AP 1001

Figure 1001-8

Three Mile Island Nuclear Station

Special Operating Procedure

SIDE 1

SOP No. Z-12 Rev 1 (From SOP Log Index)

Rev. 1

NOTE: Instructions and guidelines in AP 1001 must be followed when completing this form.

Unit No. 2

Date 4/3/79

1. Title H_2 Recombiner Operation

2. Purpose (include purpose of SOP)

To specify operation of the H_2 Recombiner.
Rev 1 increases setpoint of temp controller for more stable operation per AI representative

3. Attach procedure to this form written according to the following format.

A. Limitations and Precautions
   1. Nuclear Safety
   2. Environmental Safety
   3. Personnel Safety
   4. Equipment Protection

B. Prerequisites

C. Procedure

4. Generated by J E Morck Date 4/3/79

5. Duration of SOP - Shall be no longer than 90 days from the effective date of the SOP or (a) or (b) below — whichever occurs first.

(a) SOP will be cancelled by incorporation into existing or new permanent procedure submitted by R P Warren ☒

(b) SOP is not valid after _____ ☐
(fill in circumstances which will result in SOP being cancelled)

6. (a) Is the procedure Nuclear Safety Related?
If "yes", complete Nuclear Safety Evaluation. (Side 2 of this form) ..... Yes ☐ No ☐

(b) Does the procedure affect Environmental Protection?
If "yes", complete Environmental Evaluation. (Side 2 of this Form) ..... Yes ☐ No ☐

(c) Does the procedure affect radiation exposure to personnel? ..... Yes ☐ No ☐

NOTE: If all answers are "no", the change may be approved by the Shift Supervisor. If any questions are answered "yes", the change must be approved by the Unit Superintendent.

7. Review and Approval

Approved — Shift Supervisor B Mehler 4-3-79 Date

Reviewed — List members of PORC contacted R W Bonsal (V-Chairman) 4-3-79 Date

PORC 4/3/79 J E Morck 4/3/79 Date

ALARA J E Floyd 4/3/79 Date

[redacted] Approved - Unit Superintendent J J Fielding 4/3/79 Date

8. SOP is Cancelled

Shift Supervisor/Shift Foreman _____ Date _____

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TMI-03 Rev. 8/77

THREE MILE ISLAND NUCLEAR STATION
UNIT #2 OPERATING PROCEDURE 2104-6.4
HYDROGEN RECOMBINER OPERATING PROCEDURE

1.0 REFERENCES

1.1 Drawings Applicable to Operation

1.1.1 Reactor Bldg. Ventilation and Purge, B&R Flow Diagram 2041.

1.2 Operating Procedures Applicable to Operation.

1.2.1 2102-1, Plant Operating Limits and Precautions.

1.2.2 2102-2 Plant Setpoints.

1.3 Manufacturers Instruction Manuals

1.3.1 Manual for the Thermal Hydrogen Recombiner System, B&R File No. 123.

1.4 System Descriptions

1.4.1 Hydrogen Recombiner, Index No. 63.

1.5 Curves, Tables, Etc.

1.5.1 Table 4-1, Instrument and Power Cable Connections.

1.5.2 Table 4-2, Recombiner Instrument and Control Settings.

1.5.3 Table 4-3, Post - LOCA Hydrogen Recombination Record.

2.0 LIMITS AND PRECAUTIONS

2.1 Equipment

2.1.1 Assure Bus supply breaker is OFF before connecting the power cable for the Recombiner Console.

2.1.2 Do not operate the Recombiner with RB pressure > 10 psig.

2.1.3 If H2 concentration is suspected of approaching 9%, initiate N_2 dilution by opening AH-V164 and AH-V165 and AH-V139 and AH-V140. See step 4.2.1. This may be done initially.

2.1.4 See Figure 4-2 for layout of both recombiners.

2.1.5 Establish communications as necessary between control room. Fuel handling Building and Auxiliary Building.

2.1.6 Prior to starting H2 recombiner, ensure that RB was sampled for H2 within

past 12 hours and concentration is $\geq$ 4%, initiate nitrogen dilution per step 4.2.1.b.

2.1.7 When operating H2 recombiner controls after flow from containment is initiated, do not walk past control cabinets toward fuel pools as this may be a high radiation area.

2.1.8 Ensure portable radiation monitor is available at control cabinets.

2.1.9 Notify Health Physics and NRC prior to commencement of flow to insure initiation of Enviromental Monitoring Procedures.

2.1.10 Closely monitor Auxiliary Building and Fuel Handling Building area and process monitors (efflvent).

If HP-R-3240 increases to = 4000 mr/hr secure flow.

2.2 Administrative

2.2.1 The operator should be aware of the consequences of any action taken on this system prior to taking that action.

2.2.2 This procedure is applicable to both the installed and spare H2 recombiner. Due to H2 production, it may be necessary to run both recombiners in parallel.

3.0 PREREQUISITES (Initial each step upon completion)

_____ 3.1 Verify Reactor Building pressure less than 10 psig.

_____ 3.2 Both recombiners have been connected both mechanically and electrically and 2393-Q1 has been satisfactorily completed.

4.0 OPERATING PROCEDURE

4.1 Initial Conditions

4.1.1 Start up of #2 Hydrogen Recombiner.

4.1.1.1 Check shut or shut tight by actually verifying tight the following valves:

AH-V1A_____	AH-V166_____
AH-V1B_____	AH-V167_____
AH-V4A_____	AH-V137_____
AH-V4B_____	AH-V138_____

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AH-V7 _____	AH-V155 _____
AH-V81 _____	AH-V156 _____
AH-V82 _____	AH-V153 _____
AH-V52 _____	AH-V154 _____
AH-V149 _____	AH-V25 _____
AH-V150 _____	AH-V80 _____
AH-V151 _____	AH-V212 _____
AH-V152 _____	
AH-V141 _____	
AH-V142 _____	

4.1.1.1.a Verify instrument settings per Table 4-2

4.1.1.2 Open the following valves:

AH-V120A _____	AH-V164 _____
AH-V120B _____	AH-V165 _____
AH-V90A _____	AH-V139 _____
AH-V90B _____	AH-V140 _____

4.1.1.3 Start #2 Hydrogen Recombiner by turning HS-1 to start.

4.1.1.4 Open AH-V3B and AH-V2B from control room.

4.1.2 Start up of #1 Hydrogen Recombiner

4.1.2.1 If #2 Recombiner is started perform steps 4.1.2.2 and 4.1.2.3, if not, perform steps 4.1.1.1 and 4.1.1.2 before proceeding.

4.1.2.2 Start #1 Hydrogen Recombiner by turning HS-1 to start.

4.1.2.3 Open AH-V3A and AH-V2A from control room.

4.2 Normal Operation

4.2.1.a The recombiner should maintain 1300 degrees as read on thermocouple TC-4 during normal operation. Hydrogen concentration in the recombiner can be monitored as follows:

$$\% H_2 = \frac{\text{Reaction chamber temp (TC-4)} - \text{Heater outlet temp (TC-3)}}{125}$$

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4.2.1.b If hydrogen concentration increases above 4%, dilute the recombiner inlet with nitrogen gas at the following flowrates:

% H2	Nitrogen Flow (SCFM)
5	12
6	20
7	26
8	30

* N2 flowrate my be limited to valves less than 30 SCFM depending on line pressure drops. (See figure 4-1 for intermediate H2 valves).

4.2.2 Periodic observations should be made of the temperatures and flow rate indicated in the control band. A suggested operators record is shown in table 4-3.

4.2.3 To increase the stability of the recombiner temperature readings, TIC-4 may be slowly increased to 1350 degrees F in 10 degree steps.

4.3 Shutdown Procedure.

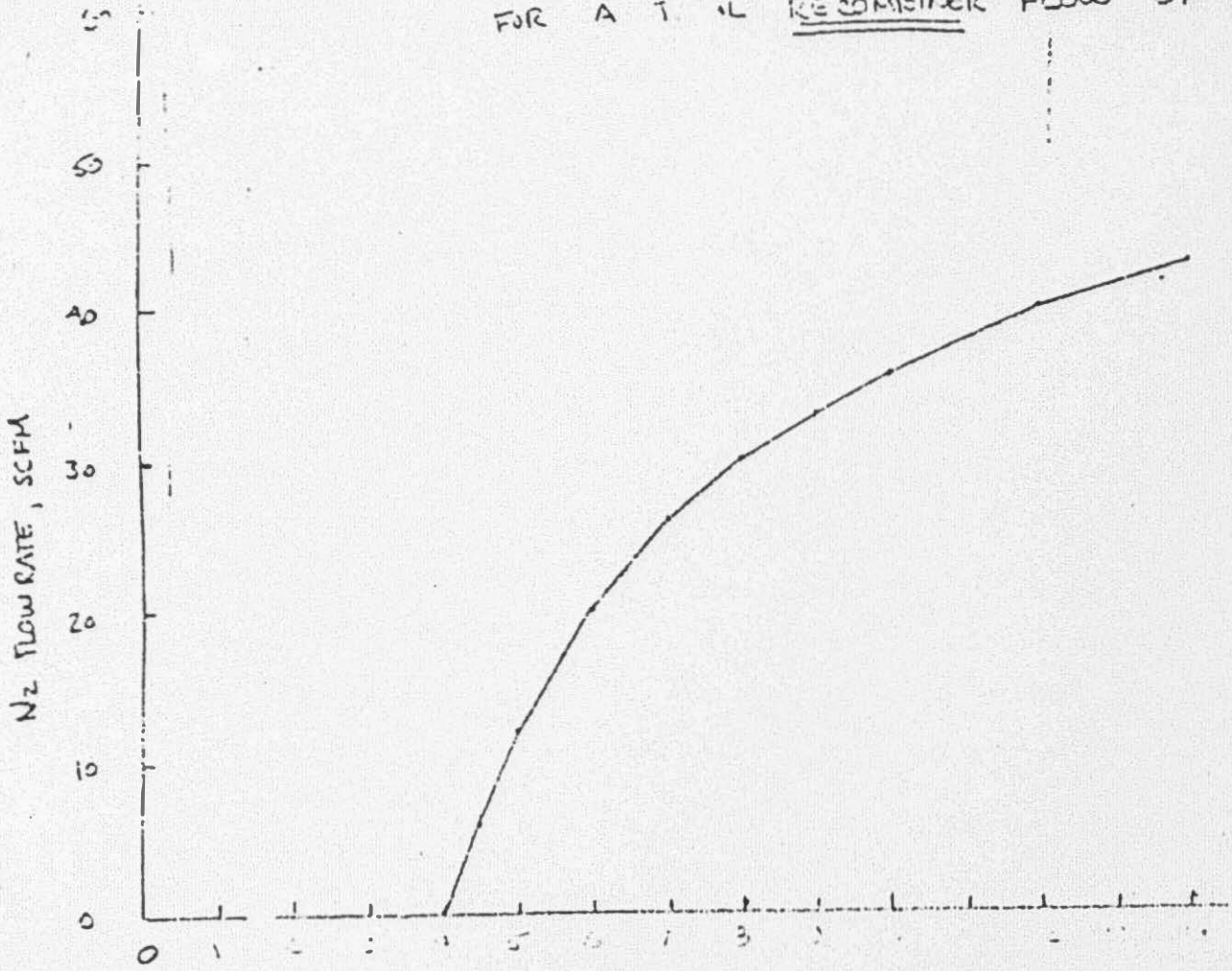
4.3.1 Reset TIC4 to 500 degrees F (260 degrees C).

When the temperature indicated on TIC4 is below 600 degrees F (316 degrees C) proceed to next step.

4.3.2 Turn HS1 to OFF

4.3.3 Close AH-V3B and AH-V2B to isolate recombiner #2 and close AH-V3A and AH-V2A to isolate recombiner #1.

FOR A T IL RECOMBINER FLOW OF GOS 1

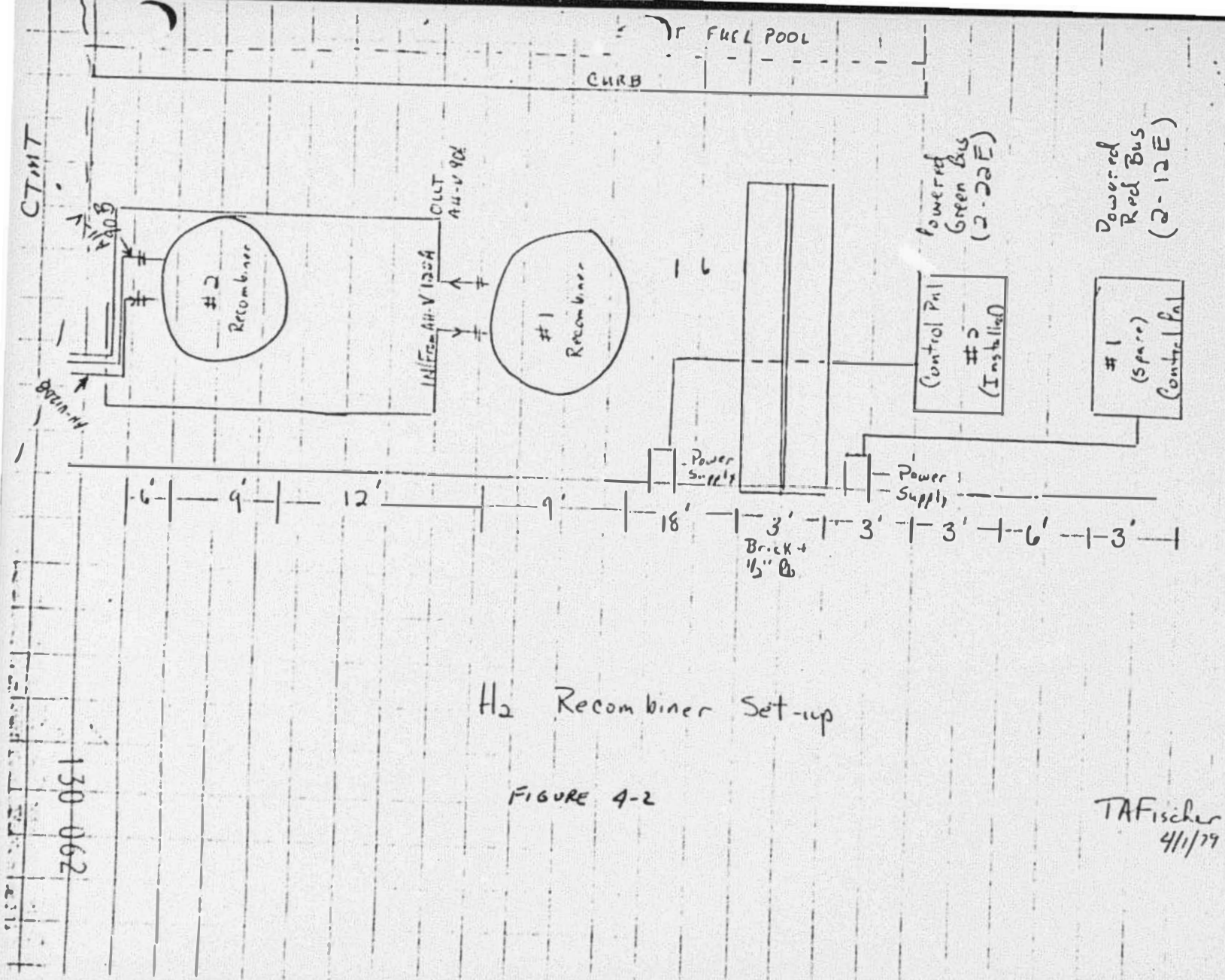


H_2 Concentration % by Vol
in Hydrogen Recombiner as determined
in Attachment "A"

Figure 4-1

GPUSC-Mellen
JJC 3/2/79
201-263-4120 x 333

130.061



H_2 Recombiner Set-up

FIGURE 4-2

TAFischer
4/1/79

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TABLE 4-1

INSTRUMENT AND POWER CABLE CONNECTIONS

	Plug Number	Receptacle Number
Recombiner Power		
Heat Exchanger Cable	P106	J106
Enclosed Blower Cable	P107	J107
Heater Cable	P108	J108
Recombiner Instrumentation		
Thermocouples	P101	J101
Differential Pressure Transmitter	P102	J102

TABLE 4-2

RECOMBINER INSTRUMENT AND CONTROL SETTING

Device	Function	Normal Operation with Hydrogen	initial #2	#1
Temperature Control °F(°C)				
TSH1	Heater Inlet - Wall	175 (79)	—	—
TSX2	Heater Outlet - Wall	1400 (760)	—	—
TS3	Heater Outlet - Gas	1300 (704)	—	—
TSH3	Heater Outlet - Gas	1500 (816)	—	—
TSH4	Reaction Chamber - Gas	1400 (760)	—	—
TSL4	Reaction Chamber - Gas	500 (260)	—	—
TIC4	Reaction Chamber - Gas	1300 (704)	—	—
TISX5	Reaction Chamber - Outlet - Wall	1400 (760)	—	—
TISX6	Heater Exchanger Outlet - Wall	150 (66)	—	—
Circuit Breakers				
CB1	Enclosed Blower Motor - 480 V	Closed	—	—
CB2	Heat Exchanger Fan Motor - 480V	Closed	—	—
CB3	Heaters - 480V	Closed	—	—
CB4	Instrument Control Power - 120V	Closed	—	—
CB5	Primary Power - 480V	Closed	—	—
	Unit Power Supply	Closed	—	—
Start Switch				
HS1		Stop*	—	—
Timers				
T1	Low Temperature Start Cutoff (h)	2	—	—
T2	Heater Power Delay (s)	60	—	—
Motor Starter				
IS1	Enclosed Blower Motor	Auto	—	—
IS2	Heat Exchanger Fan	Auto	—	—
Valves*				
V1	Flow Transmitter, L.P. Port	Open	—	—
V2	Flow Transmitter, H.P. Port	Open	—	—

*NOTE: Assure all Containment Isolation Valves are open prior to Actuating HS-1.

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TABLE 4-3

POST-LOCA HYDROGEN RECOMBINATION RECORD

Date and time of LOCA

Date and time of observation

Estimated hydrogen concentration from previous observation vol %

Annunciator panel all green?

Control or Indicator	Observed Value (°C)	Nominal Value °F (C) Setpoint
TSH1		175 (79)
TSX2		1400 (760)
TS3		1300 (704)
TSH3		1500 ~~1400~~ (~~760~~ 816)
TSH4		1450 ~~1300~~ (~~704~~ 760)
TSL4		500 ~~1300~~ (~~704~~ 260)
TIC4		1300 (704)
TISX5		1400 (760)
TISX6		150 (65)
CB1 through CB5		Closed
HS1		Start
T1		24 HRS
IS1		Auto
IS2		Auto
F11		50 cfm (minimum)

Calculated approximation of hydrogen content of influent

$$\frac{\text{Temp(TIC4)} - \text{Temp(TS3)}}{125} = \%H_2$$

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9.0 Observer_____