UNIT 1
STARTUP TEST PROCEDURE

PLANT VENT STACK FLOW
MEASUREMENT WITH VARYING
FAN COMBINATIONS

PROCEDURE SO1-CT-82-240-02

SR

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20291

UNIT 1
SAN ONOFRE NUCLEAR GENERATING STATION
STARTUP TEST PROCEDURE

PLANT VENT STACK FLOW MEASUREMENT WITH VARYING FAN COMBINATIONS

PROCEDURE SO1-CT-82-240-02

SR

1.0 OBJECTIVES

1.1 To enable the Plant Vent Stack Wide Range Gas Monitor (RIC-1254), to properly calculate stack flow for various fan combinations.

2.0 ACCEPTANCE CRITERIA

		OBJECTIVE	VERIFICATION PARAGRAPH
2.1	The Wide Range Gas Monitor (RIC-1254) plant vent stack flow indication agrees with empirical data obtained within + 10% for various flow combinations. (Cumulative errors of stack mounted flow instruments, Reference 3.6.2)	1.1	8.1.9 8.2.9 8.3.9 8.4.9 8.5.9 8.6.9

3.0 REFERENCES

3.1 Piping and Instrument Diagram 5178602, Rev. 0, CC #1

3.2 Work Package #82-240

3.3 SO1-CT-82-240-01, Plant Vent Stack Flow Measurement Calibration Test

3.4 Interconnection Wiring Diagram 451942, Rev. 0, CC #12

3.5 General Atomic Model RM-80, Wide Range Gas Monitor Software Design Document #E-115-959, Rev. 1

3.6 Station I&C Procedures

3.6.1 SO1-II-1.14, Rev. 0, Plant Vent Stack Wide Range Gas Monitor Functional Test

3.6.2 SO1-II-1.288, Rev. 0, WRGM Plant Vent Stack Instruments Calibration

3.7 Startup Problem Reports #503 and #548

3.0 REFERENCES (Continued)

3.8 Station Operating Procedures

3.8.1 SO1-5-12, Vent Stack Wide Range Gas Monitor Operation

4.0 PREREQUISITES

4.1 The system has been walked through and verified complete to the extent required to complete this test.

BHP 10-31-84
Initials/ Date

4.2 All test equipment as listed in Section 6.0 is available, calibrated, and in working order.

BHP 10-31-84
Initials/ Date

SCE QA
WITNESS POINT
Section No. 4.0
Para No. 4.3
QA Engr. [signature]
Date 10-31-84

4.3 A pretest indoctrination meeting has been held to familiarize Test and Operations personnel with the requirements of this test.

BHP 10-31-84
Initials/ Date

5.0 LIMITS AND PRECAUTIONS

5.1 The equipment or systems to be in service to support performance of this test shall be operated in accordance with appropriate Station Operating Instructions except where deviation is required by Section 8.0 of this procedure.

5.2 Ensure either that the normal fire protection equipment is in service or that temporary fire protection is established and has the concurrence of the Fire Marshal/Shift Superintendent prior to initial equipment operation.

5.3 Various combinations of fans A-21, A-22, and A-24 will be utilized during the performance of this test. Coordination with Operations will be required at all times and advance planning with Equipment Control will be necessary.

5.4 When taking velocity readings during the performance of Section 8.0, allow a minimum two minute stablization period at each increment prior to recording data.

6.0 TEST EQUIPMENT

6.1 KURZ series 1040 air velocity meter with probe and extender.
Range: 0-100 ft/sec (0-6000 ft/min) minimum
ID #: RT-1254
Accuracy: ±2% READING ± 0.25% FULL SCALE
Cal Due Date: 8-8-85

7.0 INITIAL CONDITIONS

7.1 Plant Vent Instruments PE-1254 and TE-1254 have been calibrated per Reference 3.6.2.

BHP 11-C-31-84
Initials/ Date

7.2 Measure and mark the Kurz velocity probe extender to allow insertion into the plant vent stack in the following increments:

52" 27"
47" 22"
42" 17"
37" 12"
32" 7"
2"

BHP 11-C-3134
Initials/ Date

7.3 Remove stack mounted temperature indicator TI-1254 (located at plant vent stack platform).

BHP 11-C-3134
Initials/ Date

7.4 Insert the Kurz velocity probe (on extender) into the threaded 3/4" mounting hole where TI-1254 had been installed to a distance of 52" into the plant vent stack.

BHP 11-C-3134
Initials/ Date

7.5 Perform the following with the Kurz series 1040 air velocity meter:

7.5.1 Connect the velocity probe.

BHP 11-C-3134
Initials/ Date

7.5.2 Select velocity measurement (feet per second).

BHP 11-C-3134
Initials/ Date

7.0 INITIAL CONDITIONS (Continued)

7.5.3 Energize and allow a minimum 10-minute warmup period.

Initials/ Date 10/31/84

NOTE: Major subsections of Section 8.0 need not be completed in order based upon the availability of fans A-21, A-22, and A-24, as required by Operations, or at the Test Director's discretion.

8.0 PROCEDURE AND DATA COLLECTION

NOTE: The Plant Vent Stack WRGM utilizes ΔP and temperature inputs from stack mounted instruments (PE-1254 and TE-1254) and a data base constant (Monitor item #011, "Conversion Factor, Process Flow Rate") to calculate stack flow. If the WRGM flow indication does not agree with actual flow, Monitor item #011 may be changed to allow correct calculation.

NOTE: Throughout this procedure, when the "WRGM" is referred to, this is the Plant Vent Stack Wide Range Gas Monitor, RIC-1254, located in the control room.

8.1 Fans A-21 and A-22

8.1.1 At the Control Room Plant Vent Stack WRGM, enter/verify entered a value of 3.4SE+03 into Monitor item #011.

Initials/ Date 10-31-84

8.1.2 Request Operations to operate fans A-21 and A-22 lined up to the Plant Vent Stack (fan A-24 not running).

Initials/ Date 10-31-84

8.1.3 Utilizing the Kurz velocity meter, obtain the specified incremental velocity (ft/sec) data and complete Attachment 10.1.

Initials/ Date 10-31-84

8.0 PROCEDURE AND DATA COLLECTION (Continued)

8.1.4 Record below, the total stack flow as calculated on Attachment 10.1:

37978 ft³/min

Initials/ Date 10-31-84

8.1.5 At the Control Room Plant Vent Stack Gas Monitor (WRGM) keyboard/indicator (RIC-1254), retrieve Monitor Item #029 (Plant Vent Stack Flow) and record below:

4.75E+4 ft³/min

Initials/ Date 10-31-84

8.1.6 Calculate the correct WRGM Monitor item #011 constant as follows:

$$\frac{\text{(step 8.1.4 value } 37978 \text{ ft}^3\text{/min)(3.48E+03)}}{\text{(step 8.1.5 value } 4.75E+4 \text{ ft}^3\text{/min)}} = 2782 \text{ or } 2.78E+3$$

where: 3.48E+03 = present WRGM Monitor item #011 value

Initials/ Date 10-31-84

8.1.7 Enter the value obtained in step 8.1.6 into WRGM Monitor item #011.

Initials/ Date 10-31-84

8.1.8 At the WRGM keyboard/indicator (RIC-1254), retrieve Monitor item #029 (Plant Vent Stack Flow) and record below:

3.80E+4 ft³/min

Initials/ Date 10-31-84

8.1.9 Verify the value displayed by the WRGM in step 8.1.8 is within ± 10% of the value recorded in step 8.1.4.

Initials/ Date 10-31-84

8.1.10 Record the correct WRGM Monitor item #011 constant for fans A-21 and A-22 (calculated in step 8.1.6) on Attachment 10.7.

Initials/ Date 10-31-84

8.0 PROCEDURE AND DATA COLLECTION (Continued)

8.2 Fans A-21 and A-24

8.2.1 At the Control Room Plant Vent Stack WRGM, enter/verify entered a value of 3.48E+03 into Monitor item #011.

BHP 10-31-84
Initials/ Date

8.2.2 Request Operations to operate fans A-21 and A-24 lined up to the Plant Vent Stack (fan A-22 not running).

BHP 10-31-84
Initials/ Date

8.2.3 Utilizing the Kurz velocity meter, obtain the specified incremental velocity (ft/sec) data and complete Attachment 10.2.

BHP 10-31-84
Initials/ Date

8.2.4 Record below, the total stack flow as calculated on Attachment 10.2:

43063 ft³/min

BHP 10-31-84
Initials/ Date

8.2.5 At the Control Room Plant Vent Stack Gas Monitor (WRGM) keyboard/indicator (RIC-1254), retrieve Monitor Item #029 (Plant Vent Stack Flow) and record below:

62500 ft³/min

BHP 10-31-84
Initials/ Date

8.2.6 Calculate the correct WRGM Monitor item #011 constant as follows:

$$\frac{\text{(step 8.2.4 value } 43063 \text{ ft}^3\text{/min)(3.48E+03)}}{\text{(step 8.2.5 value } 62500 \text{ ft}^3\text{/min)}} = \frac{2.68}{\text{BHP 10-31-84}} \text{ E+03}$$

where: 3.48E+03 = present WRGM Monitor item #011 value

BHP 10-31-84
Initials/ Date

8.2.7 Enter the value obtained in step 8.2.6 into WRGM Monitor item #011.

BHP 10-31-84
Initials/ Date

8.0 PROCEDURE AND DATA COLLECTION (Continued)

8.2.8 At the WRGM keyboard/indicator (RIC-1254), retrieve Monitor item #029 (Plant Vent Stack Flow) and record below:

43300 ft³/min

BHP 1-31-84
Initials/ Date

8.2.9 Verify the value displayed by the WRGM in step 8.2.8 is within ± 10% of the value recorded in step 8.2.4.

BHP 1-31-84
Initials/ Date

8.2.10 Record the correct WRGM Monitor item #011 constant for fans A-21 and A-24 (calculated in step 8.2.6) on Attachment 10.7.

BHP 1-31-84
Initials/ Date

8.3 Fans A-24 and A-22

8.3.1 At the Control Room Plant Vent Stack WRGM, enter/verify entered a value of 3.48E-03 into Monitor item #011.

BHP 1-31-84
Initials/ Date

8.3.2 Request Operations to operate fans A-24 and A-22 lined up to the Plant Vent Stack (fan A-21 not running).

BHP 1-31-84
Initials/ Date

8.3.3 Utilizing the Kurz velocity meter, obtain the specified incremental velocity (ft/sec) data and complete Attachment 10.3.

BHP 1-31-84
Initials/ Date

8.3.4 Record below, the total stack flow as calculated on Attachment 10.3:

30494 ft³/min

BHP 1-31-84
Initials/ Date

8.0 PROCEDURE AND DATA COLLECTION (Continued)

8.3.5 At the Control Room Plant Vent Stack Gas Monitor (WRGM) keyboard/indicator (RIC-1254), retrieve Monitor Item #029 (Plant Vent Stack Flow) and record below:

40000 ft³/min

BHP / 10-31-84
Initials/ Date

8.3.6 Calculate the correct WRGM Monitor item #011 constant as follows:

$$\frac{(\text{step 8.3.4 value } 30474 \text{ ft}^3/\text{min})(3.48E+03)}{(\text{step 8.3.5 value } 40000 \text{ ft}^3/\text{min})} = 2.65 E+03$$

where: 3.48E+03 = present WRGM Monitor item #011 value

BHP / 10-31-84
Initials/ Date

8.3.7 Enter the value obtained in step 8.3.6 into WRGM Monitor item #011.

BHP / 10-31-84
Initials/ Date

8.3.8 At the WRGM keyboard/indicator (RIC-1254), retrieve Monitor item #029 (Plant Vent Stack Flow) and record below:

30300 ft³/min

BHP / 10-31-84
Initials/ Date

SCE QA
WITNESS POINT
Section No. 8.3
Para No. 8.3.9
QA Engr. C.K. [illegible]
Date 10-31-84

8.3.9 Verify the value displayed by the WRGM in step 8.3.8 is within ± 10% of the value recorded in step 8.3.4.

BHP / 10-31-84
Initials/ Date

8.3.10 Record the correct WRGM Monitor item #011 constant for fans A-22 and A-24 (calculated in step 8.3.6) on Attachment 10.7.

BHP / 10-31-84
Initials/ Date

8.0 PROCEDURE AND DATA COLLECTION (Continued)

8.4 Fan A-21

8.4.1 At the Control Room Plant Vent Stack WRGM, enter/verify entered a value of 4.77E+03 into Monitor item #011.

BHP 11-1-84
Initials/ Date

8.4.2 Request Operations to operate fan A-21 lined up to the Plant Vent Stack (fans A-22 and A-24 not running).

BHP 11-1-84
Initials/ Date

8.4.3 Utilizing the Kurz velocity meter, obtain the specified incremental velocity (ft/sec) data and complete Attachment 10.4.

BHP 11-1-84
Initials/ Date

8.4.4 Record below, the total stack flow as calculated on Attachment 10.4:

26508 ft³/min

BHP 11-1-84
Initials/ Date

8.4.5 At the Control Room Plant Vent Stack Wide Range Gas Monitor (WRGM) keyboard/ indicator (RIC-1254), retrieve Monitor item #029 (Plant Vent Stack Flow) and record below:

50300 ft³/min

BHP 11-1-84
Initials/ Date

8.4.6 Calculate the correct WRGM Monitor item #011 constant as follows:

$$\frac{\text{(step 8.4.4 value } 26508 \text{ ft}^3\text{/min)(4.77E+03)}}{\text{(step 8.4.5 value } 50300 \text{ ft}^3\text{/min)}} = 2.51E+03$$

where: 4.77E+03 = present WRGM Monitor item #011 value

BHP 11-1-84
Initials/ Date

8.4.7 Enter the value obtained in step 8.4.6 into WRGM Monitor item #011.

BHP 11-1-84
Initials/ Date

8.0 PROCEDURE AND DATA COLLECTION (Continued)

8.4.8 At the WRGM keyboard/indicator (RIC-1254), retrieve Monitor item #029 (Plant Vent Stack Flow) and record below:

26400 ft³/min

BHP 11-1-84
Initials/ Date

SCE QA WITNESS POINT
Section No. 8.4
Para No. 8.4.9
QA Engr. B Dean
Date 11/1-84

8.4.9 Verify the value displayed by the WRGM in step 8.4.8 is within ± 10% of the value recorded in step 8.4.4.

BHP 11-1-84
Initials/ Date

11/1/84
DATA REVIEW

8.4.10 Record the correct WRGM Monitor item #011 constant for fan A-21 operation (calculated in step 8.4.6) on Attachment 10.7.

BHP 11-1-84
Initials/ Date

8.5 Fan A-22

8.5.1 At the Control Room Plant Vent Stack WRGM, enter/verify entered a value of 4.77E-03 into Monitor item #011.

BHP 10-31-84
Initials/ Date

8.5.2 Request Operations to operate fan A-22 lined up to the Plant Vent Stack (fans A-21 and A-24 not running).

BHP 10-31-84
Initials/ Date

8.5.3 Utilizing the Kurz velocity meter, obtain the specified incremental velocity (ft/sec) data and complete Attachment 10.5.

BHP 10-31-84
Initials/ Date

8.5.4 Record below, the total stack flow as calculated on Attachment 10.5:

15939 ft³/min

BHP 10-31-84
Initials/ Date

8.0 PROCEDURE AND DATA COLLECTION (Continued)

8.5.5 At the Control Room Plant Vent Stack Wide Range Gas Monitor (WRGM) keyboard/ indicator (RIC-1254), retrieve Monitor item #029 (Plant Vent Stack Flow) and record below:

21000 ft³/min

BHP 10-31-84
Initials/ Date

8.5.6 Calculate the correct WRGM Monitor item #011 constant as follows:

$$\frac{(\text{step 8.5.4 value } 15989 \text{ ft}^3/\text{min})(4.77\text{E}{+}03)}{(\text{step 8.5.5 value } 21000 \text{ ft}^3/\text{min})} = 3.63\ \text{E}{+}03$$

where: 4.77E + 03 = present WRGM Monitor item #011 value

BHP 10-31-84
Initials/ Date

8.5.7 Enter the value obtained in step 8.5.6 into WRGM Monitor item #011.

BHP 10-31-84
Initials/ Date

8.5.8 At the WRGM keyboard/indicator (RIC-1254), retrieve Monitor item #029 (Plant Vent Stack Flow) and record below:

16000 ft³/min

BHP 10-31-84
Initials/ Date

SCE QA
WITNESS POINT
Section No. 8.5
Para No. 8.5.9
QA Engr. R Weiss
Date 10-31-84
11/1/84
DATA REVIEW

8.5.9 Verify the value displayed by the WRGM in step 8.5.8 is within ± 10% of the value recorded in step 8.5.4.

BHP 10-31-84
Initials/ Date

8.5.10 Record the correct WRGM Monitor item #011 constant for fan A-22 operation (calculated in step 8.5.6) on Attachment 10.7.

BHP 10-31-84
Initials/ Date

8.0 PROCEDURE AND DATA COLLECTION (Continued)

8.6 Fan A-24

8.6.1 At the Control Room Plant Vent Stack WRGM, enter/verify entered a value of 4.77E+03 into Monitor item #011.

BHP 11-1-84
Initials/ Date

8.6.2 Request Operations to operate fan A-24 lined up to the Plant Vent Stack (fans A-22 and A-21 not running).

BHP 11-1-84
Initials/ Date

8.6.3 Utilizing the Kurz velocity meter, obtain the specified incremental velocity (ft/sec) data and complete Attachment 10.6.

BHP 11-1-84
Initials/ Date

8.6.4 Record below, the total stack flow as calculated on Attachment 10.6:

22130 ft³/min

BHP 11-1-84
Initials/ Date

8.6.5 At the Control Room Plant Vent Stack Wide Range Gas Monitor (WRGM) keyboard/ indicator (RIC-1254), retrieve Monitor item #029 (Plant Vent Stack Flow) and record below:

42800 ft³/min

BHP 11-1-84
Initials/ Date

8.6.6 Calculate the correct WRGM Monitor item #011 constant as follows:

$$\frac{(\text{step 8.6.4 value } 22130 \text{ ft}^3/\text{min})(4.77\text{E}+03)}{(\text{step 8.6.5 value } 42800 \text{ ft}^3/\text{min})} = 2.47\text{E}+03$$

where: 4.77E + 03 = present WRGM Monitor item #011 value

BHP 11-1-84
Initials/ Date

8.0 PROCEDURE AND DATA COLLECTION (Continued)

8.6.7 Enter the value obtained in step 8.6.6 into WRGM Monitor item #011. BHP / 11-1-84 Initials/ Date

8.6.8 At the WRGM keyboard/indicator (RIC-1254), retrieve Monitor item #029 (Plant Vent Stack Flow) and record below:

22200 ft³/min

BHP / 11-1-84 Initials/ Date

SCE QA WITNESS POINT
Section No. 8.6
Para No. 8.6.9
QA Engr. R Dav
Date 11-1-84

8.6.9 Verify the value displayed by the WRGM in step 8.6.8 is within ± 10% of the value recorded in step 8.6.4. BHP / 11-1-84 Initials/ Date

11/1/84 DATA REVIEW

8.6.10 Record the correct WRGM Monitor item #011 constant for fan A-24 operation (calculated in step 8.6.6) on Attachment 10.7. BHP / 11-1-84 Initials/ Date

8.7 Plant Vent Stack Flow Profiles

NOTE: The two fan flow profiles obtained per this procedure may be used in Engineering evaluations of isokinetic conditions in the Plant Vent Stack per SPR #548 (part of Reference 3.7).

8.7.1 Plot the velocity profiles on Attachment 10.8 (utilizing the velocity data for distances of 2", 7", 12", 17", 22", 27", 32", 37", 42", 47" and 52" traversing the stack as obtained per Attachments 10.1, 10.2 and 10.3) for the following fan combinations:

8.7.1.1 A-21 and A-22 GW / 11/1/84 Initials/ Date

8.7.1.2 A-21 and A-24 GW / 11/1/84 Initials/ Date

8.7.1.3 A-24 and A-22 GW / 11/1/84 Initials/ Date

9.0 SYSTEM RESTORATION

9.1 Remove the Kurz velocity probe (on extender) from the threaded 3/4" mounting hole on the Plant Vent Stack (previously installed in step 7.4).

Initials/ Date 11-1-84

Verified By/Date 11/1/84

9.2 Install the stack mounted temperature indicator TI-1254 (previously removed in step 7.3).

Initials/ Date 11-1-84

Verified By/Date 11/1/84

9.3 Inform SCE Station Shift Superintendent that the procedure has been completed and that the system may be lined up and placed in service in accordance with Station Operating Instructions or as necessary to support plant conditions.

SCE Station Shift Superintendent

Initials/ Date

9.4 Enter the proper constant per Attachment 10.7 into the WRGM Monitor item #011 which corresponds to the present operating Plant Vent Stack fan(s) combination.

Initials/ Date /

Verified By/Date /

9.5 Prepare and process a TCN to Station procedure SO1-II-1.14 (Reference 3.6.1) to incorporate the unique constants for various fan combinations as recorded on Attachment 10.7 of this procedure.

Initials/ Date /

Verified By/Date /

9.6 Prepare and process a TCN to Station procedure SO1-5-12 (Reference 3.8.1) to incorporate the unique constants for various fan combinations as recorded on Attachment 10.7 of this procedure.

Initials/ Date /

Verified By/Date /

10.0 ATTACHMENTS

10.1 Fans A-21 and A-22 Flow Measurement

10.2 Fans A-21 and A-24 Flow Measurement

10.3 Fans A-24 and A-22 Flow Measurement

10.4 Fan A-21 Flow Measurement

10.5 Fan A-22 Flow Measurement

10.6 Fan A-24 Flow Measurement

10.7 Flow Constants

10.8 Flow Profiles

RPlocic:20291

ATTACHMENT 10.1

FANS A-21 AND A-22 FLOW MEASUREMENT

52" measurement

37 ft/sec X 60 sec/min X 4.860 ft² = 10789 ft³/min

47" measurement

47 ft/sec X 60 sec/min X 4.363 ft² = 12304 ft³/min

42" measurement

46 ft/sec X 60 sec/min X 3.273 ft² = 9033 ft³/min

37" measurement

45 ft/sec X 60 sec/min X 2.182 ft² = 5891 ft³/min

32" measurement

42 ft/sec X 60 sec/min X 1.091 ft² = 2749 ft³/min

27" (center of stack) measurement:

41 ft/sec X 60 sec/min X 0.136 ft² = 335 ft³/min

22" measurement

37 ft/sec X 60 sec/min X 1.091 ft² = 2422 ft³/min

17" measurement

35 ft/sec X 60 sec/min X 2.182 ft² = 4582 ft³/min

12" measurement

36 ft/sec X 60 sec/min X 3.273 ft² = 7070 ft³/min

7" measurement

38 ft/sec X 60 sec/min X 4.363 ft² = 9948 ft³/min

2" measurement

36 ft/sec X 60 sec/min X 4.860 ft² = 10498 ft³/min

Total Plant Vent Stack Flow for Fans A-21 and A-22:

$$\frac{\text{(27" flow) } 335}{} + \frac{\text{(22" flow) } 2422 + \text{(32" flow) } 2749}{2} +$$

$$\frac{\text{(17" flow) } 4582 + \text{(37" flow) } 5891}{2} + \frac{\text{(12"flow) } 7070 + \text{(42"flow) } 9033}{2}$$

$$+ \frac{\text{(7"flow) } 9948 + \text{(47" flow) } 12304}{2} + \frac{\text{(2" flow) } 10498 + \text{(52"flow) } 10789}{2}$$

= 37918 ft³/min (total flow)

ATTACHMENT 10.2

FANS A-21 AND A-24 FLOW MEASUREMENT

52" measurement

43 ft/sec X 60 sec/min X 4.860 ft² = 12539 ft³/min

47" measurement

56 ft/sec X 60 sec/min X 4.363 ft² = 14660 ft³/min

42" measurement

55 ft/sec X 60 sec/min X 3.273 ft² = 10801 ft³/min

37" measurement

55 ft/sec X 60 sec/min X 2.182 ft² = 7201 ft³/min

32" measurement

50 ft/sec X 60 sec/min X 1.091 ft² = ~~3660~~ 3273 BHP 10-31-34 ft³/min

27" (center of stack) measurement:

47 ft/sec X 60 sec/min X 0.136 ft² = 384 ft³/min

22" measurement

45 ft/sec X 60 sec/min X 1.091 ft² = 2946 ft³/min

17" measurement

46 ft/sec X 60 sec/min X 2.182 ft² = 6022 ft³/min

12" measurement

51 ft/sec X 60 sec/min X 3.273 ft² = 10015 ft³/min

7" measurement

52 ft/sec X 60 sec/min X 4.363 ft² = 13613 ft³/min

2" measurement

49 ft/sec X 60 sec/min X 4.860 ft² = 14283 ft³/min

Total Plant Vent Stack Flow for Fans A-21 and A-24:

(27" flow) 384 + (22" flow) $\frac{2946}{2}$ + (32" flow) ~~3660~~ 3273 BHP 10-31-34 +

(17" flow) $\frac{6022}{2}$ + (37" flow) 7201 + (12" flow) $\frac{10015}{2}$ + (42" flow) 10801

+ (7" flow) $\frac{13613}{2}$ + (47" flow) 14660 + (2" flow) $\frac{14283}{2}$ + (52" flow) 12539

= 43063 ft³/min (total flow)

ATTACHMENT 10.3

FANS A-24 AND A-22 FLOW MEASUREMENT

52" measurement

22 ft/sec X 60 sec/min X 4.860 ft² = 6415 ft³/min

47" measurement

37 ft/sec X 60 sec/min X 4.363 ft² = 9686 ft³/min

42" measurement

36 ft/sec X 60 sec/min X 3.273 ft² = 7070 ft³/min

37" measurement

37 ft/sec X 60 sec/min X 2.182 ft² = 4844 ft³/min

32" measurement

37 ft/sec X 60 sec/min X 1.091 ft² = 2422 ft³/min

27" (center of stack) measurement:

35 ft/sec X 60 sec/min X 0.136 ft² = 286 ft³/min

22" measurement

31 ft/sec X 60 sec/min X 1.091 ft² = 2029 ft³/min

17" measurement

27 ft/sec X 60 sec/min X 2.182 ft² = 3535 ft³/min

12" measurement

30 ft/sec X 60 sec/min X 3.273 ft² = 5891 ft³/min

7" measurement

34 ft/sec X 60 sec/min X 4.363 ft² = 8901 ft³/min

2" measurement

33 ft/sec X 60 sec/min X 4.860 ft² = 9623 ft³/min

Total Plant Vent Stack Flow for Fans A-24 and A-22:

(27" flow) 286 + $\frac{(22\text{" flow}) \ 2029 + (32\text{" flow}) \ 2422}{2}$ +

$\frac{(17\text{" flow}) \ 3535 + (37\text{" flow}) \ 4844}{2}$ + $\frac{(12\text{" flow}) \ 5891 + (42\text{"flow}) \ 7070}{2}$

+ $\frac{(7\text{" flow}) \ 8901 + (47\text{" flow}) \ 9686}{2}$ + $\frac{(2\text{" flow}) \ 9623 + (52\text{"flow}) \ 6415}{2}$

= 30004 ft³/min (total flow)

ATTACHMENT 10.4

FAN A-21 FLOW MEASUREMENT

52" measurement

21 ft/sec X 60 sec/min X 4.860 ft² = 6124 ft³/min

47" measurement

31 ft/sec X 60 sec/min X 4.363 ft² = 8115 ft³/min

42" measurement

30 ft/sec X 60 sec/min X 3.273 ft² = 5891 ft³/min

37" measurement

29 ft/sec X 60 sec/min X 2.182 ft² = 3797 ft³/min

32" measurement

27 ft/sec X 60 sec/min X 1.091 ft² = 1767 ft³/min

27" (center of stack) measurement:

25 ft/sec X 60 sec/min X 0.136 ft² = 204 ft³/min

22" measurement

25 ft/sec X 60 sec/min X 1.091 ft² = 1637 ft³/min

17" measurement

26 ft/sec X 60 sec/min X 2.182 ft² = 3404 ft³/min

12" measurement

27 ft/sec X 60 sec/min X 3.273 ft² = 5302 ft³/min

7" measurement

31 ft/sec X 60 sec/min X 4.363 ft² = 8115 ft³/min

2" measurement

29 ft/sec X 60 sec/min X 4.860 ft² = 8456 ft³/min

Total Plant Vent Stack Flow for Fan A-21:

$$\text{(27" flow) } 204 + \frac{\text{(22" flow) } 1637}{2} + \text{(32" flow) } 1767 +$$

$$\frac{\text{(17" flow) } 3404}{2} + \text{(37" flow) } 3797 + \frac{\text{(12"flow) } 5302}{2} + \text{(42"flow) } 5891 +$$

$$\frac{\text{(7"flow) } 8115}{2} + \text{(47" flow) } 8115 + \frac{\text{(2" flow) } 5456}{2} + \text{(52"flow) } 6124$$

= 26508 ft³/min (total flow)

ATTACHMENT 10.5

FAN A-22 FLOW MEASUREMENT

52" measurement

20 ft/sec X 60 sec/min X 4.860 ft² = 5832 ft³/min

47" measurement

20 ft/sec X 60 sec/min X 4.363 ft² = 5236 ft³/min

42" measurement

18 ft/sec X 60 sec/min X 3.273 ft² = 3535 ft³/min

37" measurement

14 ft/sec X 60 sec/min X 2.182 ft² = 1833 ft³/min

32" measurement

10 ft/sec X 60 sec/min X 1.091 ft² = 655 ft³/min

27" (center of stack) measurement:

9 ft/sec X 60 sec/min X 0.136 ft² = 73 ft³/min

22" measurement

8 ft/sec X 60 sec/min X 1.091 ft² = 524 ft³/min

17" measurement

10 ft/sec X 60 sec/min X 2.182 ft² = 1309 ft³/min

12" measurement

15 ft/sec X 60 sec/min X 3.273 ft² = 2946 ft³/min

7" measurement

18 ft/sec X 60 sec/min X 4.363 ft² = 4712 ft³/min

2" measurement

18 ft/sec X 60 sec/min X 4.860 ft² = 5249 ft³/min

Total Plant Vent Stack Flow for Fan A-22:

(27" flow) 73 + (22" flow) $\frac{524}{2}$ + (32" flow) 655 +

(17" flow) $\frac{1309}{2}$ + (37" flow) 1833 + (12"flow) $\frac{2946}{2}$ + (42"flow) 3535

+ (7" flow) $\frac{4712}{2}$ + (47" flow) 5236 + (2" flow) $\frac{5249}{2}$ + (52"flow) 5832

= 15939 ft³/min (total flow)

ATTACHMENT 10.6

FAN A-24 FLOW MEASUREMENT

52" measurement

23 ft/sec X 60 sec/min X 4.860 ft² = 6707 ft³/min

47" measurement

28 ft/sec X 60 sec/min X 4.363 ft² = 7330 ft³/min

42" measurement

23 ft/sec X 60 sec/min X 3.273 ft² = 4517 ft³/min

37" measurement

18 ft/sec X 60 sec/min X 2.182 ft² = 2357 ft³/min

32" measurement

15 ft/sec X 60 sec/min X 1.091 ft² = 982 ft³/min

27" (center of stack) measurement:

17 ft/sec X 60 sec/min X 0.136 ft² = 139 ft³/min

22" measurement

19 ft/sec X 60 sec/min X 1.091 ft² = 1244 ft³/min

17" measurement

22 ft/sec X 60 sec/min X 2.182 ft² = 2880 ft³/min

12" measurement

24 ft/sec X 60 sec/min X 3.273 ft² = 4713 ft³/min

7" measurement

25 ft/sec X 60 sec/min X 4.363 ft² = 6545 ft³/min

2" measurement

23 ft/sec X 60 sec/min X 4.860 ft² = 6707 ft³/min

Total Plant Vent Stack Flow for Fan A-24:

(27" flow) $\frac{139}{}$ + (22" flow) $\frac{1244}{2}$ + (32" flow) 982 +

(17" flow) $\frac{2880}{2}$ + (37" flow) 2357 + (12" flow) $\frac{4713}{2}$ + (42" flow) 4517

+ (7" flow) $\frac{6545}{2}$ (47" flow) 7330 + (2" flow) $\frac{6707}{2}$ + (52" flow) 6707

= 22130 ft³/min (total flow)

ATTACHMENT 10.7

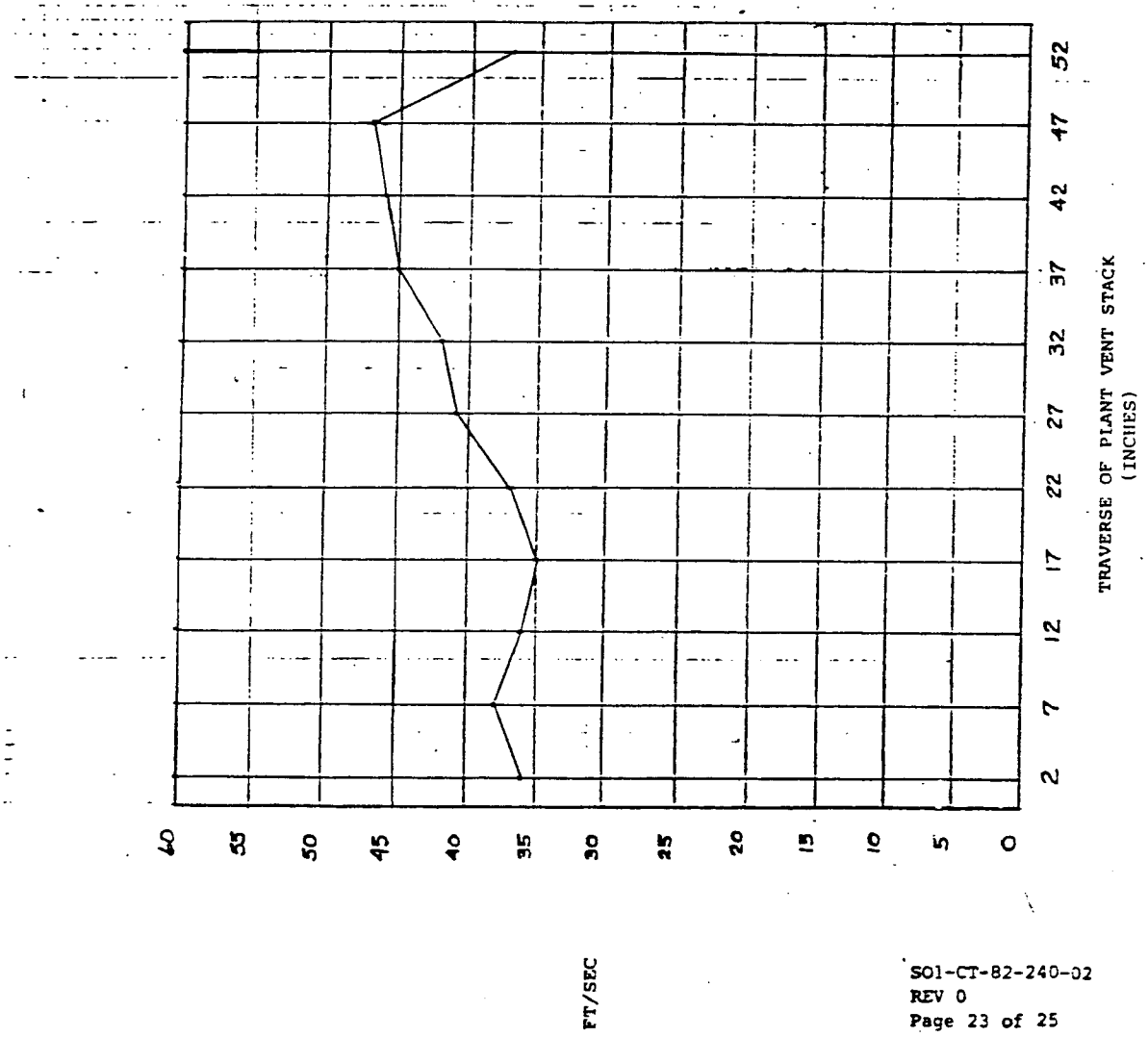
FLOW CONSTANTS

Operating Fans vs. Plant Vent Stack Wide Range Gas Monitor (RIC-1254) Constant Values for Monitor item #011, "Conversion Factor for Process Flow:"

Fan(s) Operating:	Monitor item #011 constant:
A-21 and A-22	2.78E+3
A-21 and A-24	2.66E+03
A-24 and A-22	2.65E+03
A-21	2.51E+03
A-22	3.63E+03
A-24	2.47E+03

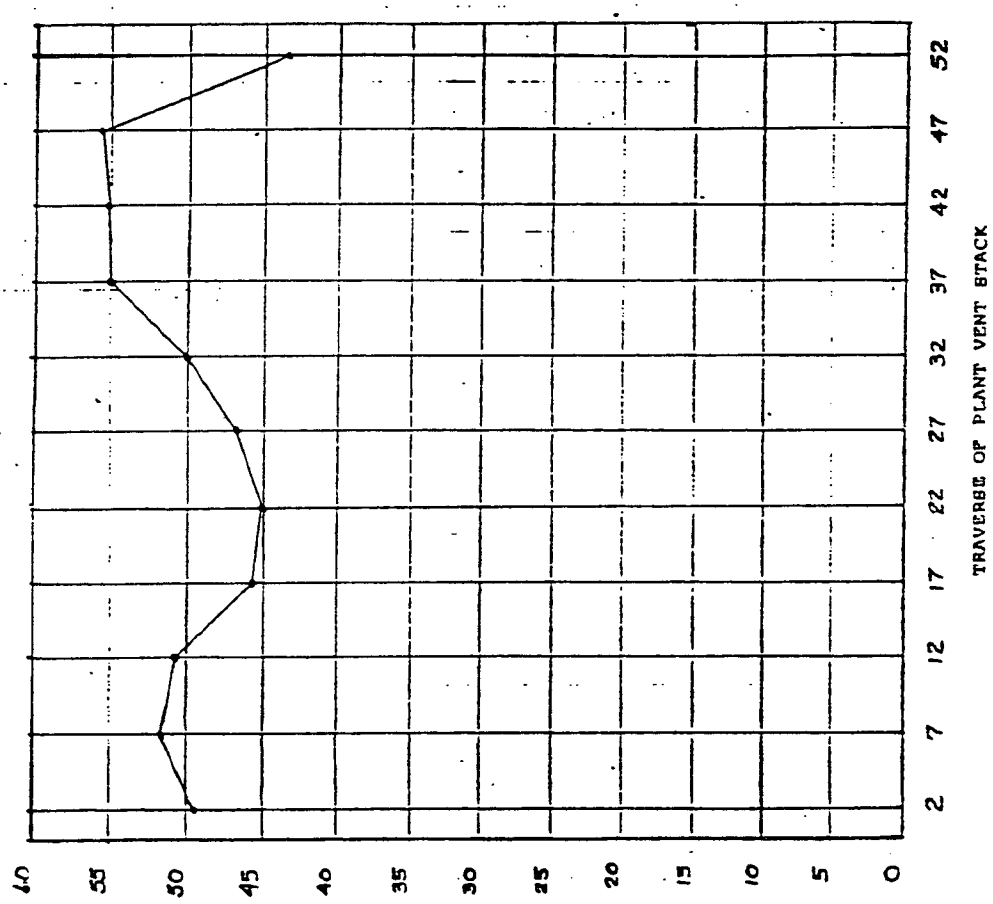
ATTACHMENT 10.8

FLOW PROFILE FOR FANS A-21 AND A-22
PAGE 1 of 3



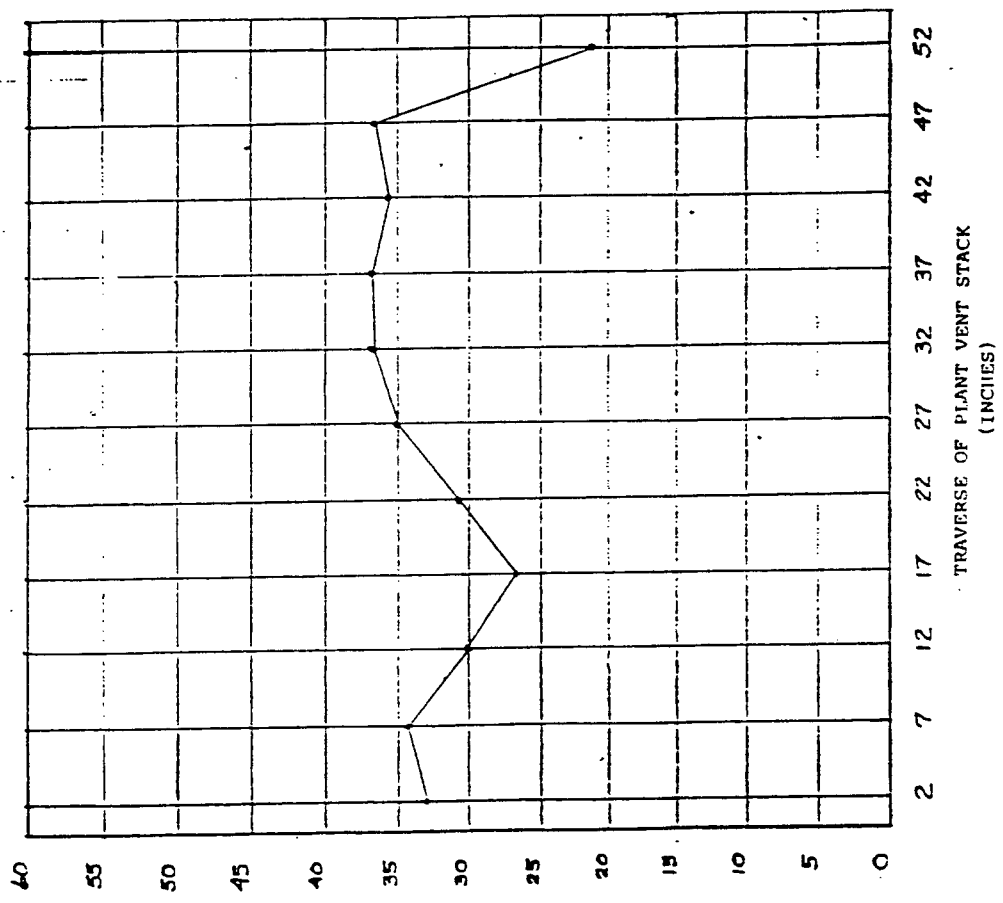
ATTACHMENT 10.8

FLOW PROFILE FOR FANS A-21 AND A-24
PAGE 2 of 3



ATTACHMENT 10.8

FLOW PROFILE FOR FANS A-24 AND A-22
PAGE 3 of 3



STACK FLOWRATE ESTIMATION FORM

If the flowrate monitor for Radiation Monitoring Channel R-1254 is inoperable, estimate stack flowrate using the Table below and document on this form. Use one (1) form for each day that the flowrate requires estimation.

CAUTION ======= The flow rate estimation is a Tech Spec Action requirement. Therefore, it must be completed within the four-hour time period.

Single Fan Operating	Estimated Flow Rate ($ft.^3/in.$)
One (1)	20,000
Two (2)	40,000

Date: _____

Time	Estimated Flow Rate	Initials

TCN

STACK FLOWRATE ESTIMATION FORM (Continued)

ESTIMATION PERFORMED BY:

Operator Signature	Initials	Date

COMMENTS: _____

TCN

_____

_____

_____

_____

_____

_____

_____

APPROVED BY: _____ _____
SRO Operations Supervisor Date