





FORT ST. VRAIN NUCLEAR GENERATING STATION  
PUBLIC SERVICE COMPANY OF COLORADO

AOP D-1  
Issue 55  
Page 1 of 2

NRC1

TITLE: SINGLE CIRCULATOR TRIP

RESPONSIBLE FOR			
AUTHORIZED BY			
PORC REVIEW	PORC 877 APR 11 1990		EFFECTIVE DATE 4-19-90
DCCF NUMBER (S)	90-0137		

FT. ST. VRAIN  
NON-CONTROLLED  
COPY

VERIFY ISSUE STATUS  
WITH SITE DOCUMENT  
CONTROL CENTER PRIOR  
TO USE

9005100029 900427  
PDR ADDCK 05000267  
P PDR

(D-1)  
SINGLE CIRCULATOR TRIP OR ONE CIRCULATOR TRIP IN EACH LOOP  
SYMPTOM-ACTION MATRIX

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1.3 Verify/set circulator brake and seal and isolate circulator auxiliaries.		XX		XX		
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## INTRODUCTION

Circulator trips are initiated by the Plant Protective System (PPS) to protect the circulators and associated equipment against various auxiliary equipment and control system failures.

When the cause of the trip is loss of bearing water pressure, all the circulator auxiliaries are isolated. In this event, the circulator brake is applied when the speed has coasted down to 700 rpm. Twenty seconds later, the static shaft seal is automatically applied.

## DISCUSSION OF SYMPTOMS

### 1.1 Helium Circulator Speed High.

Speed sensors monitoring shaft speed actuate the circulator trip logic system when circulator speed exceeds 8,800 rpm. Actuation of at least two of the three sensors is required to cause trip.

Excessive circulator speed is an indication of a speed controller failure or other circulator system failure necessitating rapid shutdown of the circulator. The speed sensing system response and trip setting are chosen so that, for the case of the maximum overspeed situation possible (loss of restraining torque), the circulator speed will remain within design limits.

### 1.2 Helium Circulator Penetration Pressure High.

Pressure exceeding 810 psig in the circulator penetration will actuate pressure switches. Actuation of at least two of the three switches is required to cause trip.

Circulator penetration overpressure is indicative of a pipe rupture within the penetration. A circulator trip is initiated and the purified helium pressurizing line to the penetration is closed to prevent moisture backflow into the purified helium system. The relief of the overpressure is handled by the circulator penetration relief valves. The trip point is set above normal operating pressure but below the circulator penetration relief valve setting.

### 1.3 Helium Circulator Loss of Bearing Water.

Pressure switches sensing the difference between primary coolant pressure and bearing water pressure actuate at a differential of 475 psid. Actuation of two of the three switches is required to cause trip of the steam drive and prevent automatic water turbine start.



NOTE: After a loss of normal bearing supply (loss of all three pumps in a loop) the NBW isolation valves (-1) and the flow control valves close to prevent re-establishing normal bearing water on top of back-up bearing water. These valves must be shut (on controller/handswitches) in order to re-open.

Loss of bearing water is potentially damaging to the helium circulator. The trip point is set to ensure that the normal and auxiliary bearing water sources are available; if not, the circulator is tripped. The line to the bearing water accumulator opens automatically, due to reversal of differential pressure across a check valve, to allow use of the stored water during circulator coast down.

#### DISCUSSION OF OPERATOR ACTION

2.1 Ensure penetration interspace block valve closed.

High penetration pressure indicates a bearing water pipe leak in the penetration. The purified helium penetration interspace block valve is shut automatically to prevent water from backing up the line and getting into the purified helium system. The operator acts as a backup to the PPS.

2.2 Ensure Tripped Circulator Water Speed, Water Inlet, and Water Outlet Block Valves Close.

This step verifies proper circulator shutdown by PPS.

2.3 Verify/Set circulator brake and seal, and isolate circulator auxiliaries.

- 1) The circulator must coast down to less than 700 rpm before brake will set. The static seal is inhibited from setting by a 20 second time delay after the brake is applied.

The static seal will be damaged if applied while the shaft is turning. The circulator brake is provided to stop the shaft when it is necessary as a result of dynamic seal or bearing malfunction.

- 2) Isolate circulator auxiliaries.

By isolating circulator auxiliaries, any leakage in bearing water piping or buffer helium piping will be stopped.



2.4 Monitor Critical Safety Functions Per EOP's.

Monitor critical safety functions per EOP's and perform steps of EOP's as required.