



Polaris Diagnostics & Engineering Ltd has been commissioned by Scottish Hydro Electric Transmission (SHE Transmission), to carry out a Level 1 condition assessment of Deanie GT1 132/11kV Transformer.

The level 1 condition assessment has been carried out, based on a review and independent assessment of the historic oil data and SSEN Report T2BP-ACR-0025 Revision 1.1 dated October 2019, both supplied by SHE Transmission.

Based on the assessment of the historical & current asset condition data, GT1 is in a condition commensurate with age and the transformer condition will continue to deteriorate, by ageing, during the RIIO T2 period. There is an increased risk of failure of the asset within this period due to an underlying thermal abnormality and contamination of the main tank oil. Further intervention will be required within the RIIO-T2 period to mitigate this increased risk of failure.

There is evidence that the transformer has externally deteriorated and requires immediate action, as defined by the iSIM system. Additional inspection and evaluation is required.

There is an underlying thermal abnormality which is developing as evidenced by the presence of dissolved ethylene, in both the main tank and tap changer selector, which is increasing. To identify the source of the dissolved ethylene electrical testing would be required. Whilst these magnitudes of dissolved gases are still at relatively low level, the dissolved ethylene should be kept under surveillance, in order to check for further manifestation on what could become degenerative thermal abnormality.

Oil processing or long term topping up of the main tank oil has had a dilution effect on the measured 2FAL concentrations and as this is used to predict the condition of the paper insulation and “estimated residual life remaining” of that insulation, the estimate of 55% life remaining is considered optimistic. The DDF of the oil indicated the presence of a contaminant. The oil would require to be regenerated to restore the DDF levels to a quality defined as “Good” by IEC 60422, but this process would further dilute the concentrations of 2FAL and would render the estimated DP redundant as an ageing indicator. The elevated DDF will require to be investigated.

This transformer is internally in “reasonable condition” but has an underlying thermal abnormality and contamination of the main tank oil will require monitoring in the form of increased oil surveillance and may require enhanced maintenance within this period to prevent deterioration that may lead to failure. A ‘mid-life’ refurbishment should be considered in order to return the asset to a condition such that it will extend the asset life.

In order to mitigate the risk of an increased likelihood of failure during the RIIO T2 period and to understand the scope of work for a “mid-life” refurbishment, the following recommendations are made:

- Frequency of oil sampling should be increased to monitor both dissolved ethylene and DDF. This should be done every 3 months with additional oil analysis (over and above routine measurements) to include IFT, Sediment & Sludge and Particle Count.
- Detailed inspection of the asset – outage required.
- Inspection and assessment of the moisture management system.
- 132kV bushings should be oil sampled for DGA and moisture analysis and assessed by the criteria set out in National Grid TGN 82. In addition the bushing power factor and capacitance should be measured. This would require an outage and the removal of the 132kV and 11kV bushings to facilitate the testing.
- Detailed condition assessment of the transformer to include Sweep Frequency Response Analysis (SFRA), Dielectric Frequency Response (DFR), 10kV Power Factor, 5kV Insulation Resistance and DC Winding Resistance testing. This would require an outage and the removal of the 132kV and 11kV bushings to facilitate the testing.
- Following detailed inspection continue with routine inspection.
- Continue with routine maintenance.
- Detailed load flow monitoring.

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