

Estimation of DTRF Operational Tritium Inventory Using Cryogenic Distillation Column Temperature

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For safe and efficient operation of the Darlington Nuclear Generating Station's Tritium Removal Facility (DTRF), it is necessary to track the amount of operational tritium inventory within the DTRF's process systems. Previous methodology that tracks operational tritium inventory is based on performing a tritium mass balance and does not provide an instantaneous way to determine inventory in the DTRF. The estimate of operational tritium inventory using this method is susceptible to increasing cumulative error of approximately $\pm 2.6\%$ per day as the DTRF continues to operate. Current methodology attempts to compensate for this cumulative error by assuming a constant value for operational tritium inventory whenever Mass 5 is detected by mass spectroscopy of tritium draw-off gas. However, this assumption is flawed and introduces significant error to the estimation of operational tritium inventory. A new method based on temperature of the cryogenic high tritium distillation (HTD) process is proposed which can track operational tritium inventory in a more instantaneous fashion and provides a result with a constant error of $\pm 14\%$ that does not increase over time.