



Polaris Diagnostics & Engineering Ltd has been commissioned by Scottish Hydro Electric Transmission (SHE Transmission), to carry out a Level 1 condition assessment of Kilmorack 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 SSEN Report T2BP-ACR-0021 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 oil leakage. 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 further inspection and evaluation. Given that the transformer is located in close proximity to the River Beaully, the transformer should be considered as an environmental hazard until such times as the oil leaks have been repaired or the transformer is replaced.

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

The transformer having an estimated 56% residual life remaining in the paper insulation. This suggests that the paper insulation is in a good condition given its age.

This transformer is internally in “reasonable condition” but has an underlying thermal abnormality and 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. The external condition is aged. The transformer has active oil leaks and presents a significant environmental hazard. 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 dissolved ethylene, moisture content and dielectric breakdown voltage. This should be done every 6 months.
- The transformer will require to be cleaned down to mitigate the health and safety risk from bird droppings to facilitate a detailed inspection.
- Detailed inspection of the asset – outage required – to identify the source of the oil leaks.
- 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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