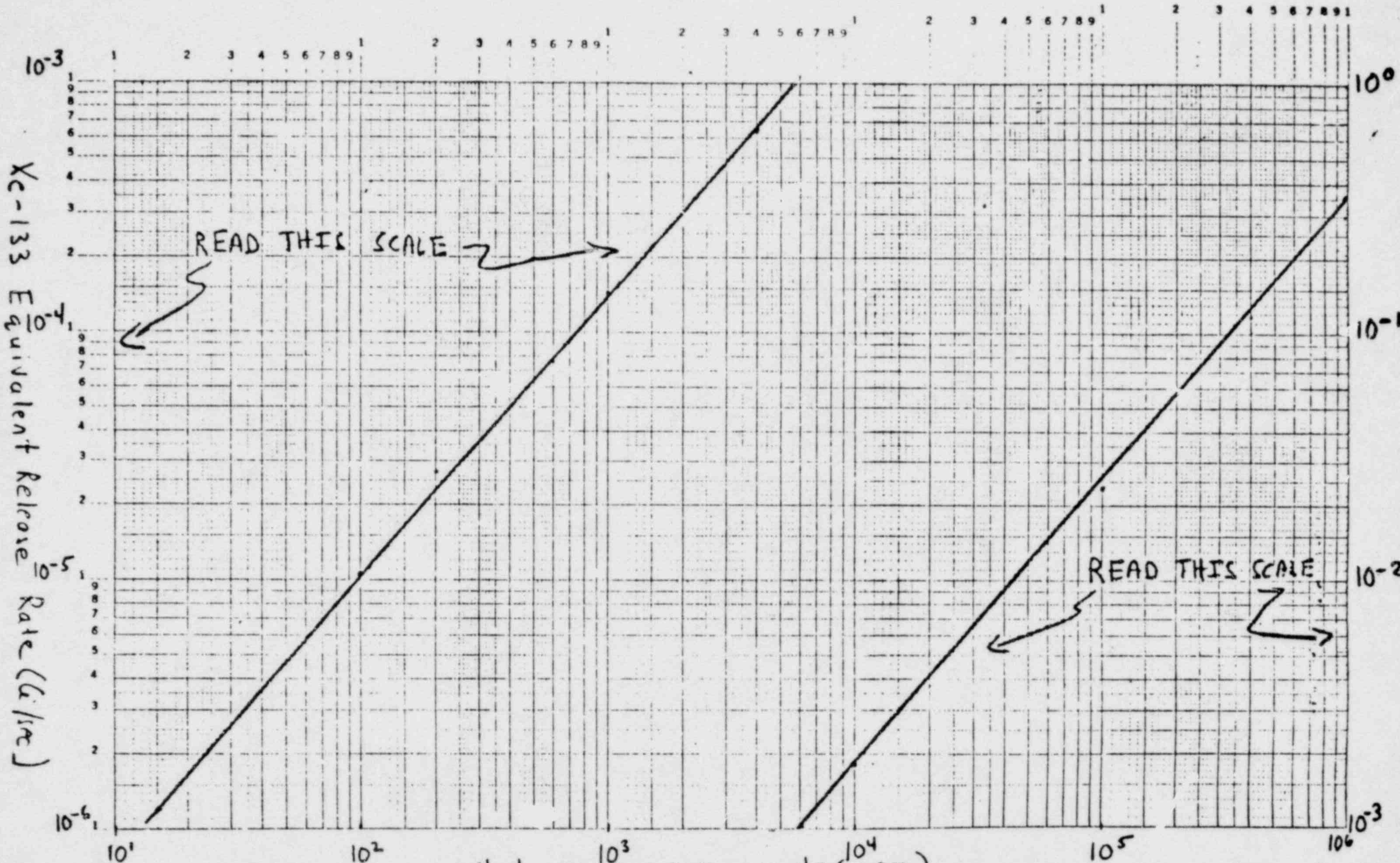
(Basis: 2 Fans / 25,000 cfm)

K+E LOGARITHMIC 3 x 3 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7522

ATTACHMENT 1.3-5

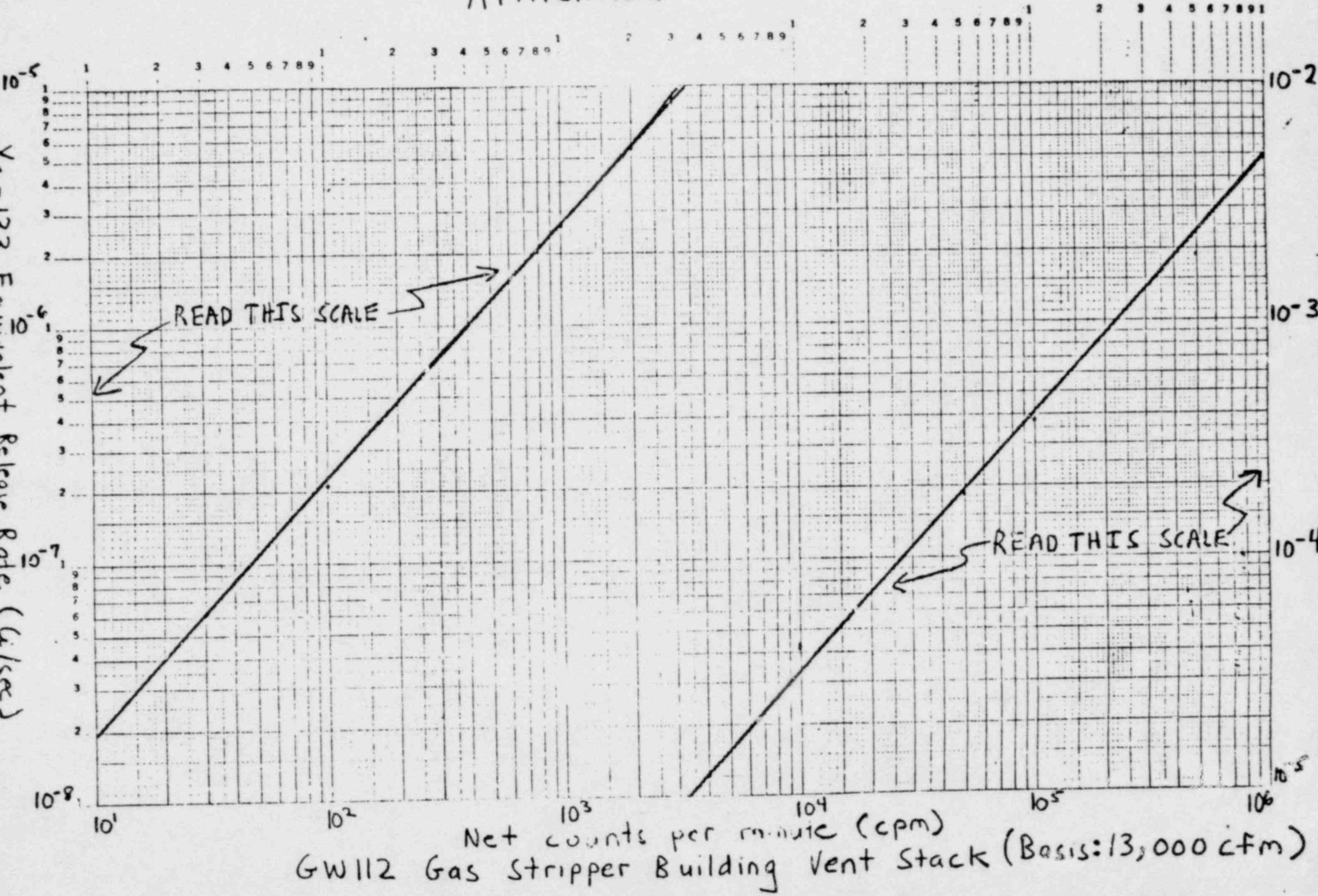


ATTACHMENT 1.3-6

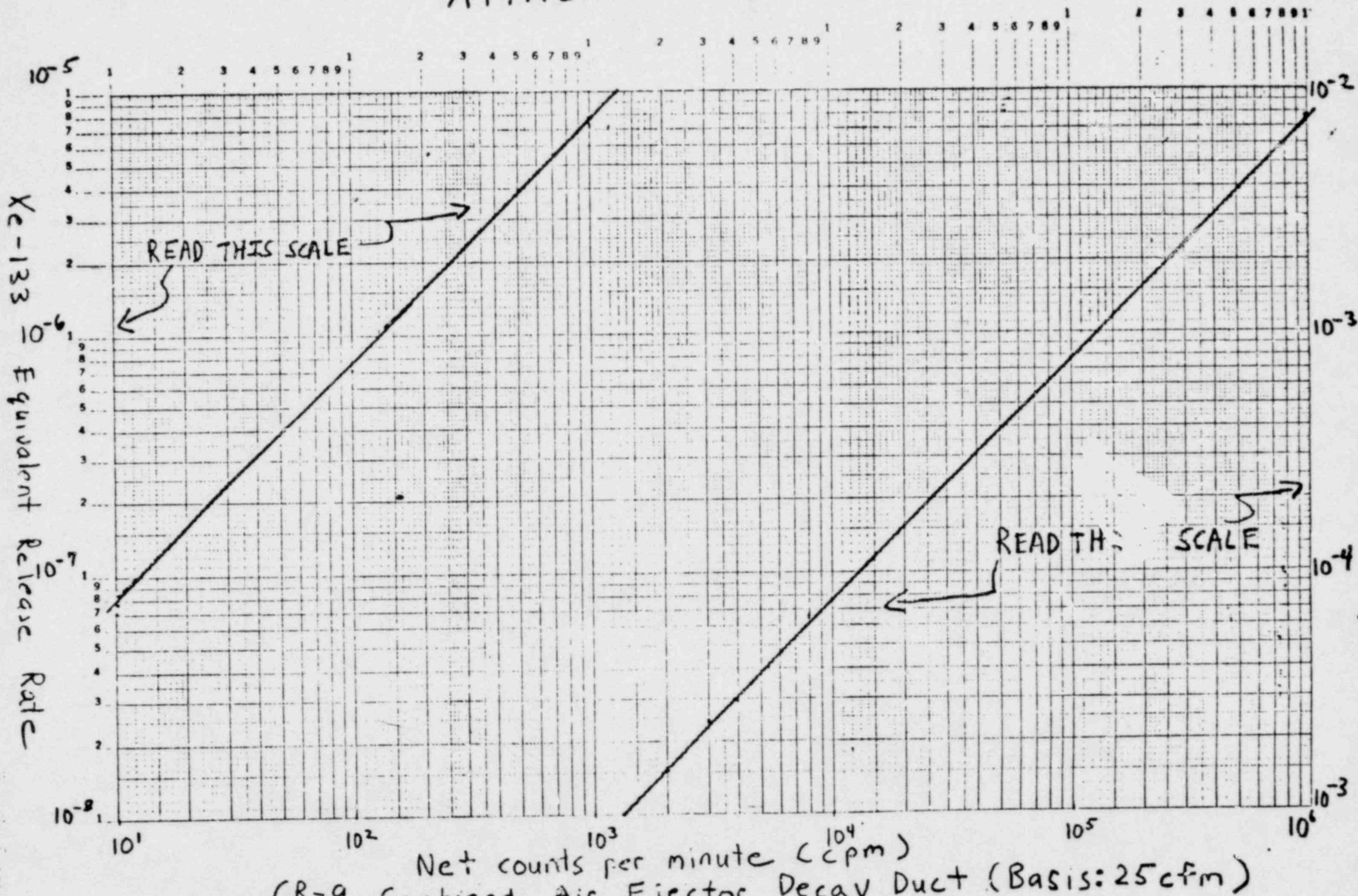


Unit 2 Containment Noble Gas Monitor - R12 (Basis: 2 Fans/25,000 cfm)

ATTACHMENT 1.3-7



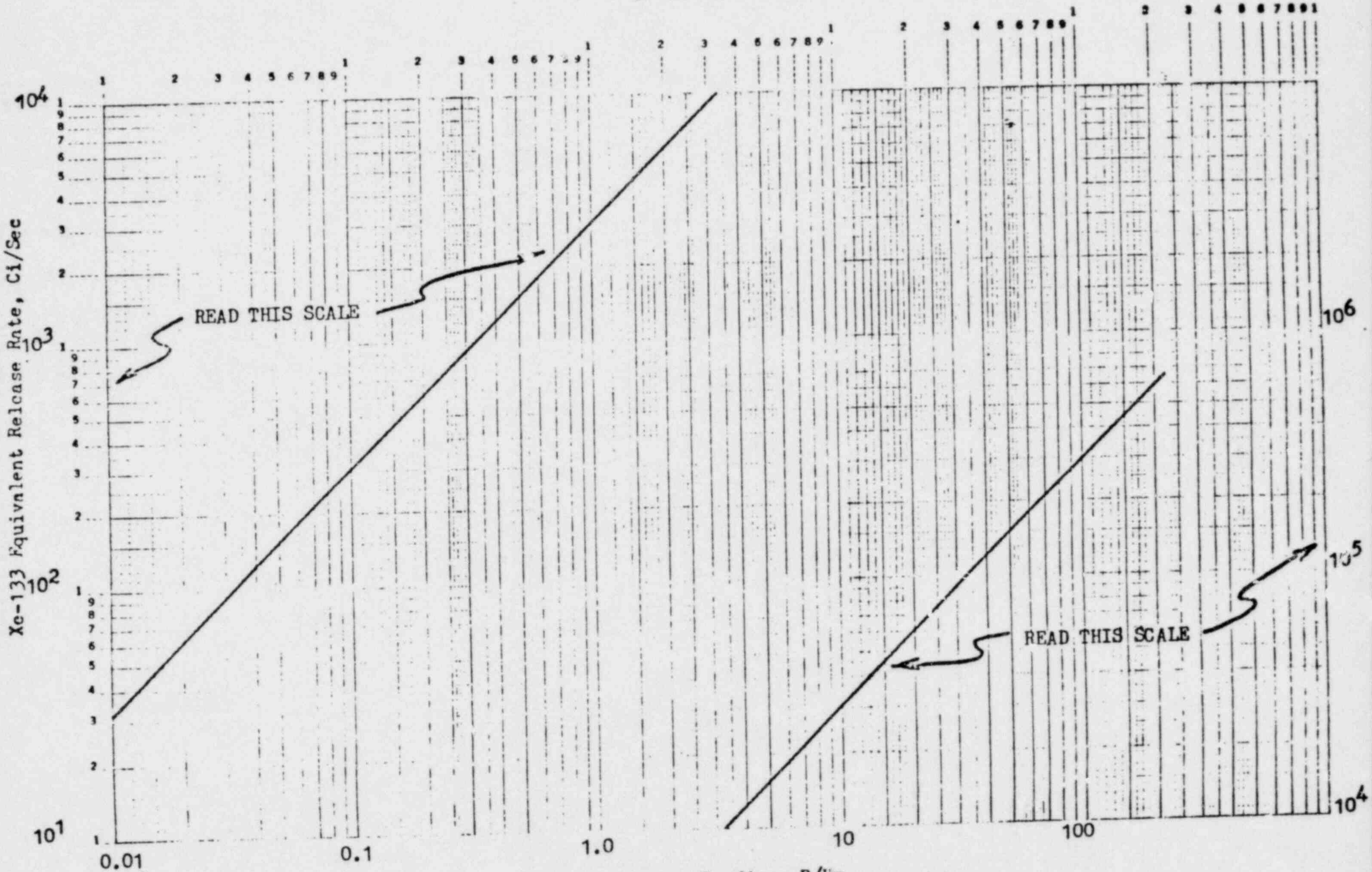
ATTACHMENT 1.3-8



K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7522

ATTACHMENT 1.3-9



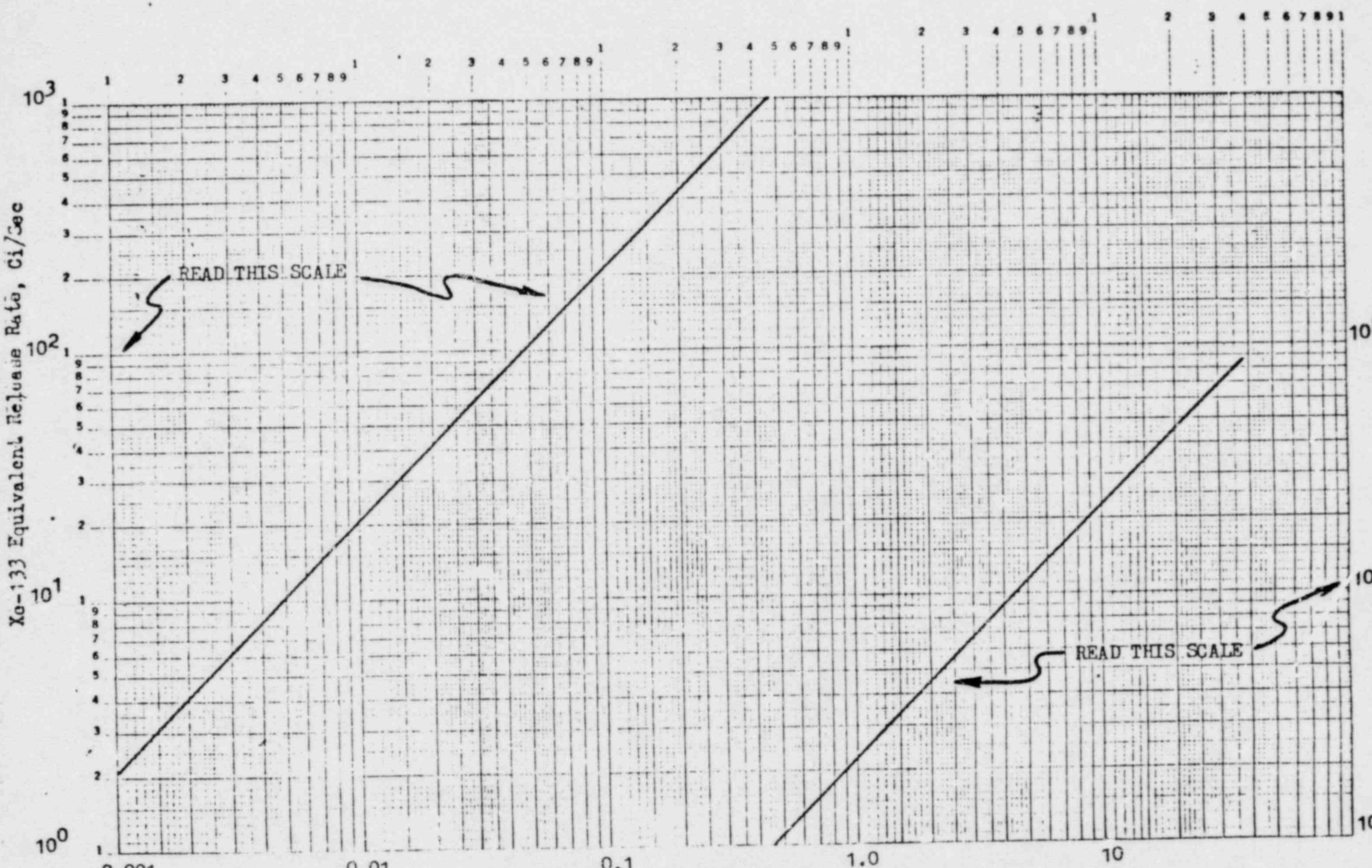
Meter Reading, R/Hr

Auxiliary Building Stack (61,400 cfm)

(Measurement at RADECO Pallet with an 8" x 8" x 9" Expansion Chamber)

K&E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7522

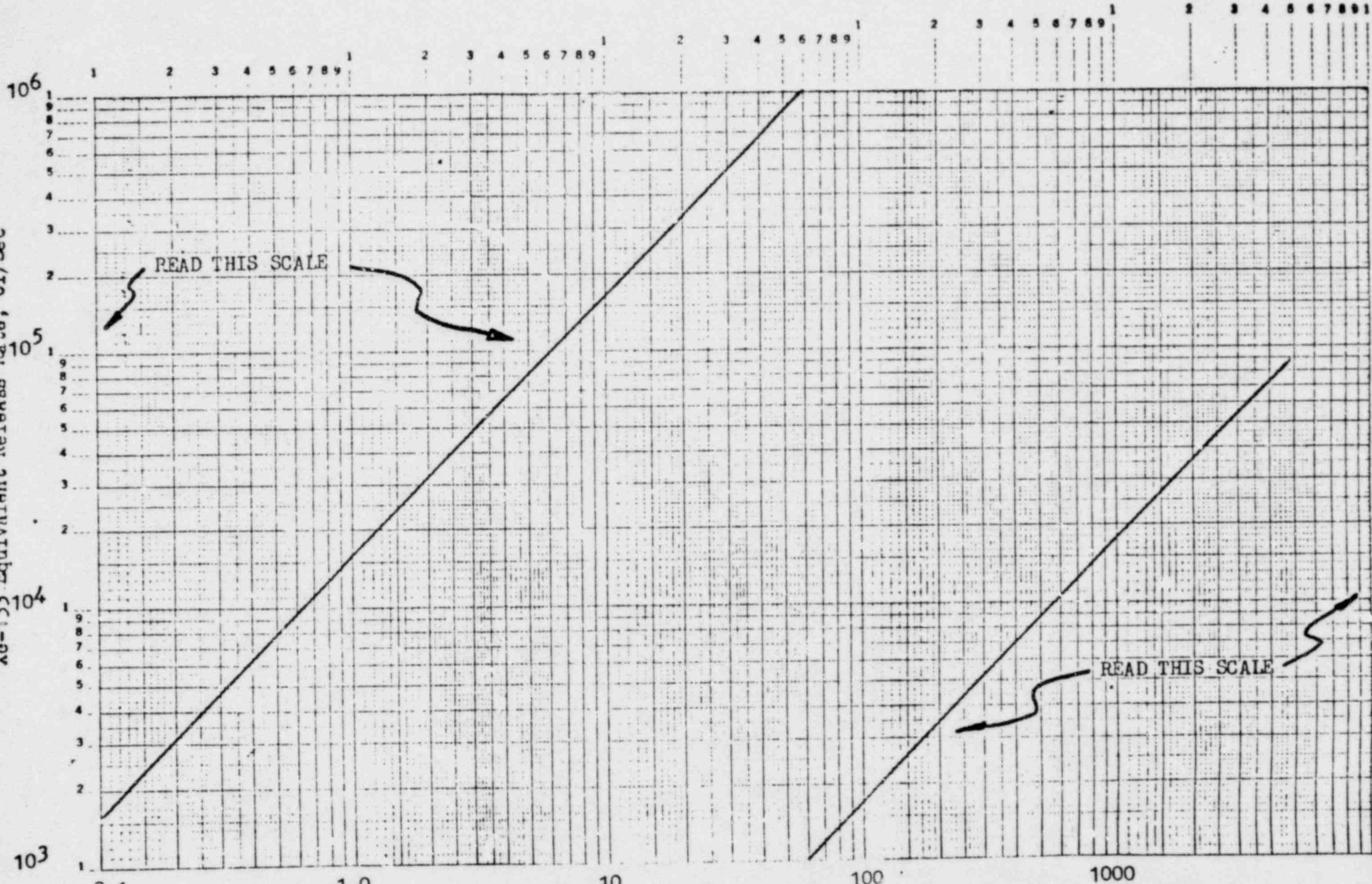
ATTACHMENT 1.3-10



Meter Reading, R/Hr
Drumming Area Stack (43,100 cfm)
(Measurement at RADECO Pallet with an 8" x 8" x 9" Expansion Chamber)

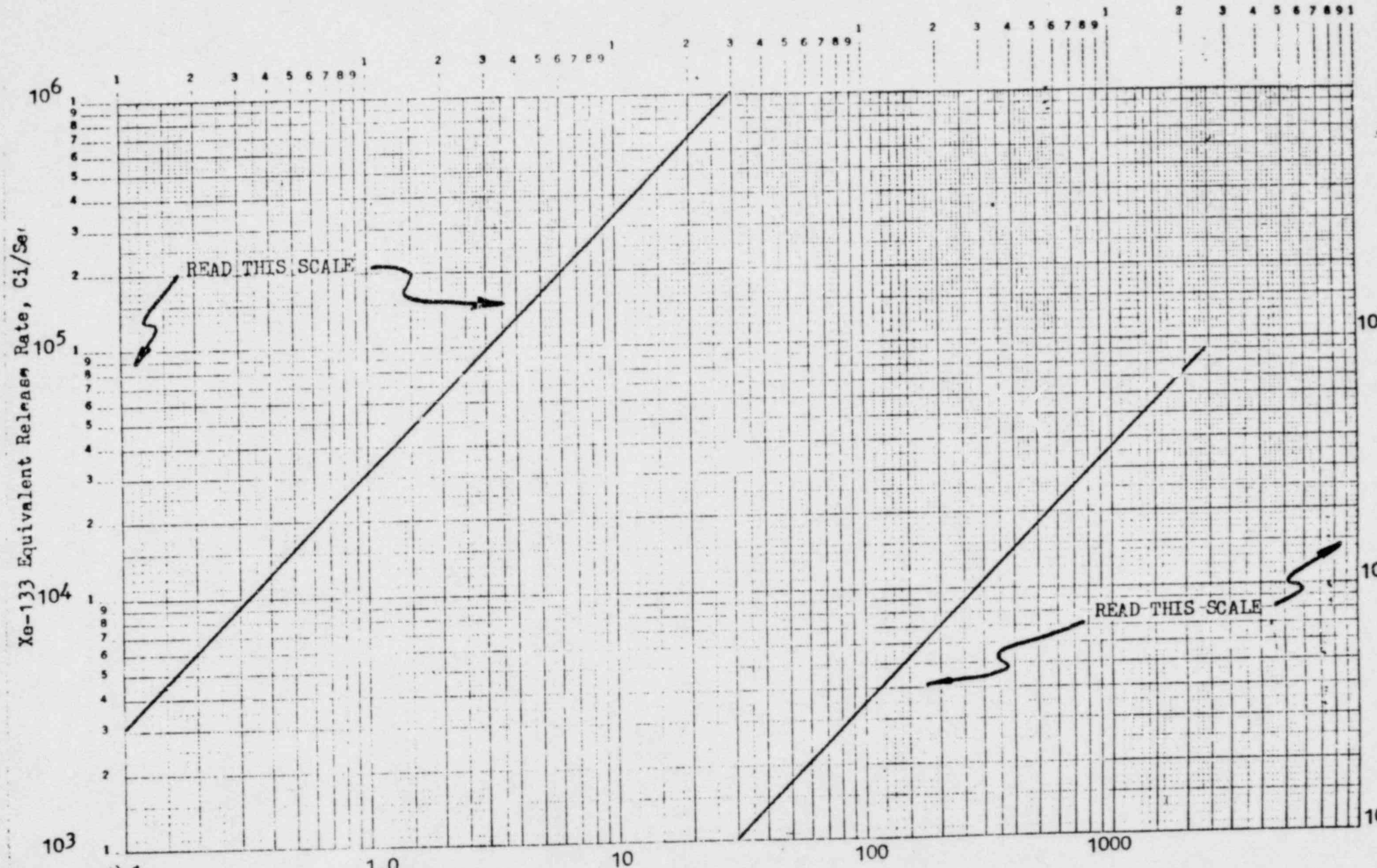
46 7522

ATTACHMENT 1.3-11



Meter Reading, R/Hr
Containment Purge Exhaust (1 Fan, 12,500 cfm)
(Measurement at 3/4" Containment Purge Line)

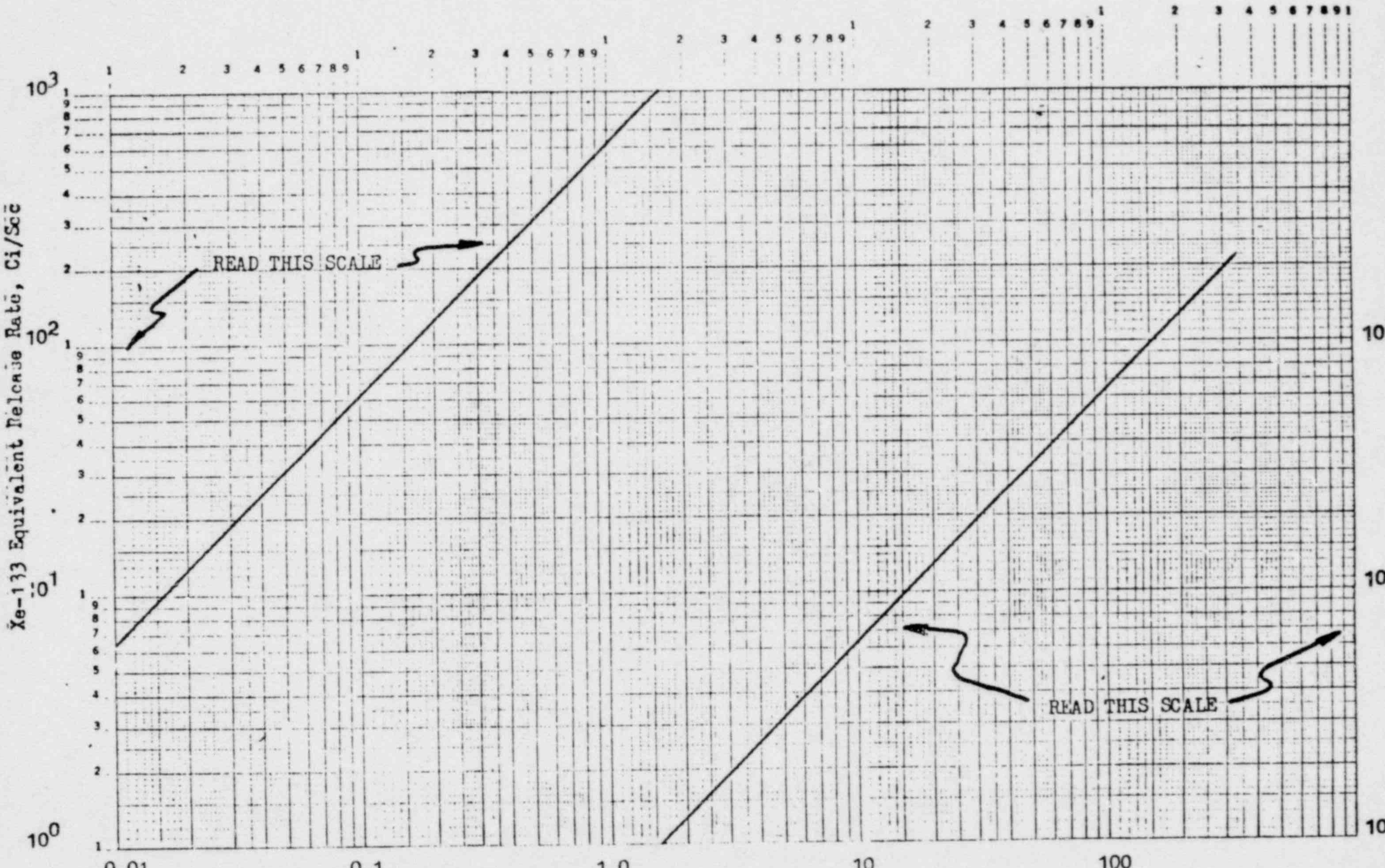
ATTACHMENT 1.3-12



Meter Reading, R/Hr
Containment Purge Exhaust (2 Fans, 25,000 cfm)
(Measurement at 3/4" Containment Purge Sample Line)

K&E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7522

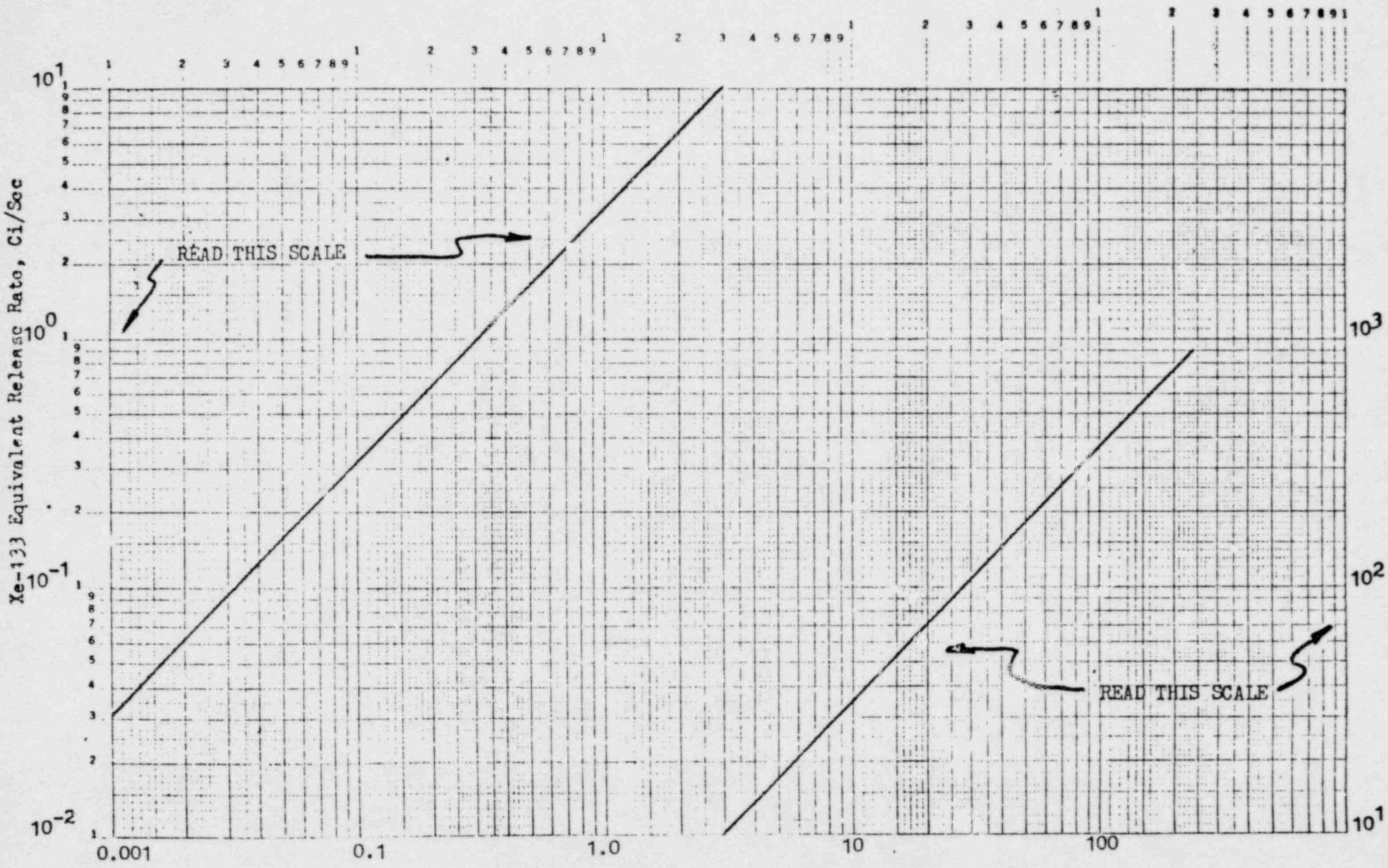
ATTACHMENT 1.3-13



Meter Reading, R/Hr
Gas Stripper Stack (13,000 cfm)
(Measurement at RADECO Pallet with an 8" x 8" x 9" Expansion Chamber)

K+E LOGARITHMIC x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7522

ATTACHMENT 1.3-14

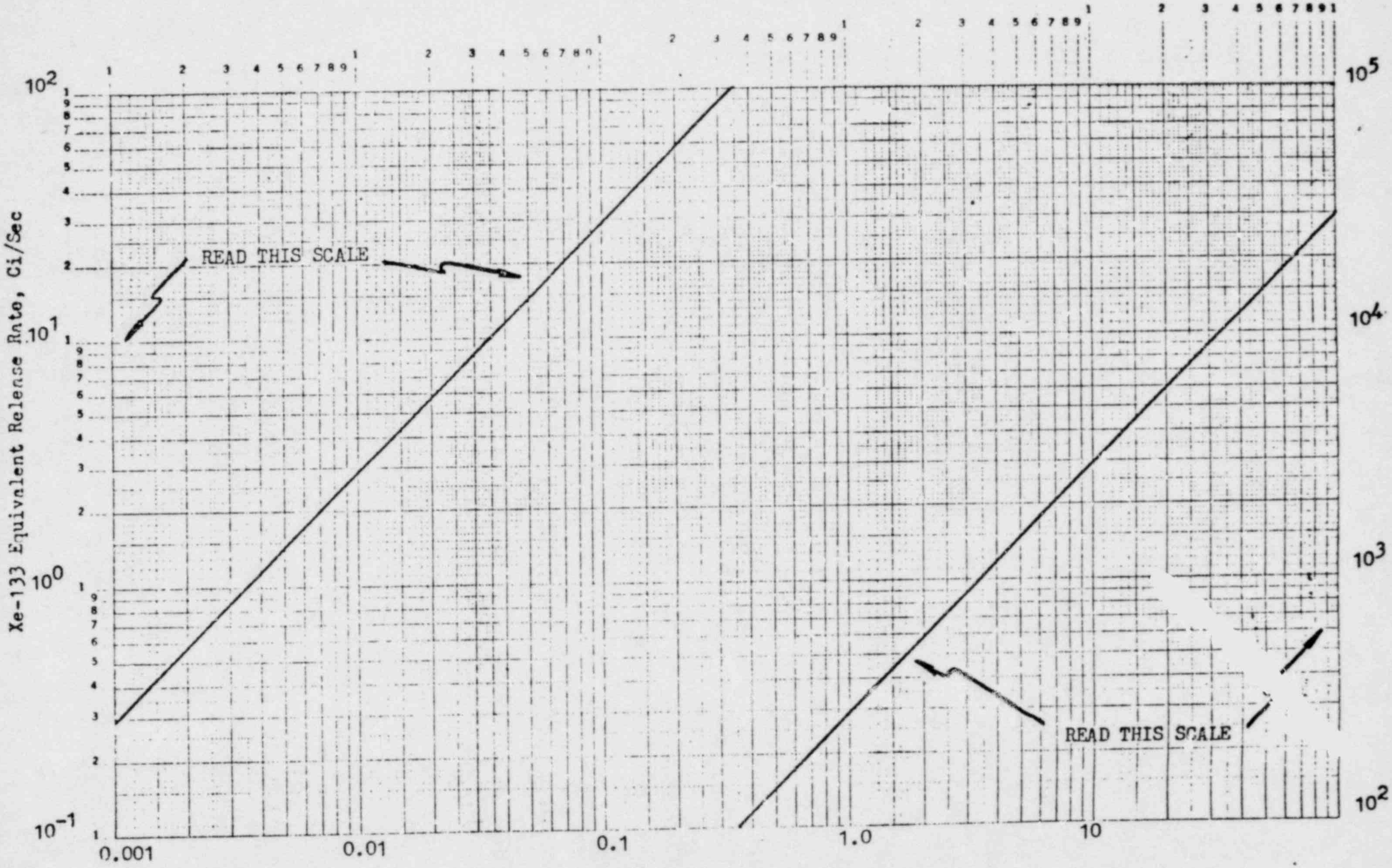


Meter Reading, R/Hr

Combined Air Ejector Decay Duct (25 cfm) (Measurement at 4" SCH 40 Exhaust Pipe)

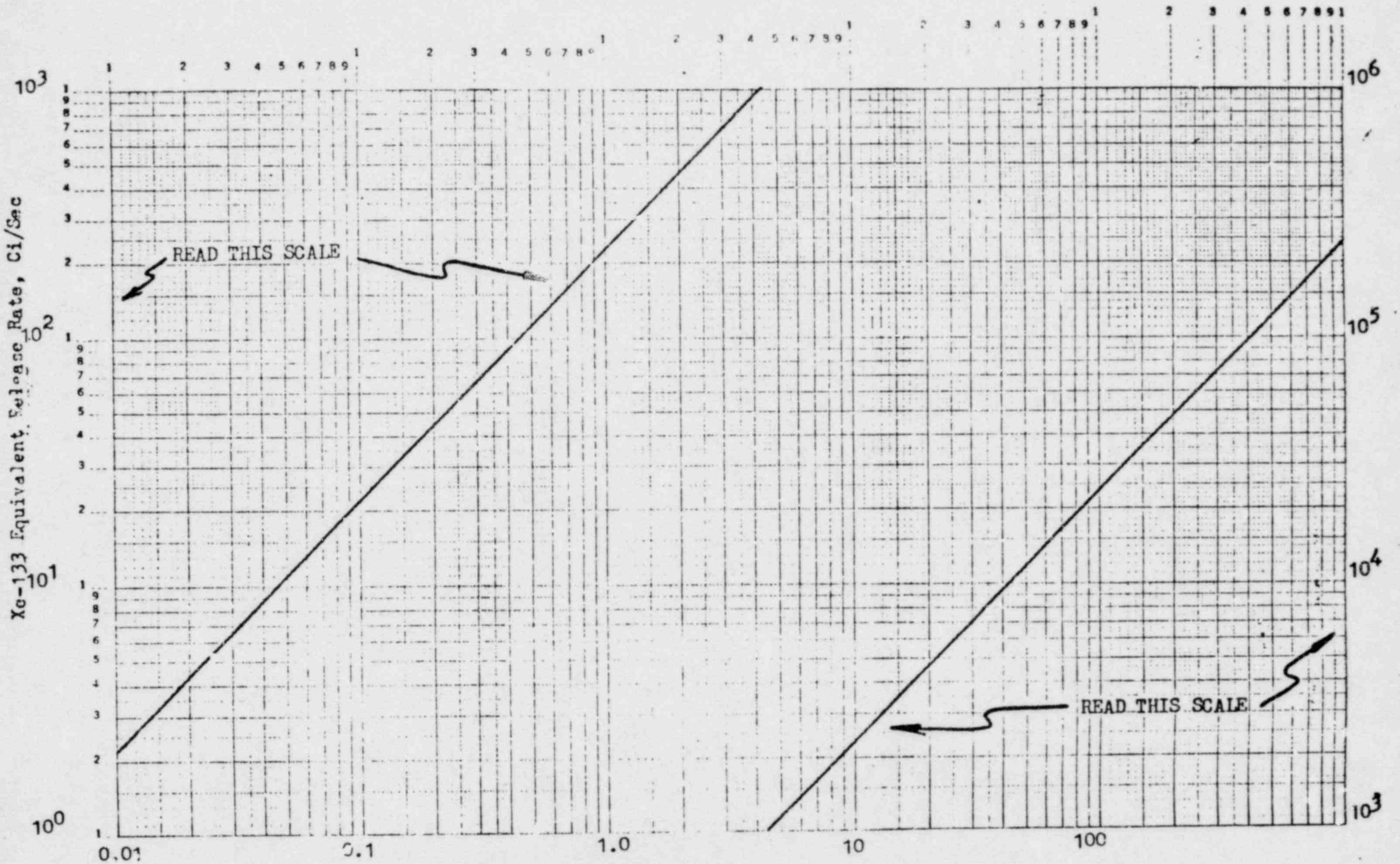
(If the measured flow is different a ratio of $\left(\frac{\text{Measured Flow}}{25\ \text{cfm}}\right)$ should be applied)

ATTACHMENT 1.3-15



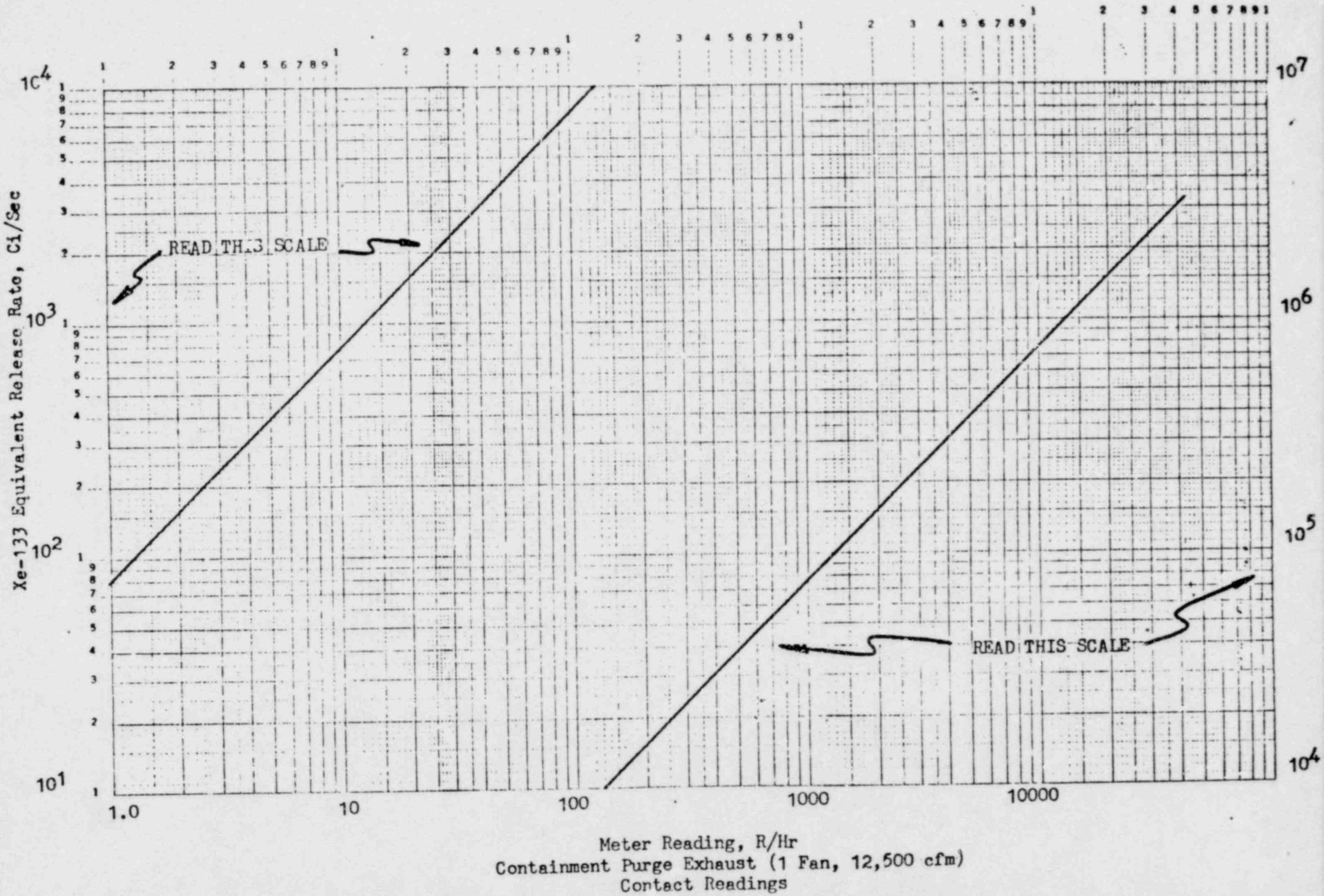
Meter Reading, R/Hr
Auxiliary Building Stack (61,400 cfm)
Contact Readings

ATTACHMENT 1.3-16

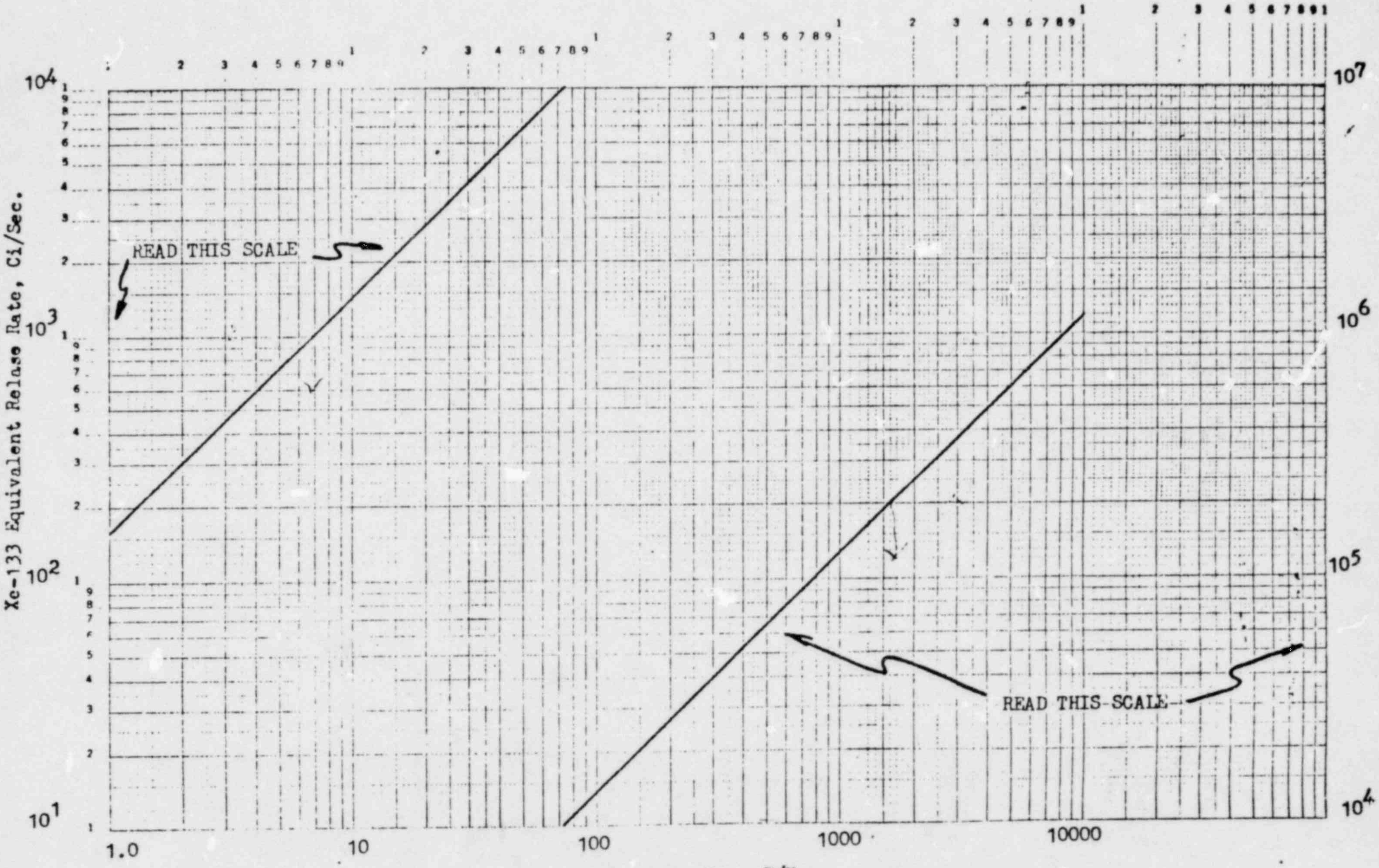


Meter Reading, R/Hr
Drumming Area Stack (43,100 cfm)
Contact Readings

ATTACHMENT 1.3-17

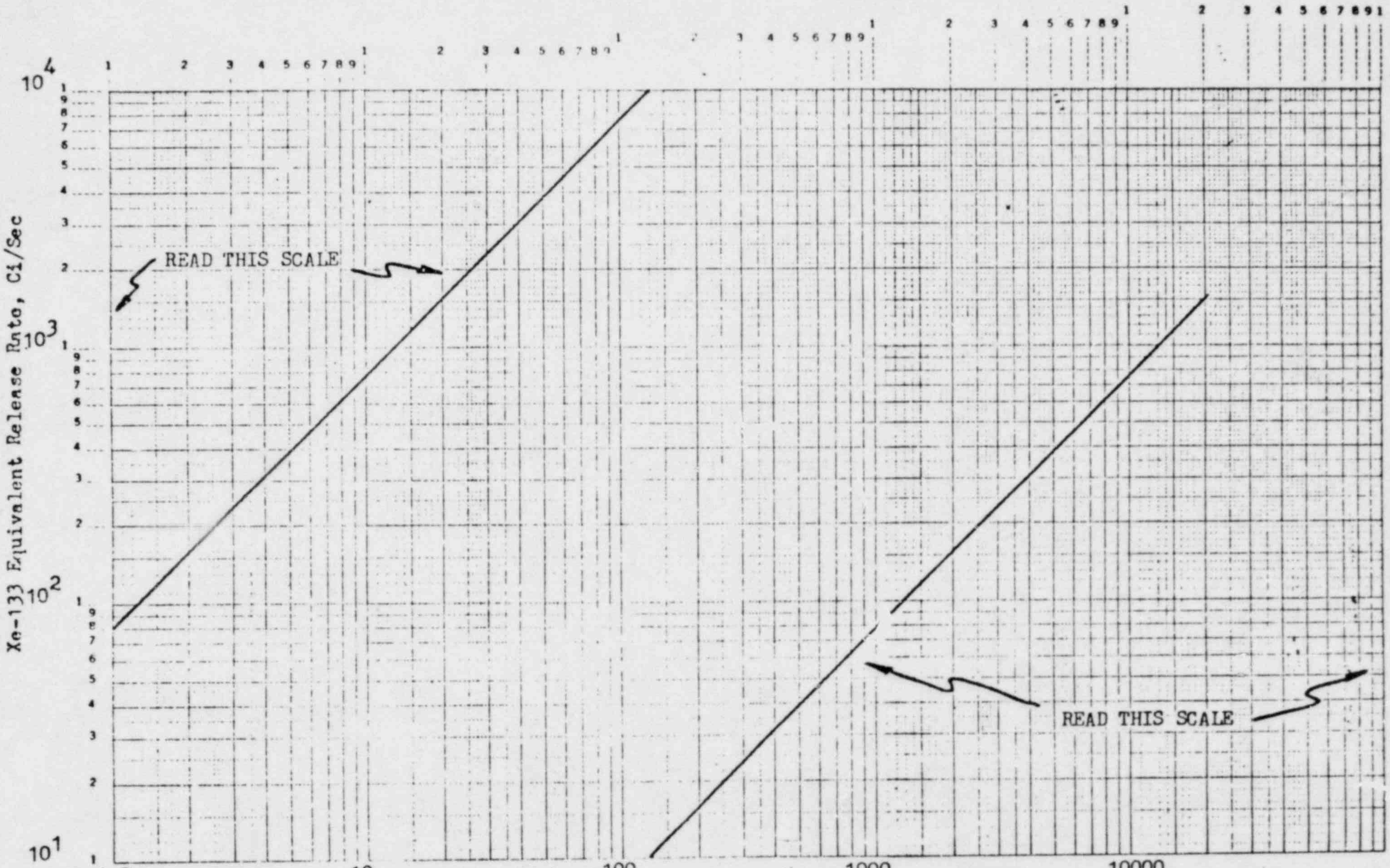


ATTACHMENT 1.3-18



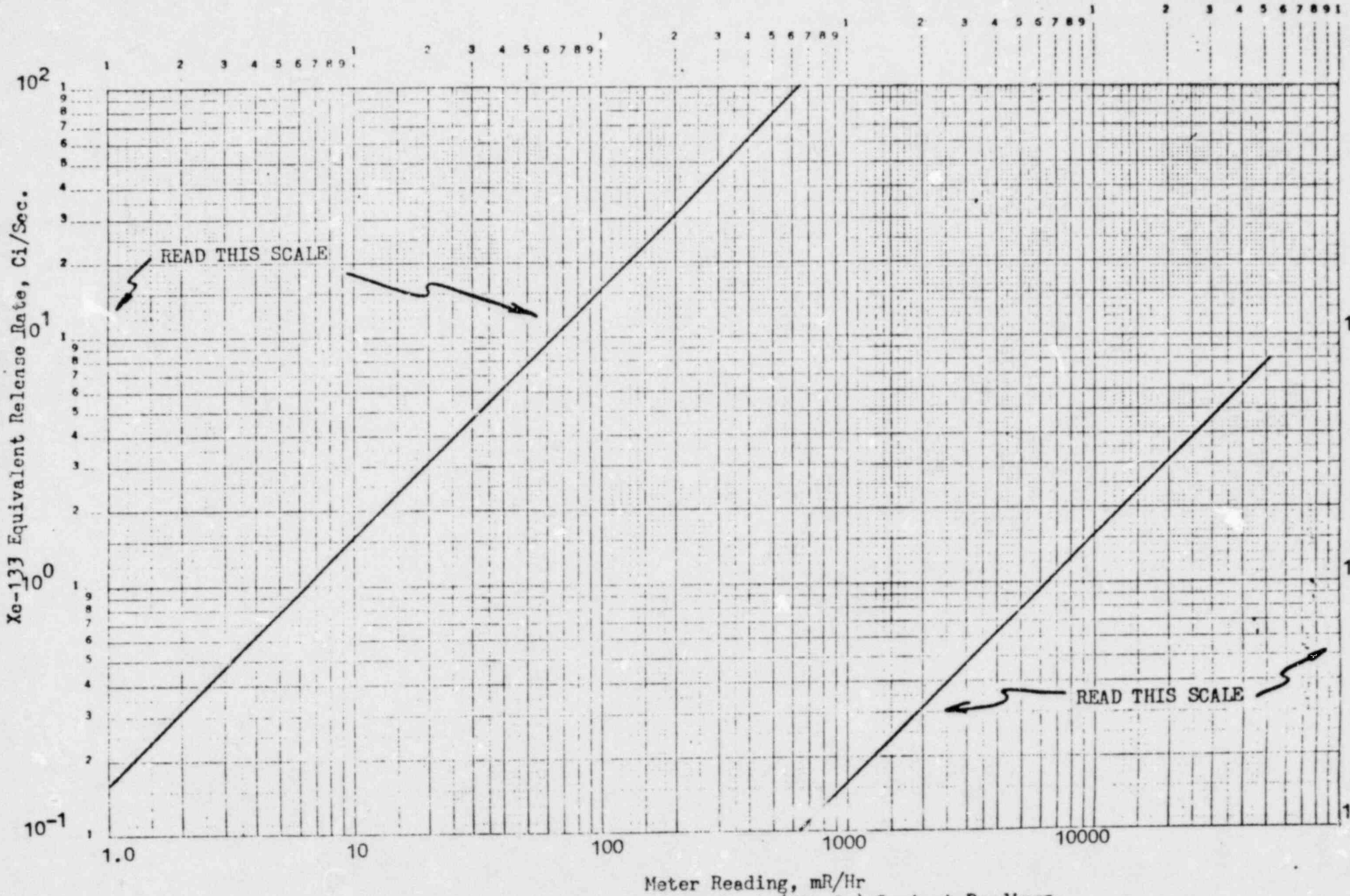
Meter Reading, R/Hr
Containment Purge Exhaust (2 Fans, 25,000 cfm)
Contact Readings

ATTACHMENT 1.3-19



Meter Reading, mR/Hr
Gas Stripper Stack (13,000 cfm)
Contact Readings

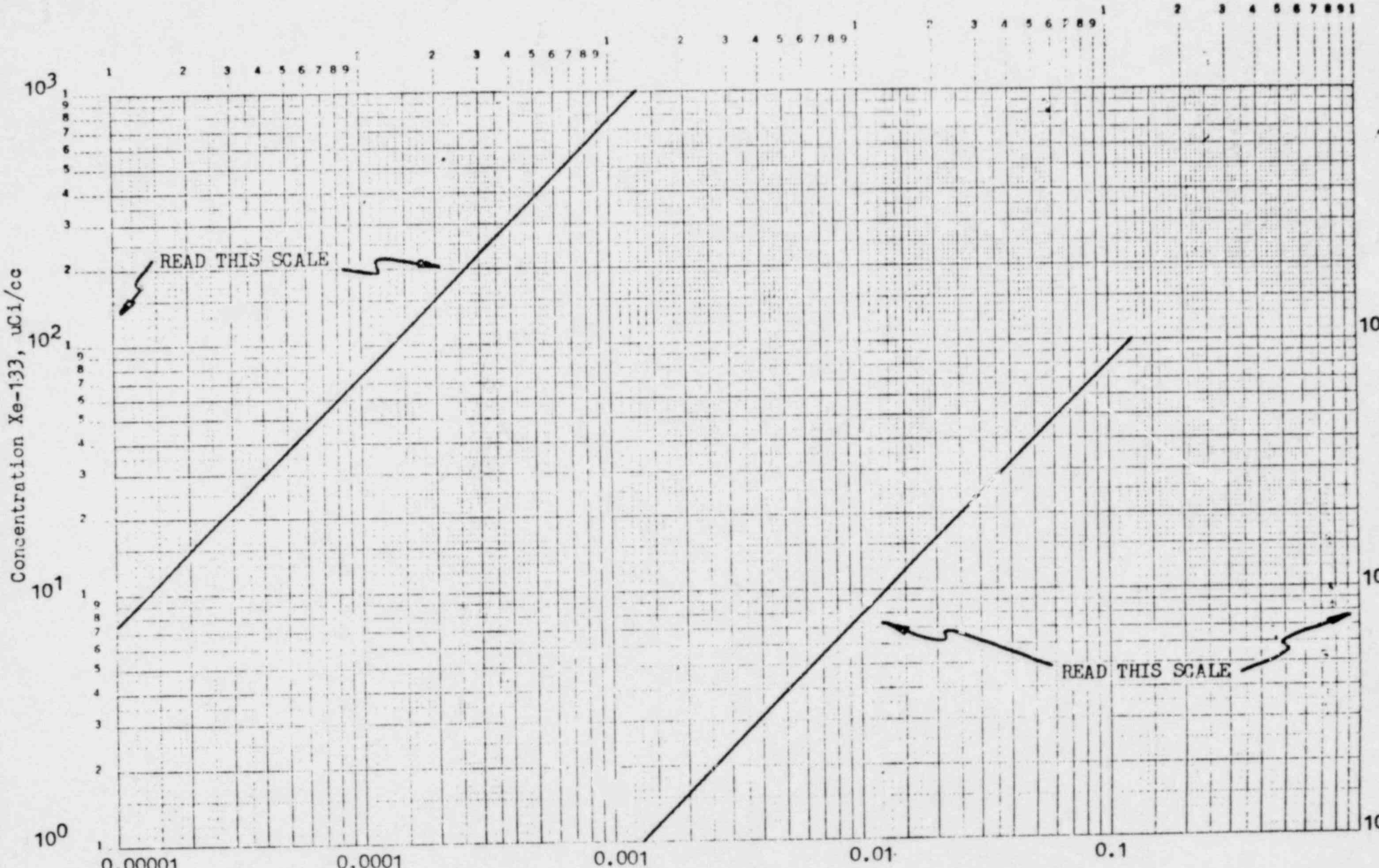
ATTACHMENT 1.3-20



Combined Air Ejector Decay Duct (25 cfm) Contact Readings

(If the measured flow is different a ratio of ($\frac{\text{measured flow}}{\text{25 cfm}}$) should be applied)

ATTACHMENT 1.3-21



Meter Reading, R/Hr
Main Steam Header
(Measurement at Steamline Safety Valve and Atmospheric Dump Valve Header)

RADIOLOGICAL DOSE EVALUATION

1.0 GENERAL

The purpose of this procedure is to provide a method to quickly estimate (1) X/Q using meteorological overlays, (2) thyroid and whole body dose using X/Q and (3) ground deposition using an approximation of D/Q.

2.0 REFERENCES

2.1 U. S. NRC Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Release of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Revision 1", October 19[illegible].

2.2 U. S. EPA, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents", EPA-520/1-75-001, September 1975. See Appendix D "Technical Bases for Methods that Estimate the Projected Thyroid Dose and Projected Whole Body Gamma Dose from Exposure to Airborne Radioiodines and Radioactive Noble Gases".

2.3 U. S. NRC Regulatory Guide 1.4, "Assumptions used for Evaluating the Potential Radiological Consequences of a Loss-of Coolant Accident for Pressurized Water Reactors", Revision 2, June 1976.

2.4 TID 14844, "Calculation of Distance Factors for Power and Test Reactor Sites", March 23, 1962.

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Ensure that all PBNP maps to be used by this procedure and their corresponding meteorological overlays are based on the same scale.

3.2 This procedure will be accompl[illegible]ed in the technical support center by a person designated by the Shift Supervisor or the Technical Support Manager. It will usually be done in conjunction with the Chemistry/Health Physics Supervisor when available.

4.0 INITIAL CONDITIONS

4.1 A release of airborne radioactivity has occurred or a release is anticipated.

4.2 An emergency or potential emergency condition is anticipated to have offsite dose consequences.

5.0 PROCEDURE

5.1 Determination of X/Q, Atmospheric Dispersion Factor

5.1.1 Obtain the following information from the indicated source and enter this data in the appropriate space on form EPIP-07 (attached).

Source	Data
EPIP-04	(a) wind speed in-mph
EPIP-04	(b) wind direction
EPIP-04	(c) time of reactor shutdown
EPIP-04	(d) time of release to containment
EPIP-04	(e) time of release from the plant
Health Physics or Operating logs or projected estimate	(f) duration or expected duration of the release in-hours
EPIP 1.3 results	(g) gross Xe-133 equivalent release rate in Ci/sec

5.1.2 Visually check cloud cover and incoming solar radiation. With this information, use Attachment 1.4-1 to ascertain the appropriate stability class. Enter the stability class (h), on form EPIP-07.

5.1.3 Place the overlay corresponding to the stability class on the map. Using the plant as a pivotal point, align the centerline of the overlay to the downwind direction from the plant.

5.1.4 Determine the distance, (i) mi. to the point on the map where a dose projection is desired. This would typically be a location for sampling or the exclusion area boundary. Enter description or designation (j) of this location on form EPIP-07. If the location is on a line, enter the Xu/Q (k) value for that line from the overlay on form EPIP-07. If the location is not on a line, move to the next inner-most line (toward the plant) and enter the Xu/Q (k) value for that line on form EPIP-07.

5.1.5 On Attachment 1.4-2 find the column headed by the Xu/Q (k) value just determined. Move down this column to the row corresponding to the wind speed, (a) mph noted earlier. Enter this value as X/Q (l) on form EPIP-07.

5.2 Whole Body Dose Estimate

NOTE: IF THE NOBLE GAS SOURCE TERM IS DETERMINED BY GRAB SAMPLE RESULTS WHICH GIVES AN INVENTORY OF SPECIFIC NUCLIDES, THEN A CONSERVATIVE WHOLE BODY DOSE ESTIMATE CAN BE MADE BY COMPLETING FORM EPIP-09.

5.2.1 Enter the gross Xe-133 equivalent release rate (g) on form EPIP-08 from form EPIP-07.

5.2.2 Enter the expected inhalation period, EIP, in hours (f) on form EPIP-08 from form EPIP-07.

5.2.3 Calculate the projected whole body dose on form EPIP-08 by using the equation:

$$D(\text{Rem}) = \overset{(1)}{X/Q\ (\text{sec/m}^3)} \times \overset{(g)}{Q\ (\text{Ci/sec})} \times Kr\ (\text{Rem m}^3/\text{Ci - Hrs}) \times EIP\ (\text{Hrs})$$

where:

D = whole body dose (Rem)

X/Q = atmospheric dispersion coefficient determined in Step 5.1.5 (sec/m^3) (1)

Q = release rate (Ci/sec)

Kr = Dose Factor $(\frac{\text{rem m}^3}{\text{Ci hrs}})$ Attachment 1.4-3

EIP = Expected Inhalation (Exposure) Period (Hours)

5.3 Thyroid Dose Estimate

5.3.1 Calculate the projected thryoid dose by using the whole body dose calculated in Section 5.2 of this procedure.

5.3.2 Record the projected whole body dose on form EPIP-08 in Section 2.

5.3.3 Choose the appropriate figure based upon the type of accident which has occurred.

a. Loss of Coolant Accident (LOCA) - Figure 1.4-1 and Figure 1.4-2.

b. Gap Activity Accident - Figure 1.4-3.

c. Fuel Handling Accident - Figure 1.4-4.

d. Steam Generator Tube Rupture - Figure 1.4-5.

NOTE: IF THE TYPE OF ACCIDENT IS UNKNOWN, USE THE LOCA FIGURES.

5.3.4 Obtain the ratio factor that relates the whole body dose to a thyroid dose from the figure chosen with the corresponding appropriate time after the accident and record on form EPIP-08, Section 2.

5.3.5 Calculate the projected thyroid dose my multiplying the whole body dose by the ratio factor obtained in Step 5.3.4 on form EPIP-08, Section 2.

5.4 <u>Radionuclide Ground Deposition Estimation</u>

NOTE: FORM EPIP-10 CAN BE COMPLETED ONLY IF IODINE GRAB SAMPLE RESULTS OR PARTICULATE RELEASE RATES ARE AVAILABLE. IF FORM EPIP-10 CANNOT BE COMPLETED, PROCEED WITH STEP 5.4.5 OF THIS SECTION.

5.4.1 Enter the I-131 equivalent release rate or the specific particulate release rate on form EPIP-10 from grab sample results or from environmental monitoring results.

5.4.2 Enter the duration of release expected inhalation period (f) from form EPIP-07 on form EPIP-10.

5.4.3 Enter the value of X/Q (1) on form EPIP-10 as determined in Step 5.1.5.

5.4.4 Complete Section 2 of form EPIP-10 to calculate the ground deposition using the equation:

$$\text{Dep } (\mu\text{Ci/m}^2) = \text{F} \times .05 \text{ (m/sec)} \times 3600 \text{ (sec/hr)} \times 10^6 \text{ } (\mu\text{Ci/Ci}) \times \text{X/Q (sec/m}^3) \times \text{Q (Ci/sec)} \times \text{EIP (hrs)}$$

$$\text{Dep} = \text{F} \times 1.8 \times 10^8 \times \underset{(1)}{\text{X/Q}} \times \underset{(g)}{\text{Q}} \times \underset{(f)}{\text{EIP}}$$

Dep = ground deposition (μCi/m^3)

X/Q = atmospheric dispersion factor from Step 5.1.5 (sec/m^3)

Q = radionuclide release rate (Ci/sec)

EIP = estimated release duration (hrs)

F = fraction of isotope subject to deposition (unitless)

3600 = conversion (sec/hr)

10^6 = conversion (μCi/Ci)

0.05 = assumed deposition velocity (m/sec)

5.4.5 Complete Section 1 of form EPIP-11 from available data and calculations just performed.

5.4.6 Enter the date and time of these calculations and sign form EPIP-11.

5.4.7 Forward completed attachments to the Technical Support Manager for review. The Technical Support Manager will relay results to the Site Manager.

ATTACHMENT 1.4-1

DETERMINATION OF ATMOSPHERIC STABILITY CLASS

Surface Wind Speed, (at 50 meters) mph	Day			Night	
	Incoming Solar Radiation			Thinly Overcast	
	Strong	Moderate	Slight	> 1/2 low cloud	< 1/2 cloud
< 4	A	A-B	B		
4-7	A-B	B	C	E	F
7-11	B	B-C	C	D	E
11-13	C	C-D	D	D	D
>13	C	D	D	D	D

The neutral class D, should be assumed for overcast conditions during day or night.

"Strong" incoming solar radiation corresponds to a solar altitude greater than 60° with clear skies; "slight" incoming solar radiation corresponds to a solar altitude from 15°-35° with clear skies. Cloudiness will decrease incoming solar radiation and should be considered along with solar altitude when determining solar radiation. Incoming radiation that would be strong with clear skies can be expected to reduce to moderate with broken (5/8 to 7/8 cloud cover) middle clouds and to slight with broken low clouds. Night refers to the period from one hour before sunset to one hour after sunrise.

ATTACHMENT 1.4-2

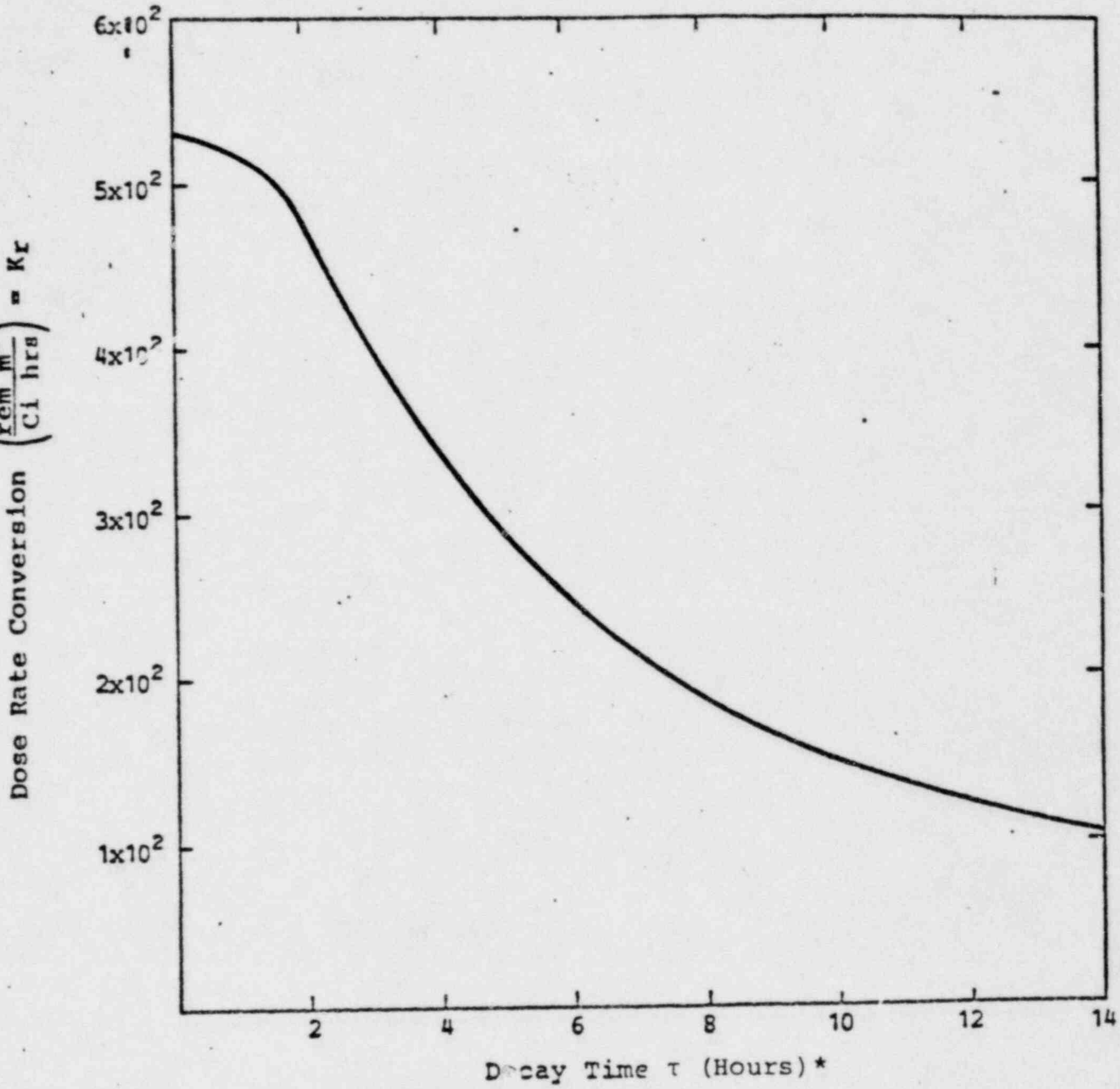
Xu/Q = [illegible] X [illegible] / MPH

MPH	2.5×10^{-5}	1.0×10^{-5}	7.5×10^{-6}	5.0×10^{-6}	2.5×10^{-6}	7.5×10^{-7}	5.0×10^{-7}	2.5×10^{-7}
1	5.6×10^{-5}	2.2×10^{-5}	1.7×10^{-5}	1.1×10^{-5}	5.6×10^{-6}	1.7×10^{-6}	1.1×10^{-6}	5.6×10^{-7}
2	2.8×10^{-5}	1.1×10^{-5}	8.4×10^{-6}	5.6×10^{-6}	2.8×10^{-6}	8.4×10^{-7}	5.6×10^{-7}	2.8×10^{-7}
3	1.9×10^{-5}	7.5×10^{-6}	5.6×10^{-6}	3.7×10^{-6}	1.9×10^{-6}	5.6×10^{-7}	3.7×10^{-7}	1.9×10^{-7}
4	1.4×10^{-5}	5.6×10^{-6}	4.2×10^{-6}	2.8×10^{-6}	1.4×10^{-6}	4.2×10^{-7}	2.8×10^{-7}	1.4×10^{-7}
5	1.1×10^{-5}	4.5×10^{-6}	3.4×10^{-6}	2.2×10^{-6}	1.1×10^{-6}	3.4×10^{-7}	2.2×10^{-7}	1.1×10^{-7}
6	9.3×10^{-6}	3.7×10^{-6}	2.8×10^{-6}	1.9×10^{-6}	9.3×10^{-7}	2.8×10^{-7}	1.9×10^{-7}	9.3×10^{-8}
7	8.0×10^{-5}	3.2×10^{-6}	2.4×10^{-6}	1.6×10^{-6}	8.0×10^{-7}	2.4×10^{-7}	1.6×10^{-7}	8.0×10^{-8}
8	7.0×10^{-6}	2.8×10^{-6}	2.1×10^{-6}	1.4×10^{-6}	7.0×10^{-7}	2.1×10^{-7}	1.4×10^{-7}	7.0×10^{-8}
9	6.2×10^{-6}	2.5×10^{-6}	1.9×10^{-6}	1.2×10^{-6}	6.2×10^{-7}	1.9×10^{-7}	1.2×10^{-7}	6.2×10^{-8}
10	5.6×10^{-6}	2.2×10^{-6}	1.7×10^{-6}	1.1×10^{-6}	5.6×10^{-7}	1.7×10^{-7}	1.1×10^{-7}	5.6×10^{-8}
11	5.1×10^{-6}	2.0×10^{-6}	1.5×10^{-6}	1.0×10^{-6}	5.1×10^{-7}	1.5×10^{-7}	1.0×10^{-8}	5.1×10^{-8}
12	4.7×10^{-6}	1.9×10^{-6}	1.4×10^{-6}	9.2×10^{-7}	4.7×10^{-7}	1.4×10^{-7}	9.2×10^{-8}	4.7×10^{-8}
13	4.3×10^{-6}	1.7×10^{-6}	1.3×10^{-6}	8.6×10^{-7}	4.3×10^{-7}	1.3×10^{-7}	8.6×10^{-8}	4.3×10^{-8}
14	4.0×10^{-6}	1.6×10^{-6}	1.2×10^{-6}	8.0×10^{-7}	4.0×10^{-7}	1.2×10^{-7}	8.0×10^{-8}	4.0×10^{-8}
15	3.7×10^{-6}	1.5×10^{-6}	1.1×10^{-6}	7.5×10^{-7}	3.7×10^{-7}	1.1×10^{-7}	7.5×10^{-8}	3.7×10^{-8}
16	3.5×10^{-6}	1.4×10^{-6}	1.0×10^{-6}	7.0×10^{-7}	3.5×10^{-7}	1.0×10^{-7}	7.0×10^{-8}	3.5×10^{-8}
17	3.3×10^{-6}	1.3×10^{-6}	9.9×10^{-7}	6.6×10^{-7}	3.3×10^{-7}	9.9×10^{-8}	6.6×10^{-8}	3.3×10^{-8}
18	3.1×10^{-6}	1.2×10^{-6}	9.3×10^{-7}	6.2×10^{-7}	3.1×10^{-7}	9.3×10^{-8}	6.2×10^{-8}	3.1×10^{-8}
19	2.9×10^{-6}	1.2×10^{-6}	8.8×10^{-7}	5.9×10^{-7}	2.9×10^{-7}	8.8×10^{-8}	5.9×10^{-8}	2.9×10^{-8}
20	2.8×10^{-6}	1.1×10^{-7}	8.4×10^{-7}	5.6×10^{-7}	2.8×10^{-7}	8.4×10^{-8}	5.6×10^{-8}	2.8×10^{-8}
25	2.2×10^{-6}	8.9×10^{-7}	6.7×10^{-7}	4.5×10^{-7}	2.2×10^{-7}	6.7×10^{-8}	4.5×10^{-8}	2.2×10^{-8}
30	1.9×10^{-6}	7.5×10^{-7}	5.6×10^{-7}	3.7×10^{-7}	1.9×10^{-7}	5.6×10^{-8}	3.7×10^{-8}	1.9×10^{-8}
35	1.6×10^{-6}	6.4×10^{-7}	4.8×10^{-7}	3.2×10^{-7}	1.6×10^{-7}	4.8×10^{-8}	3.2×10^{-9}	1.6×10^{-8}
40	1.4×10^{-6}	5.6×10^{-7}	4.2×10^{-7}	2.8×10^{-7}	1.4×10^{-7}	4.2×10^{-8}	2.8×10^{-8}	1.4×10^{-8}

ATTACHMENT 1.4-2 (Cont)

Xu/Q

MPH	1.0 X 10^{-7}	5.0 X 10^{-8}	1.0 X 10^{-8}	7.5 X 10^{-9}	5.0 X 10^{-9}	2.5 X 10^{-9}	1.0 X 10^{-9}
1	2.2 X 10^{-7}	1.1 X 10^{-7}	2.2 X 10^{-8}	1.7 X 10^{-8}	1.1 X 10^{-9}	5.6 X 10^{-9}	2.2 X 10^{-9}
2	1.1 X 10^{-7}	5.6 X 10^{-8}	1.1 X 10^{-8}	8.4 X 10^{-9}	5.6 X 10^{-9}	2.8 X 10^{-9}	1.1 X 10^{-9}
3	7.5 X 10^{-8}	3.7 X 10^{-8}	7.5 X 10^{-9}	5.6 X 10^{-9}	3.7 X 10^{-9}	1.9 X 10^{-9}	7.5 X 10^{-10}
4	5.6 X 10^{-8}	2.8 X 10^{-8}	5.6 X 10^{-9}	4.2 X 10^{-9}	2.8 X 10^{-9}	1.4 X 10^{-9}	5.6 X 10^{-10}
5	4.5 X 10^{-8}	2.2 X 10^{-8}	4.5 X 10^{-9}	3.4 X 10^{-9}	2.2 X 10^{-9}	1.1 X 10^{-9}	4.5 X 10^{-10}
6	3.7 X 10^{-8}	1.9 X 10^{-8}	3.7 X 10^{-9}	2.8 X 10^{-9}	1.9 X 10^{-9}	9.3 X 10^{-10}	3.7 X 10^{-10}
7	3.2 X 10^{-8}	1.6 X 10^{-8}	3.2 X 10^{-9}	2.4 X 10^{-9}	1.6 X 10^{-9}	8.0 X 10^{-10}	3.2 X 10^{-10}
8	2.8 X 10^{-8}	1.4 X 10^{-8}	2.8 X 10^{-9}	2.1 X 10^{-9}	1.4 X 10^{-9}	7.0 X 10^{-10}	2.8 X 10^{-10}
9	2.5 X 10^{-8}	1.2 X 10^{-8}	2.5 X 10^{-9}	1.9 X 10^{-9}	1.2 X 10^{-9}	6.2 X 10^{-10}	2.5 X 10^{-10}
10	2.2 X 10^{-8}	1.1 X 10^{-8}	2.2 X 10^{-9}	1.7 X 10^{-9}	1.1 X 10^{-9}	5.6 X 10^{-10}	2.2 X 10^{-10}
11	2.0 X 10^{-8}	1.0 X 10^{-8}	2.0 X 10^{-9}	1.5 X 10^{-9}	1.0 X 10^{-9}	5.1 X 10^{-10}	2.0 X 10^{-10}
12	1.9 X 10^{-8}	9.2 X 10^{-9}	1.9 X 10^{-9}	1.4 X 10^{-9}	9.2 X 10^{-10}	4.7 X 10^{-10}	1.9 X 10^{-10}
13	1.7 X 10^{-8}	8.6 X 10^{-9}	1.7 X 10^{-9}	1.3 X 10^{-9}	8.6 X 10^{-10}	4.3 X 10^{-10}	1.7 X 10^{-10}
14	1.6 X 10^{-8}	8.0 X 10^{-9}	1.6 X 10^{-9}	1.2 X 10^{-9}	8.0 X 10^{-10}	4.0 X 10^{-10}	1.6 X 10^{-10}
15	1.5 X 10^{-8}	7.5 X 10^{-9}	1.5 X 10^{-9}	1.1 X 10^{-9}	7.5 X 10^{-10}	3.7 X 10^{-10}	1.5 X 10^{-10}
16	1.4 X 10^{-8}	7.0 X 10^{-9}	1.4 X 10^{-9}	1.0 X 10^{-9}	7.0 X 10^{-10}	3.5 X 10^{-10}	1.4 X 10^{-10}
17	1.3 X 10^{-8}	6.6 X 10^{-9}	1.3 X 10^{-9}	9.9 X 10^{-10}	6.6 X 10^{-10}	3.3 X 10^{-10}	1.3 X 10^{-10}
18	1.2 X 10^{-8}	6.2 X 10^{-9}	1.2 X 10^{-9}	9.3 X 10^{-10}	6.2 X 10^{-10}	3.1 X 10^{-10}	1.2 X 10^{-10}
19	1.2 X 10^{-8}	5.9 X 10^{-9}	1.2 X 10^{-9}	8.8 X 10^{-10}	5.9 X 10^{-10}	2.9 X 10^{-10}	1.2 X 10^{-10}
20	1.1 X 10^{-8}	5.6 X 10^{-9}	1.1 X 10^{-9}	8.4 X 10^{-10}	5.6 X 10^{-10}	2.8 X 10^{-10}	1.1 X 10^{-10}
25	8.9 X 10^{-9}	4.5 X 10^{-9}	8.9 X 10^{-10}	6.7 X 10^{-10}	4.5 X 10^{-10}	2.2 X 10^{-10}	8.9 X 10^{-10}
30	7.5 X 10^{-9}	3.7 X 10^{-9}	7.5 X 10^{-10}	5.6 X 10^{-10}	3.7 X 10^{-10}	1.9 X 10^{-10}	7.5 X 10^{-10}
35	6.4 X 10^{-9}	3.2 X 10^{-9}	6.4 X 10^{-10}	4.8 X 10^{-10}	3.2 X 10^{-10}	1.6 X 10^{-10}	6.4 X 10^{-10}
40	5.6 X 10^{-9}	2.8 X 10^{-9}	5.6 X 10^{-10}	4.2 X 10^{-10}	2.8 X 10^{-10}	1.4 X 10^{-10}	5.6 X 10^{-10}



* ELAPSED TIME BETWEEN IN-CORE EQUILIBRIUM OF NOBLE GASES AND THE BEGINNING OF EXPOSURE.

WHOLE BODY NOBLE GAS DOSE RATE CONVERSION

VS

DECAY TIME

POINT BEACH NUCLEAR PLANT

FOR X/Q DETERMINATION

(a) Wind speed ___________ mph

(b) Wind direction ______________

(c) Time of reactor shutdown ____________________

(d) Time of release to containment ______________

(e) Time of release from the plant ______________

(f) Expected inhalation period (duration of release) __________hrs*

(g-1) Gross iodine source term _______ ______ Ci/sec

(g-2) Gross noble gas source term ____________ Ci/sec

(g-3) I-131 equiv source term (if known) __________ Ci/sec

(h) Stability class ______________

(i) Distance to dose projection location _____ ____ mi.

(j) Description of dose projection location ___________________________

(k) Xu/Q (from overlay) ____________________

(l) X/Q (from Attachment 1.4-2) ____________________ sec/m^3

*If unknown, assume 1 hour in order to obtain an initial inhalation dose rate estimate.

Time/Date Completed ____

Completed By ____

EPIP-07
(07-81)

POI?T BEACH NUCLEAR PLANT

ESTIMATED WHOLE BODY AND THYROID PROJECTED DOSES*

1. Calculate the Projected Whole Body Dose Due to Noble Bases
(Using values from EPIP-07

$$\text{Dose (Rem)} = X/Q\ (\text{sec}/m^3) \times Q\ (\text{Ci/sec}) \times Kr\ \left(\frac{\text{rem } m^3}{\text{Ci hrs}}\right) \times \text{EIP (hrs)}$$

Dose (Rem) = ______ x ______ x ______ x ______
(1) (g) Kr (Attachment 1.4-3) (f)

Whole Body Dose = ______ Rem

2. Calculate the Projected Thyroid Dose

Dose (Rem) = Whole Body Dose (Rem) x Ratio Factor

Dose (Rem) = ______ x ______

Thyroid Dose = ______ Rem

*For a discussion of possible errors, refer to Section 5 of Appendix L of EPA 520/1-75-001.

Completed By ______ Time/Date Completed ______

POINT BEACH NUCLEAR PLANT

ESTIMATED WHOLE BODY DOSE CALCULATION WORKSHEET FOR SPECIFIC NOBLE GAS RELEASES

1. Enter data as required below

   a. Specific Noble Gas release rates (Ci/sec) (record in column 1 of section II below)
   b. X/Q as determined in step 5.1.5 ________ (sec/m^3) = (1) from EPIP-07*
   c. Expected Inhalation Period ________ (hrs) = (f) from EPIP-07*

2. Calculate dose for each nuclide and sum all doses to get total dose using the formula:

Isotope	Release Rate (Ci/sec)	x	X/Q (sec/m^3) (1)	x	Exposure Period (hrs) (f)	x	Dose Rate Conversion $_{Kr}$ ($\frac{rem\ m^3}{Ci\ hrs}$)	=	Dose
Kr-85	________	x	________	x	________	x	1.84	=	________
Kr-85m	________	x	________	x	________	x	1.34×10^2	=	________
Kr-87	________	x	________	x	________	x	6.77×10^2	=	________
Kr-88	________	x	________	x	________	x	1.68×10^3	=	________
Xe-133	________	x	________	x	________	x	3.36×10^1	=	________
Xe-133m	________	x	________	x	________	x	2.87×10^1	=	________
Xe-135	________	x	________	x	________	x	2.06×10^2	=	________
Xe-135m	________	x	________	x	________	x	3.56×10^2	=	________
Xe-138	________	x	________	x	________	x	1.01×10^3	=	________
Ar-41	________	x	________	x	________	x	1.01×10^3	=	________

Total Whole Body Dose = ________ rem

Time/Date Completed ______________________________

Completed By ______________________________

POINT BEACH NUCLEAR PLANT

ESTIMATED GROUND DEPOSITION CALCULATION WORKSHEET FOR PARTICULATE RADIONUCLIDE RELEASES

1. Enter data as required below

   a. Specific Particulate Release rates or I-131 equivalent release rate (Ci/sec) record in column 2 of section II below).

   b. X/Q __________ (sec/m^3) = (1) from EPIP-07*

   c. Duration of release EIP (Expected Inhalation Period)____________(hrs.) = (f) from EPIP-07*

2. Calculate deposition for each nuclide and sum all depositions to get total deposition using the formula:

$$\text{Dep } (\mu Ci/m^2) = {**}A\left(\frac{m\ \ \mu Ci}{hr\ \ Ci}\right) \times \frac{X}{Q}\ (sec/m^3) \times Q\ (Ci/sec) \times EIP\ (hrs)$$

Isotope	$A\left(\frac{m\ \ \mu Ci}{hr\ \ Ci}\right)$	x	$\frac{X}{Q}$ (sec/m^3) (1)	x	Q (Ci/sec) (g)	x	EIP (hrs) (f)	=	Deposition ($\mu Ci/m^2$)
I-131 or equiv*	9×10^6	x	________	x	________	x	________	=	________
Cs-137	1.8×10^8	x	________	x	________	x	________	=	________
Sr-89	1.8×10^8	x	________	x	________	x	________	=	________
Sr-90	1.8×10^8	x	________	x	________	x	________	=	________
							Total Deposition	=	________ $\mu Ci/m^2$

* If only total Iodine is available, use of this value will result in an overly conservative estimate of Deposition of I-131.

** The product of F, 0.05, 3600 and 10^6 is evaluated and set equal to A.

Time/Date Completed ____________________________

Completed By ____________________________

FIGURE 1.4-1

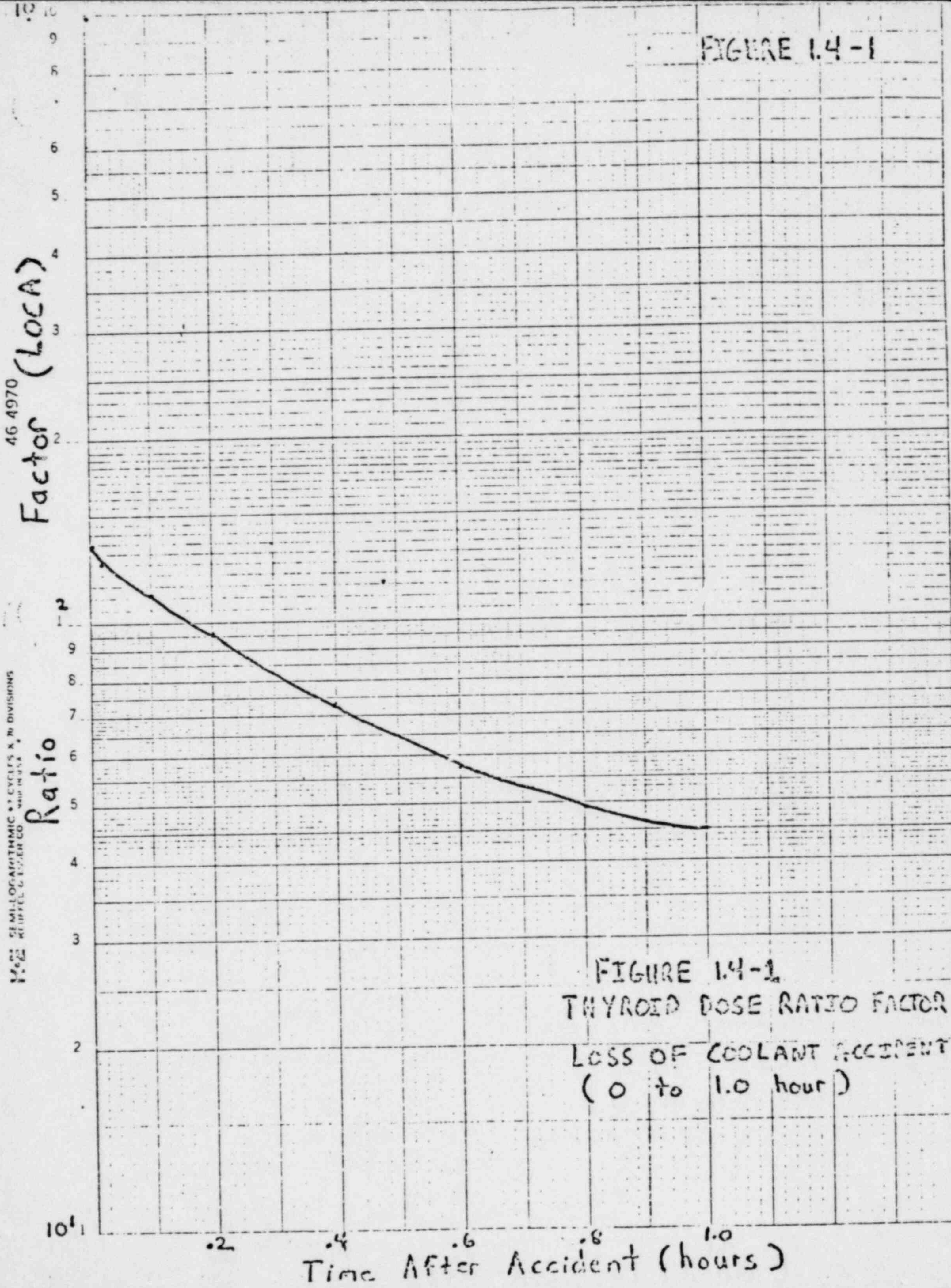


FIGURE 1.4-1
THYROID DOSE RATIO FACTOR
LOSS OF COOLANT ACCIDENT
(0 to 1.0 hour)

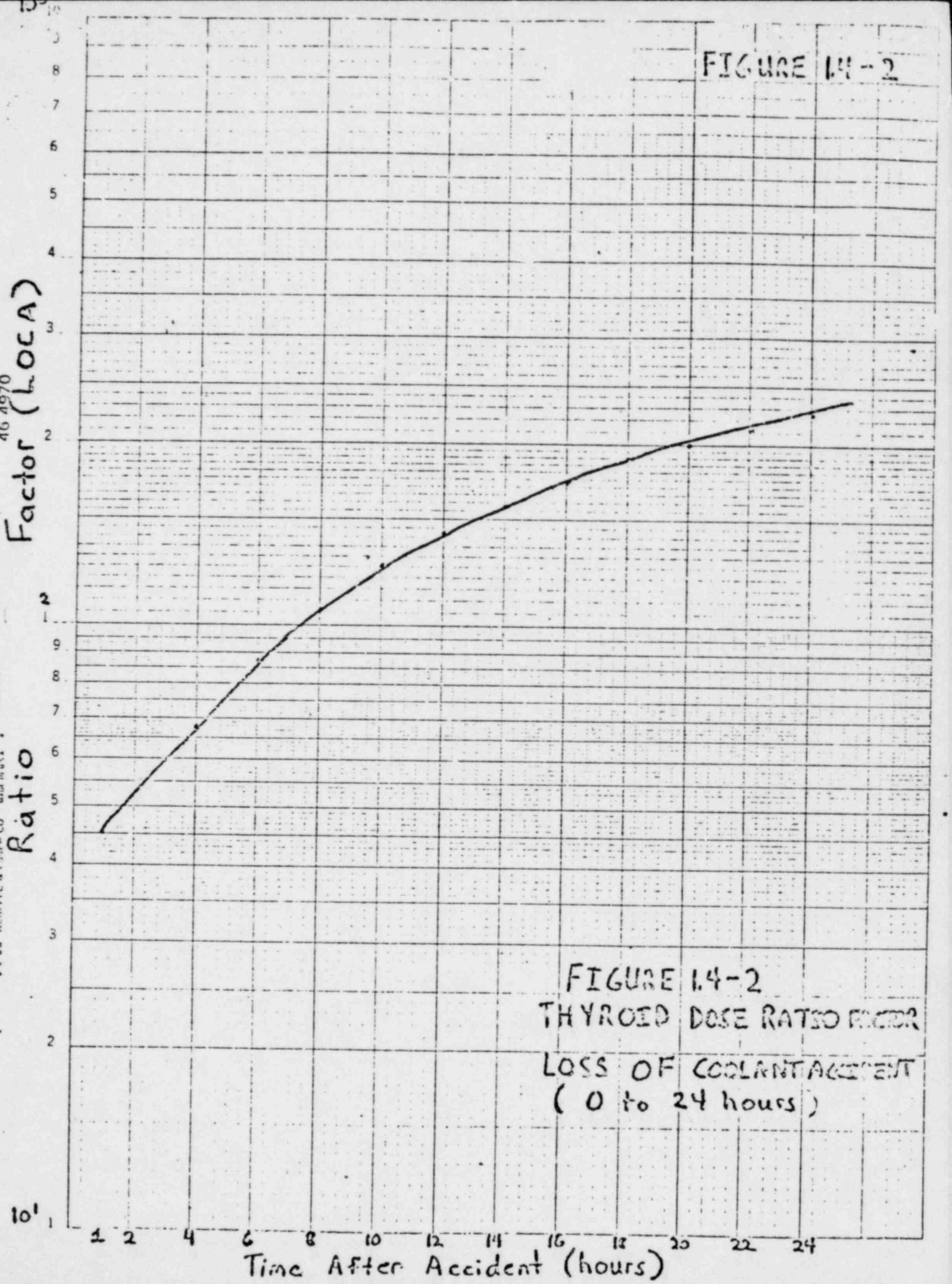


FIGURE 1.4-2
THYROID DOSE RATIO FACTOR
LOSS OF COOLANT ACCIDENT
(0 to 24 hours)

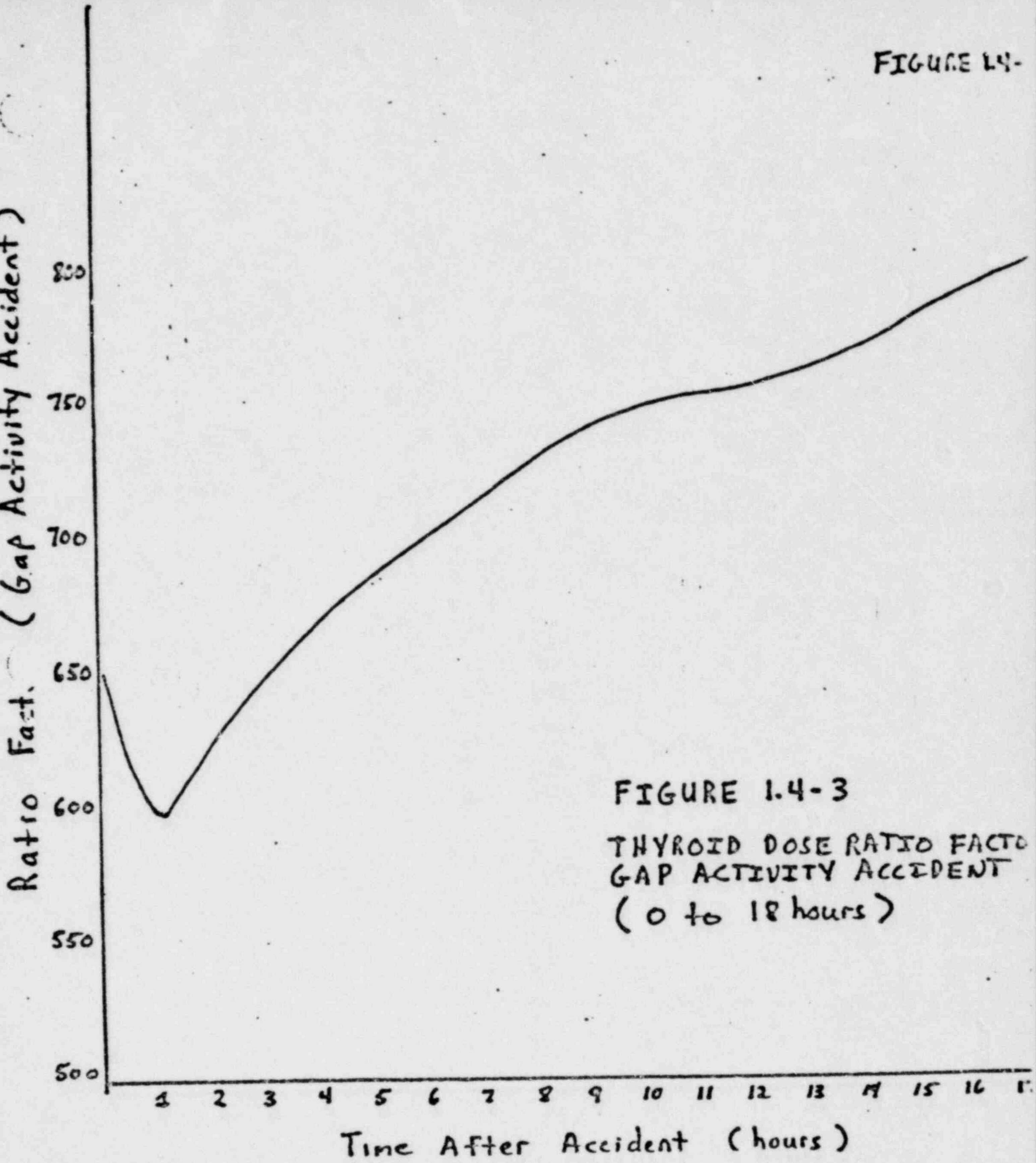


FIGURE 1.4-3

THYROID DOSE RATIO FACTO
GAP ACTIVITY ACCIDENT
(0 to 18 hours)

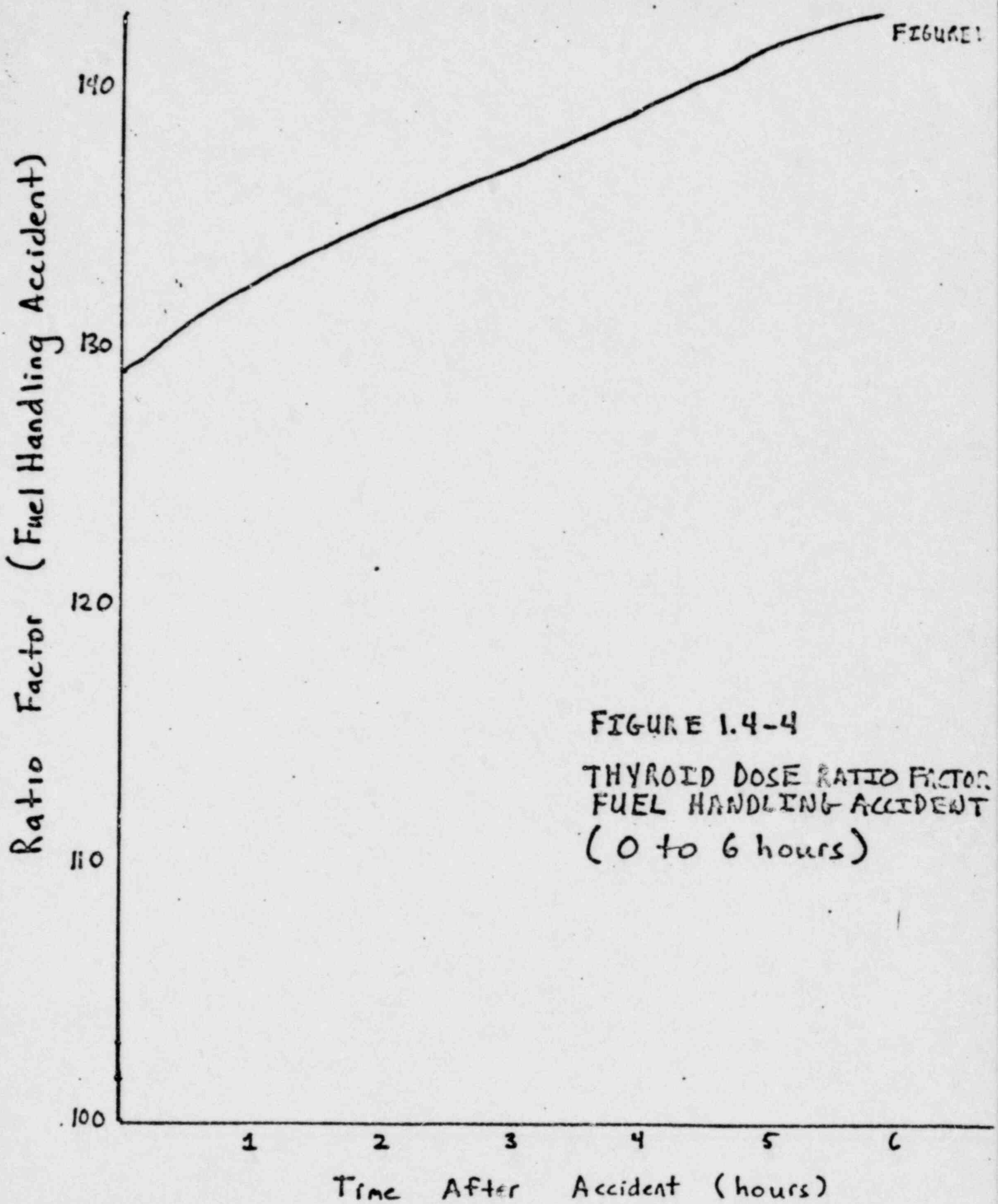


FIGURE 1.4-4

THYROID DOSE RATIO FACTOR
FUEL HANDLING ACCIDENT
(0 to 6 hours)

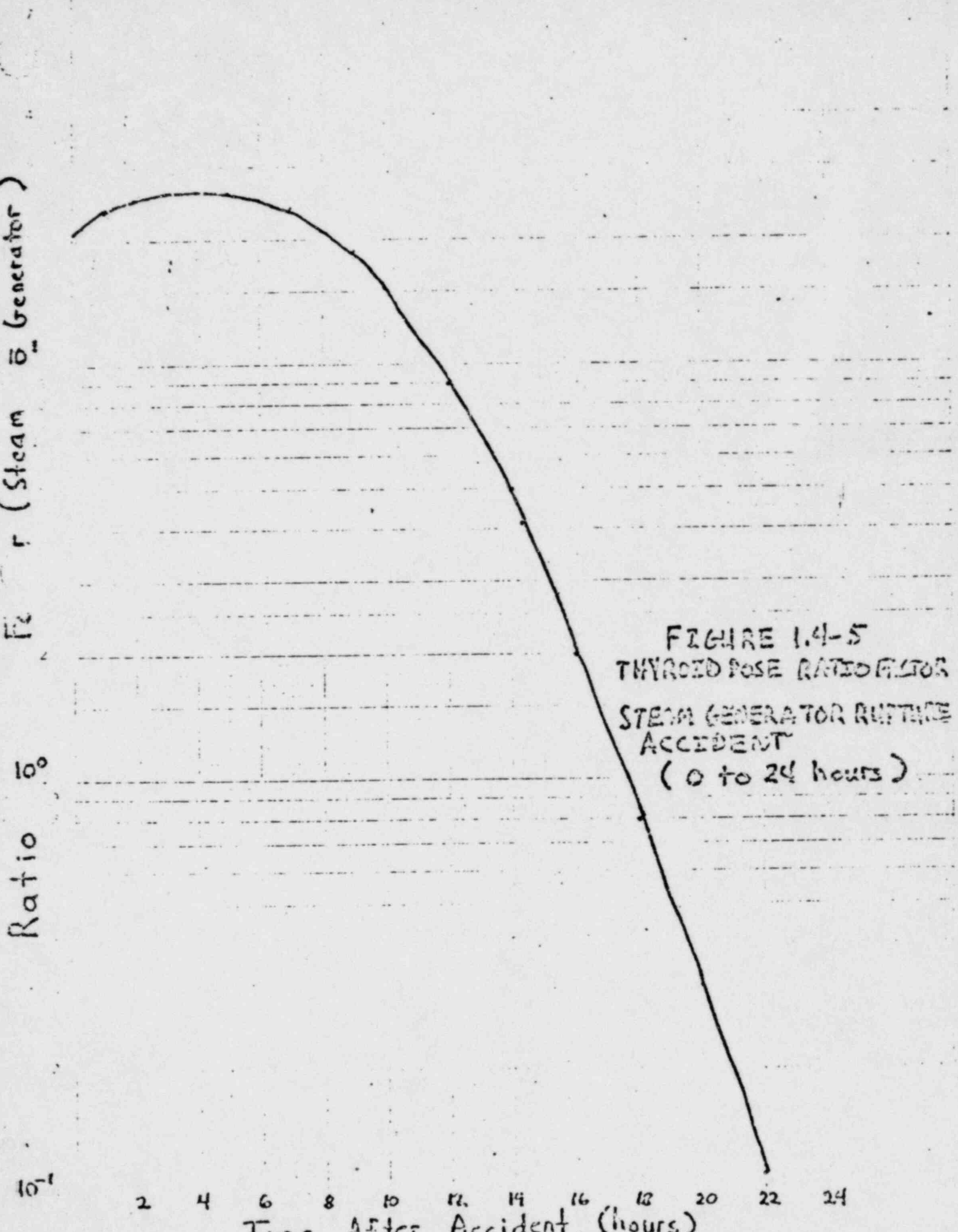


FIGURE 1.4-5
THYROID DOSE RATIO FACTOR
STEAM GENERATOR RUPTURE ACCIDENT
(0 to 24 hours)