Date Filed: September 23, 2026

Witness: John P. DiPaola-Tromba
Request from: Office of Consumer Counsel

Question:

Refer to Exhibit CLP-TSP-1 at 55, "…plan to maintain a transformer fleet that does not exceed 70 years of age." Identify every law, regulation, manufacturer requirement, or mandatory engineering standard that requires a substation transformer to be retired at 40 years, 70 years, or any other specified age. If no such requirement exists, please confirm.

a. Provide all existing studies, analyses, and historical data relied upon by the Company to conclude that transformer failure risk increases rapidly as transformers approach or exceed 70 years of age. If the Company has not performed an empirical analysis using its transformer-failure experience, please justify.
b. Provide the Company data and analyses used to establish the transformer age thresholds or replacement criteria in the TSP, including the stated 40-year useful life and increased failure risk near 70 years. Include the age and cause of failure for each Company transformer that failed during the period covered by the analysis. If the criteria are not based on the Company's actual failure experience, identify the source on which they are based.

Response:

There are no laws, regulations, manufacturer requirements, or mandatory engineering standards that require substation transformers to be retired at a specific age. The age of a power transformer is one of the most important factors in assessing asset condition. Although actual service life varies widely depending on the manufacturer's design, quality of assembly, materials used, operating history, current operating conditions, and maintenance history, the average expected life for an individual transformer is approximately 40 years according to industry consortiums, and manufacturers. International reliability surveys (i.e., CIGRE) report major failure rates on the order of ~0.3% per transformer-year across large populations, with failure behavior influenced by aging and asset condition. Industry asset-management guidance supports risk-based decision-making that balances failure risk and cost.

Eversource employs several methods to both actively and passively monitor the health of distribution power transformers within its service area. Active and continuous monitoring methods include out of specification alarming. Alarms may include indications for bushing monitoring (if applicable), LTC trouble, dissolved gas (if applicable), oil level alarms, and oil temperature alarms, among others.

This information along with periodic maintenance and testing reports provide data into Eversource's condition-based asset management methodology that draws on multiple sources including:

- Transformer nameplate characteristics
- Oil quality and DGA trends
- Abnormal thermal, electrical, or core indicators derived from PTX health modeling
- Maintenance and inspection records
- Power Factor Testing

Eversource utilizes a detailed asset health score generated through the Electric Power Research Institute (EPRI) PTX tool to assess power transformer asset health. OCC-596, Attachment 4 CONFIDENTIAL, is a technical guide to the EPRI Power Transformer Expert System (PTX). The PTX tool evaluates normal degradation, abnormal operating conditions, oil quality, and age to produce two critical indicators: the Long-Term Health Index (LTI) and the Short-Term Health Index (STI). The PTX health index is measured in the range of 0 to 1, with 0 meaning healthy and 1 needing immediate replacement. A value greater than 0.5 is considered poor health, such that if repair/replacement is not performed the transformer will continue to decline leading to equipment failure.

Eversource has 27 transformers in CT, or about 8.6% of the fleet, that fall within the range considered to be in poor condition. This means that without repair or replacement, their condition is expected to continue declining, increasing the risk of equipment failure. As a result, Eversource continues to prioritize and initiate replacement projects for these transformers.

Attachments included note that multiple industry sources discuss aging and failure rates of substation power transformers.

- OCC-596, Attachment 1 CONFIDENTIAL, A2 Cigre Brochure 939 AC Transformer Reliability

- OCC-596, Attachment 2 CONFIDENTIAL, 1013566 Plant Support Engineering Large Transformer End of Expected Life Considerations and the Need for Planning

- OCC-596, Attachment 3, EXEC-2022-001242 - Large Power Transformer Resilience Report 7-10-24

- OCC-596, Attachment 4 CONFIDENTIAL, 3002026877_Power Transformer Expert System (PTX) Software Application Guide_ Introduction to PTX, Overview, Technical Basis and Application Information

Based on industry experience, while transformers can operate beyond their typical design life of 40 years, the risk of failure exponentially increases after 70 years of service life, due to paper insulation degradation. OCC-596, Attachment 1 CONFIDENTIAL, a CIGRE study from 2024, shows the failure rate of transformers has a noticeable increase starting at 40 years and exponentially increases as the asset exceeds 65 years old. This study reviewed analysis of thousands of transformers including many voltage classes from around the world to build depth into the data available. OCC-596, Attachment 2 CONFIDENTIAL is an EPRI paper discussing "Large Transformer End-of-Expected Life" which notes "the useful life of a large, oil-filled transformer is between 30 and 40 years with insulation or bus supports being the most likely to fail due to age. For the insulation, thermal aging of the paper insulation is the likely cause of failure."

OCC-596, Attachment 3, is a Department of Energy report from 2024, citing that large power transformers "are typically considered to have a design lifetime on the order of 40 years. In 2014, a DOE report estimated that the average age of LPTs in the North American grid was 38–40 years, indicating that a substantial fraction of those LPTs are at or over that design lifetime. These LPTs will ultimately need to be replaced or refurbished." These industry research groups and others have provided basis within their published studies to support the concerns of failure with any transformer over 40 years in-service.

As a result, Eversource's Asset Health philosophy for transformers is to operate transformers to their maximum useful life, but plan to maintain a transformer fleet that does not exceed 70 years of age and an average age of approximately 35 years. The objective is to find the balance between affordability and preventing an aged transformer fleet that approaches the "knee of the curve" which results in failure rates that increase significantly. With a large portion of the transformer fleet being between 50 and 80 years old, as these transformers continue to approach and exceed 70 years, the rate of failure will increase rapidly. Due to the complexity and time duration of procuring and replacing transformers, a significant increase in failures would result in the inability to maintain reliability by reactively replacing an increased volume of transformer failures.

The six most recent failures of transformers in CT were all attributed to internal failures of the transformer. The ages of the failed transformers were 32, 50, 52, 52, 56, and 83 years old at the time of the failure.