Transformer Health Assessment Report

TR-005: Epsilon Power Station Unit

⚠️ CRITICAL ALERT

Parameter	Value
Status	🔴 CRITICAL
Health Score	28/100
Risk Level	SEVERE
Scenario	Partial Discharge Activity

Transformer Information

Attribute	Details
Transformer ID	TR-005
Name	Epsilon Power Station Unit
Location	Southern Power Complex
Rating	150 MVA
Voltage	400/132 kV
Age	20 years
Last Maintenance	2025-06-28
Next Scheduled	**EMERGENCY**

Current Operating Parameters

Temperature Readings

- **Top Oil Temperature:** 72°C (Normal: <65°C) ⚠️ Elevated
- **Winding Temperature:** 88°C (Normal: <90°C) ⚠️ Near Limit

- **Current Load:** 78% of rated capacity

Oil Quality Parameters

Parameter	Value	Limit	Status
Moisture Content	38 ppm	<25 ppm	❌ High
Tan Delta	2.45%	<1.0%	❌ Critical
Breakdown Voltage	28 kV	>50 kV	❌ Critical

Dissolved Gas Analysis (DGA) - ⚠️ DISCHARGE GASES DETECTED

Gas	Concentration	Limit	Status
Hydrogen (H_2)	485 ppm	<100 ppm	❌ HIGH
Methane (CH_4)	165 ppm	<50 ppm	❌ HIGH
Acetylene (C_2H_2)	**35 ppm**	<3 ppm	❌ CRITICAL
Carbon Monoxide (CO)	380 ppm	<300 ppm	❌ Elevated
Carbon Dioxide (CO_2)	1680 ppm	<2500 ppm	⚠️ Elevated

Fault Diagnosis

Primary Fault Type: Active Partial Discharge in HV Winding

Analysis: The high acetylene concentration (35 ppm) is definitive evidence of electrical discharge activity within the transformer. Acetylene is only generated by high-energy electrical arcing or discharge. Combined with elevated hydrogen, this indicates active partial discharge causing progressive insulation damage.

Partial Discharge Measurements:
- PD Magnitude: >500 pC (detected via acoustic emission)
- Location: HV winding, phase B area
- Pattern: Consistent with void discharge in solid insulation

Root Cause Assessment:
1. Void formation in winding insulation (aging)
2. Possible delamination of pressboard
3. Moisture migration reducing dielectric strength
4. 20-year age contributing to insulation degradation

Risk Factors

Risk	Severity	Probability
Active partial discharge	Critical	Confirmed
High acetylene (C_2H_2)	Critical	Active
Winding insulation damage	Critical	Progressive
Internal flashover	Severe	High risk
Explosion/fire	Severe	Possible

IMMEDIATE ACTIONS REQUIRED

1. **CRITICAL:** Schedule immediate outage - DO NOT delay
2. **IMMEDIATE:** Reduce load to minimum operational level
3. **Within 48 hours:** Complete transformer isolation
4. **Required:** Internal inspection and PD source location
5. **Prepare:** Contingency for unit replacement

Repair/Replacement Assessment

Given the age (20 years) and severity of the partial discharge activity:

Option	Estimated Cost	Timeframe	Recommendation
Rewinding	High	3-6 months	Consider
Replacement	Very High	6-12 months	Evaluate
Repair + Risk	Medium	1-2 months	Not Recommended

Assessment: Due to the transformer's age and the severity of PD activity, replacement planning should begin immediately while repair options are evaluated.

Report Generated: January 12, 2026
Assessment Engineer: Predictive Analytics System
Classification: CRITICAL - IMMEDIATE ACTION REQUIRED

⚠️ **WARNING: Active partial discharge can progress to complete insulation failure within days to weeks. Internal flashover risk is significant.**