Polaris Diagnostics & Engineering Ltd has been commissioned by Scottish Hydro Electric Transmission (SHE Transmission), to carry out a Level 1 condition assessment of St Fillans 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 T2-EJP-0041 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 deteriorate by ageing during the RIIO T2 period. There is an increased risk of failure due to an underlying thermal abnormality which will require monitoring in the form of increased DGA surveillance and may require enhanced maintenance within this period.

There is evidence that the transformer has external ageing which requires further inspection and evaluation. Given that the transformer is located in close proximity to a water course, the transformer should be considered as an environmental hazard until such times as the oil leaks have been assessed. There is a reported issue with "availability of spares" which needs to be investigated.

There is an underlying thermal abnormality as evidenced by the presence of dissolved ethylene levels in the main tank. To identify of 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.

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 40% life remaining is considered optimistic. The oil is oxidised which would require to be regenerated to restore the oxidation levels to a quality defined as "Good" by IEC 60422, but this process would further dilute the concentrations of 2FAL. This would render the estimated DP redundant as an ageing indicator.

The conclusion of the proposed detailed evaluation, taking into account all risk factors associated with GT1, should indicate if the transformer is to be recommended for replacement or subjected to a programme of refurbishment.

In order to further assess and manage the condition of this transformer, the following recommendations are made:

- Investigation into a lack of available spare parts. This should be thoroughly risk assessed with particular reference to the longevity of the transformer.
- Detailed inspection of the asset – outage required.
- 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.
- Inspection and assessment of the moisture management system.
- Following detailed inspection continue with routine inspection.
- Increase the oil sampling frequency to 6 months to keep the dissolved ethylene under surveillance.
- Continue with routine maintenance.
- Detailed load flow monitoring.

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